ANTARCTIC CHEILOSTOMATOUS BRYOZOA

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PREFACE

This account of the Antarctic Cheilostomatida is the result of research conducted between 1985 and 1991, supported by awards from the Natural Environment Research Council (1985–1987) and the Leverhulme Trust (1988–1991). It is based principally on the immense collections of Antarctic Bryozoa formerly held by the Institute of Oceanographic Sciences, Deacon Laboratory. These collections were originally accumulated by A.B. Hastings, at the Natural History Museum, London, and consisted of samples collected by practically every British Antarctic research programme, commencing with the National Antarctic Expedition (1901–1904), the British Antarctic (*Terra Nova*) Expedition (1910–1913), *Discovery* Investigations (1925–1939), Operation Tabarin (1943–1945), and the Falkland Islands Dependencies Survey (1946–1960). Additional material, recently collected around Signy Island, was provided by the British Antarctic Survey, Cambridge. Through the courtesy of Dr. Dennis P. Gordon, New Zealand Oceanographic Institute (NZOI), the even larger, and mostly unworked, collections of the NZOI were made available for comparative study and contributed significantly to the research programme. Original material was also obtained from the collections of the United States Antarctic Research Programmes (1958–1982) through the kindness of their present custodian, Dr. Judith E. Winston, Virginia Museum of Natural History. Type and other original materials from the expeditions of the *Challenger*, the *Romanche*, the *Belgica* and *Le Francais* were re-examined. The taxonomic results of this work, including the description of new taxa and the revision of existing taxa, the construction of synonymies, and some contributions to classification, have been published in a series of research papers. Most of the conclusions arrived at in these papers have been upheld in this synopsis, although a few have been revised or modified following the examination of further material. No new taxa are introduced here, but a substantial proportion of the species included is redescribed and illustrated for the first time, a number of new synonymies is justified and some new taxonomic combinations are presented. Cheilostomate classification is presently undergoing a profound re-evaluation, driven by often startling new insights into morphology revealed by routine scanning electron micrography. The classification employed here is thus unlikely to remain stable for long. It incorporates all presently published opinion, and follows the classification and sequence proposed by Gordon (1984, 1986, 1989a).

This synopsis is essentially a practical guide for the identification of the Antarctic Cheilostomatida. It includes an artificial dichotomous key to the genera. Each family and genus is fully diagnosed, and for each genus there is a key for the identification of its constituent species. Species descriptions are as comprehensive as the material available for study allowed, and include all reliable information on biology, habitat and geographical distribution.

Synonymies are founded for the most part on the re-examination of previously published materials, and on reliable published sources. Such taxonomic discussion as is included, at various taxonomic levels, is mostly for the benefit of the specialist, but it is hoped that it is presented in a manner that does not obstruct the invertebrate zoologist or ecologist in using the work for its primary purpose, namely identification. All species recorded from Antarctica are illustrated.

This book is not intended to be a general introduction to bryozoans and bryozoology. Consequently, the introduction and following short sections on biology and ecology, and zoogeography, are deliberately neither comprehensive nor synthesizing. They are intended merely to emphasize the special characteristics of the Antarctic cheilostomates, and to summarize present understanding of the group in these regions.

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Swansea

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CONTENTS

1 INTRODUCTION

Systematic research on the Antarctic Bryozoa has a comparatively short history. The first marine invertebrates to be described from Antarctica were a few molluscs and crustaceans collected from strand line debris on the South Shetland Islands by James Eights, surgeon and naturalist with the U.S. Antarctic Exploring Expedition (Eights 1833). It is probable that Eights encountered bryozoan colonies among the beach debris, but he neither collected nor recorded them (Winston and Hayward 1994). James Clark Ross made the first dredge hauls in Antarctic coastal waters in 1841, in the course of the *Erebus* and *Terror* Antarctic expeditions. It is known that he and Joseph Dalton Hooker made extensive collections of Antarctic marine invertebrates. Hooker prepared illustrations of many of the specimens they collected, including some collected while en route to Antarctica, and the surviving drawings, conserved at the Natural History Museum, London, apparently include a number of bryozoans (Davenport and Fogg 1989), but Ross's collections were not worked up and were eventually destroyed. Antarctic bryozoans were not collected again until Michaelsen's visit to South Georgia in 1892–1893.

In describing and defining the Antarctic bryozoan faunas it has always been important to consider those of adjacent Subantarctic regions, especially the south-west Atlantic and magellanic South America (Fig. 1), and early biological explorations of these regions were generally more successful. Quoy and Gaimard (1824) appear to be the first to describe Bryozoa from the Magellan Strait area, in their account of the 1817–1820 voyage of the *Uranie* and the *Physicienne.* D'Orbigny (1841–1847) reported further species collected by the *Astrolabe.* Species collected by Charles Darwin on the *Beagle* were not separately published, but were incorporated in the British Museum collections and later described or listed by Busk (1852, 1854, 1875). Jullien's (1888) report on the Bryozoa collected by the French scientific expedition to Cape Horn (1882–1883) was the first monographic work on the Subantarctic bryozoans of magellanic South America, and remains an important taxonomic source today. However, the first major contribution to the taxonomy of the Subantarctic Bryozoa was Busk's (1884) report on the species collected on the voyage of the *Challenger.* Between the Magellan Strait and the Falkland Islands the *Challenger* sampled four stations, which yielded 22 species of Cheilostomatida, only nine of which Busk considered to be undescribed. Three abyssal stations were worked in the South Indian Ocean, at 53°S, 62°S and 65°S, producing five species of Cheilostomatida. Deep-water species generally do not extend into Antarctic shelf seas, but *Challenger* Stn. 157, at 1950 fms depth, is the type locality of *Camptoplites bicornis* (Busk), varieties of which are abundant throughout Antarctic coastal waters. Around Crozet Id., Prince Edward Id., Kerguelen and Heard Id., the *Challenger* sampled eight stations, including one at abyssal depth. A total of 58 cheilostomate species was described by Busk (1884) from these samples, 36 of which were new to science.

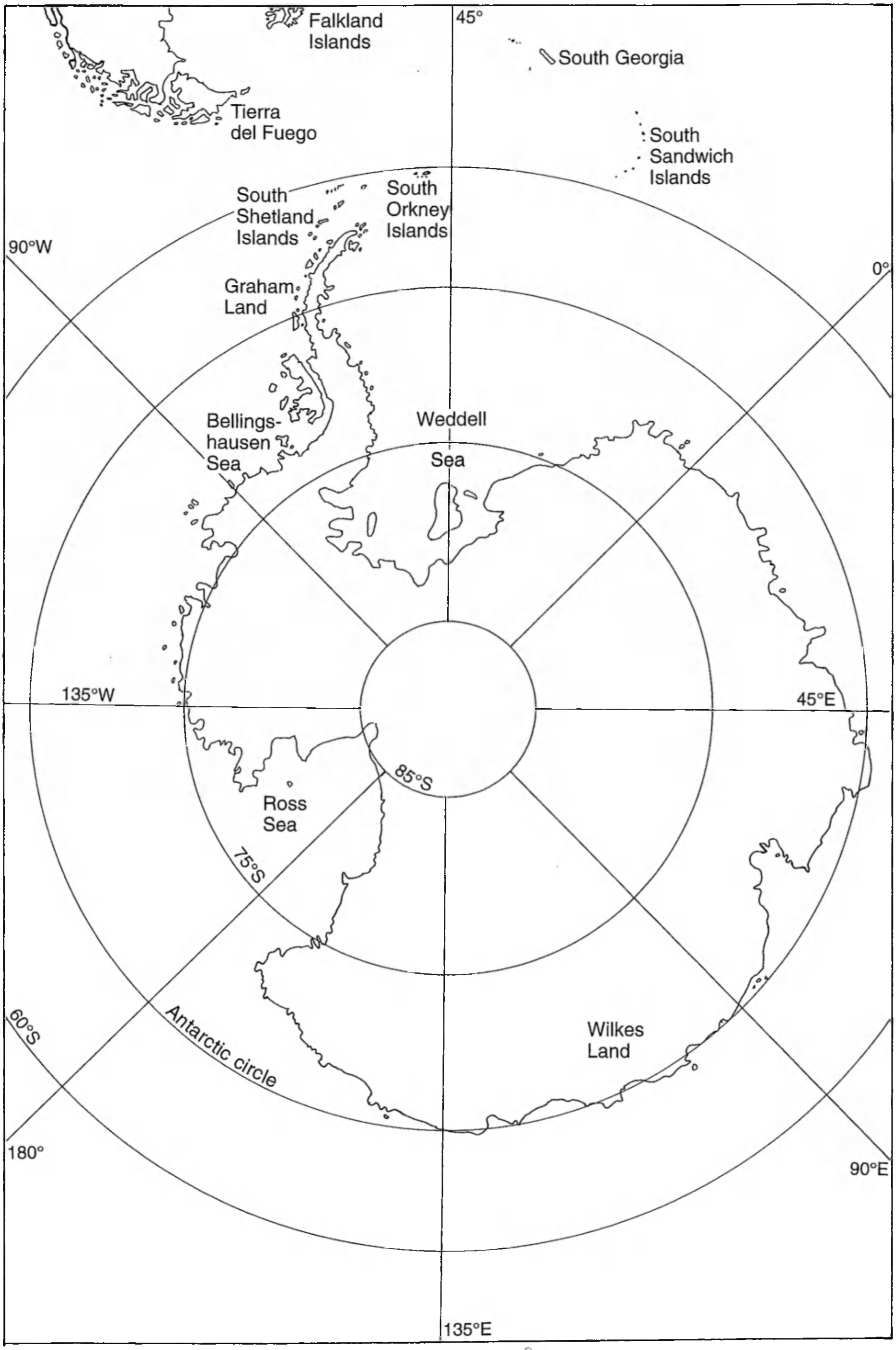


Fig. 1. Antarctica and the Antarctic seas.

Antr. Convergence ??

Kirkpatrick (1902) was the first author to record bryozoans from an Antarctic mainland locality, namely Cape Adare, on the western edge of the Ross Sea. Unfortunately, the material available to Kirkpatrick seems to have been limited in both quantity and quality; he listed seven taxa from samples dredged off the Cape, and a single new species, *Alcyonidium flabelliforme*, from beach debris. The foundation for Antarctic bryozoan research was finally established by the publication of Waters' (1904) report on the bryozoan collections of the Belgian Antarctic Expedition, 1897–1899. The *Belgica* report described 89 taxa from 13 stations in the Bellingshausen Sea, western Antarctica. One station was at 2800 m depth; the rest were located on the Antarctic continental shelf, at 410–469 m depth. No fewer than 58 species were described as new, and of the balance perhaps a majority have subsequently been shown to represent species other than those to which they were attributed by Waters (1904), and have also been redescribed as new species. Waters was aware of the importance of considering the Antarctic faunas in context with those of adjacent Subantarctic regions, and during his work re-examined materials studied by both D'Orbigny and Jullien. He also recognized the uniqueness of elements of the Antarctic fauna, and introduced the new genera *Systenopora* and *Cellarinella*. Calvet's (1904a,b) report on the Bryozoa collected by Michaelsen's 1892–1893 research cruise included both Subantarctic and Antarctic species. He described 61 taxa from the Magellan Strait, Tierra del Fuego, Patagonia, the Falkland Islands and South Georgia. The South Georgia samples contained 11 species, three of which were described as new. His account of the 1903–1905 French Antarctic Expedition to the west coast of Grahamland (Calvet 1909) complements Waters' (1904) *Belgica* report, detailing 44 species, 16 of which were described as new. Undoubtedly the most important of these early studies is that of Kluge (1914) on the Bryozoa collected by the German South Polar Expedition, 1901–1903. Of the 84 taxa described, 63 were from Antarctic localities, and 50 of these were new. Kluge gave the first comprehensive account of the Antarctic Flustridae, four additional species of which have since been discovered, and, as '*Bugula*', introduced many of the presently known species of *Camptoplites*.

The Australasian Antarctic Expedition, 1911–1914, collected the first bryozoans from Australian Antarctic Territory and from Adelie Land, sampling nine stations between 92° and 145°. The collections were first examined by L.R. Thornely, who published (1924) a superficial and poorly illustrated account of 68 species, including five new species. The known species listed by Thornely (1924) included some taxa described by Waters (1904) and Calvet (1909), but also many unlikely records such as the north-east Atlantic *Cellaria fistulosa* (Linnaeus), and her work generally contributed little of use to Antarctic bryozoology. Livingstone (1928) re-examined the collection, correcting where possible Thornely's identifications, and describing 78 species, only four of which he considered to be new. Livingstone was unable to trace specimens of 14 of the species listed by Thornely. Although he recognized in the collections many of the species described by Waters (1904) and Calvet (1909), Livingstone also made some unlikely attributions, such as the north-east Atlantic *Cribrilina punctata* (Hassall).

The bryozoan collections of the British National Antarctic Expedition (NAE) (1901–1904) and the *Terra Nova* Expedition (1910–1914) remained unstudied for years. The NAE collections were sorted and largely identified by H.W. Burrows, who unfortunately did not complete his work. Burrows' materials then passed to E. Palk, who had been given the task of identifying and describing the *Terra Nova* bryozoans. Palk did not finish her work either, and both collections, together with Burrows' manuscript account, and his drawings of NAE bryozoans were given to the Natural History Museum, London, where they remain.

The next phase of British biological exploration in Antarctica began in late 1918 with the formation of a committee to report on prospects for research and development in the Falkland Islands Dependencies. Whaling, and the marine biological background to whaling, were the major considerations of this body, and they gave rise to the *Discovery* committee which organized the series of voyages between 1925 and 1951 which became known as *Discovery* Investigations, and resulted in the long series of *Discovery* Reports, published between 1929 and 1967. The scope of the research undertaken by *Discovery* Investigations was immense (see Hardy 1967), embracing hydrology, geology, sedimentology and marine biology of the entire Southern Ocean. In addition to the major research, on plankton, whales and whaling, and fisheries, the committee began to accumulate enormous collections of marine invertebrates, which were sorted and offered to specialists to work up. A.B. Hastings undertook to study the bryozoan collections made by *Discovery* Investigations, incorporating the old NAE and *Terra Nova* collections in her work. Her intention had been to monograph the entire Subantarctic and Antarctic Bryozoa in a series of '*Discovery*' Reports but only one was ever completed (Hastings 1943) and the bulk of the *Discovery* collections was still unidentified at the time of her death. Hastings' (1943) *Discovery* report treated six families: the Aeteidae, Scrupariidae, Bicellariellidae, Farciminariidae, Epistomiidae and Scrupocellariidae. In all 120 taxa were recorded, 95 of which were from Antarctica, including 24 new species or varieties and one new genus. The work was comprehensive, with synonymies and geographical distributions exhaustively researched, and with keys for the identification of genera and species. Unfortunately, few of the species were described in detail, discussion was often limited to taxonomic or synonymic problems and the illustrations, although good, were far too few. Hastings' (1943) *Discovery* report is an indispensable work of scholarship, but of little practical help to any but the most experienced bryozoan specialist.

M.D. Rogick was the first modern author to publish on the Antarctic Bryozoa, and from 1953 to 1965 she produced 13 papers on the Bryozoa of the U.S. Navy's 1947–1948 Antarctic expedition. Rogick's papers included accounts of 29 new species from Marguerite Bay, Peter I Id., Wilkes Land and the Ross Sea. She effectively monographed the species of *Cellarinella* and Cellariidae (Rogick 1956d), and her clear, detailed descriptions and beautiful, accurate drawings made her work of great practical value to other workers. Antarctic marine biological research entered a period of rapid expansion from the late 1960s, which continues today. Almost every year since 1968 has seen a number of publications on Antarctic bryozoans, and the number of active specialists has increased steadily. In the past two decades numerous new species and genera have been described, and even a number of new families. The taxonomic diversity of the Antarctic Bryozoa has thus greatly increased, and its distinctiveness has sharpened as taxonomic revision has revealed many more endemic species and genera. This work is intended to be a 'synopsis'. Large areas of the Antarctic shelf sea floor have still to be explored by taxonomic biologists, and it is certain that in the Bryozoa, as in probably most other phyla, the number of described species will increase steadily for some time to come. The process will not, however, be entirely dependent on the rate of new collecting, as large, indeed very large, accumulations of benthic samples are held, still unworked, by many national research institutions around the world.

2 THE ANTARCTIC CHEILOSTOMATIDA

The Cheilostomatida comprises the majority of living species of marine bryozoans. With the exception of certain estuarine habitats, and Northern Hemisphere intertidal seaweed habitats, where species of Ctenostomatida may predominate, the cheilostomates everywhere outnumber the heavily calcified Cyclostomatida and the non-calcified ctenostomates. Cheilostomate colonies exhibit an immensely wide diversity of form, and, while colony form may be characteristic for a family or genus, it is only rarely so at the species level. The taxonomy of the group is largely founded on the characters of the constituent zooids of the colony.

The cheilostomate zooid approximates to a box, calcified to a greater or lesser extent, with a hinged, frontally situated operculum closing the orifice through which the feeding lophophore is protruded (Fig. 2). In many cheilostomate species at least part of the frontal surface is membranous and plays an important role in the hydrostatic system for everting the lophophore-bearing polypide. Contraction of parietal muscles arising from the lateral walls of the zooid and inserting on the membrane raises internal hydrostatic pressure, and, as divaricator muscles closing the operculum relax, the operculum opens and the polypide everts. Withdrawal is accomplished by relaxation of the parietal muscles and contraction of longitudinal retractor muscles inserted close to the lophophore base. Lightly calcified zooids with almost entirely membranous frontal surfaces are seen in such genera as *Membranipora*, a specialized epiphyte of kelp blades in which fast growth and widely dispersing larvae compensate for the effects of predation on the unprotected colony surface. Throughout the Cheilostomatida, however, there is evidence of evolutionary trends towards the development of calcified structures that serve to protect the vulnerable frontal surface of the zooid. The area of frontal membrane has been reduced in some groups by calcifying part of the frontal body wall, often but not always accompanied by the development of spines or other processes bordering and often overarching the membrane. In others the membrane has been entirely overlain or underlain by calcification to form a continuous, calcified frontal shield (Fig. 2). In all groups these evolutionary trends have been mediated by the necessity to maintain the functioning of the hydrostatic system.

The nature of the frontal shield of the cheilostomate zooid has thus had a particular significance for the classification of the group. An early scheme divided the order into two suborders, the Anasca and the Ascophora. In the former, part or all of the frontal surface of the zooid was membranous, though often surrounded or overarched by spines, or underlain to a greater or lesser extent by a calcified plate, the cryptocyst. Cryptocystal calcification might or might not occur simultaneously with gymnocystal calcification, in which a proportion of the frontal body wall was calcified. In the Ascophora the entire

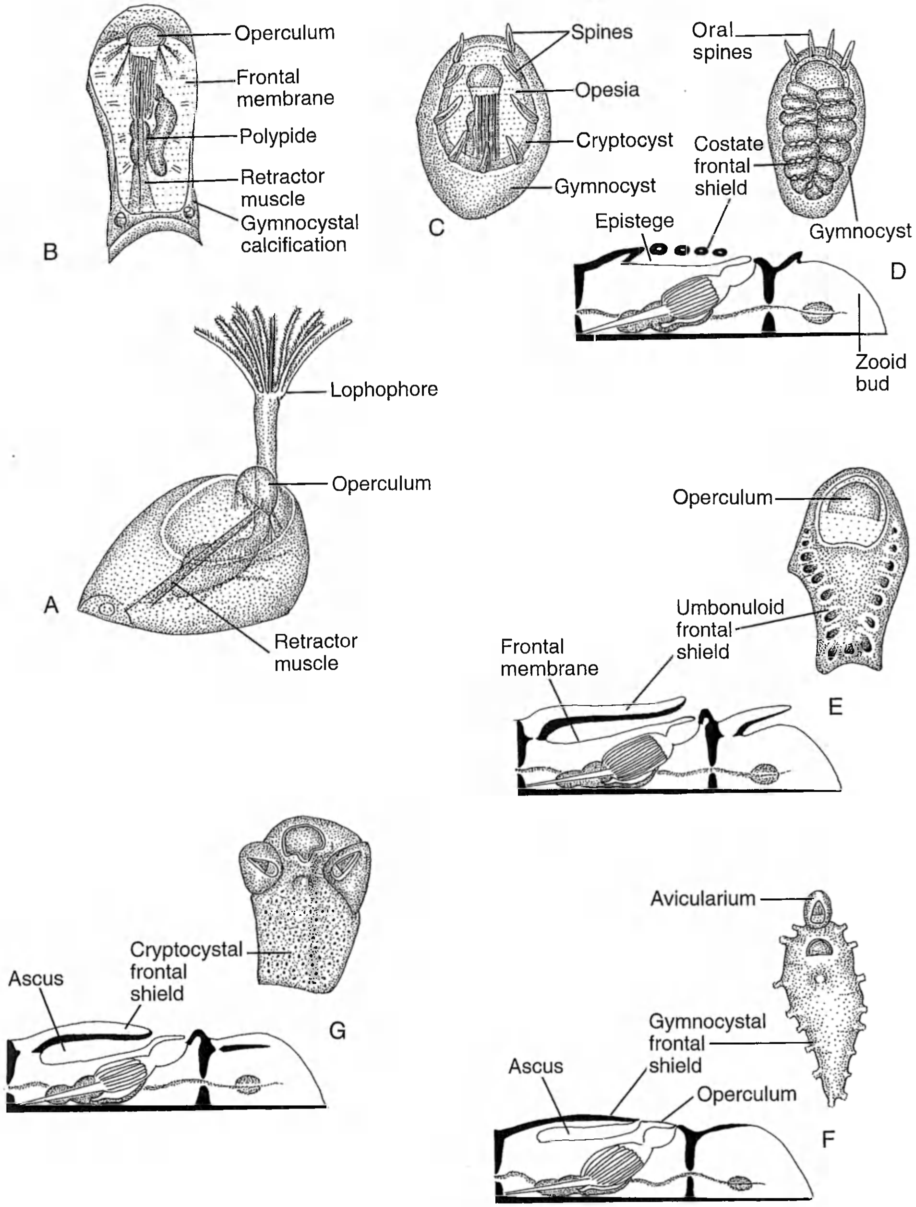


Fig. 2. Frontal shield morphology in cheilostomate bryozoans. A. Basic autozooid form in an hypothetical, possibly uncalcified, gymnolaemate ancestor. B. *Membranipora* (Malacostegina), with largely membranous frontal wall. C. *Callopora* (Neocheilostomina), with calcified gymnocyst, and a rim of cryptocyst beneath the frontal membrane defining the opesia. D. Cribriomorph autozooid with fused spines above the frontal membrane and a space, the epistege, between. E. Umbonulomorph autozooid, with umbonuloid frontal shield arching above the frontal membrane. F. Hippothoomorph autozooid, with gymnocystal frontal shield. G. Lepraliomorph autozooid, with cryptocystal frontal shield.

frontal surface was calcified and the operculum came to close a defined orifice in the resulting calcified shield. The hydrostatic system continued to function as a reduced number of parietal muscles was relocated to insert on the floor of an internal compensating sac, or ascus, which lay beneath the frontal shield (Fig. 2). That this division of the cheilostomates was artificial was suggested by the Cribriomorpha, in which a frontal membrane bearing an operculate orifice was covered by a perforate shield of fused, flattened spines. Such a frontal shield could be derived conceptually from a spine-bearing anascan, and progressive fusion of the spines could be seen to lead to a uniformly porous frontal shield, characteristic of many ascophorans. Silén (1942) and Harmer (1957) both considered the problem of cheilostomate classification and sought to derive ascophoran frontal shields from anascan stocks. Silén's proposals were especially radical, dispensing entirely with the Anasca and Ascophora, combining the Cheilostomatida and Ctenostomatida as a single suborder of the Gymnolaemata, and then dividing this group into eight 'sections' largely on the basis of their frontal wall structure. Harmer (1957) retained the Anasca and Ascophora as separate suborders but recognized two major types of frontal shield formation in the latter, and divided it into two divisions, the Ascophora Imperfecta and the Ascophora Vera. Neither scheme was subsequently adopted by systematists but Silén's work stimulated a great deal of research into the morphology and formation of the ascophoran frontal shield. For the most part this research has permitted clearer distinctions to be drawn between different ascophoran groups, with often profound consequences for taxonomy, but has not resolved the basic problem of defining the limits of the ascophorans. Recent classifications (e.g., d'Hondt 1985; Gordon 1989a) dispense with Anasca as a natural grouping, whilst retaining the Ascophora, still embracing the perhaps transitional Cribriomorpha (Table 1). Gordon (1989a,b, 1993) has made a major contribution towards a reappraisal of ascophorine systematics, based on studies of the frontal shield in a wide range of genera. His taxonomic scheme is accordingly adopted here.

Zooid polymorphism is especially characteristic of the Cheilostomatida, being more broadly and variously expressed among these than among the other

Table 1 Proposed higher-level classifications of the cheilostomatous Bryozoa

According to d'Hondt (1985)	According to Gordon (1989a)
Subclass Cheilostomona	Order Cheilostomida
Order Protocheilostomida	Suborder Protocheilostomina
Order Eucheilostomida	Suborder Inovicellina
Suborder Inovicellatina	Suborder Scrupariina
Suborder Scrupariinina	Suborder Malacostegina
Suborder Malacostegina	Suborder Neocheilostomina
Suborder Neocheilostomina	Infraorder Pseudomalacostegomorpha
Infraorder Pseudomalacostegomorpha	Infraorder Cellulariomorpha
Infraorder Cellulariomorpha	Infraorder Cryptocystomorpha
Infraorder Cryptocystidomorpha	Suborder Ascophorina
Infraorder Ascophoromorpha	Infraorder Cribriomorpha
	Infraorder Hippothoomorpha
	Infraorder Umbonulomorpha
	Infraorder Lepraliomorpha

orders of living Bryozoa (Fig. 3). The basic feeding zooid, or autozooid, has been modified in many ways, to serve functions that in most cases are still not clearly understood. Polymorphism may be expressed simply in the polypide, as in the case of the specialized male zooids seen in some species (Cook 1979), but is most usually seen in the skeletal morphology. In what appears to be the simplest type of polymorph, the kenozooid, the polypide is lacking and the zooid may be differently shaped, or of a different size than the autozooid. Kenozooids contribute to the colony basal attachment in such genera as *Reteporella,* and the uncalcified rootlets of certain species are also zooid polymorphs, which may be defined as kenozooids. In *Klugerella* certain zooids of a colony have reduced frontal shields but grossly enlarged opercula and, by analogy with similarly polymorphic tropical species (Cook 1979), may prove nonetheless to possess normally functioning polypides. These polymorphs perhaps have a protective function, discouraging micropredators or large prospecting larvae, and are usually considered to foreshadow the more radically modified polymorphs, the avicularia (Fig. 3), which are particularly characteristic of the Cheilostomatida. Avicularia are found in all cheilostomate groups, except for the Inovicellina, Scrupariina and Malacostegina, and perhaps occur in a majority of species. Within a single species avicularia may be monomorphic or polymorphic, with a fixed origin and location relative to the autozooid, or varying in position and orientation from one autozooid to the next. In many cases a species typically displays a monomorphic adventitious avicularium, with a fixed position and orientation, while additional, often larger, adventitious or vicarious avicularia occur regularly or irregularly elsewhere in the colony. Increasing order within a cheilostomate colony is considered to reflect increasing integration of colony form and function (Cook 1979). Another major type of polymorph is the vibraculum (e.g., Fig. 93), which differs from avicularia with setiform mandibles in having a musculature and pivotal system that permits the seta to move in more than one plane. The vibraculum is found only in a few families in the infraorder Cellulariomorpha, while setiform avicularia occur in many families throughout the Neocheilostomina. The functions of the bewildering variety of avicularia are still largely unknown, although, as Winston (1991) suggested, most polymorphs will prove to serve specific defensive functions against particular micropredators or epifaunal organisms. Co-evolutionary pressures might even account for some of the more extraordinary forms of avicularia. Regardless of their functions, polymorphs are viewed as taxonomically highly significant. Their occurrence, form and distribution are used to define species, and to a lesser extent genera, but are less important at higher taxonomic levels. Polymorphism in the Cheilostomatida embraces a range of other structures. Spines, scuta and other processes are all considered to be zooid polymorphs. Each has a coelomic cavity with a peritoneal lining, and is isolated from the coelom of the bearing autozooid by a specialized communication pore, or septulum, identical to those seen between adjacent autozooids.

A further important morphological feature of the Cheilostomatida is the brood chamber (Fig. 4). In the Inovicellina these are simple membranous sacs attached externally, at the distal end of the zooid. In the Scrupariina they are

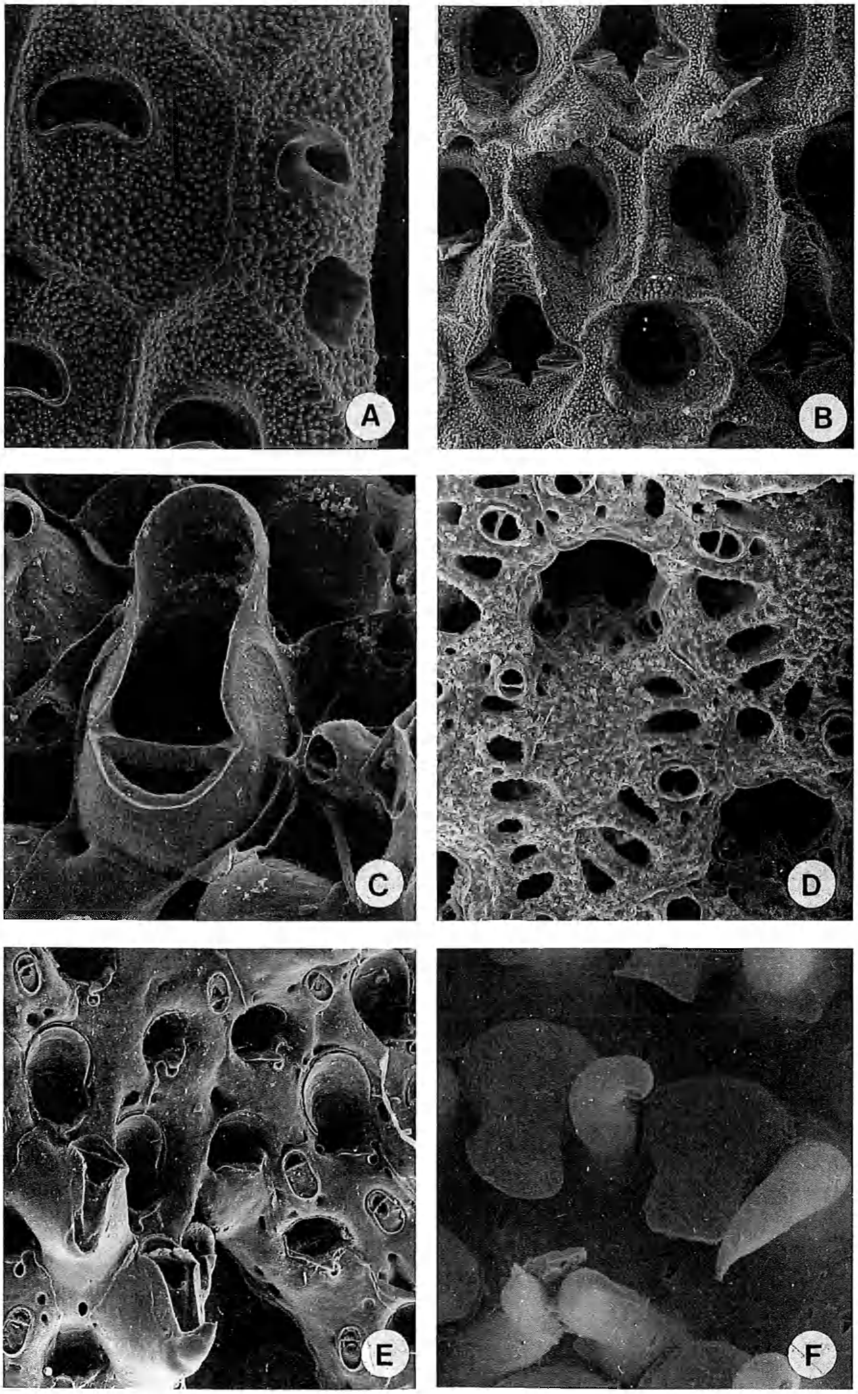


Fig. 3. Some cheilostomate polymorphs. A. *Melicerita flabellifera:* branch edge showing a kenozooid with the base of a rhizoid; ×75. B. *Swanomia membranacea:* part of a branch with two vicarious avicularia; ×39. C. *Osthimosia malingae:* a giant vicarious avicularium; ×75. D. *Bostrychopora dentata:* autozooids with numerous small adventitious avicularia; ×60. E. *Reteporella frigida:* autozooids with two types of adventitious avicularia; ×45. F. *Isoschizoporella tricuspis:* ovicells flanked by erect, columnar avicularia; ×40.

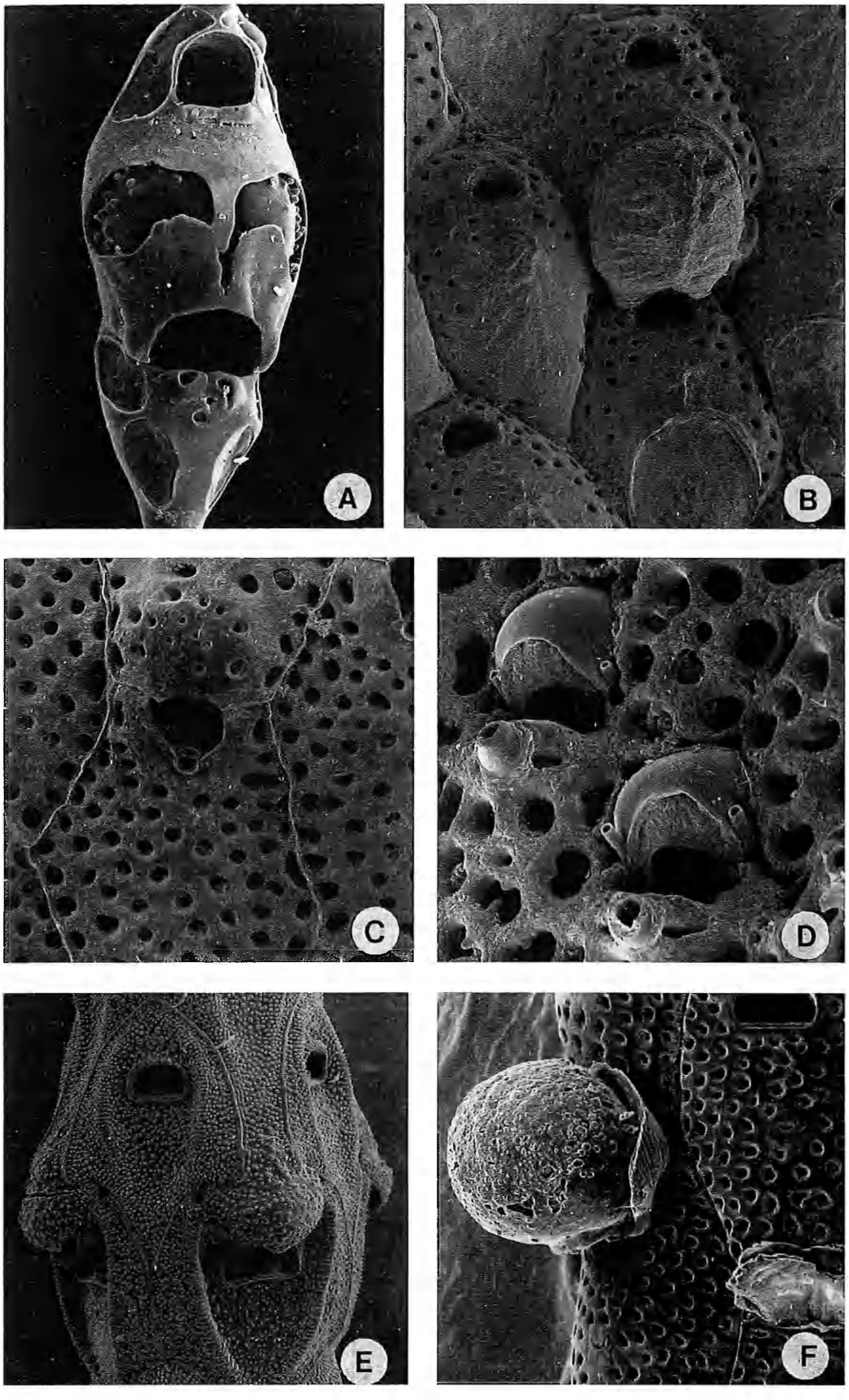


Fig. 4. Some cheilostomate brooding structures. A. *Talivittaticella frigida:* an internode comprising a brooding female zooid below an autozooid; ×80. B. *Fenestrulina proxima:* an ovicelled autozooid; ×40. C. *Smittina alticollarita:* an ovicelled autozooid; ×35. D. *Arachnopusia decipiens:* ovicelled autozooids; ×55. E. *Cellaria incula:* part of an internode with immersed (endotoichal) ovicells; ×55. F. *Adelascopora jeqolqa:* autozooid with ovicell; ×50.

lightly calcified bivalved chambers borne by specially modified zooids. In the Malacostegina embryos are not brooded at all, but develop externally into free-swimming planktotrophic cyphonautes larvae. Among the Neocheilostomina and the Ascophorina lecithotrophy appears to be the rule, and embryos are brooded by the maternal zooid. In a minority of species this occurs within the tentacle sheath of an otherwise unmodified zooid, but in the majority the brooding zooid is morphologically distinct from all others in the colony. In some species brooding is internal and the brooding zooid is radically different in shape and size to other zooids, and is generally termed a gonozooid. In most, the embryo is brooded in a chamber, the ovicell, attached to the distal end of a zooid which may be morphologically distinctive and by definition female (as in *Hippothoa*), or otherwise little different from others in the colony. The ovicell in some species is simply an expansion of the distal end of the brooding zooid, and thus part of it. In others, the ovicell is an independent polymorph, budded from the maternal zooid, or from the zooid distal to it, or may even be a compound structure developed from one or more neighbouring zooids, with or without a skeletal contribution from the maternal zooid. Brooding structures in the Ascophorina in particular are complex and diverse, and promise to provide insight into cheilostomate systematics and phylogeny. They are consequently of considerable significance to taxonomy.

The Antarctic cheilostomate fauna includes representatives of almost all major taxonomic groups. The exceptions are the Protocheilostomina and the Inovicellina. Species of *Aetea* (Inovicellina) are known to occur in Subantarctic regions of the south-west Atlantic but have yet to be reported from Antarctica. There is no *a priori* reason why Aeteidae should be absent from Antarctic coastal waters, and it may be that their inconspicuous form and often cryptic habitats have led to their being overlooked, and that more careful study of shallow benthic habitats will eventually reveal their presence. The Scrupariina comprises very few species worldwide, but the Antarctic fauna includes *Brettiopsis triplex*, which develops dense tufted colonies, and which may prove to be common in shallow waters. The Malacostegina is represented by just two species, in the family Electridae, both of which are essentially epiphytic or epizooic. Among the Pseudomalacostegomorpha, the Flustridae is represented by 11 species. In this family the typical colony is erect, branching, flabellate and very lightly calcified (e.g., Fig. 54). The frontal surface of the zooid is almost entirely membranous, although small portions of gymnocystal calcification occur proximally in some species. Immersed or partly immersed ovicells are characteristic of a majority of species, but in *Carbasea* embryos are incubated within externally unmodified zooids. Spines may be present, and also avicularia, either vicarious or adventitious, typically monomorphic within a species and rarely frequent. The Calloporidae and Chaperiidae include numerous encrusting species, often with small and rather cryptic colonies. In almost all species the zooid has a well developed gymnocyst, while the cryptocyst is variably developed, being pronounced in *Amphiblestrum* and *Chaperiopsis* but minimal in *Ellisina*. Ovicells and avicularia are present in both families. In *Chaperiopsis* avicularia are typically polymorphic, some types occurring in fixed positions, others variable in both position and frequency.

The Cellulariomorpha is abundant throughout Antarctic seas. There are numerous species, and they may occur in dense multispecies communities. In all families, except the Beaniidae, the colony is erect, unilaminar and branching, the zooids in one to many series, and usually only lightly calcified (e.g., Fig. 79). The cellularine zooid is typically elongate, with an oval frontal membrane comprising half or less its total length; the rest of the zooid consists of smooth gymnocystal calcification, with a narrow border of cryptocyst underlying the membrane, and defining the opesia. Spines are typically present, often numerous and long, and a specialized palmate spine, the scutum, is seen in many families. Avicularia occur in most species, monomorphic or polymorphic, with fixed and/or variable positions. *Camptoplites* is especially notable. Most of its numerous species are endemic to Antarctica; they form dense bushy colonies, which often dominate the benthos in some regions, and are unique in possessing bird's head avicularia with long, or very long, flexible peduncles which are capable of frequent, fast, supple movement. These avicularia are most often polymorphic, and up to four types may be found in a single species. All cellularines bear ovicells, which may be short, cap-like extensions of the distal wall, as in *Himantozoum*, or globular, prominent structures of presently unknown morphological origins. By analogy with species of Bugulidae from other regions, some of these may prove to be complex polymorphic structures. The Beaniidae are distributed worldwide, and are remarkably homogeneous in form. In almost all species the colonies are sessile, loosely coherent or disjunct, with shoe-shaped zooids displaying an entirely membranous frontal surface, which may or may not be bordered by spines. Avicularia, when present, are of the pedunculate, bird's head type, and ovicells are generally very small.

The Cryptocystomorpha display a wide variety of colony form, from encrusting unilaminar sheets or patches, to stout coralliform growths, to the erect branching colonies of the Cellariidae. *Cellaria*, the most familiar genus, is characterized by delicate, dichotomously branching colonies consisting of slender cylindrical nodes linked by chitinous internodes. There are many species of *Cellaria* in the Antarctic fauna and their colonies frequently develop dense, conspicuous clumps. In all species in this infraorder the gymnocyst is absent or minimal and the membranous frontal surface is underlain largely or entirely by cryptocystal calcification. Avicularia are present in almost every genus and may be monomorphic or polymorphic. Ovicells may be prominent, or immersed and not readily evident.

The preponderance of Antarctic Cheilostomatida belongs to the suborder Ascophorina. The four infraorders constituting the Ascophorina are distinguished principally by the morphology of the calcified zooid frontal shield. Frequently, frontal shield type correlates with other morphological characteristics, so that a species' affinities may be recognized by low-magnification, external examination. In many instances, however, the nature of the frontal shield can only be established by scanning electron microscopy (SEM) examination of its under surface, as evidenced by Gordon (1989a,b). The results of such investigation have often been surprising, overturning long established classifications, and leading to many genera and families being assigned to unexpected groupings. Gordon (1989a) has advocated the grouping of families into superfamily units within the four newly recognized infraorders, and his superfamilies are accepted here. However, it is implicit in his work that the classification of many genera will be altered, that some families may be divided and that further superfamily groupings may be necessary as the nature of the frontal shield is established in a wider range of ascophorine genera. It is highly probable that ascophorine classification will be fluid for some years ahead.

The Cribriomorpha is the most easily recognized of the ascophorine infraorders. In cribriomorph zooids (Fig. 2) the membranous frontal wall is covered by an arched, reticulate shield originating from the fusion of flattened, hollow spines, or costae, the spinocystidean condition first described by Silén (1942). Between the shield and the membrane is a space, the epistege, which is morphologically exterior to the zooid. As the membrane is depressed to allow polypide eversion, water flows into the epistege over the operculum or through the spaces between the costae, compensating for the reduced volume of the zooid. In most cribriomorphs the spinous origin of the frontal shield is still evident, but in others fusion is so complete that its nature is only demonstrated by the regular, radiating series of minute intercostal pores. Cribriomorphs display well developed polymorphism, with adventitious and vicarious avicularia occurring throughout the group, and indeed the hollow, coelomate spines constituting the shield arise as zooid polymorphs. The Antarctic Cribriomorpha fauna is largely dominated by species of *Arachnopusia,* which, although widely distributed in the southern hemisphere, is especially speciose in Antarctic seas. In *Arachnopusia* the frontal shield may be rudimentary, with few costae and sparse fusions, or especially well developed, with small pores marking the boundaries of fused costae. Its colonies may be patch-like and relatively inconspicuous, or erect and plate-like, and very large.

In the Umbonulomorpha a frontal shield develops through the calcification of an overarching fold of proximal frontal body wall (Fig. 2). The original membranous frontal wall of the zooid remains beneath the shield, and the space between them is again morphologically exterior to the zooid. Water enters the compensating space through the distal aperture in the shield, which is not homologous with the zooid orifice and not always coincident with it. The umbonuloid shield may be recognized in some genera by an extensive aperture, with an operculate membrane visible within it, extending proximally beneath the shield. However, it has been demonstrated (Gordon 1989a) that the umbonuloid shield may be represented by a small distal fold beyond the edge of a calcified frontal surface otherwise derived, as in *Escharella* and *Exochella,* and is not readily apparent from frontal examination. Numerous genera and families have been newly recognized as umbonulomorph, and without doubt others currently classified among the remaining two infraorders will also prove to be so. At present relatively few umbonulomorphs are recognized among the Antarctic fauna, but these include the genera *Exochella* and *Cellarinella* (Fig. 5), both especially rich in species and the latter endemic to Antarctica. Umbonuloid species embrace every type of colony form, from small, patch-like, to erect, plate-like or branching. Many are heavily calcified, and all display zooid polymorphism to a greater or lesser extent.

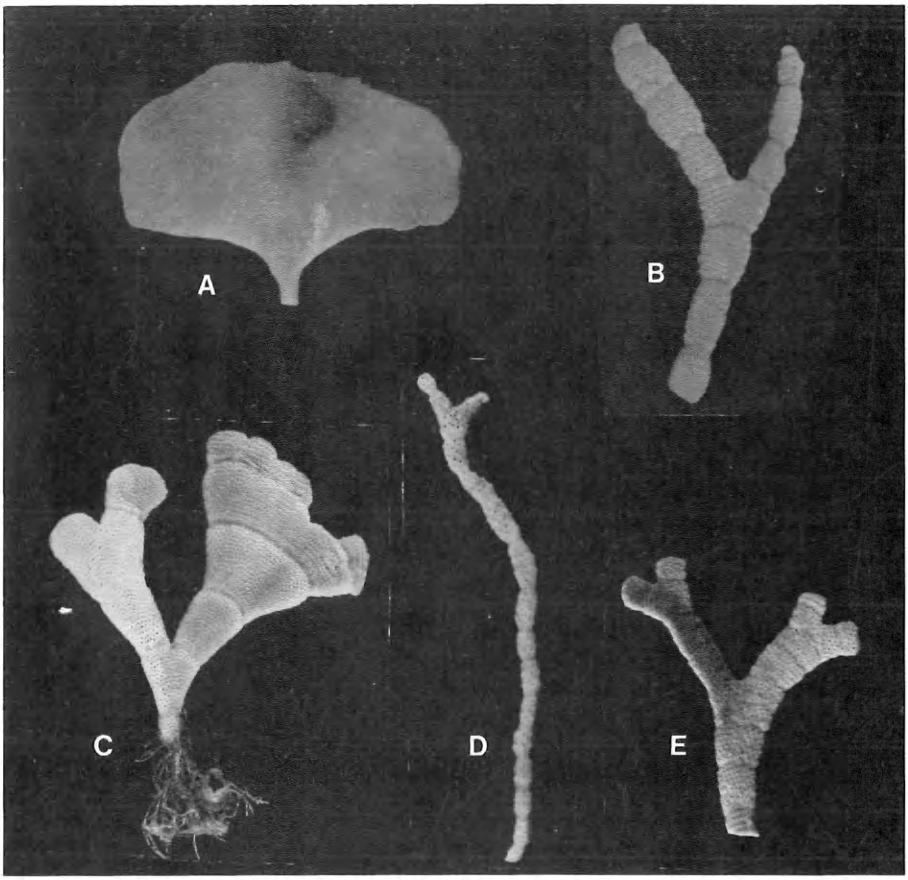


Fig. 5. Colony form in some *Cellarinella* species. A. *C. latilaminata*, Signy Id., height 45 mm. B. *C. rogickae*, Ross Sea, height 49 mm. C. *C. watersi*, Signy Id., height 63 mm. D. *C. margueritae*, Ross Sea, height 65 mm. E. *C. nutti*, Ross Sea, height 34 mm.

The Hippothoomorpha is even less well represented in Antarctica than the umbonulomorphs, comprising just the two families Hippothoidae (Figs 148–150) and Catenicellidae (Fig. 4A), neither of which includes species with large or conspicuous colonies. In this infraorder frontal shield morphology is of a type referred to as gymnocystidean (Fig. 2), formed simply by complete calcification of the primitively membranous outer body wall. A portion of the body wall proximal to the orifice invaginates to form a cuticle-lined sac, the ascus, which constitutes a new type of compensating space, again morphologically exterior to the zooid. In the Lepraliomorpha an ascus is also present beneath a completely calcified frontal shield (Fig. 2). In this infraorder, however, the frontal shield is of a type referred to as cryptocystidean, by analogy with the Cryptocystomorpha. It develops as a calcified plate beneath the frontal body wall, which remains membranous, and is separated from it by a coelomic space, the hypostegal coelom, which communicates with the main coelom of

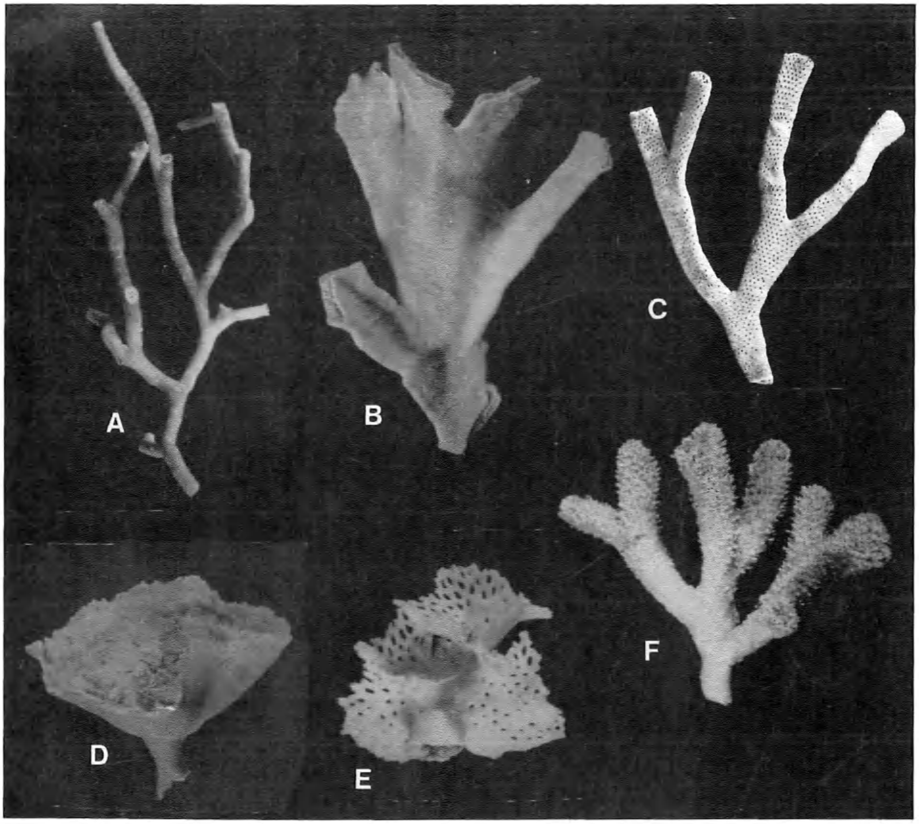


Fig. 6. Colony form in some cheilostomates. A. *Cellarinella foveolata,* Ross Sea, height 76 mm. B. *Cellarinelloides crassus,* Ross Sea, height 74 mm. C. *Systenopora contracta,* Ross Sea, height 62 mm. D. *Smittina abditavicularis,* Ross Sea, height 32 mm. E. *Reteporella hippocrepis,* Ross Sea, height 28 mm. F. *Orthoporidra compacta,* Signy Id., height 40 mm.

the zooid via frontal septula. The Lepraliomorpha presently includes the majority of the Antarctic Ascophorina. It includes one family, the Eminooeciidae, and a number of genera that appear to be endemic to Antarctica, but also a number of others, such as *Smittina, Fenestrulina, Osthimosia* and *Reteporella,* which have wide geographical distributions outside Antarctica, but seem to be especially rich in species in Antarctic shelf seas. Many form massive, branched or lamellar colonies (Fig. 6) which appear to be long-lived, while others occur only as tiny patches or pisiform nodules. The entire spectrum of cheilostomate polymorphism is seen in this infraorder.

3 BIOLOGY AND ECOLOGY

The Bryozoa, and especially the Cheilostomatida, are uniquely a major part of the marine benthic community over large areas of the Antarctic continental shelf. In parts of the North Sea, and in Tasman Bay, New Zealand (Bradstock and Gordon 1983), bryozoan communities constitute the larger part of the sessile, benthic biomass, but nowhere except Antarctica do they achieve such a conspicuous presence over such wide geographical areas. Together with sponges they are the most significant occupiers of space (Bullivant 1961) and bryozoan skeletons and sponge spicules may comprise the larger part of the coarse bottom sediment (Bullivant 1967). These bryozoan communities have received only passing attention from ecologists, at least partly because of their inaccessibility, and because of the extreme difficulties attending field ecology in Antarctica. In McMurdo Sound, Ross Sea, stable benthic communities of sessile filter-feeding animals, with their attendant epizoites and predators, develop below the reach of ice scour and anchor ice formation, i.e., below 30 m, and between 30 and 60 m sponges appear to be the major space occupiers, although some erect bryozoans are quite common (Dayton *et al.* 1974). Winston (1983) recorded several species of *Cellarinella* and *Melicerita,* both of which produce erect, rigid colonies, at 55 benthic stations in the Ross Sea, but found that they reached greatest abundance at 300–600 m. Off the South Shetland Isles mixed communities of sessile, filter-feeding organisms were richly developed at 80–110 m (Winston and Heimberg 1988), and bryozoans constituted 14.6% of the total biomass, ascidians 18.7% and sponges 31.7%.

The ecology of Antarctic bryozoans ought to prove especially interesting, if analogies may be drawn with the sponge communities studied by Dayton *et al.* (1974). The Antarctic benthic environment is undeniably harsh, but it is predictable and stable, and below the limit of the ice physical disturbance is a rare, random event. Under these conditions the structure of the benthic community is largely mediated by interactions between the constituent species. However, for bryozoans, and indeed for the larger part of the Antarctic benthos, direct field observations and measurements, and experimental ecological information, are rare and insights into bryozoan ecology must of necessity be based on inferences drawn from preserved samples, interpreted in the light of the few ecological investigations so far achieved. As with certain other Antarctic marine invertebrates, bryozoans have been characterized as large, long-lived, slow growing and lightly calcified. These generalizations have been based on relatively few faunal accounts, which in turn have usually been based on rather small collections of the larger, more conspicuous and most abundant species. Winston and Heimberg (1988) found that the Low Island bryozoan benthos was dominated by five species with erect, lightly calcified, foliaceous colonies, and bottom samples in all Antarctic collections have often consisted of just one, or a very few, species with large overall colony size. The North Sea species

Flustra foliacea (Linn.) attains a height of 20 cm, may live beyond 12 years (Stebbing 1971) and displays an annual growth rate little more than those recorded by Winston and Heimberg (1988) for similar Antarctic flustrines. Bradstock and Gordon (1983) recorded equally large colonies of ascophorine Cheilostomatida in the Tasman Sea, and the largest recorded bryozoan colony still seems to be the specimen of *Pentapora fascialis* (Pallas) from south-west England, described by Hincks (1880a) as 'exceeding seven feet in circumference'. Further, while four of the five species noted by Winston and Heimberg (1988) were long-lived perennials, *Carbasea ovoidea*, which grew equally large, was an annual species, with a yearly growth increment more than five times that of the others. Calcification is energetically expensive in polar environments, and it is probably true that fast growing annual species, such as *C. ovoidea*, are lightly calcified for that reason, that long-lived lightly calcified species must rely on forms of defence other than that provided by calcification, and that thick calcification can occur in long-lived slow growing species. However, there are numerous apparently long-lived species with erect, plate-like colonies, such as *Isoschizoporella tricuspis*, which are lightly calcified and extremely brittle while not appearing to possess any additional defensive capability, judging from the degree of fouling and boring seen on most specimens. The reticulate colonies of certain Antarctic species of *Reteporella* (Fig. 6) grow larger than those of related species anywhere else in the world, yet are no more nor less heavily calcified. *Orthoporidra compacta* (Fig. 6) common in many parts of Antarctica, produces massive, branching colonies, up to 5 cm in height and spread, with the branches 1 cm or more in thickness. Thus, there are no easy generalizations to be made about the Antarctic Cheilostomatida.

An assumption that might be introduced with more confidence is that Antarctic bryozoan communities will prove to be as speciose and complex as those of equally stable tropical communities. As sampling becomes more comprehensive, and more selective in the sense of examining formerly neglected habitats, and as taxonomic research increases without the pressure to produce completed expedition reports, so the roll of species steadily rises. The broken and eroded fragments of larger species are colonized by numerous species, which appear to have small definitive colony size, which breed at a small size and perhaps thereafter die. They are possibly short-lived annual species, comparable to those found in shell gravel habitats in temperate seas (Grant and Hayward 1985; Bishop 1994). In the past these small species have frequently been overlooked, probably because of the onerous demands of sorting by microscope through volumes of bryozoan fragments. Certain other species seem to occur most frequently as epizoites of larger bryozoan species. They may themselves be quite extensive, e.g., *Trilaminopora trinervis*, and may perhaps be adapted to their particular niche to the extent that they do not survive the destruction of their host colony, being unable to live on fragments. Discovery of these species demands examination of the basal regions and abfrontal surfaces of large plate-like, folded or enrolled colonies. This is easily achieved with broken or damaged specimens of large bryozoans, but the conscientious taxonomist baulks at destroying good specimens on the chance of finding cryptic epizoites. Many new species of Antarctic Cheilostomatida have been described in recent years, often from small or cryptic substrata, and it is certain that many more await discovery. Once species diversity can be accurately estimated for particular habitats, then objectives for ecological research will be much clearer.

The only significant contribution to the study of life cycles in Antarctic bryozoans is that of Winston (1983) who considered growth, reproduction and mortality in two cheilostomate types, *Melicerita obliqua*, an erect cryptocystomorph, and three species of *Cellarinella*, a genus of erect, heavily calcified ascophorines. All four species were apparently slow growing, long-lived perennials. Their colonies showed regular, transverse growth checks (Fig. 5) reflecting pauses in calcification which were assumed to have an annual periodicity and thus could be used to age individual colonies. *Cellarinella* showed 10 to 22 growth checks, *Melicerita* up to 22, and maximum internode length was only 5.6 cm, suggesting that all four species were very slow growing and very long-lived. *Melicerita* appeared to recommence skeletal growth in late summer, while the *Cellarinella* species began in early winter and continued into late winter. Reproductive rates varied markedly between the two cheilostomate types, with *Cellarinella* producing an estimated 5–10 embryos per colony annually compared to 100–200 for *Melicerita*, and these differences reflected profoundly different life strategies. All of the *Cellarinella* colonies examined by Winston (1983) showed evidence of continuous regenerative growth; none displayed a complete astogenetic sequence and none had the ancestrula intact, while many appeared to have originated from broken colony fragments. Conversely, the *Melicerita* specimens each represented a complete colony with all astogenetic stages visible, and most often with the originating ancestrula still present. *Cellarinella* populations thus appear to be clones of regenerated fragments in which asexual propagation is more significant in maintaining the population than sexual reproduction. In contrast, the *Melicerita* populations consisted of sexually originated colonies, regenerative growth did not occur and sexual reproduction maintained the population. However, while regenerative growth appeared to be more important than sexual reproduction in individual colonies, Winston (1983) noted the possibility that the reproductive output of a *Cellarinella* thicket was perhaps comparable to that of a *Melicerita* colony. *Polirhabdotos inclusum* is another erect species that appears to exist as continually regenerating clonal thickets (Hayward and Thorpe 1987), and in which the reproductive output of single colonies appears to be on a par with that of *Cellarinella*, but much more variable. Periodic growth checks and ovicell banding (Fig. 5) are a feature of many of the larger Antarctic Cheilostomatida, and may eventually prove to be of considerable significance in comparative studies of growth and reproduction among the bryozoan benthos, particularly as Winston's (1983) data suggested that the timing of skeletal growth, perhaps including the production of brood chambers, and thus the sexual reproduction cycle, varied between species. At present, such ecological data that are available do not include good serial samples over protracted periods of time. Moyano (1984a) reported the settlement of 46 bryozoan species on artificial surfaces in the Ross Sea over a ten-year period, but as the data was provided for him it excluded any record of the time and duration of immersion of the settlement plates. Growth and reproduction and their timing, duration and rates in relation to the constant and predictable seasonal physical phenomena in Antarctic habitats offer tremendous potential for research, especially considering the diversity of colony size and form, and hence life strategies, present among the bryozoan fauna of single, limited habitats.

Sanderson, Thorpe and Clarke (1994) produced the first experimental study of feeding in Antarctic bryozoans, using aquarium-maintained colonies of the erect, flustriform *Himantozoum antarcticum* collected from Signy Island. The lophophore of *H. antarcticum* is large compared with those of most temperate and tropical bryozoans. Its feeding rate (estimated as the mean feeding current velocity) was comparable to that recorded for temperate species feeding at the lower end of the temperature range at which they were active. At low temperatures its feeding rate matched that of the northern temperate species *Flustrellidra hispida* (Fabricius), but as *F. hispida* was one of the few temperate species with a much larger tentacle bell than *H. antarcticum*, and considering the 50% increase in water viscosity experienced by *H. antarcticum*, the latter was clearly the more efficient feeder at low temperatures. The feeding rate of *H. antarcticum* fluctuated in response to food availability, increasing with increasing particle concentration, but not declining through predicted satiation. Whilst able to take advantage of periods of maximum food abundance, it seems that *H. antarcticum* is especially adapted to maintain efficient feeding at times of food shortage. It remains to determine whether this simply enables the colony to sustain itself through seasonal periods of shortage, or whether its feeding efficiency allows it to continue growth and reproduction. Seasonal growth checks in calcified colonies might then simply reflect pauses in the energetically expensive process of skeletal growth, and it is possible that other physiological processes might be less dependent on seasonally varying food supplies than is supposed. In some species, including *Polirhabdotos inclusum* and most species of *Cellarinella*, the orifices of zooids in the basal regions of the colony become sealed by calcification. This may be a defensive measure, preventing the occupation of non-feeding zooids by folliculinids, or other small, sessile organisms, or an anti-predator measure. But it is possible, especially in species with developed regenerative abilities, in which the eventual loss of the colony base is unimportant, that the colony is simply closing down and abandoning its lower regions, so that resources may be concentrated in actively growing and reproducing parts of the colony.

4 ZOOGEOGRAPHY

The bryozoan collections of the *Belgica* Expedition were the first strictly Antarctic samples to be made available for specialist study. Their importance was fully appreciated by A.W. Waters (1904), who considered that they demonstrated the existence of a highly distinctive Antarctic fauna that would prove to be very much more diverse than these first collections showed. In his discussion of geographical distributions Waters (1904) brusquely disposed of the bipolar theory of distribution, applied to Bryozoa by Pfeffer (1890), and remarked that Pfeffer's material consisted of just 18 species, of Subantarctic rather than Antarctic origin, which were anyway probably incorrectly identified. The first systematic treatment of Antarctic bryozoan distribution patterns was that of Hastings (1943), who carefully distinguished between the Antarctic and Subantarctic realms, and assigned the islands of the Southern Ocean to one or other of the two on hydrological and faunistic grounds. She tabulated the distribution of 60 species and varieties of (mostly) Buguloidea represented in the *Discovery* collections, including 17 that had occurred only at abyssal depths. Only seven of these taxa were collected from both Antarctic and Subantarctic localities, and of these only *Caberea darwinii* achieved a wide geographical distribution in both realms. Hastings (1943) noted the faunal similarities between the deep outer Patagonian Shelf and the Antarctic peninsula, which appeared to support one prevalent view for the origins of the Antarctic fauna as a whole. Another opinion, that the Antarctic fauna arose through the immigration of ancestral stocks from abyssal habitats (Levinsen 1917), was not favoured by the *Discovery* results.

In her final paper on Antarctic Bryozoa Rogick (1965) stated that 321 species had been recorded from Antarctic regions, as defined by Hastings (1943), and tabulated 179 that had been recorded only from Antarctica, and that could thus be considered to be endemic species. Of these, 158 belonged to the Cheilostomatida. Obviously, the quality of zoogeographical analysis, and the value of any conclusions it offers, depend ultimately on sound faunistics. Any analysis of Antarctic bryozoan distributions is still premature when such large areas of the benthic realm have still to be fully explored, and when the rate of discovery of new species is still comparatively high, although the regular updating of checklists is useful in determining in which geographical areas and for which systematic groups information is both reliable and extensive. Hastings' (1943) initial survey was unusually well founded, and the distribution patterns she observed have proved to be applicable to an increasing number of species. Her results were based on very large collections, made over a span of approximately 30 years, and encompassing a very wide geographical range. She was able to incorporate Kluge's (1914) data, following taxonomic revision, and the smaller contributions of Waters (1904) and Calvet (1909). She limited herself to just six families, and the thoroughness of her work is attested by the fact that, although some of her species have recently been subject to taxonomic revision, few further species of Buguloidea have since been described from Antarctica. Rogick's work (1955–1965) covered a broader taxonomic spectrum than that of Hastings, but the material she had to work with was unfortunately very limited and from comparatively few localities.

In defining the Antarctic bryozoan fauna and in plotting the geographical distributions of the different species it is important to consider that of the Subantarctic regions of South America, the Magellanic province, especially as in the past it has often been treated together with the Antarctic peninsula and the Scotia Arc. Moyano's research (1982, 1983, 1991) on the Chilean fauna has contributed significantly towards a clarification of the faunal differences between the two regions, and provides a different perspective on the origin of the Antarctic fauna. A study of the distribution of 195 species from Chile, including the Juan Fernandez Islands, highlighted the faunal dissimilarity between the Magellanic province and Antarctica (Moyano 1982), and emphasized the sharp discontinuity between the bryozoan faunas of the Patagonian Shelf and the Scotia Arc. It was also noted (Moyano 1983) that the origins and evolutionary history of the Bryozoa of both Antarctica and magellanic South America could not be understood without reference to the still poorly known but very extensive Tertiary fossil faunas of Patagonia. In tabulating the distribution of 267 Chilean species, including the Easter Island fauna, Moyano (1983) strengthened his previous conclusions and pointed out that the origins of certain elements of the Antarctic fauna, such as the diverse Phidoloporidae, might be sought in Australian Tertiary faunas, where systematically related groups were apparently common. This suggestion was simultaneously put by Winston (1983) who proposed an Australian Tertiary ancestral stock for both *Cellarinella* and *Melicerita.* Moyano (1985b) refined his argument in his study of the Lekythoporidae, an essentially southern hemisphere, cold-water family with representative species in Antarctica, South America, South Africa and Australia. He proposed that the present day lekythoporids evolved from ancestral stocks in a Weddellian province of Gondwanaland. Moyano's most recent (Moyano 1991) analysis of the Chilean fauna, again including Easter Island, listed 470 species. The basic weakness of much of the currently available data on Antarctic faunas was revealed by a curious anomaly in a dendrogram of affinity based on the Kulzinsky 2 Index. This showed a 65% similarity between the bryozoan fauna of South Georgia and that of the Ross Sea, but only a 40% similarity between South Georgia and the nearby Shag Rocks. Such a result is directly attributable to the paucity of basic faunistic data for much of the Antarctic realm.

Antarctic zoogeography is thus still little further forward than it was following Hastings' (1943) survey of the Buguloidea, and detailed analysis is pointless until a sound faunistic basis has been achieved. The geographical distributions given for each species described here incorporate all reliable published references, and all of the material identified in the course of this work. The systematic list of species that precedes the main key may be considered the most current checklist of the Antarctic Cheilostomatida, and on the basis of this and previous works it is possible to indicate which species appear to be endemic to

Antarctica, and might thus be considered to have evolved there. Species presently known only from the region of the Antarctic Peninsula and the Scotia Arc are also indicated, as are those which have so far only been found in the Ross Sea. While the list will certainly lengthen as taxonomic research continues, and while the preliminary categorization of the species is equally certain to be modified, it is not unreasonable at this point to make a few generalizations.

The fauna described in this synopsis comprises 264 species of Cheilostomatida. Of these 215 are here regarded as endemic Antarctic species; this figure, 81%, is high for any invertebrate group, for any zoogeographic region. Thirteen superfamilies, 31 families and 99 genera are represented in the fauna (Table 2). None of the superfamilies or families is endemic, and perhaps very few of the genera either. However, this last point is difficult to judge. Taxonomic revision of Antarctic Cheilostomatida in recent years has led to the introduction of many new genera, either for the reception of distinctive new species, or for previously described species now recognized as systematically unrelated to the genera to which they had been assigned. At present, a substantial number of these genera is monotypic, for endemic Antarctic species, but it is possible that additional species may be attributed to those genera from regions outside Antarctica. Despite these reservations, it is nonetheless possible to view certain genera as endemic to the Antarctic Seas. For example, *Klugeflustra* comprises four species with strictly Antarctic distributions; all have been recognized for more than 50 years (though the genus is more recent) and no further species have been described for almost as long. *Nematoflustra* is also a recent genus for a long established Antarctic species, and is presently monotypic. Both of these genera seem to be likely Antarctic endemics. *Icelozoon* and *Exallozoon* are two chaperiid genera introduced by Gordon (1982) for three Antarctic endemics, and both Gordon and subsequent authors (Hayward and Thorpe 1988d) failed to discover additional species in extensive systematic studies of southern hemisphere Chaperiidae. It is not unreasonable to regard both genera as Antarctic endemics. *Camptoplites* is not endemic to Antarctica, but nine of the ten Antarctic species are, and the genus is elsewhere represented by a very few species from essentially abyssal habitats. Among the Cellarioidea, *Swanomia* (three species) and *Larvapora* (one species) are unrecorded outside of Antarctica, and in the Sclerodomidae 14 of the 15 known species of *Cellarinella* are Antarctic endemics while the fifteenth, unfortunately the genus type, is perhaps only remotely related to the others. *Isoschizoporella* (Schizoporelloidea) is a distinctive genus with four species presently referred to it, all of them known only from Antarctica. Finally, the three known species of *Orthoporidra* (Lekythoporidae) are endemic to Antarctica, while the other genera referred to the family have entirely southern hemisphere, cold-water geographical distributions.

The Antarctic Cheilostomatida is systematically diverse. The Schizoporelloidea is the most richly represented superfamily with 63 species, 58 of them endemic, in seven families. Among these the Smittinidae is the largest, with 34 species (33 endemic) in 12 genera. It is probable that a number of new genera will eventually be recognized among the Antarctic Smittinidae, most especially for some of the species presently assigned to the apparently cosmopolitan

Table 2 Summary of the described Antarctic Cheilostomatida

	Species total	Total endemic species
Superfamily SCRUPARIOIDEA	3	1
1. Scrupariidae	3	1
Superfamily MEMBRANIPOROIDEA	35	29
2. Electridae	2	1
3. Flustridae	11	10
4. Calloporidae	11	10
5. Chaperiidae	11	8
Superfamily BUGULOIDEA	48	30
6. Bugulidae	20	15
7. Cabereidae	21	12
8. Beaniidae	7	3
Superfamily MICROPOROIDEA	7	3
9. Microporidae	6	2
10. Onychocellidae	1	1
Superfamily CELLARIOIDEA	23	17
11. Cellariidae	20	15
12. Aspidostomatidae	3	2
Superfamily ARACHNOPUSIOIDEA	11	10
13. Arachnopusiidae	11	10
Superfamily CRIBRILINOIDEA	4	4
14. Cribrilinidae	4	4
Superfamily UMBONULOIDEA	34	32
15. Umbonulidae	1	1
16. Exochellidae	15	14
17. Lepraliellidae	1	1
18. Metrarabdotosidae	1	1
19. Sclerodomidae	16	15
Superfamily HIPPOTHOOIDEA	7	3
20. Hippothoidae	7	3
Superfamily CATENICELLOIDEA	1	1
21. Catenicellidae	1	1
Superfamily SCHIZOPORELLOIDEA	63	58
22. Eminooeciidae	5	5
23. Hippopodinidae	6	6
24. Hippoporinidae	1	1
25. Schizoporellidae	4	2
26. Smittinidae	34	33
27. Inversiulidae	1	1
28. Microporellidae	12	11
Superfamily CELLEPOROIDEA	24	23
29. Celleporidae	14	13
30. Phidoloporidae	10	10
Superfamily CONESCHARELLINOIDEA	4	4
31. Lekythoporidae	4	4

Smittina (13 Antarctic species, all endemic). It is equally probable that some of the genera assigned here to the Smittinidae will be transferred to other families, or even superfamilies, as the phylogeny of the Cheilostomatida becomes more clearly understood. The Buguloidea is the next most diverse superfamily, with 48 species (30 endemic) in three families, followed by the Membraniporoidea with 35 species (29 endemic) in five families. The family

Membraniporidae, however, has not been reported from Antarctic waters, presumably because worldwide the distribution of membraniporids is governed by the distribution of suitable macroalgal substrata. The Umbonuloidea is represented by 34 species in Antarctica, with 29 of the 32 endemic umbonuloids belonging to the Exochellidae and the Sclerodomidae. The Celleporoidea (24 species, 23 endemic) and the Cellarioidea (23 species, 17 endemic) are also very diverse, though encompassing few families, but there is a large interval between them and the next most diverse group, the Arachnopusioidea, which has 11 species (10 endemic) in the single family Arachnopusiidae.

It was noted above that few new species of Buguloidea have been described from Antarctica since Hastings' (1943) Discovery report.* In that time there have been also comparatively few new species described in the Flustridae, Microporidae, Cellariidae, Sclerodomidae or Cribrilinidae. The rate of discovery of new species has been highest in recent years in these groups which have always posed difficulties in identification, such as the Celleporidae, and in which taxonomy has only begun to improve following the wider use of SEM in comparative morphological studies. In others, such as the Exochellidae, Microporellidae and Smittinidae, problems of identification have been compounded by taxonomic confusion, and are also more easily solved by SEM examination and the recognition of fine-scale morphological characteristics. It is probable that a substantial number of Antarctic Cheilostomatida remains to be described, and will be recognized in the next few years. They will result partly from taxonomic revision leading to a better definition of species' identities in some families, and partly through the recognition of species typically developing small, inconspicuous or cryptic colony forms.

*LIU and HU (1991) described a collection of cheilostomate Bryozoa from off the Antarctic Peninsula which included a new species of *Camptoplites*. Their paper was received as this volume was going to press.

5 SYSTEMATIC LIST OF SPECIES DESCRIBED

Endemic species are marked with an asterisk (*). A, Presently recorded only from the Ross Sea; B, presently recorded only from the Antarctic Peninsula and/or the Scotia Arc.

Order CHEILOSTOMATIDA
Suborder INOVICELLINA
Superfamily Aeteoidea
Family Aeteidae
Aetea anguina (Linn.)
Aetea ligulata Busk

Suborder SCRUPARIINA
Superfamily Scruparioidea
Family Scrupariidae
**Brettiopsis triplex* (Hastings)
Leiosalpinx inornata (Goldstein)
Scruparia ambigua (d'Orbigny)

Suborder MALACOSTEGINA
Superfamily Membraniporoidea
Family Membraniporidae
Membranipora de Blainville

Family Electridae
Electra longispina (Calvet)
**Harpecia spinosissima* (Calvet)

Suborder NEOCHEILOSTOMINA
Infraorder PSEUDOMALACOSTEGOMORPHA
Superfamily Flustroidea
Family Flustridae
**Carbasea curva* (Kluge)
Carbasea ovoidea Busk
**Klugeflustra antarctica* (Hastings)
**Klugeflustra drygalskii* (Kluge)
*B *Klugeflustra onychocelloides* (Calvet)
**Klugeflustra vanhoffeni* (Kluge)
**Isosecuriflustra angusta* (Kluge)
**Isosecuriflustra tenuis* (Kluge)
**Isosecuriflustra thysanica* (Moyano)
**Austroflustra vulgaris* (Kluge)
**Nematoflustra flagellata* (Waters)

Superfamily Calloporoidea
Family Calloporidae
*B *Pyriporoides uniserialis* (Waters)
**Ellisina antarctica* Hastings
**Ellisina constantia* (Kluge)
*B *Amphiblestrum familiaris* Hayward and Thorpe
Amphiblestrum georgensis Hayward and Thorpe
*B *Amphiblestrum inermis* (Kluge)
*A *Amphiblestrum rossi* Hayward and Thorpe
**Crassimarginatella inconstantia* (Kluge)
**Crassimarginatella perlucida* (Kluge)
**Valdemunitella lata* (Kluge)
*B *Xylochotridens rangifer* Hayward and Thorpe

Family Chaperiidae
Chaperiopsis cervicornis (Busk)
Chaperiopsis galeata (Busk)
*B *Chaperiopsis orbiculata* Hayward and Thorpe
Chaperiopsis patulosa (Waters)
*B *Chaperiopsis protecta* (Waters)
**Chaperiopsis quadrispinosa* (Kluge)
*B *Chaperiopsis rotundata* Hayward and Thorpe
*B *Chaperiopsis signyensis* Hayward
**Icelozoon dichotomum* (Kluge)
**Icelozoon lepralioides* (Kluge)
**Exallozoon simplicissimum* (Kluge)

Infraorder CELLULARIOMORPHA
Superfamily Buguloidea
Family Bugulidae
Bugula longissima Busk
**Bugulella klugei* (Hastings)
**Camptoplites bicornis* (Busk)
**Camptoplites angustus* (Kluge)

Camptoplites areolatus (Kluge)
Camptoplites asymmetricus (Hastings)
**Camptoplites giganteus* (Kluge)
**Camptoplites latus* (Kluge)
**Camptoplites lewaldi* (Kluge)
*A *Camptoplites rectilinearis* Hastings
**Camptoplites retiformis* (Kluge)
**Camptoplites tricornis* (Waters)
**Cornucopina lata* (Kluge)
*B *Cornucopina ovalis* Hastings
Cornucopina pectogemma (Goldstein)
**Cornucopina polymorpha* (Kluge)
**Himantozoum antarcticum* (Calvet)
Himantozoum obtusum Hastings
Klugella buski Hastings
**Klugella echinata* (Kluge)

Family Cabereidae
Caberea darwinii Busk
**Amastigia antarctica* (Kluge)
Amastigia benemunita (Busk)
**Amastigia cabereoides* (Kluge)
Amastigia crassimarginata (Busk)
**Amastigia gaussi* (Kluge)
Amastigia kirkpatricki (Levinsen MS, in Harmer)
**Amastigia solida* (Kluge)
**Notoplites antarcticus* (Waters)
*A *Notoplites crassiscutus* Hastings
**Notoplites drygalskii* (Kluge)
Notoplites elongatus (Busk)
**Notoplites klugei* (Hasenbank)
**Notoplites tenuis* (Kluge)
*A *Notoplites uniserialis* Hastings
**Notoplites vanhoffeni* (Kluge)
**Notoplites watersi* (Kluge)
Tricellaria aculeata (d'Orbigny)
Menipea flagellifera Busk
Menipea kempi Hastings
Menipea patagonica Busk

Family Beaniidae
Beania challengeri Hastings
Beania costata (Busk)
**Beania erecta* Waters
**Beania erecta* var. *livingstonei* Hastings
Beania inermis (Busk)
Beania magellanica (Busk)
**Beania scotti* Hastings

Infraorder CRYPTOCYSTOMORPHA
Superfamily Microporoidea
Family Microporidae
**Micropora brevissima* Waters
Micropora notialis Hayward and Ryland
*B *Apiophragma hyalina* (Waters)
Andreella uncifera (Busk)
Flustrapora magellanica Moyano
Ogivalia elegans (d'Orbigny)

Family Onychocellidae
**Chondriovelum adeliense* (Livingstone)

Superfamily Cellarioidea
Family Cellariidae
**Cellaria aurorae* Livingstone
Cellaria clavata (Busk)
*A *Cellaria coronata* (Rogick)
**Cellaria diversa* Livingstone
**Cellaria incula* Hayward and Ryland
Cellaria malvinensis (Busk)
**Cellaria moniliorata* Rogick
*A *Cellaria sagittula* Hayward and Ryland
**Paracellaria wandeli* (Calvet)
Paracellaria calveti (D'Hondt)
*B *Paracellaria elephantina* Hayward and Thorpe
**Swanomia membranacea* (Thornely)
**Swanomia belgica* Hayward and Ryland
**Swanomia brevimandibulata* (Moyano)
Stomhypselosaria watersi Hayward and Thorpe
Melicerita blancoae López Gappa
*A *Melicerita digeronimoi* Rosso
*B *Melicerita flabellifera* Hayward and Winston
**Melicerita latilaminata* Rogick
**Melicerita obliqua* (Thornely)
Family Aspidostomatidae
Aspidostoma giganteum (Busk)
**Aspidostoma coronatum* (Thornely)
**Larvapora mawsoni* (Livingstone)

Suborder ASCOPHORINA
Infraorder CRIBRIOMORPHA
Superfamily Cribrilinoidea
Family Cribrilinidae

**Dendroperistomata projecta* (Waters)
*A *Figularia discors* Hayward and Taylor
**Filaguria spatulata* (Calvet)
**Klugerella antarctica* (Kluge)

Infraorder UMBONULOMORPHA
Superfamily Arachnopusioidea
Family Arachnopusiidae
Arachnopusia monoceros (Busk)
**Arachnopusia aquilina* Moyano
*B *Arachnopusia aviculifera* Hayward and Thorpe
*B *Arachnopusia columnaris* Hayward and Thorpe
**Arachnopusia decipiens* Hayward and Thorpe
*B *Arachnopusia ferox* Hayward and Thorpe
**Arachnopusia gigantea* (Kluge)
**Arachnopusia inchoata* Hayward and Thorpe
**Arachnopusia latiavicularis* Moyano
*B *Arachnopusia tubula* Hayward and Thorpe
**Trilaminopora trinervis* (Waters)

Superfamily Umbonuloidea
Family Umbonulidae
**Astochoporella cassidula* Hayward and Thorpe

Family Exochellidae
Exochella longirostris Jullien
**Exochella avicularis* Hayward
*B *Exochella elegans* Hayward
**Exochella hymanae* (Rogick)
**Exochella rogickae* Hayward
*B *Exochella umbonata* Hayward
**Escharella mamillata* Hayward and Thorpe
**Escharella watersi* Hayward and Thorpe
**Escharoides praestita* (Waters)
*B *Escharoides torquata* Hayward and Ryland
**Escharoides tridens* (Calvet)
**Romancheina asymmetrica* Moyano
**Romancheina barica* (Rogick)
**Antarcticaetos bubeccata* (Rogick)
**Lageneschara lyrulata* (Calvet)

Family Lepraliellidae
*A *Acanthophragma polaris* Hayward

Family Metrarabdotosidae
**Polirhabdotos inclusum* (Waters)

Family Sclerodomidae
*B *Cellarinella anomala* Hayward and Ryland
Cellarinella dubia Waters
*A *Cellarinella edita* Hayward and Ryland
**Cellarinella foveolata* Waters
**Cellarinella latilaminata* Moyano
**Cellarinella laytoni* Rogick
**Cellarinella margueritae* Rogick
**Cellarinella njegovanae* Rogick
**Cellarinella nodulata* Waters
**Cellarinella nutti* Rogick
**Cellarinella rogickae* Moyano
**Cellarinella rossi* Rogick
*B *Cellarinella terminata* Hayward and Winston
*B *Cellarinella virgula* Hayward and Ryland
**Cellarinella watersi* Calvet
**Cellarinelloides crassus* Moyano
**Systenopora contracta* Waters

Infraorder HIPPOTHOOMORPHA
Superfamily Hippothooidea
Family Hippothoidae
**Plesiothoa calculosa* Hayward
Hippothoa flagellum Manzoni
Celleporella alia Hayward
**Celleporella antarctica* Moyano and Gordon
Celleporella bougainvillei (d'Orbigny)
*B *Celleporella dictyota* Hayward
Celleporella discreta (Busk)

Superfamily Catenicelloidea
Family Catenicellidae
**Talivittaticella frigida* (Waters)

Infraorder LEPRALIOMORPHA
Superfamily Schizoporelloidea
Family Eminooeciidae
**Eminooecia carsonae* (Rogick)
**Isoschizoporella tricuspis* (Calvet)

**Isoschizoporella secunda* Hayward and Taylor
**Isoschizoporella similis* Hayward and Thorpe
*A *Isoschizoporella virgula* Hayward and Thorpe

Family Hippopodinidae
**Dakariella dabrowni* (Rogick)
*A *Dakariella concinna* Hayward
*B *Trilochites biformatus* (Waters)
*B *Ralepria conforma* Hayward
**Toretocheilum absidatum* Rogick
**Toretocheilum turbinatum* Hayward

Family Hippoporinidae
**Kymella polaris* (Waters)

Family Schizoporellidae
**Buffonellodes antarctica* Hayward

Family Lacernidae
Lacerna eatoni (Busk)
Lacerna hosteensis Jullien
**Lacerna watersi* Hayward and Thorpe

Family Smittinidae
**Smittina abditavicularis* Rogick
**Smittina alticollarita* Rogick
**Smittina anecdota* Hayward and Thorpe
**Smittina antarctica* (Waters)
*A *Smittina diffidentia* Hayward and Thorpe
**Smittina directa* (Waters)
**Smittina glebula* Hayward and Thorpe
**Smittina incernicula* Hayward and Thorpe
**Smittina excertaviculata* Rogick
**Smittina obicullata* Rogick
**Smittina pileata* (Waters)
*B *Smittina pocilla* Hayward and Thorpe
**Smittina rogickae* Hayward and Taylor
*A *Smittoidea albula* Hayward and Taylor
Smittoidea conspicua (Waters)
**Smittoidea malleata* Hayward and Thorpe
**Smittoidea ornatipectoralis* Rogick
**Smittoidea pugiuncula* Hayward and Thorpe
**Smittoidea rhynchota* Hayward and Thorpe
**Aimulosia antarctica* (Powell)
Aimulosia australis Jullien
**Hippadenella inerma* (Calvet)
**Smittinella rubrilingulata* Rogick
**Thrypticocirrus contortuplicata* (Calvet)
**Thrypticocirrus phylactelloides* (Calvet)
*A *Thrypticocirrus rogickae* Hayward and Thorpe
**Pemmatoporella marginata* (Calvet)
**Bostrychopora dentata* (Waters)
**Rhamphosmittina bassleri* (Rogick)
**Aspericreta crassatina* (Waters)
**Aspericreta favulosa* (Hayward and Thorpe)
*B *Aspericreta georgensis* Hayward and Thorpe
*A *Tracheloptyx antarctica* Hayward
*B *Hippomonavella pellucidula* (Calvet)

Family Inversiulidae
Inversiula nutrix Jullien

Family Microporellidae
**Microporella stenoporta* Hayward and Taylor
**Fenestrulina antarctica* Hayward and Thorpe
*A *Fenestrulina cervicornis* Hayward and Ryland
**Fenestrulina crystallina* Hayward and Ryland
*B *Fenestrulina exigua* (Waters)
Fenestrulina fritilla Hayward and Ryland
*B *Fenestrulina jocunda* Hayward and Ryland
Fenestrulina parvipora (Waters)
*B *Fenestrulina proxima* (Waters)
*B *Fenestrulina rugula* Hayward and Ryland
**Adelascopora jeqolqa* Moyano

*B *Adelascopora secunda* Hayward and Thorpe

Superfamily Celleporoidea
Family Celleporidae
Osthimosia bicornis (Busk)
**Osthimosia clavata* (Waters)
*A *Osthimosia claviformis* Hayward
*B *Osthimosia curtioscula* Hayward
*B *Osthimosia fusticula* Hayward
**Osthimosia malingae* Hayward
**Osthimosia mariae* Hayward
**Osthimosia milleporoides* (Calvet)
**Osthimosia notialis* Hayward
**Osthimosia phalacrocoraca* Hayward
*B *Osthimosia rudicula* Hayward
*B *Buffonellaria frigida* (Waters)
*B *Galeopsis bullatus* Hayward
**Spigaleos horneroides* (Waters)

Family Phidoloporidae
**Reteporella antarctica* (Waters)
**Reteporella erugata* Hayward
**Reteporella frigida* (Waters)
**Reteporella gelida* (Waters)
**Reteporella hippocrepis* (Waters)
**Reteporella lepralioides* (Waters)
**Reteporella longichila* Hayward
*A *Reteporella parva* Hayward
*B *Reteporella protecta* (Waters)
*B *Rhynchozoon fistulosum* Hayward

Superfamily Conescharellinoidea
Family Lekythoporidae
**Turritigera cribrata* Hayward
**Orthoporidra compacta* (Waters)
**Orthoporidra brachyrhyncha* Moyano
**Orthoporidra stenorhyncha* Moyano

6 KEY TO GENERA OF ANTARCTIC CHEILOSTOMATIDA

1. **Colony form unique** (Fig. 7): consisting of a closely encrusting, branching, stolonal portion, swollen at regular intervals, with a slender, erect cylinder, 0.5–1.5 mm long, bearing a terminal frontal membrane, rising from each swelling .... *Aetea* (p. 52)
   Colony not as described **2**
2. **Colony erect, flexible**, branching, jointed or unjointed; lightly calcified and frondose; **or** with autozooids in single to multiple series, dividing dichotomously; **or** arranged in slender cylinders linked by flexible chitinous joints **3**
   Colony erect, rigid; twig-like, reticulate, plate-like, or massive; **or** encrusting. Not flexible **33**
3. **Frontal wall of autozooid calcified**, with or without an overlying membrane. Operculum fitting more or less exactly over the aperture in a gymnocystal calcified wall 4
   Frontal wall of autozooid entirely membranous, or with peripheral calcification variously developed, but operculum always set in a distinct frontal membrane which is not underlain completely by calcified cryptocyst 9
4. Colony frondose, unjointed; or with slender branches linked by chitinous joints. Autozooids with large, D-shaped orifice and **a distinct ascopore** (Fig. 8). No avicularia .... *Adelascopora* ....(p. 300)
   Colony frondose or jointed. **Autozooids without an ascopore.** Avicularia present 5
5. Colony frondose, bilaminar, **unjointed**................ 6
   Colony slender, **jointed** 7
6. Autozooids with smooth frontal calcification bordered by marginal pores. Avicularia oval, situated on frontal wall of autozooids. Ovicell elongate oval, conspicuous ...... *Kymella* (p. 250)
   Autozooids with finely perforated, granular cryptocystal calcification beneath a distinct frontal membrane. Avicularia large, vicarious, with rectangular rostrum. No ovicells .... *Flustrapora* (p. 155)

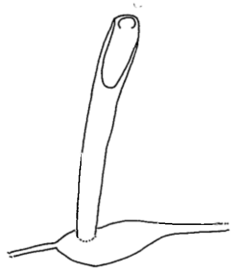


Fig. 7. *Aetea* autozooid.

Fig. 8. *Adelascopora* autozooid.

7. **Autozooids arranged in branching uniserial** chains, each internode consisting of a single or double zooid (Fig. 9). Frontal wall of autozooid with a small cribrate shield proximal to a D-shaped orifice, and elongate lateral pore-chambers (vittae). Minute adventitious avicularia present at disto-lateral corners of autozooids .... *Talivittaticella* (p. 238)
   Branches consist of multizooidal cylinders, linked by distinct chitinous joints 8
8. Autozooids thickly calcified, the cryptocyst usually developing projecting knobs or processes adjacent to the opesia, which is typically longer than wide with convex proximal lip and massive proximo-lateral denticles. Avicularia interzooidal, with projecting, triangular rostrum .... *Paracellaria* (p. 167)
   Autozooids lightly calcified, without cryptocystal processes. Opesia more nearly D-shaped, with less prominent condyles. Avicularia interzooidal or vicarious .... *Cellaria* (p. 160)
9. **Colony with branches each consisting of a single series of autozooids** **10**
   Colony branches biserial to multiserial, or frondose **14**
10. **Autozooid bearing small spines distal to opesia**. Avicularia, if present, pedunculate, 'bird's-head' type. Dichotomy of branch characteristic: twinned distal buds produce an autozooid and a slender, tubular structure which fuses with a lateral budding site on the new autozooid (Fig. 10) .... *Bugulella* (p. 93)
    Autozooids without spines. Avicularia, if present, sessile. Branch dichotomy, when present, results in two separate rami **11**
11. Autozooids short, horn-shaped. Consists of single chains of encrusting zooids with erect chains budded from the frontal surface of encrusting autozooids (Fig. 11). Branch dichotomy achieved by new chain budding from frontal surface of an autozooid; distal bud thus always single .... *Scruparia* (p. 56)
    Autozooids very long and slender, or short and clavate. Open dichotomous branching achieved through twinned distal buds **12**
12. Autozooids short, clavate. Opesia comprising about one-third total zoid length, with broad cryptocystal rim .... *Notoplites uniserialis* (p. 137)

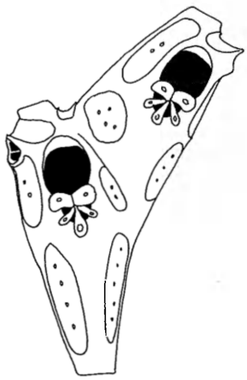


Fig. 9. *Talivittaticella:* twinned autozooids at a dichotomy.

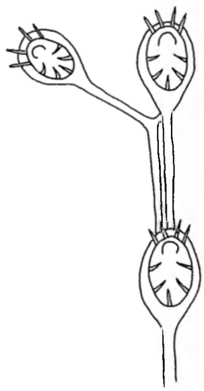


Fig. 10. *Bugulella:* autozooids at a dichotomy.

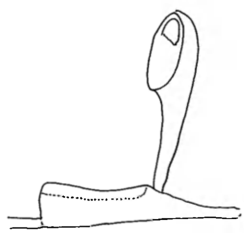


Fig. 11. *Scruparia* autozooids.

Autozooids very long and slender. Opesia oval, comprising about one-fifth total zooid length; or very elongate, equal to about half zooid length. No cryptocystal rim **13**

13. Autozooids with short, oval opesia, equivalent to one-fifth total length. No avicularia.................. .... *Leiosalpinx* (p. 55)

Autozooids with very elongate opesia. Small sessile avicularia present at distal corners of autozooids..................................... *Brettiopsis* (p. 54)

14. **Colony unjointed, bilaminar.** Occasionally with narrow, dichotomously dividing branches, more typically frondose **15**

Colony jointed or unjointed, but always unilaminar. Typically with narrow, dichotomously dividing branches, occasionally frondose **19**

15. Colony with slender, spindly branches, often four-sided at base. No avicularia. Ovicell projecting conspicuously, elongate oval, the ectooecium consisting of paired calcified plates with a longitudinal median suture ....*Klugeflustra antarctica* (p. 62)

Avicularia present, though sometimes inconspicuous **16**

16. **Avicularia adventitious**, situated at proximal ends of autozooids.. **17**

Avicularia interzooidal or vicarious, clearly interspaced among autozooids **18**

17. Avicularia sessile, oval, much smaller than autozooid width. Autozooids without spines............. ....*Austroflustra* (p. 70)

Avicularia columnar, as broad as autozooid. Spines present at distal end of autozooid, or along margins .... *Klugella* (p. 119)

18. Avicularia with short, triangular rostrum, disto-laterally and proximo-laterally orientated ....*Isosecuriflustra* (p. 66)

Avicularia with semi-elliptical rostrum, directed distally ....*Klugeflustra* (p. 61)

19. **Colony frondose** **20**

Colony with biserial to multiserial branches, but not frondose... **23**

20. Autozooids broad, flat, linguiform to hexagonal, very lightly calcified. No spines, avicularia or ovicells..................................... *Carbasea* (p. 59)

Spines and/or avicularia and/or ovicells present **21**

21. Each autozooid with a conspicuous distal avicularium, bearing a slender, whip-like mandible, often exceeding 2 mm length .... *Nematoflustra* (p. 70)
 Avicularia, if present, with short, non-setiform mandibles **22**
22. Autozooids bearing spines distally and laterally. Avicularia pedunculate, at the proximal end of the autozooid; infrequent .... *Klugella echinata* (p. 121)
 Autozooids without spines. Avicularia vicarious, sessile, intercalated within zooid rows .... *Isosecuriflustra* (p. 66)
23. Avicularia absent **24**
 Avicularia present, though sometimes infrequent **25**
24. Colony branches biserial to multiserial. Autozooids elongate, rectangular, almost entirely membranous frontally; distal corners may be produced as short spinous processes .... *Himantozoum* (p. 116)
 Colony branches strictly biserial. Autozooids clavate, broadest distally, with oval frontal membrane occupying distal half .... *Notoplites klugei* (p. 136)
25. Colony lightly calcified, frontal surface of autozooid entirely membranous. Avicularia vicarious, with elongate semielliptical mandible .... *Isosecuriflustra tenuis* (p. 67)
 Calcification more substantial. Frontal surface of autozooid with an oval opesia and variably developed gymnocystal and/or cryptocystal calcified frontal wall **26**
26. Bird's head avicularia present, often abundant; typically polymorphic, varying greatly in size, with long, flexible peduncles (Fig. 12) .... *Camptoplites* (p. 94)
 Avicularia, if present, sessile **27**
27. Terminal wall of autozooid, seen in basal view, distinctly forked — or fish-tail shaped (Fig. 13) .... *Bugula* (p. 91)
 Terminal wall of autozooid, when visible in basal view, straight or slightly curved, not fish-tailed **28**
28. Colony branches biserial, the two series in strict alternating sequence. Autozooids with slender, tubular proximal portions, forming the main

Fig. 12. *Camptoplites* autozooid with bird's head avicularium.

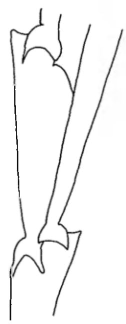


Fig. 13. *Bugula* autozooids in basal view.

axis of the branch, and oval distal portions bearing the frontal membrane projecting perpendicularly to branch axis (Fig. 14). Distal end of autozooid with a narrow process bearing two to many very long, basally jointed spines .... *Cornucopina* (p. 112)

Colony biserial to multiserial. Opesiae of autozooids normal or only slightly acute to long axis of branch. Without spine-bearing distal process **29**

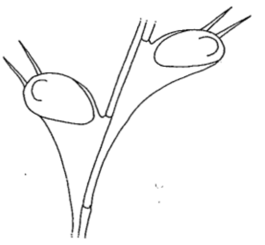


Fig. 14. *Cornucopina* autozooids.

29. **Avicularia or vibracula present** on basal surfaces of autozooids **30**

Neither avicularia nor vibracula on basal surfaces of autozooids **31**

30. Basal heterozooid a vibraculum or an avicularium; in either case small, inconspicuous, not obscuring basal wall of autozooid. Biserial or multiserial, in the latter the basal walls of middle row zooids often not visible in basal view .... *Amastigia* (p. 123)

Basal heterozooid a gigantic vibraculum, almost entirely hiding basal wall of bearing autozooid. Branches strictly biserial........... *Caberea* (p. 122)

31. Joints at a branch dichotomy pass through the opesiae of the inner autozooids of each new ramus (Fig. 15) .... *Menipea* (p. 141)

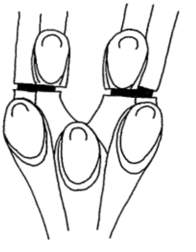


Fig. 15. *Menipea:* autozooids at a dichotomy.

Joints at a branch dichotomy pass below the opesiae of the inner autozooids of each new ramus **32**

32. The axillary autozooid at a bifurcation enclosed on each side by a complete autozooid, with the plane of the joint passing distally to all three opesiae (Fig. 16) .... *Notoplites* (p. 131)

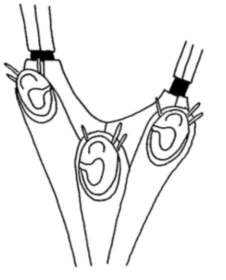


Fig. 16. *Notoplites:* autozooids at a dichotomy.

Axillary autozooid at a bifurcation not enclosed, flanked by the proximal parts of the outer autozooid of each new ramus, which are crossed by the jointing plane .... *Tricellaria* (p. 140)

33. **Colony erect, rigid, branched or unbranched**. Flat and curved, or narrowly cylindrical, but **always slender**, even twig-like, rarely exceeding 5 mm wide **34**

Colony encrusting or erect, but in the latter case reticulate, plate-like, or massive; **not slender, twig-like** **46**

34. **Frontal wall of autozooid partly membranous**, with a large, elongate oval opesia. Minute avicu-

laria may be present at disto-lateral corners of autozooid .... *Ogivalia* (p. 157)

Frontal wall of autozooid entirely calcified, with or without an overlying membrane. Aperture or opesia coinciding exactly with operculum **35**

35. **Frontal wall of autozooid consisting of a concave anascan cryptocyst** below a conspicuous frontal membrane. Opesia with a well defined rim, with a pronounced proximal lip and prominent proximo-lateral condyles **36**

Frontal wall of autozooid a convex, calcified ascophoran shield, not overlain by a frontal membrane. Operculum set within a recessed aperture, often not visible **39**

36. Colony thin and flat, in the form of a curved and sabre-like, or irregularly branched rod. Autozooids hexagonal, with narrow, crescentic opesiae. Avicularia, when present, with crescentic mandibles .... *Melicerita* (p. 174)

Colony stout, cylindrical, thickly calcified. Opesia more or less D-shaped **37**

37. Aperture of ovicell hidden by a projecting hood, flanked by large cryptocystal processes. **Avicularia present only at axil** of dichotomy, with short, semielliptical mandible .... *Stomhypselosaria* (p. 173)

Aperture of ovicell with at most a short distal lip. Avicularia frequent along length of branch, **not at axil** **38**

38. Avicularia vicarious, as large as or larger than the autozooids .... *Swanomia* (p. 170)

Avicularia interzooidal, no larger than the opesia of the autozooid .... *Paracellaria* (p. 167)

39. **Frontal wall of autozooid with marginal pores only** **40**

Frontal wall of autozooid evenly perforated **45**

40. Avicularia lateral to orifice; either small and oval, or gigantic, with a massive, hooked, triangular rostrum projecting conspicuously from branch axil **41**

Avicularia proximal to orifice, small **42**

41. Primary orifice with a distinct sinus. Avicularia disto-lateral to orifice, single or paired (Fig. 17). Ovicell with a granular frontal tabula. Autozooid frontal wall with few small pores .... *Galeopsis* (p. 312)

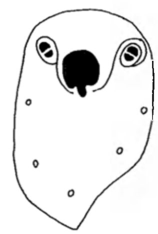


Fig. 17. *Galeopsis:* autozooid and paired avicularia.

Primary orifice without a sinus, partly hidden by a prominent, proximal lip. Avicularia lateral to orifice; small, or grossly enlarged with hooked rostrum. Ovicell uniformly smooth. Autozooid frontal wall with numerous, large marginal pores .... *Antarcticaetos* (p. 209)

42. Primary orifice D-shaped, hidden by a short, complex peristome incorporating a proximo-lateral avicularium, disto-laterally directed, adjacent to a median pseudosinus (Fig. 18) .... *Polirhabdotos* (p. 212)

Primary orifice sinuate or lepralioid, not hidden by a peristome, with medio-proximal avicularium, proximally directed **43**

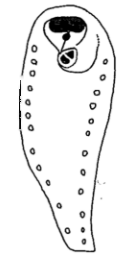


Fig. 18. *Polirhabdotos* autozooid.

43. Primary orifice lepralioid, with shallowly concave proximal border (Fig. 19). Ovicell globular, its aperture rim arched but not projecting .... *Eminooecia* (p. 239)

Primary orifice narrowly sinuate **44**

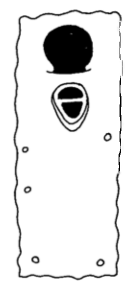


Fig. 19. *Eminooecia* autozooid.

44. Median suboral avicularium constant, on proximal rim of peristome, partly hiding sinus. Ovicell spherical, with a rounded, imperforate frontal tabula .... *Spigaleos* (p. 314)

Median suboral avicularium sporadic, distant from sinus. Ovicell produced frontally into a projecting spout, flanked distally and laterally by spike-like columnar avicularia .... *Isoschizoporella virgula* (p. 245)

45. Individual autozooid boundaries distinct. Primary orifice, with lyrula and condyles, and operculum clearly visible in newly budded autozooids (Fig. 20). Peristome short, tubular, with medio-proximal notch. Avicularia sporadic, always proximal to orifice, proximally directed. Ovicell hyperstomial, conspicuous .... *Smittina directa* (p. 263)

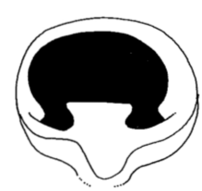


Fig. 20. Smittinid orifice.

Individual autozooid boundaries not apparent, colony surface evenly and coarsely reticulo-punctate. Primary orifice, lacking lyrula and condyles, apparent only at branch tip, operculum absent. Peristome complex, incorporating one or more variously orientated avicularia. Frontal avicularia often frequent, with varying orientation. No visible ovicell (Fig. 21) .... *Cellarinella* (p. 213)

Fig. 21. *Cellarinella* autozooids and avicularia.

46. **Colony erect**, repeatedly branched and anastomosed to form a reticulate structure; some-

times a simple sheet, or a shallow cup, but often complexly folded **47**

Colony encrusting or erect, but not reticulate **48**

47. Colony regularly reticulate, the mesh fine or coarse, but constant for each species (Fig. 6E). Primary orifice visible in frontal view. Ovicell distal to orifice, typically elongate oval, with a narrow, longitudinal frontal fenestra .... *Reteporella* (p. 316)

Colony irregularly reticulate, branch thickness and mesh size varying widely. Primary orifice hidden by a deep peristome, typically ringed by a number of short, columnar avicularia. Ovicell proximal to orifice, spherical, smooth, imperforate .... *Turritigera* (p. 327)

48. **Colony forming erect, brittle plates**; unilaminar or bilaminar, flat or variously folded, enrolled or anastomosed **49**

Colony encrusting; or developing massive, nodular, or stout, branching forms, but not plate-like **64**

49. Frontal surface of autozooid a thickly calcified, concave anascan cryptocyst, overlain by a frontal membrane. Opesia coincident with operculum, with thickened proximal lip and often conspicuous proximo-lateral condyles 50

Frontal surface of autozooid a calcified ascophoran shield, without an overlying frontal membrane **52**

50. Colony thin, flat, brittle, fan-shaped. Autozooids hexagonal, with crescentic opesia situated close to middle. Ovicell endotoichal, recognized by a small, triangular aperture distal to opesia (Fig. 22) .... *Melicerita flabellifera* (p. 175)

Fig. 22. *Melicerita:* autozooid, with ovicell aperture.

Colony stout, thickly calcified. Autozooids rectangular or hexagonal, with opesia close to distal end. Ovicell not completely immersed, cap-like or globular **51**

51. Autozooids rectangular, rather flat. Opesia more or less D-shaped. Avicularia vicarious, as large as autozooids. Ovicell cap-like, its aperture crossed by two short longitudinal struts .... *Larvapora* (p. 180)

Autozooids hexagonal, convex. Opesia with massively thickened proximal lip, appearing crescentic. Avicularia adventitious, much smaller than autozooids. Ovicell globular .... *Aspidostoma* (p. 178)

52. **Autozooids with evenly perforated frontal wall 53**

Autozooid frontal wall with marginal pores only 57

53. Primary orifice clearly visible, with a distinct lyrula (Fig. 23). Avicularia present, often polymorphic, but always one immediately proximal to orifice, often partly enclosed within peristome, proximally directed .... *Smittina* (p. 256)

Primary orifice, when visible, concave or convex, but without a distinct lyrula **54**

Fig. 23. *Smittina* orifice.

54. Primary orifice not visible, enclosed by a deep, complex peristome incorporating one or more avicularia. Individual zooid boundaries not apparent, entire colony surface coarsely reticulo-punctate. No visible ovicell .... *Cellarinella* (p. 213)

Primary orifice readily visible. Zooid boundaries distinct. Ovicells present **55**

55. Autozooid frontal wall rather flat; primary orifice flush with frontal surface, not surrounded by a peristome, proximal edge shallowly concave or with a slight median convexity. Ovicells perforated. Avicularia usually absent; occasionally one, small, medio-proximal to orifice, proximally directed .... *Thrypticocirrus* (p. 279)

Primary orifice enclosed by a peristome. Avicularia may be abundant, proximo-lateral to orifice and elsewhere on frontal wall **56**

56. Peristome round, with a narrow medio-proximal notch. Avicularia sporadic, monomorphic; situated proximo-lateral to peristome, on one or both sides. Ovicell spherical, with a few small pores .... *Dakariella* (p. 245)

Peristome with prominent proximal lip surmounted by one or more small avicularia, enclosing a small avicularium laterally on each side (Fig. 24). Ovicell imperforate, with a triangular area of entooecium exposed frontally, and typically with one or more small avicularia distally .... *Arachnopusia* (p. 185)

Fig. 24. *Arachnopusia:* distal end of ovicelled autozooid.

57. No avicularia. Autozooids large, flask-shaped. Primary orifice wider than long, with a short, broad lyrula, enclosed by a deep, tubular

peristome. Ovicell imperforate ....
.... *Lageneschara* (p. 210)
Avicularia present. Peristome lacking, or small, not completely hiding orifice........................ **58**

58. Primary orifice with a medio-proximal lyrula (Fig. 25).. **59**
Primary orifice without a lyrula......................... **61**

59. A single prominent avicularium medio-proximal to orifice, perpendicular to frontal plane; rostrum strongly hooked, facing laterally. Similar avicularia may occur along margins of zooids. Ovicell with one or two small pores close to aperture, obscured by later calcification (Fig. 25) .... *Rhamphosmittina* (p. 283)
Suboral avicularium, if present, normal to frontal plane, with rostrum proximally directed....... **60**

Fig. 25. *Rhamphosmittina:* orifice and avicularium.

60. A small oval avicularium present in each proximo-lateral corner of peristome; size variable. No median suboral avicularium. Ovicell usually indistinct, with few pores .... *Bostrychopora* (p. 282)
A single median suboral avicularium always present, with rostrum proximally directed. Ovicell large and conspicuous, regularly perforated .... *Smittoidea* (p. 268)

61. **Ovicell with numerous frontal pores**. Avicularia sparse; dimorphic, usually small, proximo-lateral to orifice, occasionally enlarged, almost median suboral........... *Hippomonavella* (p. 289)
Ovicell imperforate, or with just one central pore. Avicularia frequent, median suboral, proximally directed **62**

62. Primary orifice broadly or narrowly sinuate (Fig. 26). Ovicell smooth, imperforate, associated with one to three large avicularia, which may be produced apically into tall spikes ....
.... *Isoschizoporella* (p. 241)
Primary orifice more or less oblong, the proximal border straight or slightly convex. Ovicell with a single central pore, without associated avicularia **63**

Fig. 26. *Isoschizoporella:* orifice and avicularium.

63. Ovicell cap-like, no longer than orifice, with a comparatively large central pore. Avicularia dimorphic, short, triangular or elongate, oval
.... *Astochoporella* (p. 197)
Ovicell globular, twice length of orifice, sutured, with an indistinct central pore. Avicularia

monomorphic, short, oval .... *Pemmatoporella* (p. 282)

64. **Colony erect**, forming stout clavate or tree-like forms, sparsely branched; **or** massive, developing cylinders or nodules or irregular mounds; **or** pisiform, developing irregular spheres on erect substrata **65**

Colony entirely encrusting, forming uniserial chains, small regular patches, or extensive, irregular sheets. Unilaminar or bilaminar, but not erect **74**

65. **Frontal surface of autozooid a thickly calcified, concave anascan cryptocyst**, overlain by a frontal membrane **66**

Frontal surface of autozooid a calcified ascophoran shield without an overlying membrane **68**

66. Opesia equivalent to one-quarter total zooid length; proximal rim curved, depressed, not continuous with distal rim (Fig. 27). Avicularium vicarious, slightly smaller than autozooid, the rostrum asymmetrical, thin, pointed .... *Chondriovelum* (p. 158)

Opesia small, about one-eighth total zooid length, the distal and proximal rims continuous, or with a massively thickened proximal lip. Avicularia vicarious, rectangular, or adventitious, triangular **67**

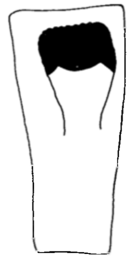


Fig. 27. *Chondriovelum* autozooid.

67. Autozooids rectangular, flat. Opesia more or less D-shaped. Avicularia vicarious, as long as autozooids, rectangular. Ovicell cap-like, its aperture divided by two longitudinal struts .... *Larvapora* (p. 180)

Autozooids hexagonal, convex. Opesia with massively thickened proximal lip, appearing crescentic. Avicularia adventitious, much smaller than autozooids (Fig. 28). Ovicell globular........ .... *Aspidostoma* (p. 178)

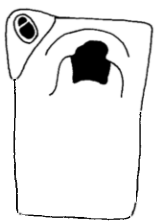


Fig. 28. *Aspidostoma* autozooid.

68. **Autozooids with evenly perforated frontal wall** **69**

Frontal wall of autozooids with marginal pores only **71**

69. Aperture of zooid a longitudinal slit, its rim bearing one to many small oval avicularia .... *Systenopora* (p. 230)

Aperture of zooid with or without associated avicularia, but transversely oval, round or irregular, not a longitudinal slit **70**

70. Aperture transversely oval, with prominent, medially peaked proximal lip. Avicularia sparse, large, adjacent to aperture but not incorporated within peristome, mandible wider than long (Fig. 29) .... *Cellarinelloides* (p. 228)

Aperture round, oval, or irregular, with complex proximal lip. One or more avicularia incorporated within peristome. Frontal suboral avicularia often present .... *Cellarinella* (p. 213)

Fig. 29. *Cellarinelloides:* autozooid and avicularium.

71. **Primary orifice with reversed orientation**, so that sinus appears distal; visible only at growing tips, or in broken sections, hidden in early ontogeny by a deep tubular peristome, usually ringed by small avicularia (Fig. 30). Ovicell on proximal side of peristome, smooth, imperforate **72**

Primary orifice with normal orientation, in most species clearly visible at all ontogenetic stages; peristome variably developed, but not completely obscuring orifice. Ovicell with a frontal pore, or extensive tabula **73**

Fig. 30. *Orthoporidra:* orifice and peristome.

72. Colony slender, branching frequently, often anastomosed. Peristome rim typically with numerous small, similar-sized avicularia.......................
....*Turritigera* (p. 327)

Colony stout, clavate, or with few, thick branches. Peristome incorporating a single columnar, medio-proximal avicularium, with smaller ones developing on its rim in later ontogeny ....
....*Orthoporidra* (p. 327)

73. Primary orifice with smooth rim; suboral avicularia oval (Fig. 31). Ovicell with a central pore, or a small fenestra. Large spatulate avicularia often abundant................... *Osthimosia* (p. 301)

Primary orifice with finely toothed rim; suboral avicularium transversely orientated, with hooked, triangular rostrum. Ovicell with a small frontal tabula. Diamond-shaped frontal avicularia present.............. *Rhynchozoon* (p. 326)

Fig. 31. *Osthimosia:* distal end of ovicelled autozooid.

74. **Colony comprising uniserial chains** of encrusting zooids **75**

Colony forming patches or sheets, coherent or disjunct, but not uniserial chains.................. **79**

75. Frontal wall of autozooid entirely calcified. Autozooids polymorphic: thread-like or fusiform autozooids; short, ovicelled female zooids; minute dwarf zooids (zooeciules)................. **76**

Frontal wall of autozooid with a distinct membrane. Autozooids monomorphic.................. **77**

76. Autozooids diffuse, slender, with thread-like proximal portion (cauda) two or three times as long as oval distal portion. Frontal wall smooth.. *Hippothoa* (p. 231)

Autozooids crowded, club-shaped, proximal cauda scarcely developed. Frontal wall rugose, transversely ridged .... *Plesiothoa* (p. 238)

77. Autozooids horn-shaped, without spines or cryptocyst. Budding erect uniserial branches from the frontal surfaces of encrusting zooids .... *Scruparia* (p. 56)

Autozooids fusiform or oval, with spines and extensive cryptocyst. No erect branches........ **78**

78. Autozooids tapered proximally, with extensive gymnocyst comprising half total length. Ovicell elongate oval, imperforate... *Pyriporoides* (p. 72)

Autozooids truncate proximally, with negligible gymnocyst. Ovicell short, spherical, with narrow, transverse fenestra ...... *Icelozoon* (p. 89)

79. **Frontal surface of autozooid with distinct membrane**; entirely membranous, or bordered by gymnocyst, or partly or wholly underlain by cryptocyst, but clearly visible **80**

Frontal surface of autozooid a calcified shield; regularly perforated, or with marginal pores only, or formed from flat, fused spines with spaces between, but without an overlying frontal membrane.. **97**

80. Frontal wall of autozooid entirely membranous, or with a minimal area of indistinct calcification in each proximal corner 81

Frontal wall of autozooid with cryptocyst; extending under whole of membrane, with operculum and opesia exactly coincident, or smaller, with opesia much larger than operculum; sometimes present simply as a thickened granular or crenellate rim to the opesia **88**

81. Frontal surface entirely membranous; no spines or avicularia **82**

Frontal surface partly or wholly membranous, but spines and/or avicularia present **83**

82. Colony an extensive, lightly calcified sheet on fronds of macroalgae. Autozooids rectangular, with low lateral walls, and a tubercle on each distal corner. No ovicells .... *Membranipora* (p. 57)

Colony forming small patches on various substrata. Autozooids rectangular, with deep lateral walls; no tubercles. Ovicells present .... *Exallozoon* (p. 90)

83. Colony disjunct, consisting of shoe-shaped zooids, partly erect, linked by short tubular processes arising from lateral and basal walls. Few to many spines present. Avicularia pedunculate, resembling birds' heads (Fig. 32) .... *Beania* (p. 146)

Fig. 32. *Beania* autozooid.

Colony coherent, zooids entirely repent. Avicularia, if present, sessile **84**

84. Autozooids lacking spines, or with just a single, indistinct distal pair **85**

Membrane bordered by numerous, often long spines **87**

85. A single short spine present at each distal corner of zooid. Avicularium with elongate triangular mandible. Ovicell with a large fenestra on each side of a longitudinal median suture .... *Klugeflustra onychocelloides* (p. 62)

No spines. Avicularium with oval mandible **86**

86. Avicularia absent. Ovicell short, partly immersed, with median suture, and elongate transverse fenestra on each side....... *Valdemunitella* (p. 80)

Avicularia present, infrequent. Ovicell elongate oval, prominent, with narrow border of ectooecium, and finely granular entooecium exposed frontally .... *Crassimarginatella* (p. 78)

87. Gymnocyst comprising up to three-quarters zooid length. Seven long, equal-sized spines regularly spaced around membrane .... *Harpecia spinosissima* (p. 58)

Gymnocyst comprising only one-quarter zooid length. Fifteen very long spines around membrane, the medio-proximal spine longer than the rest .... *Electra longispina* (p. 57)

88. **Cryptocyst entire**, opesia and operculum almost or exactly coincident **89**

Cryptocyst smaller: from a narrow granular rim to a broad sheet, **but opesia always larger than operculum** **91**

89. Each autozooid with a large, transversely orientated avicularium on its proximal frontal wall, with stout, hooked rostrum ... *Andreella* (p. 155)

Avicularia small, interzooidal, sometimes infrequent; rostrum not hooked........................... **90**

90. Autozooids flat, the frontal membrane bordered by a raised mural rim. Cryptocyst with numerous small pores, opesia with regular D-shaped rim .... *Micropora* (p. 153)
    Autozooids convex, without a mural rim. Cryptocyst imperforate; opesia with a massively thickened proximal lip, appearing crescentic .... *Aspidostoma* (p. 178)
91. Avicularia absent **92**
    Avicularia present **94**
92. Opesia constitutes about three-quarters total zooid length, with narrow granular band of cryptocyst around proximal and lateral borders. Prominent forked or spatulate spines around distal half of zooid .... *Xylochotridens* (p. 81)
    Cryptocyst more extensive, opesia in distal third of zooid **93**
93. Opesia with pronounced lateral condyles. Cryptocyst with a pair of large opesiules (Fig. 33). No occlusor laminae .... *Apiophragma* (p. 154)
    Opesia without condyles, cryptocyst without opesiules. Occlusor laminae visible within cavity of zooid at distal end .... *Icelozoon* (p. 89)
94. Spines absent, except on ancestrula and periancestrular zooids. Cryptocyst a thickened, crenellate rim to opesia. Ovicell imperforate, surmounted by an avicularium or a small kenozooid .... *Ellisina* (p. 73)
    Spines present on all autozooids; if absent, then autozooid with extensive cryptocyst **95**
95. Each autozooid with a single pair of distal spines, one or both of which gigantic — longer than autozooid. Lateral adventitious avicularia present, each with a short, thick process projecting over frontal membrane (Fig. 34). Cryptocyst a thickened rim .... *Arachnopusia gigantea* (p. 192)
    Autozooids with numerous spines, or lacking them entirely. Cryptocyst more extensive; avicularia without projecting processes................. **96**
96. Opesia oval, with occlusor laminae visible in zooid cavity at distal end (Fig. 35). Avicularia polymorphic, numerous, sessile and/or pedunculate. Spines typically long, well developed .... *Chaperiopsis* (p. 81)

Fig. 33. *Apiophragma* autozooid.

Fig. 34. *Arachnopusia gigantea* autozooid.

Fig. 35. *Chaperiopsis* autozooid.

Opesia trilobed. No occlusor laminae. Avicularia monomorphic, transversely orientated on proximal frontal wall of autozooid .... *Amphiblestrum* (p. 76)

97. Frontal shield of autozooid formed from three fused elements, with distinct sutures between; bordered by few, large, irregular marginal pores and with a single trilobed central foramen. A pair of small adventitious avicularia at distal end of each autozooid; larger vicarious avicularia sporadic .... *Trilaminopora* (p. 196)

Frontal shield not as described **98**

98. **Frontal wall of zooid a costate shield**: formed from fused, flattened spines, with pores between (Fig. 36) 99

Frontal wall perforate or imperforate, but not a costate shield... **102**

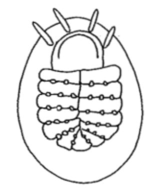


Fig. 36. Cribriomorph autozooid.

99. Frontal shield formed from about 12 pairs of closely fused costae, with numerous small pores between — about ten in a complete transverse row. Up to nine distal oral spines. Avicularia adventitious, with slender pointed rostrum, usually adjacent to aperture .... *Dendroperistomata* (p. 181)

Frontal shield formed from about eight pairs of broad, loosely fused costae, with few, large pores or slits between. Avicularia vicarious or interzooidal, not associated with aperture. Up to four distal spines only.............................. **100**

100. Avicularium interzooidal, small; budded from distal wall of autozooid .... *Figularia* (p. 182)

Avicularium vicarious, as large as autozooid, with spatulate rostrum and small costate frontal shield **101**

101. Costae bifurcate distally, prior to line of fusion. Ovicell with a single central foramen, bordered by a thickened ridge. Oral spines cylindrical .... *Klugerella* (p. 185)

Costae not bifurcate distally. Ovicell with paired frontal fenestrae, on each side of a median suture. Proximal oral spines spatulate... *Filaguria* (p. 183)

102. **Frontal wall of autozooid evenly perforated**, with or without a larger median ascopore........... **103**

Frontal wall imperforate; or with marginal pores only; or with marginal pores and a single median ascopore.. **115**

103. Avicularia absent **104**
Avicularia present **107**

104. Primary orifice with straight or convex proximal border; flush with frontal surface, sometimes with a thickened rim but without a prominent peristome .... *Thrypticocirrus* (p. 279)
Primary orifice enclosed by a well developed peristome, largely obscuring it in later ontogeny **105**

105. Peristome broadly flared and trilobed, partly fusing in ovicelled zooids to form distinctive pseudospiramina (Fig. 37). Primary orifice wider than long .... *Tracheloptyx* (p. 289)
Peristome thickened, with a small median notch in proximal edge but not trilobed **106**

106. Primary orifice with broad, anvil-shaped lyrula; a small suboral denticle within peristome notch, in front of lyrula (Fig. 38). Ovicell imperforate .... *Smittinella* (p. 279)
Primary orifice with narrow, tapered lyrula, sometimes indistinct; no suboral denticle. Ovicell with few large pores frontally............................ ....*Aspericreta* (p. 285)

107. A distinct ascopore present on frontal wall of autozooid (Fig. 39) **108**
Without an ascopore....................................... **109**

108. Primary orifice oval, operculum hinged along distal edge. A stout umbonate avicularium on each side of ascopore, with minute semielliptical mandible. No ovicells ..... *Inversiula* (p. 290)
Primary orifice D-shaped, hinged along proximal edge. Avicularia proximo-lateral to ascopore, single, with elongate mandible. Ovicells present .... *Microporella* (p. 291)

109. Primary orifice with a distinct medio-proximal lyrula (Fig. 40). A single median suboral avicularium always present; occasionally enclosed within peristome, or proximal to it. Ovicell perforate...................................... *Smittina* (p. 256)
Primary orifice with straight, concave or sinuate, or slightly convex proximal border, but without a distinct lyrula... **110**

110. Primary orifice with concave or sinuate proximal border... **111**
Primary orifice straight or slightly convex proximally, or shielded by a projecting peristomial lip.. **112**


Fig. 37. *Tracheloptyx:* peristome in non-brooding and ovicelled autozooids.


Fig. 38. *Smittinella rubrilingulata* orifice.


Fig. 39. *Microporella* autozooid.


Fig. 40. *Smittina* orifice.

111. Primary orifice with narrow sinus. A single median suboral avicularium present, with umbonate cystid; no peristome .... *Ralepria* (p. 249)

Primary orifice shallowly concave, enveloped by a complete peristome with a deep medio-proximal notch. Avicularia dimorphic, lateral suboral, single or paired, oval .... *Dakariella* (p. 245)

112. Frontal shield of autozooid densely perforated by small pores arranged in transverse rows. Aperture of zooid transversely oval, spout-like, with a distal border of flattened spines and a lobed, proximal lip (Fig. 41) .... *Dendroperistomata* (p. 181)

Fig. 41. *Dendroperistomata:* distal end of autozooid.

Frontal shield with fewer, irregularly arranged pores. Peristome not as described **113**

113. Frontal wall of autozooid with few small pores. Primary orifice with convex proximal edge, enveloped by a thickened peristome. A median suboral avicularium lodged within peristome, perpendicular to frontal plane, with hooked triangular rostrum; ovicelled zooids additionally with paired lateral suboral avicularia .... *Trilochites* (p. 246)

Primary orifice flush with frontal plane, without a surrounding peristome; or overarched by a prominent proximal lip bearing one to many avicularia **114**

114. Primary orifice oblong or transversely oval, with straight or convex proximal border; no peristome. Avicularia sparse, monomorphic, median suboral. Ovicell perforate .... *Thrypticocirrus* (p. 279)

Fig. 42. *Arachnopusia:* distal end of autozooid.

Primary orifice overarched by a prominent proximal lip, typically with one to many small avicularia (Fig. 42). A pair of small avicularia enclosed within lateral borders of peristome. Ovicell with an imperforate frontal tabula; usually surmounted by one or more small avicularia .... *Arachnopusia* (p. 185)

115. Frontal wall of autozooid imperforate, typically with a median longitudinal line of umbones. Zooids polymorphic: fusiform autozooids, ovicelled female zooids, and dwarf zooids (zooeciules). Colony forming thin unilaminar patches or sheets .... *Celleporella* (p. 233)

Frontal wall with marginal pores, and sometimes a median ascopore (Fig. 43) **116**

116. A distinct ascospore present proximal to orifice or close to midpoint of zooid, frequently umbonate and with a finely denticulate, crescentic lumen (Fig. 43). No avicularia. Ovicells large, imperforate, with marginal fluting .... *Fenestrulina* (p. 291)

Ascopore lacking... **117**

117. **Avicularia absent** **118**

Avicularia present **122**

118. Autozooids large, flask-shaped. Primary orifice with broad, short lyrula, hidden by a deep, tubular peristome. No spines. Ovicell imperforate .... *Lageneschara* (p. 210)

Primary orifice clearly visible in frontal view. Spines present.. **119**

119. Primary orifice with a narrow, U-shaped proximal sinus **120**

Primary orifice straight, convex, or with a lyrula. Ovicell uniform, imperforate **121**

120. Frontal shield of autozooid flat. Ovicell with a peripheral ring of calcified ectooecium, and large marginal pores .... *Lacerna* (p. 253)

Frontal shield with a massive suboral umbo. Ovicell with a peripheral ring of calcified ectooecium, but no pores .... *Toretocheilum* (p. 249)

121. Primary orifice with a strongly cusped lyrula, surrounded by slender, cylindrical spines; with a pronounced suboral mucro ... *Escharella* (p. 204)

Primary orifice with a straight or slightly convex proximal edge, surrounded by six thick, flattened or forked spines .... *Acanthophragma* (p. 212)

122. **A single median suboral avicularium** present, with or without additional avicularia **123**

Avicularia lateral to orifice, not median suboral **131**

123. Primary orifice concave or sinuate proximally **124**

Primary orifice convex proximally, or with a distinct lyrula **126**

124. Primary orifice with a narrow proximal sinus. Avicularium small, oval. Ovicell imperforate .... *Buffonellodes* (p. 252)

Fig. 43. *Fenestrulina* autozooid.

Primary orifice broadly concave proximally **125**

125. Avicularia dimorphic: large, situated immediately proximal to orifice; small, just lateral-suboral; both normal to frontal plane, proximally directed. Ovicell with frontal pores .... *Hippomonavella* (p. 289)

Avicularia monomorphic, perpendicular to frontal plane, with hooked rostrum facing laterally. Ovicell imperforate .... *Buffonellaria* (p. 312)

126. Primary orifice with slightly convex proximal edge; flush with surface, no peristome **127**

Primary orifice with a distinct lyrula, enclosed by a variably developed peristome (Fig. 44) **128**

Fig. 44. Smittinid orifice.

127. Avicularium monomorphic, short, oval. Ovicell twice length of orifice, sutured, with a small central pore .... *Pemmatoporella* (p. 282)

Avicularium dimorphic; short, triangular, or elongate, oval. Ovicell cap-like, no longer than orifice, with large central pore .... *Astochoporella* (p. 197)

128. Avicularium perpendicular to frontal plane, with elongate, triangular rostrum, hooked distally, facing laterally .... *Rhamphosmittina* (p. 283)

Avicularium acute or normal to frontal plane, but disto-proximally orientated, proximally directed **129**

129. Ovicell with perforated frontal surface.. *Smittoidea* (p. 268)

Ovicell imperforate, usually with a frontal umbo **130**

130. Primary orifice with distinct rectangular lyrula (Fig. 40). Avicularium median suboral only .... *Aimulosia* (p. 275)

Primary orifice with convex proximal edge. Avicularia median suboral and lateral oral .... *Hippadenella* (p. 277)

131. Primary orifice without a peristome; seven thick spines closely spaced around its distal and lateral margins. Sinus accentuated by massive condyles. Avicularia on lateral margins of autozooids, laterally directed..*Toretocheilum* (p. 249)

Peristome present; entire, or open proximally. Spines few, or small, or absent..................... **132**

132. Orifice enclosed proximally by a flaring, spout-like lip, with single or paired lateral avicularia

within the peristome or on its lip (Fig. 45) **133**

Peristome with a single or double medio-proximal notch, or widely open proximally **134**

133. Avicularia on lateral edges of peristome, visible in frontal view, normal to frontal plane. A broad suboral shelf extends between bases of oral spines (Fig. 45) .... *Escharoides* (p. 206)

Avicularia enclosed within peristome, not visible in frontal view; plane of palate perpendicular to orifice. No oral shelf ... *Romancheina* (p. 207)

134. Peristome widely open proximally, primary orifice clearly visible. A small oval avicularium present in each proximo-lateral corner of peristome .... *Bostrychopora* (p. 282)

Peristome hiding primary orifice, its proximal edge with single or double notches, sometimes fused to form paired pseudospiramina. Avicularia single or paired, on lateral borders of autozooids, laterally directed; not associated with peristome .... *Exochella* (p. 197)

Fig. 45. *Escharoides:* orifice, peristome and avicularia.

7. SYSTEMATIC ACCOUNTS

AETEOIDEA Smitt, 1867

AETEIDAE Smitt, 1867

Colony consisting of uniserial, branching chains of autozooids, each comprising an adnate proximal portion, and an erect, tubular, distal portion. The adherent proximal portions give the appearance of a continuous, branching stolon, filiform or with regular dilatations, with the tubular distal portions (sometimes spatulate at the free end) regularly spaced along its length. In some instances the proximal 'stolonic' portions are only partly attached to the substratum, and the colony develops a diffuse, bushy form. Each autozooid comprises an attached proximal portion, a cylindrical middle region of varying length, and a distal region bearing the frontal membrane. Operculum terminal. Polypide with few tentacles, generally 12–20, and with a delicate circlet of fine teeth around base of lophophore. Embryos brooded in membranous sacs borne externally at distal end of autozooid. Small kenozooids may be intercalated between proximal portions of successive autozooids in some species; other polymorphs do not occur.

Aetea Lamouroux, 1812

With characters of the Family.

Type species: *Sertularia anguina* Linnaeus, 1758.

The genus includes relatively few species, most of which seem to have very wide geographical distributions. The type species, *A. anguina* (L.), has been reported from throughout the temperate and tropical seas of the world. However, the morphological simplicity of *Aetea* makes comparative systematic study difficult, and only a minority of published species has been adequately described. Consequently, it is possible that there may be either more, or fewer, species than are presently recognized.

Aetea anguina has been reported from the Magellanic and Patagonian regions, and *A. ligulata* Busk was originally described from Tierra del Fuego. *Aetea fuegensis* Jullien, 1888 is perhaps the same species as *A. ligulata,* and *A. curta* Jullien, 1888, may also represent a form of *A. ligulata* (Hastings 1943). *A. australis* Jullien was described from Tierra del Fuego, and what may be the same species was described and figured by Gordon (1984) from New Zealand; it has not, however, been redescribed from South America.

With the exception of Waters' (1904: 20) brief note, no species of *Aetea* has been reported from the Antarctic, and Hastings (1943: 471) stated that the presence of the genus in Antarctic waters was doubtful. However, *A. anguina* and *A. ligulata* are both probably widely distributed in adjacent regions of the south-west Atlantic; their extreme southern limits have still to be determined, and thus it seems useful to describe and figure them here.

Aetea anguina (Linnaeus) Fig. 46

Sertularia anguina Linnaeus 1758: 816
Aetea anguina: Hastings 1943: 471, Figs. 57A–C; Amor and Pallares 1965: 303, Fig.3A, pl.5, figs.2,2a; Ryland and Hayward 1977: 45, Fig.13.

Colony white. Adherent part branching freely; moniliform, with each erect portion arising from a dilatation. Erect portion of autozooid 0.6–0.8 mm long; cylindrical middle region with distinct annulations; distal region comprising one-quarter to one-third length of erect

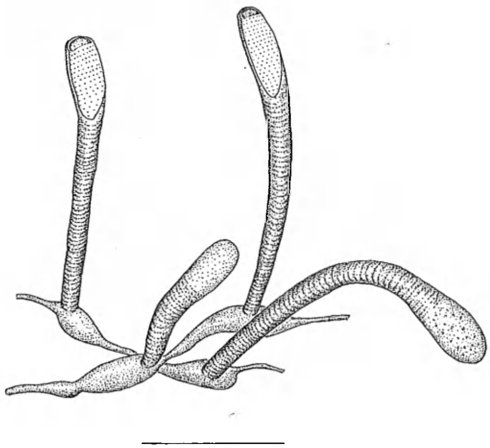


Fig. 46. *Aetea anguina.* Discovery Stn WS847. Scale = 0.5 mm.

portion, spatulate, without annulations but finely punctate, usually flexed so that the frontal membrane faces downwards towards the substratum. Polypide with 12 tentacles. Embryos golden yellow in European populations.

Aetea anguina occurs most frequently on algae, hydroids and bryozoans, but can also be found on stones, shells and other hard substrata. It is distributed from the lower intertidal, into the shallow subtidal, rarely occurring below 50 m depth. This species has been recorded from all the world's seas, with the exception of polar waters.

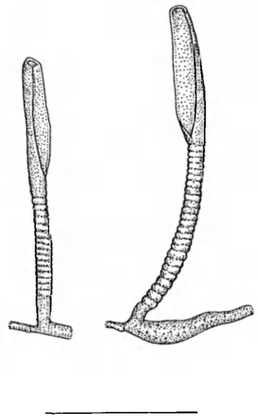


Fig. 47. *Aetea ligulata.* After Amor and Pallares, 1965. Scale = 0.5 mm.

Aetea ligulata Busk Fig. 47

Aetea ligulata Busk 1852: 31, pl.42; Amor and Pallares 1965: 305, pl.5, fig.1.

Colony white. Adherent part branching freely, moniliform, with fine punctulations, and irregular transverse corrugations. Erect portion of autozooid 0.6–1.4 mm long; cylindrical middle portion finely punctate, not annulate, but rather with smoothly rounded, transverse corrugations; distal region comprising one-third length of erect portion, cylindrical, straight, not flexed. Polypide with 14 tentacles. Embryo colour unknown.

The length of the free, erect portion of the autozooid varies widely, even within a single colony, and the shortest examples approach those of *A. curta* Jullien, which Hastings (1943) considered might be synonymous with this species. *A. ligulata* has been reported from Brazil to Patagonia, British Columbia to California, New Zealand, the Caribbean and the Red Sea. Apart from Amor and Pallares (1965), who described material from Argentina which is perhaps most similar to Busk's original material, the most complete descriptions of the species are those of Marcus (1937), from Brazil, and Gordon (1984) from New Zealand. As with other species of the genus, some doubt must be expressed concerning the synonymy of all records of this species.

SCRUPARIOIDEA Busk, 1852

SCRUPARIIDAE Busk, 1852 (emend. Silén, 1941)

Colony erect, rising from a creeping base. Autozooids arranged in branching, uniserial chains; tubular, with a distal or subterminal frontal membrane. New autozooids budded from frontal, distal and lateral budding sites. No spines or avicularia. Tentacle sheath, when everted, encircled by a band of fine teeth. Embryos brooded in keeled, bivalved brood chambers, generally borne on modified reproductive autozooids; outer layer of brood chamber membranous, inner layer calcified; several embryos are brooded simultaneously.

Brettiopsis López Gappa, 1986

Colony erect, branching, uniserial. Autozooids elongate, each giving rise to one distal bud, and one or two disto-lateral buds. Frontal membrane occupying about half autozooid length; no cryptocyst. Spines absent. Avicularia adventitious, sessile. Embryos develop in bivalved brood chambers, borne by modified autozooids.

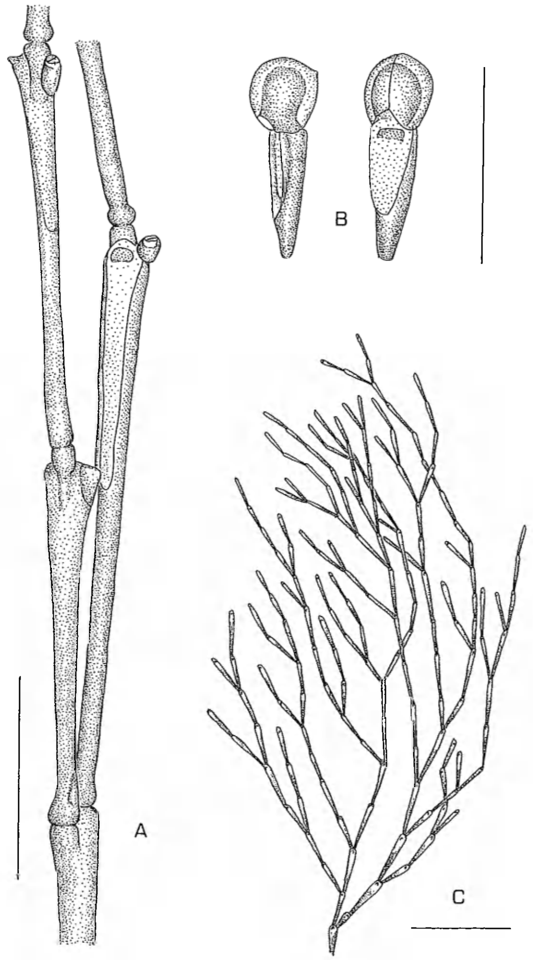


Fig. 48. *Brettiopsis triplex.* A. Autozooids at a dichotomy, with adventitious avicularia; scale = 1 mm. B. Ovicelled zooids in lateral and frontal view; scale = 2 mm. C. Part of a well grown colony; scale = 5 mm.

Type species: *Brettia triplex* Hastings, 1943.

Brettiopsis triplex (Hastings) Fig. 48

Brettia triplex Hastings 1943: 476, Fig.56D
Brettiopsis triplex: López Gappa 1986: 104, figs.1–7.

Colony delicate, diffuse, branching freely; developing a stiff, wiry tuft, up to 7 cm high, light brown in colour, attached by bundles of rhizoids. Autozooids slender, cylindrical; 1.0–4.0 mm long, 0.1 mm wide proximally, but broadening to 0.25–0.3 mm at the distal end; frontal membrane occupying distal one–third to one-half of autozooid. Each autozooid produces a single median, distal bud, giving rise to the next autozooid of the branch, and paired disto–lateral avicularia. Lateral branches arise when one of the avicularia is instead replaced by an autozooid, characteristically this occurs in alternating left/right sequence along the branch arms. Rarely, both avicularia are replaced by autozooid buds. Brooding zooids shorter than autozooids, with frontal membrane occupying two-thirds total length. Brood chamber globular, with outer membranous layer and inner calcified layer; with a distinct median keel.

Hastings (1943) described fragmentary material of this species from Oates Land. Subsequently, López Gappa (1986) was able to produce a detailed account of more extensive samples from the Weddell Sea, including a description of the brood chamber, which allies *B. triplex* closely with *Scruparia*. Additional material has been collected from 140 m off Signy Island by the British Antarctic Survey. It seems likely that *B. triplex* is an endemic Antarctic species.

Leiosalpinx Hayward and Cook, 1979

Colony erect, branching dichotomously. Autozooids in single linear series; elongate, lightly calcified, with small opesia at distal end. No spines, avicularia or ovicells.

Type species: *Alysidium inornata* Goldstein, 1882.

Brettia australis Busk, 1884 was redescribed and figured by Gordon (1986), who assigned it to *Leiosalpinx*, and suggested that it may prove to be conspecific with *L. inornata*. Gordon observed membranous embryo sacs attached to the frontal membrane in *L. australis*.

Leiosalpinx inornata (Goldstein) Fig. 49

Alysidium inornata Goldstein 1882: 42, p 1.1, fig.1
Catenaria attenuata Busk 1884: 14, pl.2, figs.1,1a
Brettia inornata: Hastings 1943: 476
Leiosalpinx inornata: Hayward and Cook 1979: 66, Figs. 2C–D; d'Hondt 1984: 107

Colony form unknown. Branches slender, dichotomous. Autozooids in single linear series, each budded from the disto-basal wall of its predecessor; 1.0–2.0 mm long, a slender horn shape, 0.05 mm wide

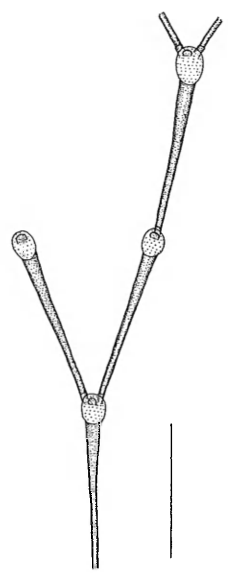


Fig. 49. *Leiosalpinx inornata*. Scale = 1 mm.

proximally, broadening to 0.2 mm at the distal end. Opesia oval, occupying the broad distal end of the autozooid, comprising one-sixth or less of its total length. Dichotomies arise when an autozooid produces twinned disto-lateral buds.

This species was described independently by Goldstein (1882) and Busk (1884), from Heard Island and Marion Island, respectively. It was reported from deep water off the South African shelf by Hayward and Cook (1979), and from Kerguelen by d'Hondt (1984). *L. australis* (Busk), which may be conspecific with *L. inornata*, is presently known from deep waters off Indonesia, and also from New Zealand. Very little material of both taxa has ever been collected; their geographical distribution is thus scarcely known, and *L. inornata* may prove to extend further south, although it is perhaps unlikely to occur in Antarctic coastal seas.

Scruparia Oken, 1815

Colony erect, branching, attached to the substratum by a series of adnate autozooids, or by a creeping kenozooidal stolon. Autozooids in uniserial chains, budding new autozooids from distal, lateral and frontal positions; tubular or clavate, with an oval opesia. No spines or avicularia. Embryos brooded in bivalved brood chambers produced by specialized female zooids; outer wall of brood chamber membranous, inner wall calcified. Polypide with a ring of fine teeth around the base of the lophophore.

Type species: *Sertularia chelata* Linnaeus, 1758.

The two species of *Scruparia* were conclusively separated by Hastings (1941). *S. chelata* is reliably known only from the seas of Western Europe. *S. ambigua* (d'Orbigny) appears to have a much broader distribution, and has been reported from almost all the world's seas, with the exception of Polar waters. However, it is known from the southern Patagonian Shelf and the Falkland Islands, and may well extend further south along the Scotia Arc.

Scruparia ambigua (d'Orbigny) Fig. 50

Eucratea ambigua d'Orbigny, 1841: pl.3, figs.13–17; 1847: 11

Scruparia ambigua: Hastings 1941: 470, text fig.2A,B; Ryland and Hayward 1977: 50, Fig.16

Colony consisting of erect, branching, uniserial chains of autozooids, rising from branching, adnate chains; diffuse and delicate, or sometimes developing dense tufts. Adnate chains branch by lateral budding; erect chains commence as frontal buds from adnate autozooids, and branch by both lateral and frontal budding. Autozooids slender, horn-shaped, 0.3–0.5 mm long; opesia oval, comprising less than half total autozooid length, parallel to basal wall of autozooid. Brood chambers borne by frontally budded reproductive zooids; globular, with a median keel marking the

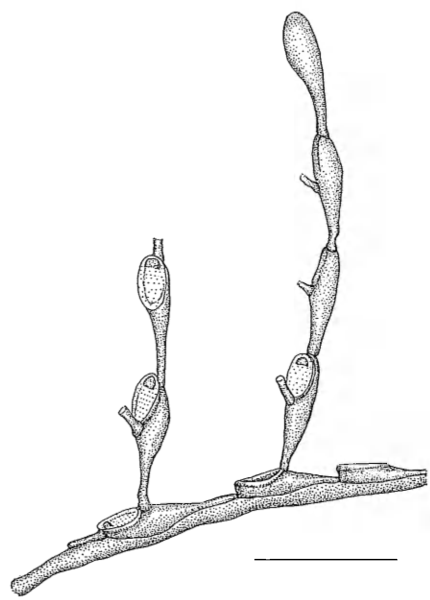


Fig. 50. *Scruparia ambigua:* portion of a colony growing on a hydroid stem; Discovery Stn WS847, Scale = 0.5 mm.

fusion of the two valves, and peaked apically.

The often inconspicuous colonies of this species are most often found attached to algae, hydroids and other bryozoans, but also occur on a wide range of organic and inorganic substrata.

MEMBRANIPOROIDEA Busk, 1854

MEMBRANIPORIDAE Busk, 1854

Colony encrusting; or erect, developing foliaceous lobes from an encrusting base. Autozooids rectangular, lightly calcified; frontal surface almost entirely membranous, the gymnocyst reduced or absent, cryptocyst variably developed. No avicularia or ovicells; multiporous septula present in vertical walls.

Membranipora de Blainville, 1830

Colony encrusting, forming broad, unilaminar sheets on marine algae. Autozooids thinly calcified, the frontal surface entirely membranous; rectangular, with tubercles in the proximal corners, sometimes massively developed, or produced as stout spines; small spinules may be present along lateral walls. Avicularia do not occur. Larva planktotrophic, referred to as a 'cyphonautes'. Ancestrula twinned.

Type species: *Flustra membranacea* Linnaeus, 1767.

The species of *Membranipora* are essentially epiphytes of the kelps, including the southern hemisphere *Macrocystis pyrifera.* As a consequence of their long-lived planktotrophic larvae, most have very broad geographic distributions, although none have been reported from Antarctic waters. The biology and ecology of the type species, *M. membranacea*, which occurs in Magellanic waters, has been described by Ryland and Hayward (1977), and a key to four species presently recognized from the Magellanic region is provided by Moyano (1966).

ELECTRIDAE STACH, 1937

Colony encrusting; or erect, developing irregular lobes from an encrusting base. Autozooids with well developed gymnocyst, imperforate or with numerous small pores; cryptocyst generally reduced; opesia often with marginal spines. No avicularia or ovicells. Larva a planktotrophic cyphonautes.

Electra Lamouroux, 1816

Colony encrusting unilaminar; or developing short, erect, bilaminate shoots. Autozooids with well developed gymnocyst, porous or imperforate; opesia comprising half to two-thirds total autozooid length, typically with marginal spines, of which the median proximal spine is characteristically present in all species, and often greatly enlarged; cryptocyst reduced to a narrow rim. Autozooids communicating via multiporous septula. Avicularia absent. No ovicells; embryos develop into cyphonautes larvae with a long free-swimming phase.

Type species: *Flustra verticillata* Ellis and Solander, 1786 = *Flustra pilosa* Linnaeus, 1767.

The type species, *Electra pilosa,* is a common coastal species, frequently associated with algae or with other sessile invertebrates, which has been reported from most of the world's seas. It has not, however, been recorded from the Subantarctic regions, where the only representative of the genus presently known is *E. longispina* (Calvet). *Electra pilosissima* Moyano, presently known only from southern Chile (Moyano 1982), is characterized by its dense border of long setose spines around the opesia.

Electra longispina (Calvet) Fig. 51

Membranipora longispina Calvet 1904a: 52; 1904b: 14, pl.1, fig.1

Colony encrusting, unilaminar. Autozooids oval, 0.5–0.65 × 0.3–0.4 mm;

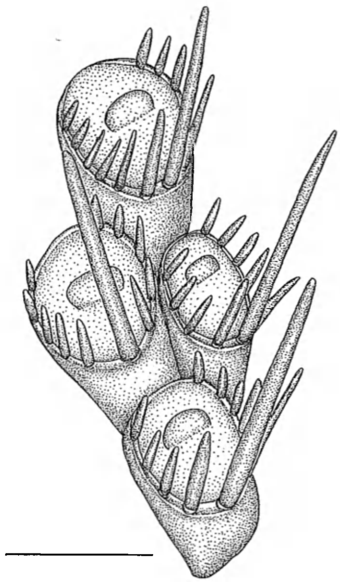


Fig. 51. *Electra longispina.* Discovery Stn 222, Cape Horn. Scale = 0.5 mm.

opesia occupying two-thirds total autozooid length; gymnocyst smooth, imperforate, continuous with lateral walls, which are tall and thin, with deep grooves between adjacent autozooids; cryptocyst reduced to a scarcely discernible rim. Opesia surrounded by 15 thick, cylindrical spines, of variable length, heavily calcified and appearing opaque white, with distinct brown, chitinous basal joints. The median proximal spine is particularly thick, commonly 0.5 to 0.8 mm long, with its rounded tip uncalcified; lateral spines are more slender, only half as long as the median proximal spine, and typically decrease in length distally.

Electra longispina has not been reported again since its original description by Calvet (1904b), who had material from Tierra del Fuego and from South Georgia, in both cases encrusting algae. Additional unpublished material is known from the Falkland Islands, also on small algae.

Harpecia Gordon, 1982

Colony encrusting, unilaminar. Autozooids with smooth gymnocyst comprising half total length; opesia with a crenulate cryptocystal rim, surrounded by erect, basally jointed spines. Avicularia absent. No ovicells; reproductive mode unknown.

Type species: *Chaperia spinosissima* Calvet, 1904a.

The genus *Harpecia* is presently monotypic.

Harpecia spinosissima (Calvet) Fig. 52

Chaperia spinosissima Calvet 1904a: 51; 1904b: 12, pl.1, figs.2a–d; 1909: 13
Membranipora ciliata Livingstone 1928: 11, pl.1, figs. 6,9
Chaperia spinosissima: Moyano 1966a: 116
Harpecia spinosissima: Gordon 1982: 3, Figs. 2C,D

Colony forming small, thick, fan–shaped lobes on hard substrata, or irregular branching cylinders on small algae, often only partly adherent. Autozooids elongate oval, almost cylindrical in loosely adherent colonies, 0.6–0.7 × 0.25–0.3 mm. Gymnocyst smooth, comprising half to three-quarters total length; opesia subterminal, D-shaped, with straight proximal edge, encircled by a thickened, crenulate, cryptocystal rim. Seven thick, cylindrical spines equally spaced around the opesia, with distinctive, brown chitinous basal joints, 0.25–0.70 mm long, typically distally directed.

This species is perhaps quite widely distributed in Antarctic waters. It has

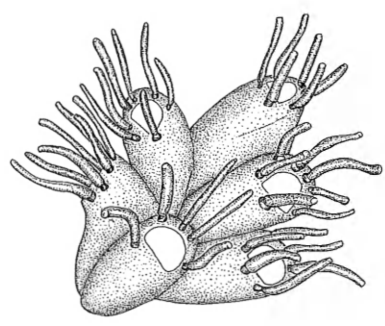


Fig. 52. *Harpecia spinosissima.* Scale = 0.5 mm.

been reported from South Georgia, the South Shetlands, and from various points in the Palmer Archipelago, and also from Adelie Land and the Ross Sea. It occurs on small algae, but is also frequent on rocks and shells, and is common in shallow water habitats at Signy Island, and Port Lockeroy, for example.

FLUSTROIDEA Lamouroux, 1821

FLUSTRIDAE Lamouroux, 1821

Colony erect, with flat, unilaminar or bilaminar, dichotomously dividing branches, narrow and strap-like, broadly frondose, or irregularly lobed; attached by sheets of encrusting autozooids, or by bundles of tubular, chitinous rhizoids. A minority of genera includes wholly encrusting species. Autozooids largely, or entirely, membranous frontally; cryptocystal calcification variably developed, usually minimal; spines present or absent. Avicularia present or absent, adventitious or vicarious. Embryos brooded within the maternal autozooid, or in ovicells, which vary in form throughout the family.

The morphology of the ovicell, the form and distribution of avicularia, and the nature of the basal attachment, all seem to be the most useful characters for distinguishing genera within the Flustridae.

Carbasea Gray, 1848

Colony erect, frondose with lobed or divided edges, or narrowly flabellate with irregular dichotomous branching; unilaminar; attached by encrusting sheets of autozooids. Autozooids simple, flat, rectangular or hexagonal; frontal surface entirely membranous, in some species with a minimal development of delicate cryptocystal calcification; linked by multiporous septula. Spines reduced or absent. No avicularia. Embryos brooded in internal ovisacs. Frond margins edged with kenozooids.

Type species: *Flustra carbasea* Ellis and Solander, 1786.

Carbasea curva (Kluge) is widely distributed in Antarctica and appears to be an endemic species. *C. ovoidea* Busk is a common Subantarctic species; it is also abundant off Low Island, South Shetlands (Winston and Heimberg 1988) and perhaps occurs elsewhere off the Antarctic Peninsula. The recently described *C. desbruyeresi* d'Hondt and Redier, 1977, is presently known only from Marion Island, Kerguelen and Bouvet Island. *Carbasea renilla* Pfeffer, 1889, from South Georgia, does not belong to this genus, and its taxonomic identity remains to be clarified.

Key to Antarctic species

1. Colony yellowish-white, lobate. Operculum occupying half total autozooid width .... *C. ovoidea*
   Colony reddish-brown, distinctly branched. Operculum occupying entire width of autozooid .... *C. curva*

Carbasea curva (Kluge) Fig. 53

Flustra curva Kluge 1914: 654, pl.32, fig.4, text fig.34

Flustra curva: Livingstone 1928: 21, pl.3, fig.5; Moyano 1966a: 117; Androsova 1972a: 94; 1972b: 326

Carbasea curva: Moyano 1972b: 85; Winston and Bernheimer 1986: 370

Colony up to 5 cm high, richly branched to give a broad fan-shape; fronds up to 5 mm wide, more or less parallel-sided but broadening towards each dichotomy, distinctly concavo-convex, with the basal surface concave; dividing dichotomously at intervals of 5–10 mm. Light reddish-brown in colour. Autozooids broadly hexagonal, but variable, and often rounded distally; 1.0–1.3 × 0.5–0.7 mm. Cryptocyst usually reduced to a small triangular area in each proximal corner of the autozooid, but sometimes forming a

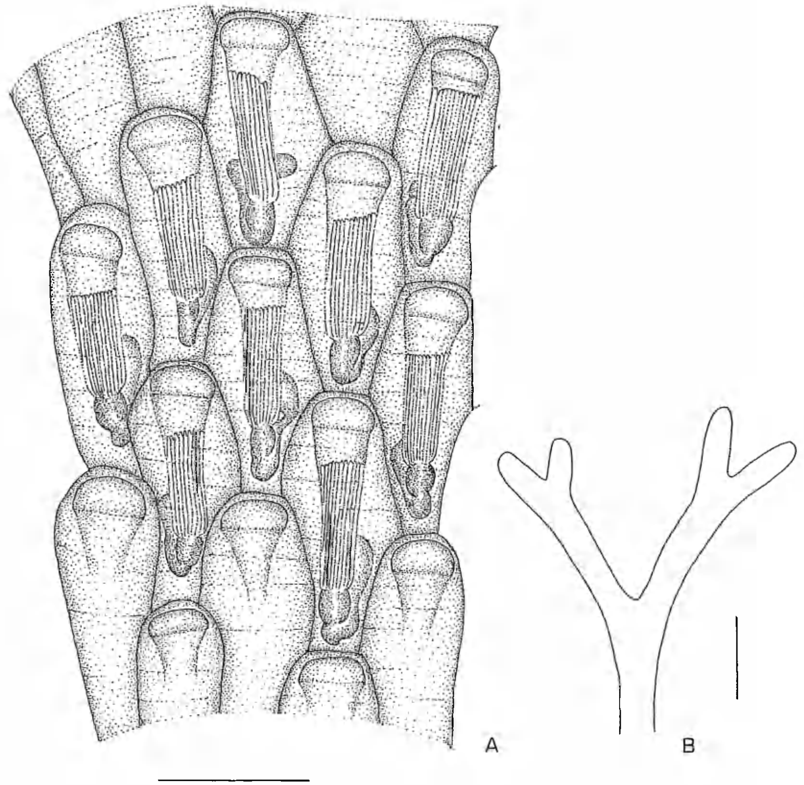


Fig. 53. *Carbasea curva*. A. Portion of a frond, branch edge on left; Discovery Stn. 42. Scale = 1 mm. B. Diagram of part of a colony; Discovery Stn. 190. Scale = 5 mm.

complete, narrow border at the proximal end; most developed in marginal autozooids where it may form a slender rim along the proximal third of the lateral walls. Operculum almost semicircular, occupying practically the whole width of the autozooid, with a distinct, thickened marginal sclerite.

Carbasea curva has been widely reported in Antarctic coastal waters. It is an endemic species. It occurs throughout the Palmer Archipelago and is common around South Georgia, where it perhaps reaches its northern limit. Winston and Bernheimer (1986) reported haemolytic activity in extracts of *C. curva* which suggested that it possessed a chemical defence system.

Carbasea ovoidea Busk Fig. 54

Carbasea ovoidea Busk 1852: 52, pl.49, figs. 5–7; 1884: 55, pl.16, fig. 3

Carbasea ramosa Jullien 1888: 75, pl.4, figs.2–4; Calvet 1904a: 9

Flustra ovoidea: Waters 1905: 232

Colony forming lobate fronds up to 5 cm high, narrow proximally, broadening rapidly distally, with a lobed, or more distinctly divided edge; lightly calcified, delicate, yellowish-white in colour. Autozooids elongate, linguiform, typically narrowest, and rather rectangular, proximally, broadly rounded distally; 0.9–1.3 × 0.3–0.4 mm. Frontal membrane thin and translucent, its proximal one-quarter underlain by a delicate cryptocyst, typically with faint sutures. Operculum occupying half total width of autozooid, semicircular, transparent, with a light brown marginal sclerite.

Carbasea ovoidea is a common Subantarctic species, distributed from Cape Horn to Marion Island. It occurs com-

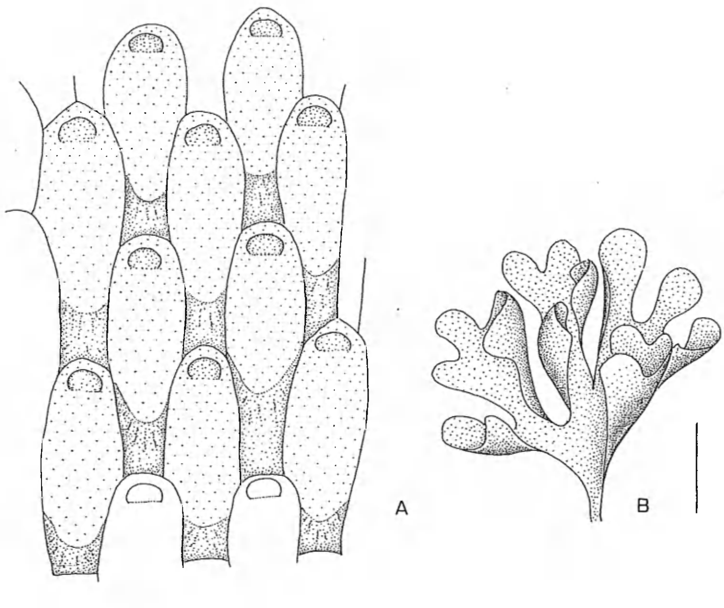


Fig. 54. *Carbasea ovoidea*. Discovery Stn. 1563, Marion Id. A. Portion of a frond; scale = 0.5 mm. B. A well grown colony; scale = 10 mm.

monly on the Southern Patagonian Shelf, and around the Falkland Islands, and Winston and Heimberg (1988) found it to be abundant at Low Island, South Shetlands, where it formed more than half the bryozoan biomass in trawls between 80 and 110 m depth. It has not been reported from elsewhere in Antarctica and perhaps reaches its southern limit off the Antarctic Peninsula. *C. desbruyeresi* d'Hondt and Redier, from the Kerguelen region, differs from *C. ovoidea* principally in lacking cryptocystal calcification.

Klugeflustra Moyano, 1972

Colony encrusting, unilaminar; or developing erect, bilaminar fronds, with rhizoids budded from the frontal surfaces of the autozooids. Frontal wall of autozooid almost entirely membranous, with only a thin marginal rim of smooth cryptocyst, and a minimal development of gymnocyst proximally; paired oral spines present in some species. Vicarious avicularia, when present, occur at the bifurcation of autozooid rows; rostrum acute to frontal plane, lightly calcified, with an extensive opesia proximal to mandible. Ovicell hyperstomial, with median longitudinal suture; both layers calcified, the ectooecium with a frontal fenestra on each side of the suture.

Type species: *Flustra vanhoffeni* Kluge, 1914.

Key to Antarctic species

1. Colony encrusting, unilaminar. Autozooid with a short spine at each distal corner. Avicularium with elongate triangular mandible .... *K. onychocelloides*

   Colony erect, bilaminar. Autozooids mostly lacking spines. Avicularium with rounded mandible, or absent 2

2. Colony bushy, with lax spindly branches less than 2 mm wide. No avicularia .... *K. antarctica*

   Colony frondose, with broad, flat branches. Avicularia present 3

3. Spines present in ovicelled autozooids only. Avicularium with semicircular mandible .... *K. drygalskii*

   All autozooids lacking spines. Avicularium with elongate semielliptical mandible .... *K. vanhoffeni*

Klugeflustra antarctica (Hastings) Fig. 55

?*Farciminaria simplex* Kluge 1914: 650, pl.28, fig.7

Farciminaria simplex MacGillivray: Livingstone 1928: 24

Farciminellum antarcticum Hastings 1943: 391, pl.8, Figs.26B,27B; Androsova 1972b: 318

Flustra astrovae Androsova 1972a: 96; 1972b: 331, fig.9

Colony erect, bilaminar, light yellowish brown, up to 20 cm in height; richly branched, lightly calcified, developing a dense, bushy form. Branches slender, commonly about 1 mm wide, broadening to about 2 mm just prior to dichotomy; proximal portion of colony thickened by numerous frontally budded rhizoids to form a distinct stalk. Immediately distal to a dichotomy, and especially in the proximalmost parts of the colony, the branches are basically quadriserial with a rectangular section; proximal to dichotomies they may comprise six to eight longitudinal series of autozooids, with an oval section; distally, branches may become bilaminate, pluriserial and distinctly flat, with up to ten series of autozooids on each side. Ovicelled autozooids tend to be grouped together in the middle regions of an internode, giving branches a moniliform appearance to the unaided eye. Autozooids very long and narrow, more or less straight-sided, truncate proximally, rounded distally; 1.5–2.5 × about 0.4 mm. No spines or avicularia. Ovicell 0.5 mm long, rather oblong in outline, projecting conspicuously from the frontal plane of the branch; entooecium entirely calcified, with faint radiating sculpture; ectooecium calcified laterally, membranous distally, median suture distinct.

Widely distributed in Antarctic waters, from Adelie Land, Oates Land and the Ross Sea, to the South Shetland Islands, the South Sandwich Islands, and South Georgia.

Klugeflustra drygalskii (Kluge) Fig. 56

Flustra drygalskii Kluge 1914: 656, pl.31, fig.5, text fig.36

Flustra drygalskii: Moyano 1966a: 117

Klugeflustra drygalskii: Moyano 1972b: 86

Colony erect, bilaminar, up to 5 cm high; forming narrow, straight-sided fronds, with truncate tips; fronds about 10 mm wide at their broad, distal ends, dividing dichotomously at regular intervals. Autozooids elongate, more or less rectangular, rounded distally, the distal terminal wall slightly raised above the frontal plane of the colony; 1.3–1.9 × about 0.5 mm; vertical walls well calcified, but no frontal calcification, spines present only in ovicelled autozooids. Avicularia 1.0 mm long, tapered proximally, truncate distally; proximal half with flat, membranous frontal wall, distal half convex, calcified, forming the rostrum supporting the deep brown, semicircular mandible at an acute angle to the frontal plane. Ovicell elongate, prominent, 0.6 mm long, with distinct median suture; ectooecium almost entirely uncalcified. Each ovicelled autozooid bears a pair of stout, curved lateral oral spines.

This distinctive species is presently known from a very few localities, off Grahamland and the coast of Kaiser Wilhelm II Land.

Klugeflustra onychocelloides (Calvet) Fig. 57

Membranipora onychocelloides Calvet 1909: 15, pl.1, fig.9

? not *Callopora onychocelloides*: Livingstone 1928: 14

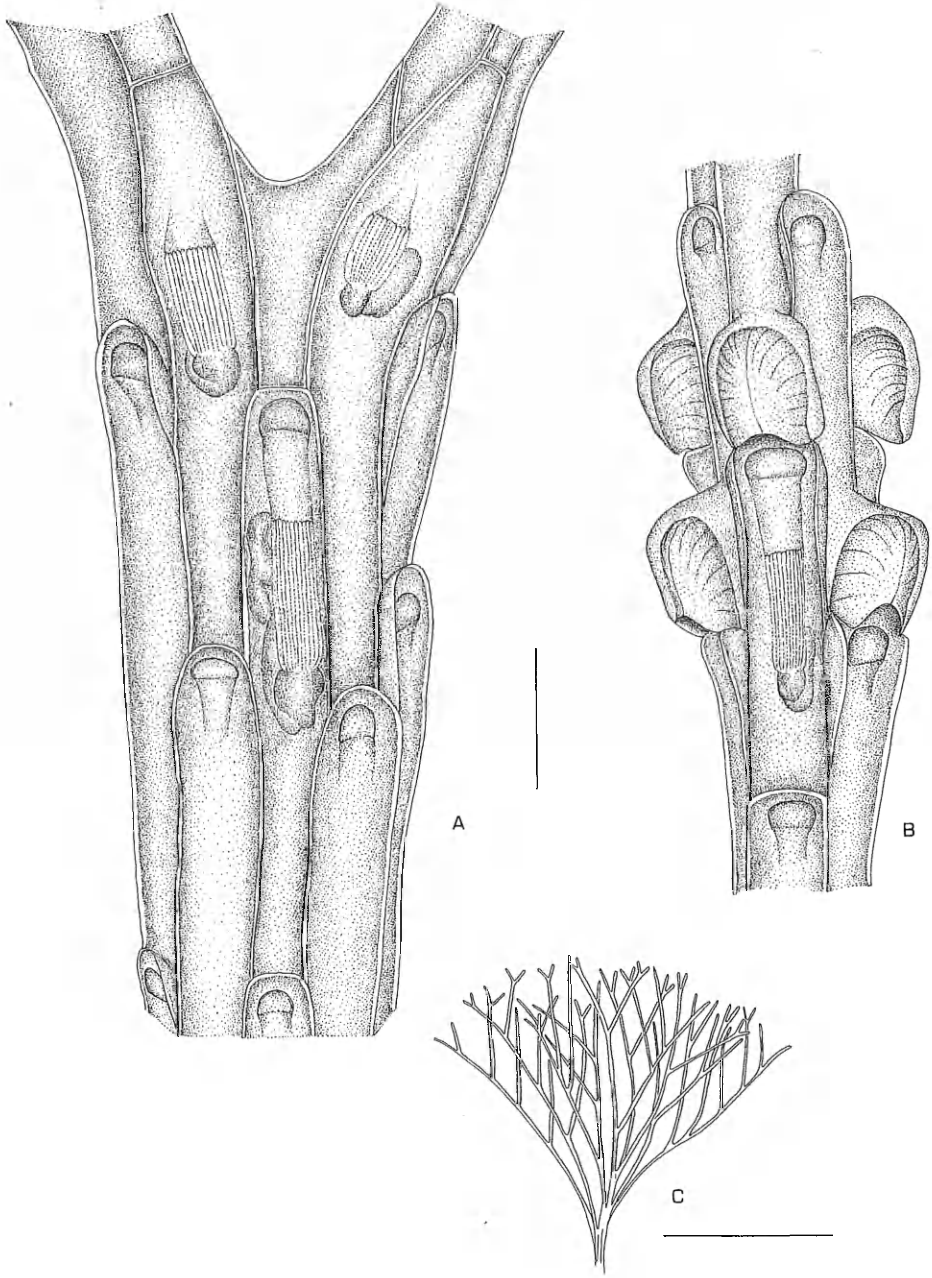


Fig. 55. *Klugeflustra antarctica.* USARP, Knox Coast. A. Autozooids at a dichotomy; scale = 0.5 mm. B. Ovicelled autozooids; scale = 0.5 mm. C. Part of a well grown colony; scale = 50 mm.

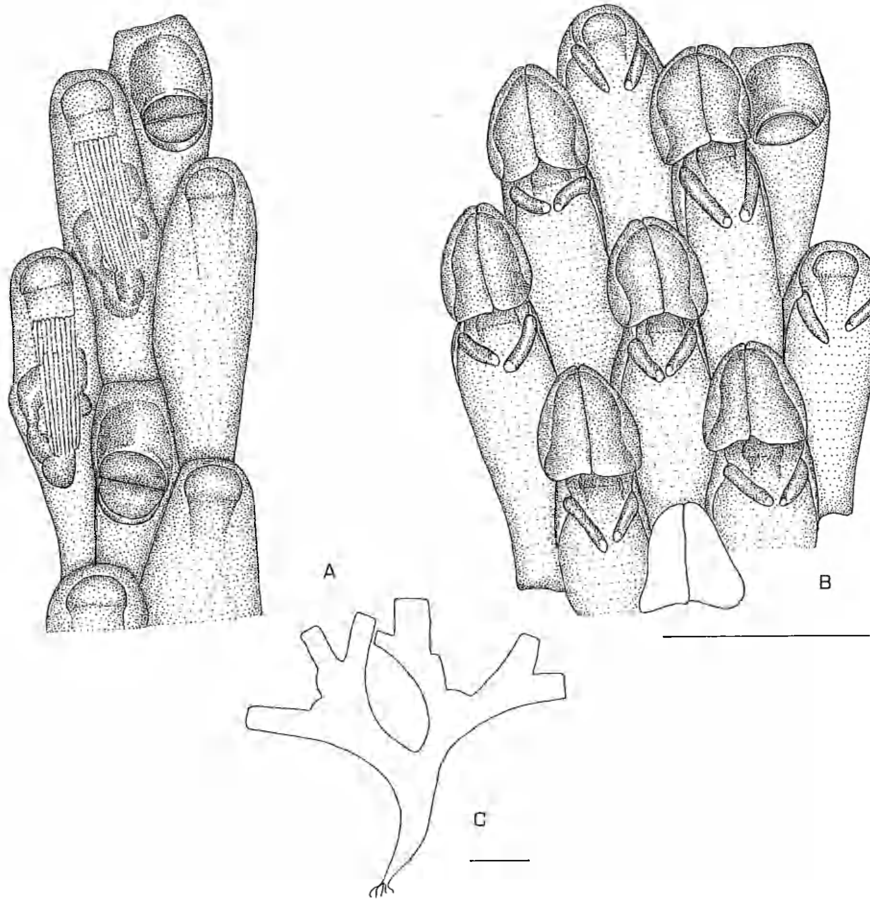


Fig. 56. *Klugeflustra drygalskii.* USARP, Hero 721, Stn. 727. A. Autozooids and avicularia; scale = 1 mm. B. Ovicelled autozooids; scale = 1 mm. C. Diagram of a colony; scale = 10 mm.

Colony encrusting, developing thin, flat, unilaminar sheets on algae. Autozooids rectangular, 0.8–1.2 × 0.3–0.5 mm; frontal surface entirely membranous, lateral walls thin and raised, with a very narrow cryptocystal rim; a triangular area of gymnocystal calcification present in each of the proximal corners of some autozooids, most usually at the bifurcation of autozooid rows. A short, cylindrical spine on each distal corner of the autozooid, persisting in ovicelled autozooids. Avicularia very infrequent, inconspicuous, less than half length of autozooid, with variable width: distal half lightly calcified, supporting the slender, triangular rostrum, acute to frontal plane; proximal half mostly comprising an oval membranous opesia. Ovicell 0.2 × 0.3 mm, slightly flattened frontally, lightly calcified, smooth surfaced and opaque; median suture distinct, with a rounded or triangular fenestra on each side, close to the aperture.

This species was described from western Antarctica by Calvet (1909), and was collected by *Discovery* Investigations from a single station off the South Sandwich

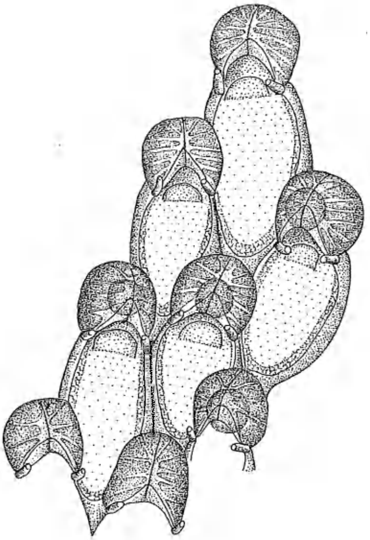


Fig. 57. *Klugeflustra onychocelloides.* Scale = 0.5 mm.

Islands. Livingstone's (1928) brief description of material from Commonwealth Bay, Adelie Land, refers to an avicularium distal to and overlapping the ovicell, and perhaps represents a species of *Ellisina.*

Klugeflustra vanhoffeni (Kluge) Fig. 58

Flustra vanhoffeni Kluge 1914: 655, pl.31, fig.4, text fig.35
Flustra vanhoffeni: Livingstone 1928: pl.3, fig.7; Moyano 1966: 117
Klugeflustra vanhoffeni: Moyano 1972b: 86; Winston and Bernheimer 1986: 370
Flustra arnaudi Androsova 1972a: 96; 1972b: 329, figs.6,7

Colony erect, bilaminar, reddish-brown in colour; developing thick, irregularly lobed or bifurcated fronds, up to 8 cm high, typically about 1 cm broad at the

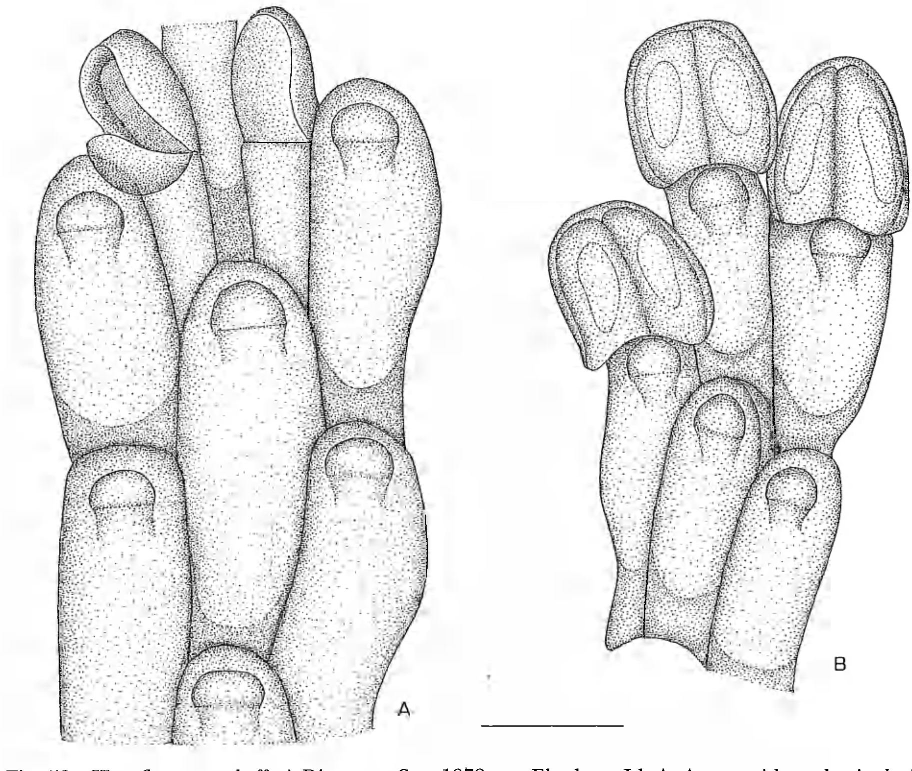


Fig. 58. *Klugeflustra vanhoffeni.* Discovery Stn. 1872, nr. Elephant Id. A. Autozooids and avicularia. B. Ovicelled autozooids. Scale = 1 mm.

colony base, with the broadest lobes achieving 2–3 cm; attached by irregular, dense bundles of rhizoids budded from the frontal surfaces of the lowermost autozooids. Autozooids elongate, linguiform; 1.0–1.6 × 0.2–0.25 mm; distal end broad, rounded, lacking spines; minimal area of gymnocyst present at proximal end of some autozooids, but no cryptocyst. Avicularia about 1.0 mm long, more slender than autozooids; proximal half tapered, with entirely membranous frontal surface; distal half consisting of a lightly calcified rostrum, acute to frontal plane, supporting an elongate, bluntly triangular mandible. Ovicell 0.5 mm long, elongate oval, with pronounced suture; aperture rim sinuous; ectooecial fenestrae occupying about half frontal area.

K. vanhoffeni has been reported from Wilhelm II Land, Queen Mary Land, Graham Land, the South Shetlands and the Palmer Archipelago.

Isosecuriflustra Liu and Hu, 1991

Colony erect, branching, unilaminar or bilaminar, attached by a thick stalk formed from bundles of chitinized rhizoids budded from the basal parts of the colony. Frontal surfaces of autozooids entirely membranous, no cryptocyst or gymnocyst; lateral and distal walls very lightly calcified; no spines. Avicularia vicarious, usually, but not invariably, at bifurcation of autozooid rows; lightly calcified, with rostrum acute to frontal plane, opesia proximal to mandible. Ovicell hyperstomial, partly immersed in succeeding autozooid; entooecium calcified, ectooecium mostly membranous, typically with calcified plates proximo-laterally; closed by the autozooidal operculum.

Type species: *Flustra tenuis* Kluge, 1914

Alloeoflustra Hayward and Winston, 1994 (type species: *Flustra angusta* Kluge, 1914) is a junior synonym of this genus.

Key to Antarctic species

1. Colony unilaminar. Avicularia with elongate, semielliptical mandible .... *I. tenuis*
   Colony bilaminar. Avicularia with short, triangular mandible 2
2. Avicularia with disto-laterally directed mandible .... *I. angusta*
   Avicularia with proximo-laterally directed mandible .... *I. thysanica*

Isosecuriflustra angusta (Kluge) Fig. 59

Flustra angusta Kluge 1914: 653, pl.31, fig.2, text fig.32
Flustra angusta: Livingstone 1928: 20; Moyano 1966a: 117; 1972b: 86; Androsova 1972a: 94; 1972b: 325
Alloeoflustra angusta: Hayward and Winston 1994: 240

Colony bilaminar, developing diffuse, spindly growths, exceeding 10 cm height, with slender branches up to 2 mm wide, dividing dichotomously at intervals of 1–3 cm; or shorter, more bushy tufts with branches up to 6 mm wide. Autozooids in four, alternating, longitudinal series on each branch face, in spindly colonies, up to 15 in bushy colonies; long and narrow, 1.0–1.6 × 0.2–0.4 mm, more or less parallel-sided, with rounded distal ends; frontal surface entirely membranous, operculum with thin marginal sclerite, twice as wide as long, occupying almost the whole width of the autozooid. Avicularia 0.3 × 0.2 mm; distal half lightly calcified, comprising a broadly triangular rostrum, acute to frontal plane and directed obliquely distally; proximal half consisting of a semicircular opesia, with a narrow, granular cryptocystal rim, and a broad border of smooth gymnocyst; mandible short, triangular, with a sharp, projecting, distal tooth. Ovicell 0.3 × 0.3 mm, slightly flattened frontally but remaining prominent; entooecium completely calcified, partly immersed, with a few faint radial striations; ectooecium consisting of paired latero-proximal flaps, meeting and fusing medially, close to the aperture, which is closed by the maternal operculum.

Although the two colony forms appear so dissimilar, the dimensions and mor-

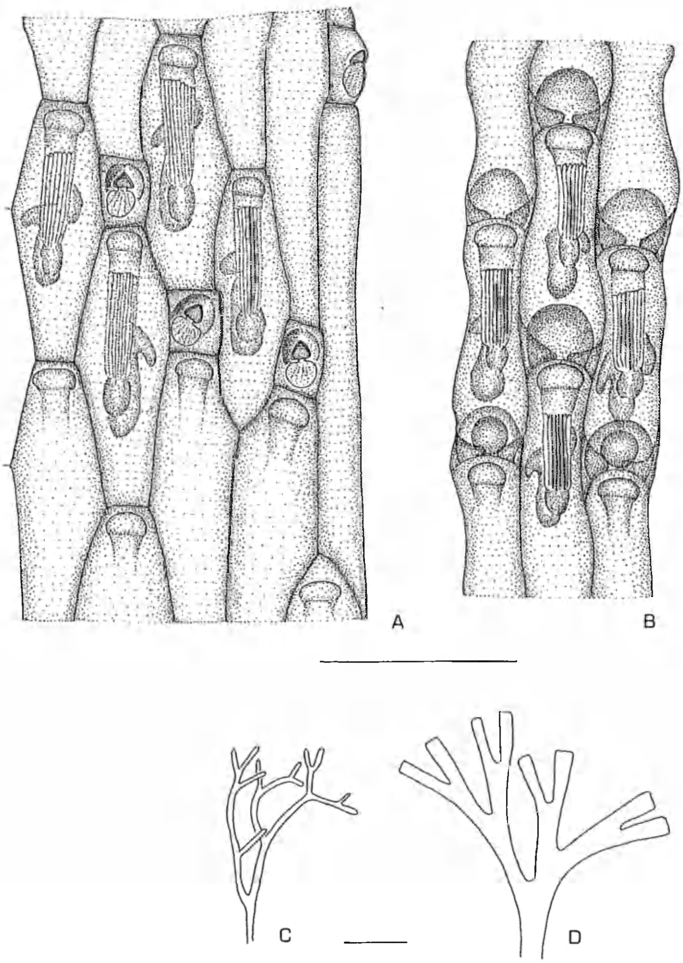


Fig. 59. *Isosecuriflustra angusta.* A. Autozooids and avicularia; branch edge to right, bordered by an elongate kenozooid; Discovery Stn. 190, Bismarck Strait. B. Ovicelled autozooids; Discovery Stn. 190. C. Diagram of a narrow-branched colony; Discovery Stn. 1652, Ross Sea. D. Diagram of a broad-branched colony; Discovery Stn. 1872, nr. Elephant Id. Scale = 1 mm (A, B); 10 mm (C, D).

phology of the autozooids, ovicells and avicularia are identical in both cases. Branch margins are edged with autozooids and avicularia, and occasional kenozooids. In the proximal parts of the colony the margins of the autozooids show signs of thickening, and lateral parts of the frontal membrane are deep brown in colour, suggesting that they may give rise to frontally budded rhizoids. However, at present the basal attachment of the colony remains unknown.

Isosecuriflustra angusta has been widely reported in Antarctic coastal waters, from Wilhelm II Land and Adelie Land, to the Ross Sea, the Palmer Archipelago and Graham Land. It appears to form dense grassy carpets, and is perhaps a conspicuous part of the sessile benthic fauna.

Isosecuriflustra tenuis (Kluge) Fig. 60

Flustra tenuis Kluge 1914: 652, pl.32, fig.5, text fig.31

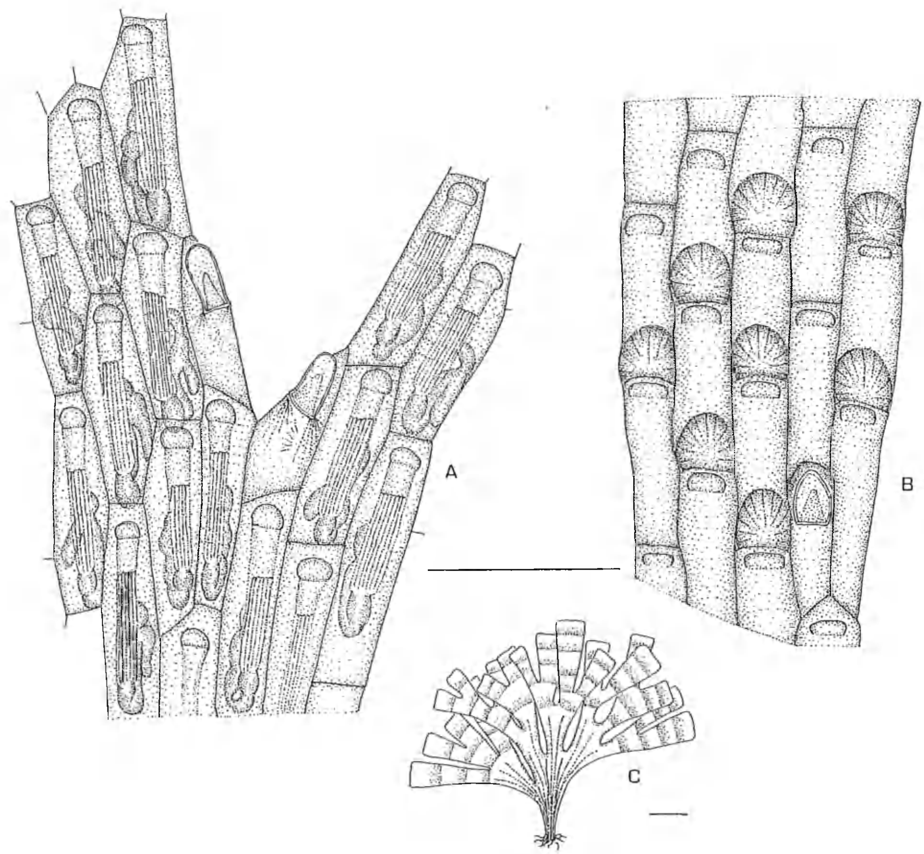


Fig. 60. *Isosecuriflustra tenuis.* A. Autozooids and avicularia at a dichotomy; Discovery Stn. 190, Bismarck Strait. B. Ovicelled autozooids; Signy Id. C. A well grown colony with growth banding; Signy Id. Scale = 1 mm (B, C); 20 mm (C).

Flustra tenuis: Livingstone 1928: 19, pl.3, fig.4; Moyano 1966a: 117; 1972b: 86; Androsova 1972a: 95; 1972b: 327; López Gappa 1982: 40

Isosecuriflustra tenuis: Liu and Hu 1991: 143

Alloeoflustra tenuis: Hayward and Winston 1994: 240

Colony unilaminar, developing broad, richly branched, flabellate fronds up to 10 cm high. Branches dividing dichotomously, commonly 1–2 cm wide. Autozooids more or less rectangular, 0.9–1.0 × 0.3–0.35 mm; frontal surface entirely membranous, operculum slightly wider than long, with thickened marginal sclerite, occupying about half total width of autozooid. Avicularia present at bifurcation of autozooid rows, and along branch margins; 0.8 mm long, slender, the distal half lightly calcified, constituting a raised, distally directed rostrum, supporting a narrow, semielliptical mandible; proximal half almost wholly membranous frontally, with just a narrow border of gymnocystal calcification. Ovicell 0.25 × 0.3 mm, partly immersed, but remaining prominent; entooecium with coarse granulations radiating across its frontal surface; ectooecium wholly membranous, or with indistinct, latero-proximal flaps of calcification; closed by maternal operculum. Branch margins are edged with avicularia, autozooids and occasional kenozooids; proximally the colony develops a stout stalk, formed from thickly chitinized rhizoids budded from the basal surface of the lowest parts of the colony, from its edges, and occasionally from the frontal surface.

Both Androsova (1972a, b) and López Gappa (1982) note that two colony forms may occur in *I. tenuis*, a yellowish, twiggy form with slender branches, and a flabellate type with reddish coloration. A broad-fronded specimen from Signy Island (British Antarctic Survey) retained a deep purplish hue when preserved in alcohol.

This species has been reported from Wilhelm II Land, Adelie Land and Graham Land, and from the South Shetlands and Signy Island.

Isosecuriflustra thysanica (Moyano) Fig. 61

Flustra thysanica Moyano 1972b: 89, pl.1, figs.1–4, pl.2, figs.5–9

Securiflustra thysanica: López Gappa 1982: 40

Alloeoflustra thysanica: Hayward and Winston 1994: 240

Colony bilaminar, with broad, square-ended fronds up to 5 cm high. Branches narrow proximally, broadening to 7 mm at tips; dividing dichotomously at irregu-

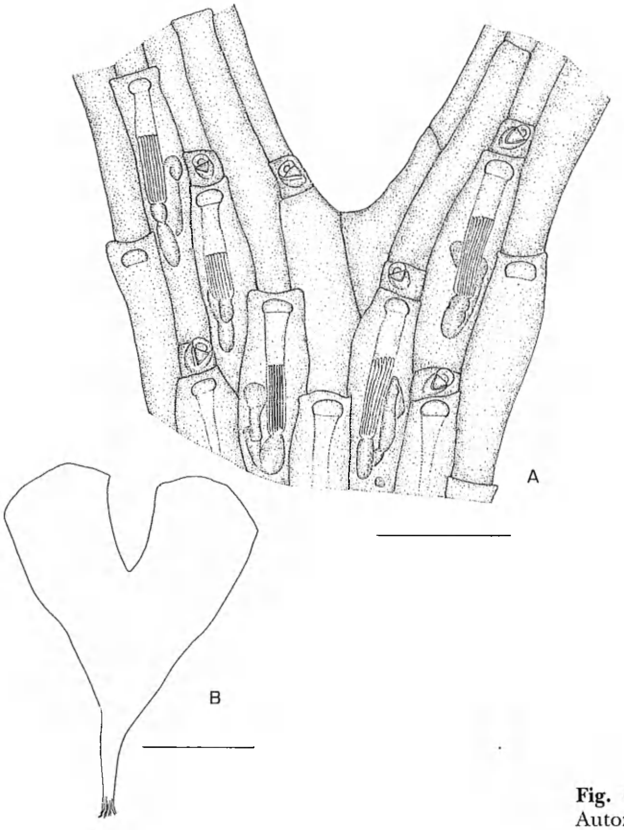


Fig. 61. *Isosecuriflustra thysanica*. A. Autozooids and avicularia at a dichotomy; scale = 1 mm. B. Diagram of a colony; scale = 10 mm.

lar intervals, but also producing wedge-shaped adventitious branches. Autozooids elongate, broadest medially, abruptly truncate distally and proximally, the distal corners slightly produced; 1.3–1.7 × about 0.5 mm. Avicularia frequent, at bifurcation of autozooid rows, or intercalated within rows, and along branch margins; more or less rectangular, 0.25–0.35 × about 0.2 mm; rostrum broadly triangular, acute to frontal plane, proximo-laterally directed; opesia small, oval, with a broad cryptocystal rim. Elongate kenozooids present along branch margins, at termination of autozooid rows, and at axils of dichotomies. Ovicell deeply immersed, visible as an opaque hemisphere distal to the maternal autozooid.

This species was described from two localities in western Antarctica (Moyano 1972b). It is not uncommon off the South Shetland Islands, and has also been collected from the Ross Sea.

Austroflustra López Gappa, 1982

Colony erect, bilaminar, frondose, dividing dichotomously; attached by tubular rhizoids budded from frontal surfaces of lowest autozooids of colony. Autozooids with membranous frontal wall, underlain proximally by a minimal area of cryptocystal calcification; without spines. Avicularia adventitious, small; occasionally more than one per autozooid, usually at the proximal end, associated with the cryptocyst. Ovicell hyperstomial, immersed; entooecium entirely calcified, ectooecium membranous frontally; closed by autozooid operculum.

Type species: *Austroflustra gerlachi* López Gappa, 1982.

Austroflustra was introduced by López Gappa (1982) for two species, *A. gerlachi* and *A. australis*, from the Burdwood Bank. Neither species has been recorded from Antarctic waters; however, López Gappa (1982) also assigned the Antarctic species *Flustra vulgaris* Kluge to his new genus.

Austroflustra vulgaris (Kluge) Fig. 62

Flustra vulgaris Kluge 1914: 654, pl.31, fig.3, text fig.33

Flustra vulgaris: Moyano 1966a: 117; Androsova 1972a: 95; 1972b: 328

Austroflustra vulgaris: López Gappa 1982: 38

Colony up to 15 cm high, with long, slender, almost parallel-sided branches, up to 8 mm wide, dividing at intervals of 1–3 cm; deeply pigmented and retaining a rich brown colour when dried. Autozooids elongate, linguiform, rounded distally, 1.2–1.8 × 0.3–0.4 mm; frontal surface entirely membranous, with an inconspicuous, minimal area of cryptocyst proximally; operculum wider than long, occupying almost whole width of autozooid, with thin marginal sclerite. Avicularia infrequent, sporadic throughout colony, situated at extreme proximal ends of autozooids; cystid rounded, 0.1 mm long, lightly calcified; rostrum acute to frontal plane, directed obliquely proximally, with broadly rounded, short, triangular mandible. Ovicell undescribed. Branch edges consist of slender kenozooids, often very much longer than autozooids.

Austroflustra vulgaris is widely distributed in Antarctic coastal waters, including Adelie Land, the Bellingshausen Sea, the Palmer Archipelago, and the South Shetland Islands.

Nematoflustra Moyano, 1972

Colony erect, unilaminar, with dichotomously dividing fronds; attached by bundles of rhizoids budded from basal and lateral surfaces of proximal parts of colony. Autozooids entirely membranous frontally; without spines. Avicularia vicarious, intercalated within autozooid rows, mandible setiform, thickly chitinized and typically very long. No ovicells.

Type species: *Flustra flagellata* Waters, 1904.

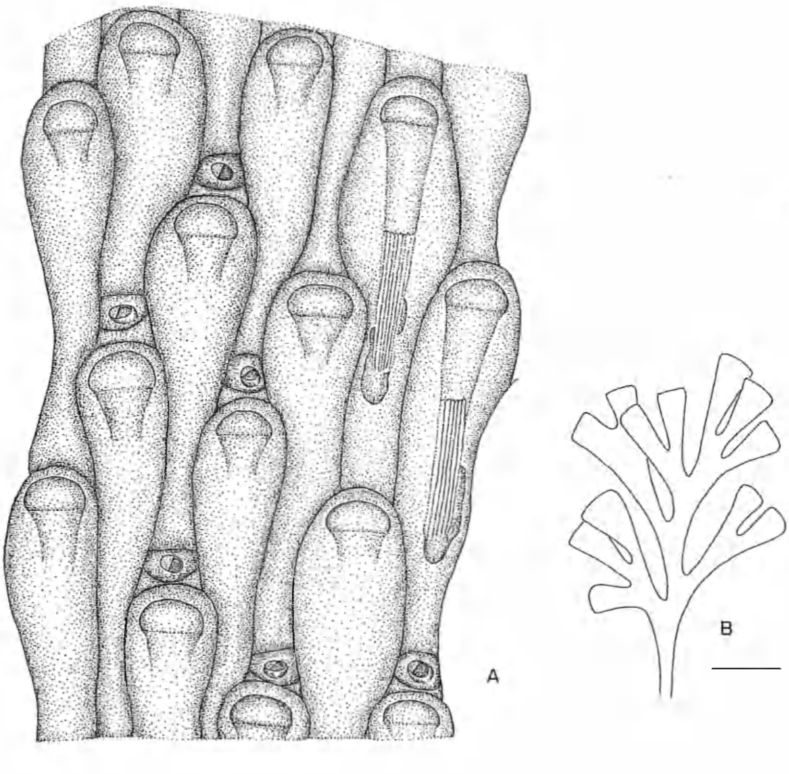


Fig. 62. *Austroflustra vulgaris.* Discovery Stn. 1872, nr. Elephant Id. A. Portion of a colony, branch edge to left; scale = 0.5 mm. B. Diagram of a colony; scale = 20 mm.

Nematoflustra flagellata (Waters) Fig. 63

Flustra flagellata Waters 1904: 27, pl.2, fig.1

Flustra flagellata: Calvet 1909: 9; Kluge 1914: 651, pl.31, fig.1; Livingstone 1928: 18; Moyano 1966a: 117; Androsova 1972a: 94; 1972b: 327

Nematoflustra flagellata: Moyano 1972b: 86; López Gappa 1982: 40; Hayward and Taylor 1984: 72; d'Hondt 1984: 97

Colony developing dense bushy tufts up to 10 cm high, with slender basal stalk of chitinized rhizoids; broadening distally, with straight-sided, truncate branches, up to 5 mm wide, dividing dichotomously at intervals of 1–2 cm. Autozooids rectangular, or narrowly linguiform, 1.0–1.3 × 0.3–0.5 mm; frontal surface entirely membranous, except in some instances where lateral walls may incurve to a slight degree; operculum distinct, thickly chitinized, with rather angular outline. Avicularia numerous, one situated at the distal end of almost every autozooid, closely associated with its distal, terminal wall; setae up to 2.5 mm long, deep brown in colour. Embryos assumed to be brooded internally. Branch margins edged with irregular kenozooids, and, basally, with tubular rhizoids.

Waters (1904) described the heterozooid of *N. flagellata* as a vibraculum, observing that the articulating surface of the seta showed a slight asymmetry of form. However, Waters' observations have yet to be substantiated by a morphological study of the musculature of the heterozooid. *Nematoflustra flagellata* is an

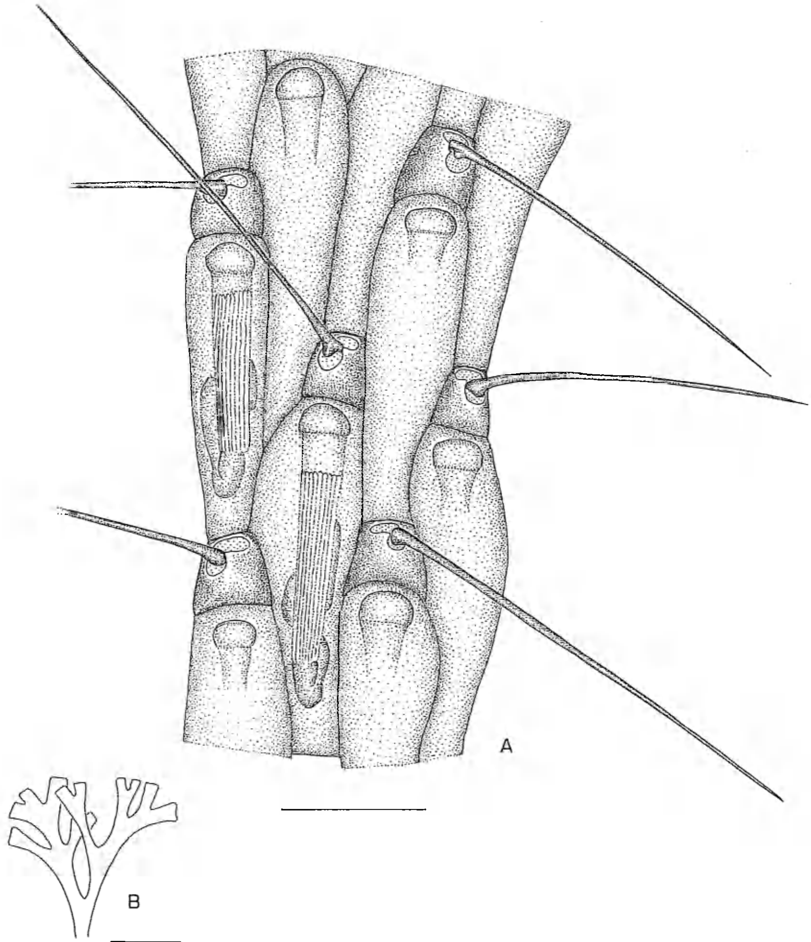


Fig. 63. *Nematoflustra flagellata.* F.I.D.S. Stn. 502. A. Portion of a branch; scale = 0.5 mm. B. Diagram of a colony; scale = 20 mm.

endemic Antarctic species; it appears to be common in Antarctic coastal waters (ranging north as far as South Georgia), and has been reported in practically every account of Antarctic bryozoans since Waters' (1904) original description of it.

CALLOPOROIDEA Norman, 1903

CALLOPORIDAE Norman, 1903

Colony encrusting; or erect, bilaminar or vinculariiform, arising from an encrusting base. Autozooids with large opesia, typically surrounded by spines, and sometimes partly obscured by them; cryptocyst and gymnocyst both present, often well developed. Avicularia present, adventitious or vicarious, sometimes absent. Ovicell hyperstomial, prominent; or immersed, reduced. Interzooidal communication via large basal pore chambers, or multiporous septula.

Pyriporoides Hayward and Thorpe, 1989b

Colony encrusting, developing branching, uniserial chains; budding cruciform, each autozooid producing one distal and paired lateral buds from small basal pore chambers. Autozooids with well developed gymnocyst, and an extensive cryptocyst with oval opesia; spines present at distal ends of autozooids. Avicularia absent. Ovicells hyperstomial, prominent.

Type species: *Membranipora uniserialis* Waters, 1904.

Pyriporoides uniserialis (Waters) Fig. 64

Membranipora uniserialis Waters 1904: 32, pl.2, fig.2

Pyriporoides uniserialis: Hayward and Thorpe 1989b: 914, Fig.1A

Colony developing spreading, uniserial chains, each autozooid producing one distal and paired lateral buds; crowded and irregular on some substrata, but with a perfect cruciform branching pattern on flat substrata. Autozooids clavate, narrowest proximally, broadest halfway along length of cryptocyst; 0.75–1.0 × 0.4–0.5 mm. Gymnocyst comprising half total autozooid length, continuous distally with smooth, sloping lateral walls; frontal membrane bounded by a smooth, thickened, mural rim and underlain for half its length by flat, smoothly calcified cryptocyst; opesia elongate oval. Six stout, pointed spines arranged in an arc at distal end of opesia. Ovicell elongate oval, smooth surfaced, imperforate, developing a short, longitudinal, frontal ridge.

This species is presently known from a few localities in the Bellingshausen Sea and the Bismarck Strait, western Antarctica. The few specimens so far collected, from 315 to 480 m, were encrusting small stones.

Ellisina Norman, 1903

Colony encrusting. Autozooids with large opesia, surrounded by narrow rim of cryptocyst; gymnocyst limited to a minimal area proximally, continuous with the incurved lateral walls. Avicularia interzooidal. Ovicells by definition endozooidal, intimately associated with a distally placed avicularium or kenozooid, which contributes the outer layer of the ovicell. Basal pore-chambers present. Spines absent, except in ancestrula and periancestrular zooids; gymnocystal tubercles may be present. Basal walls of autozooids typically partly or wholly uncalcified.

Type species: *Membranipora levata* Hincks, 1882.

Species of *Ellisina* occur in shallow shelf waters throughout the world, frequently on organic carbonate substrata. Two species are currently known from Antarctica, one of which, *E. antarctica*

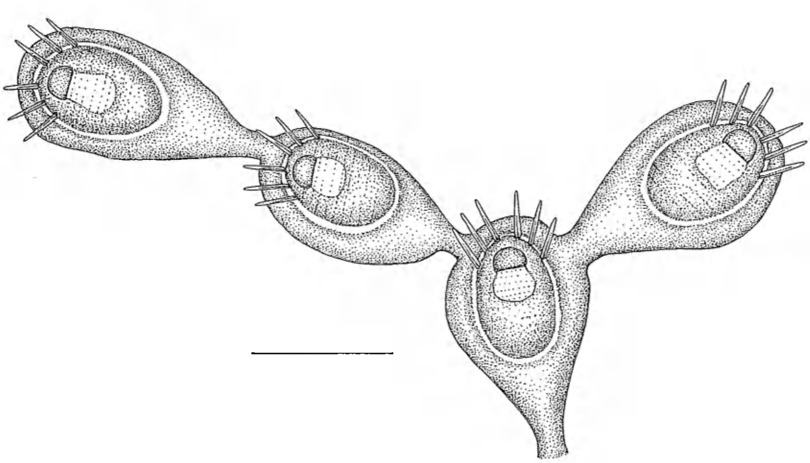


Fig. 64. *Pyriporoides uniserialis.* Discovery Stn. 190, Bismarck Strait. Scale = 0.5 mm.

Hastings, has also been reported from the Falkland Islands and the southern Patagonian Shelf, where it has been confused with *E. incrustans* (Waters). The latter species is distinguished from *E. antarctica* principally by its ovicell, which does not have an avicularium distal to it; *E. incrustans* does not extend into Antarctic seas.

Key to Antarctic species

1. Ovicell uniformly smooth, developing a small frontal ridge; invariably with an avicularium distal to it. All avicularia with mandible disto-laterally directed .... *E. antarctica*

   Ovicell with smooth proximal calcification and coarsely granular distal calcification; without a distal avicularium. Mandible of avicularium laterally directed .... *E. constantia*

Ellisina antarctica Hastings — Fig. 65A,B

Ellisina antarctica Hastings 1945: 94, fig.6
Ellisina antarctica: Hayward 1980: 702; Moyano 1984a: 80; Hayward and Taylor 1984: 72; Hayward and Thorpe 1989b: 921, Figs.5A,B.

Colony forming broad, spreading, unilaminar sheets, light brown in freshly collected specimens. Autozooids oval to irregular, separated by distinct grooves; 0.6–0.8 × 0.4–0.5 mm; very lightly calcified, with a narrow border of smooth, incurved gymnocystal calcification, and an equally narrow, finely granular, cryptocystal rim of almost constant width from the proximal end of the opesia almost to the orifice. Basal wall partly uncalcified. Avicularia frequent, each situated distal to an autozooid, with smoothly calcified, rather swollen cystid; rostrum acutely pointed, directed disto-laterally, proximal portion with a well developed, granular, cryptocyst, and only a slender central foramen, below stout, unfused condyles. Ovicell prominent, about as wide as long, always immersed in the distal avicularium, the gymnocyst of which forms the outer layer of the ovicell; frontal surface with a small ridge or umbo. Ancestrula oval, identical to later autozooids but only half as large, opesia surrounded by five to seven short, slender spines; periancestrular autozooids sometimes with a few spines at their distal ends. Irregularly shaped kenozooids, with the opesia occluded by cryptocystal calcification, occur frequently in disordered areas of the colony.

Hastings (1945) distinguished *E. antarctica* from *E. incrustans* (Waters), and considered that Antarctic records of the latter cited by both Waters (1904) and Calvet (1909) belonged to this species. She also suggested that part of the material of *Membranipora watersi* described by Kluge (1914) should be attributed to *E. antarctica*. However, Hastings (1945) was uncertain about the distinction between *E. antarctica* and the New Zealand species, *E. sericea* (MacGillivray). Gordon (1984) described new material of *E. sericea* from New Zealand, and his figures show that the avicularia, also intimately associated with the ovicells, are distinctly laterally directed and slightly smaller than those of *E. antarctica*.

Specimens of *E. antarctica* from Signy Island include colonies in which a small number of autozooids may bear a single, proximal tubercle, surmounted by a chitinous spinous tip. Many of the ovicells in these colonies have the median umbo quite strongly developed. However, there is considerable variation of these features both within and between colonies in the Signy Island samples, many of which are identical to specimens from the Ross Sea (Fig. 65A), and there seem to be no grounds for making a taxonomic distinction between them.

E. antarctica is widely distributed, and common, throughout Antarctic shelf waters, ranging north to Signy Island and South Georgia, and has been reported from the Falkland Isles and the Southern

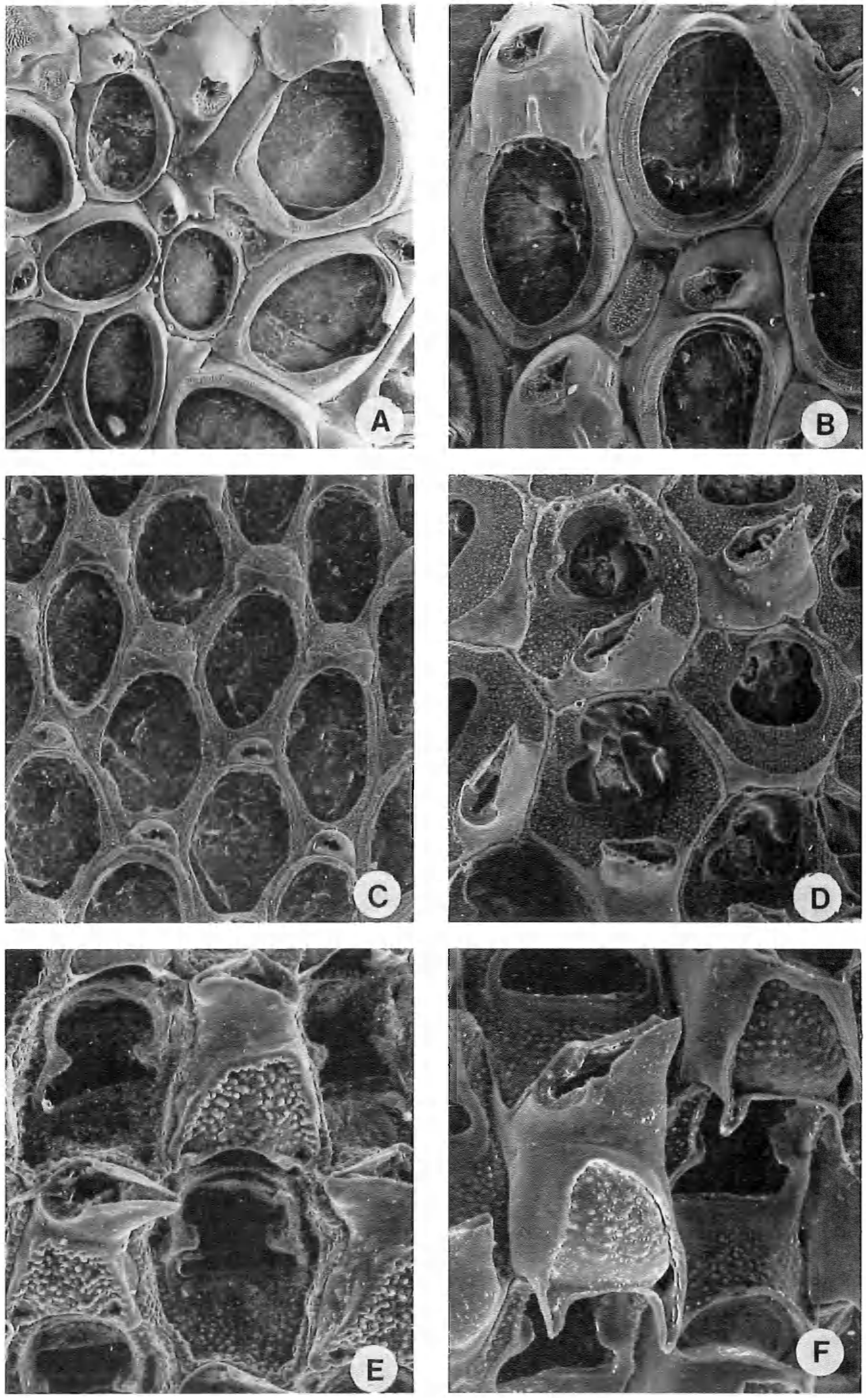


Fig. 65. A, B. *Ellisina antarctica;* Discovery Stn. 1660, Ross Sea; ×50. C. *Ellisina constantia;* Terra Nova Stn. 194, Ross Sea; ×31. D. *Amphiblestrum familiaris;* Discovery Stn. 1948, nr. Elephant Id.; ×34. E. *Amphiblestrum georgensis;* Discovery Stn. 27, South Georgia; ×70. F. *Amphiblestrum inermis;* Discovery Stn. 55, East Falkland; ×65.

Patagonian shelf (Hastings 1945). It encrusts stones, shells and other bryozoan colonies, and even small algae.

Ellisina constantia (Kluge) Fig. 65C

Membranipora constantia Kluge 1914: 661, pl.34, fig.3

Membranipora constantia: Moyano 1972a: 9

Ellisina constantia: Hayward and Thorpe 1989b: 935, Fig.5D

not *Callopora constantia*: d'Hondt 1984: 100

Colony forming thin, flat, unilaminar sheets. Autozooids large, oval to hexagonal, or irregular, separated by distinct grooves, 0.9–1.1 × 0.65–0.85 mm; vertical walls low; opesia bordered by narrow, coarsely granular cryptocyst, merging with a conspicuous, crenulate mural rim; no gymnocyst. Avicularia present at distal end of almost all autozooids: cystid smooth and rounded, rostrum bluntly triangular, laterally directed; condyles well developed, not meeting medially; cryptocyst relatively broad, with an oval opesia. Ovicell conspicuous and distinctive: calcification smooth frontally, separated by an abrupt transverse discontinuity from coarsely granular distal calcification, continuous with cryptocyst of the succeeding autozooid. Avicularia not developed distal to brooding autozooids.

Ellisina constantia is known from localities in the Bellingshausen Sea and the Ross Sea, but is probably quite widespread in Antarctic coastal waters. Its thin, flat colonies are often found on the basal surfaces of large, erect ascophorans, such as *Bostrychopora dentata* (Waters), where they are quite inconspicuous. d'Hondt (1984) described material from Kerguelen in which an adventitious avicularium was borne on a gymnocyst. It is clearly not Kluge's species.

Amphiblestrum Gray, 1848

Colony encrusting. Autozooids with a variable area of gymnocyst, and an extensive, flat cryptocyst; opesia trilobed, often markedly so, with the oval distal portion separated from a variably bilobed proximal portion by thickened condylar processes. Distal oral spines present, or rarely absent. Avicularia adventitious, generally borne on the gymnocyst, and often overlapping the ovicell of the preceding autozooid. Ovicell hyperstomial, prominent; ectooecium partly membranous, separated by a thickened ridge from a frontal area of granular entooecium, variable in extent; not closed by the autozooidal operculum. Basal pore chambers present.

Type species: *Membranipora flemingii* Busk, 1854.

Amphiblestrum is geographically widespread, with species described from all of the world's seas. Four species are presently known from Antarctica; discrimination between them is sometimes difficult, and juvenile colonies are perhaps not easily separated. Bishop and Hayward (1989) have distinguished *Amphiblestrum* from *Ramphonotus* Norman, 1903, with which it was formerly synonymized.

Key to Antarctic species

1. Autozooids with a pair of distal spines, most obvious at the growing edge of the colony....... *A. familiaris*
   Autozooids without spines.............. 2
2. Avicularia absent. Opesia broadly trilobed, the proximal edge typically concave...................... *A. rossi*
   Avicularia present. Opesia markedly trilobed, the proximal edge straight 3
3. Ovicell with prominent proximolateral processes. Autozooids >0.6 mm long, with finely granular calcification.................... *A. inermis*
   Ovicell without proximo-lateral processes. Autozooids <0.5 mm long, with coarse calcification .... *A. georgensis*

Amphiblestrum familiaris Hayward and Thorpe Fig. 65D

Amphiblestrum familiaris Hayward and Thorpe 1989b: 916, Fig. 2C

Autozooids large, broad and flat, more or less hexagonal, separated by thin, raised ridges; 0.7–0.9 × 0.6–0.8 mm. Gymnocyst present in some autozooids as a narrow, triangular area of smooth calcification, in others it forms a narrow shelf grading into the calcification of the avicularian cystid; cryptocyst flat, finely granular. Opesia equivalent to about half autozooid length, broadly trifoliate, with a border of smooth calcification; proximal edge straight, condylar processes prominent, rounded. Two short, distal spines present in early ontogeny, lost in older autozooids. Avicularium occupying almost whole width of autozooid; rostrum slender, triangular, acute to frontal plane, directed laterally, and slightly curved laterally at its distal end. Ovicells undescribed.

Amphiblestrum familiaris is especially characterized by its broad, flat autozooids, each of which has a pair of distal spines in early ontogeny, and by its opesia, which is less distinctly trilobed than in *A. inermis* and *A. georgensis*. At present, this species is known only from the South Shetland Isles.

Amphiblestrum georgensis Fig. 65E
Hayward and Thorpe

Amphiblestrum georgensis Hayward and Thorpe 1989b: 917, Fig.3A,B

Autozooids oval to hexagonal, separated by narrow grooves; 0.4–0.5 × 0.3–0.4 mm; lateral walls raised, tuberculate, with finely beaded edge. Gymnocyst obscured by avicularium; cryptocyst concave, coarsely granular; opesia about half length of autozooid, roughly trifoliate, proximal edge straight or convex, bordered by more finely granular calcification; condylar processes prominent, thick and blunt, situated about halfway along length of opesia. No distal spines. Avicularium occupying entire width of autozooid; rostrum elongate triangular, straight, acute to frontal plane, laterally directed. Ovicell about as wide as long; with a broad area of coarsely granular entooecium occupying most of frontal surface, becoming more or less triangular in later ontogeny as the thickened border of ectooecium encroaches on it.

This species is most similar to *A. inermis* (Kluge) but is distinguished by the smaller size of its autozooids, and by its thicker, more coarsely granular calcification. Further, the frontal area of entooecium in *A. georgensis* becomes progressively triangular as the ectooecial rim thickens, and the ovicell does not develop the proximal processes seen in *A. inermis*. *A. georgensis* is presently known only from South Georgia, and from a single locality on the southern Patagonian Shelf.

Amphiblestrum inermis Fig. 65F
(Kluge)

Membranipora inermis Kluge 1914: 663, pl.34, fig.6
Membranipora minax: Calvet 1909: 16
Ramphonotus inermis: Livingstone 1928: 15; Moyano 1984a: 81
Amphiblestrum inermis: Hayward and Taylor 1984: 72; Hayward and Thorpe 1989b: 917, Fig.3F

Autozooids hexagonal to quadrangular, separated by indistinct grooves; 0.6–0.7 × 0.35–0.45 mm. Gymnocyst obscured by avicularium; cryptocyst convex proximally, dipping gently towards opesia, finely and regularly granular; opesia equivalent to half autozooid length, broadly trifoliate, as wide proximally as long, with prominent, lobed condylar processes halfway along its length; calcification bordering opesia tending to be smooth. No distal spines. Avicularium prominent, occupying entire width of autozooid; rostrum elongate triangular, acute to lateral plane, laterally directed, and strongly curved at the tip. Ovicell slightly longer than wide, strongly convex; frontal area consisting almost entirely of granular entooecium, with the thin raised rim of ectooecium typically produced at the proximal corners as pointed processes; distally, the ovicell is capped by the avicularium of the next autozooid.

A. inermis is particularly characterized by the distinctive processes developed at the frontal-proximal corners of the ovicell, and by its lack of spines. It is an endemic species, widely reported from Antarctic seas and recorded along the Scotia Arc as far north as the South Sandwich Islands.

Amphiblestrum rossi Hayward and Thorpe Fig. 66A

Amphiblestrum rossi Hayward and Thorpe 1989b: 918, Fig.3C,D

Autozooids large, broad and flat, hexagonal, separated by narrow grooves; 0.85–1.10 × 0.45–0.55 mm. Gymnocyst developed as a small triangle of smooth calcification in some autozooids; cryptocyst finely granular, slightly concave medially; opesia less than half autozooid width, broadly trilobed, with a narrow border of smooth calcification; proximal edge frequently concave, condylar processes prominent, rounded. No spines. No avicularia. Ovicell about as wide as long; frontal area of granular entooecium quadrangular or triangular, variable in extent but becoming more narrowly triangular in later ontogeny. Ancestrula similar to later autozooids but with eight peripheral spines; budding a distal triplet of autozooids.

This endemic Antarctic species is presently known only from the Ross Sea. It differs from all other Antarctic species of *Amphiblestrum* in lacking both spines and avicularia, as well as in the large size of its autozooids.

Crassimarginatella Canu, 1900

Colony encrusting; or erect, rising from an encrusting base as flat or twiglike, bilaminar growths. Autozooids with extensive frontal membrane; gymnocyst variably developed, cryptocyst present as a narrow, granular rim bordering the opesia. Spines present or absent. Avicularia vicarious. Ovicell variable: prominent and globular, or small, caplike; typically with an uncalcified frontal fenestra. Vertical walls with multiporous septula.

Type species: *Membranipora crassimarginata* Hincks, 1880b.

Crassimarginatella comprises a large number of species, and the genus is widely distributed in all temperate, tropical and polar seas. As presently constituted it is a highly heterogeneous group, in need of systematic revision. Gordon (1984, 1986) has provided the most recent appraisal of southern hemisphere species, ordering them into a number of subgenera, several of which perhaps deserve independent generic status.

Key to Antarctic species

1. Autozooid with narrow, granular cryptocyst bordering the opesia. Avicularia oval, with linguiform mandible .... *C. inconstantia*
   Autozooid completely devoid of cryptocyst, frontal surface almost entirely membranous. Avicularia with short semicircular mandible .... *C. perlucida*

Crassimarginatella inconstantia (Kluge) Fig. 66B

Membranipora inconstantia Kluge 1914: 660, pl.34, fig.2

Crassimarginatella inconstantia: Hayward and Thorpe 1989b: 919, Fig.1B

Colony encrusting, forming thin, flat, unilaminar sheets. Autozooids large, oval to rectangular, separated by distinct grooves; 0.8–1.00 × 0.4–0.6 mm. Vertical walls thinly calcified, deep, with conspicuous multiporous septula; frontal surface almost entirely membranous, gymnocyst minimal, cryptocyst present as a very narrow, finely granular border to the proximal half of the opesia. No spines. Avicularia infrequent; about half size of autozooids, elongate oval, rostrum parallel-sided, rounded and slightly raised distally; mandible linguiform, about half length of cystid; proximal half with a large opesia bordered by a narrow, granular cryptocyst, condyles apparent as

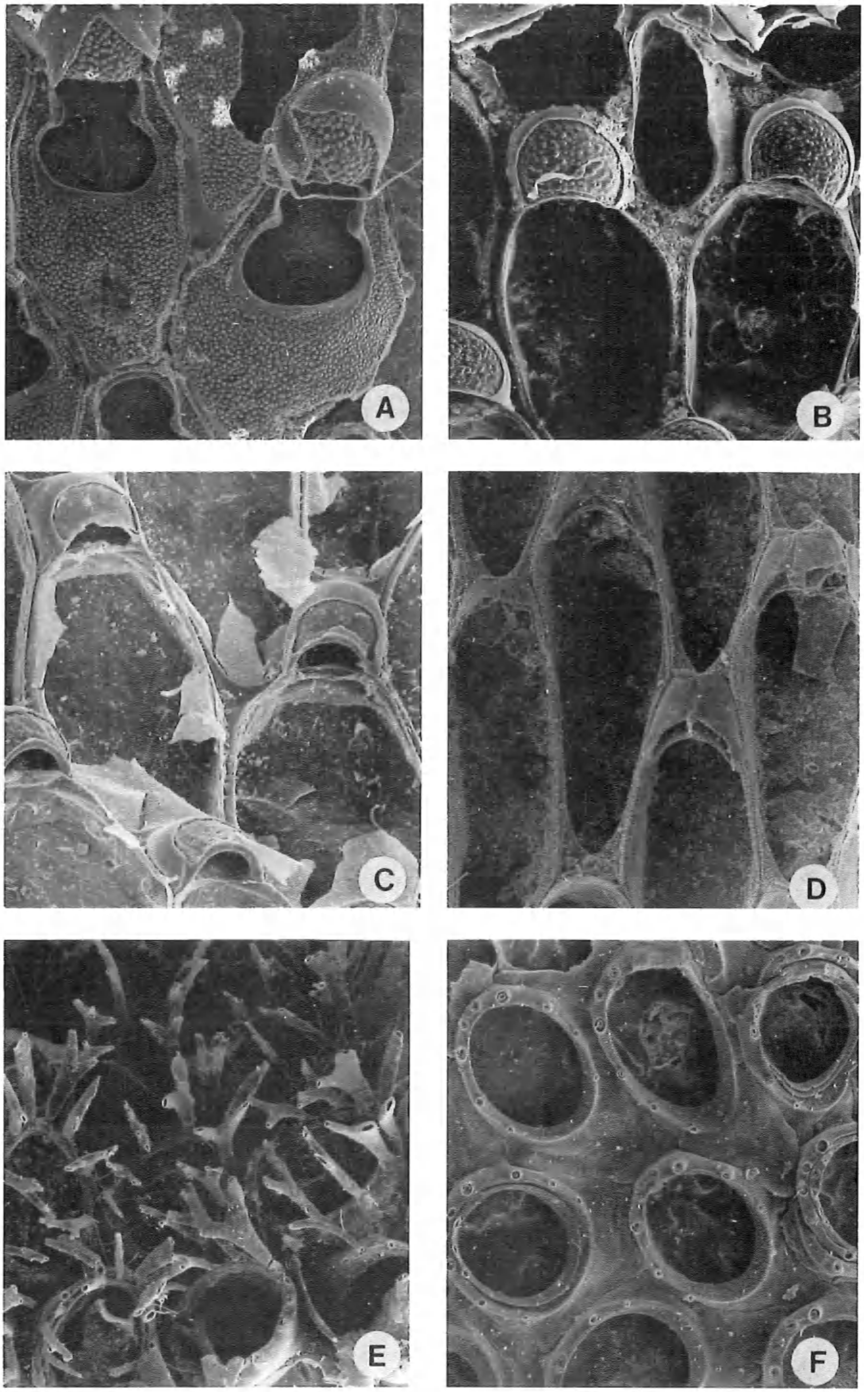


Fig. 66. A. *Amphiblestrum rossi;* Discovery Stn. 1652, Ross Sea; ×40. B. *Crassimarginatella inconstania;* Discovery Stn. 1660, Ross Sea; ×50. C. *Crassimarginatella perlucida;* McMurdo Sound, Ross Sea; ×40. D. *Valdemunitella lata;* Discovery Stn. 1652, Ross Sea; ×28. E, F. *Xylochotridens rangifer;* Antarctic Peninsula. E. Autozooids with intact spines; ×29. F. Group of cleaned autozooids; ×29.

slight thickenings only. Ovicell prominent, convex, recumbent on distally succeeding autozooid, with a smooth, peripheral band of ectooecium, frontal surface consisting entirely of granular entooecium.

The thin, flat colonies of this species, which may occur on the basal surfaces of erect, unilaminar ascophorans, such as *Lageneschara lyrulata*, are particularly inconspicuous. To date, *C. inconstantia* has been reported from Wilhelm II Land and the Ross Sea, but is probably quite widely distributed in Antarctic Shelf waters.

Crassimarginatella perlucida (Kluge) Fig. 66C

Membranipora perlucida Kluge 1914: 660, pl.34, fig.1

Crassimarginatella perlucida: Hayward and Thorpe 1989b: 920, Figs.1C,4E

Colony encrusting, developing an extensive, thin, flat, unilaminar sheet. Autozooids large, oval to hexagonal, separated by narrow grooves; 0.9–1.3 × 0.55–0.7 mm. Vertical walls low, lightly calcified, with small, indistinct septula; frontal surface entirely membranous, except for a minute area of gymnocyst in each proximal corner; no cryptocyst. No spines. Avicularia infrequent, about one-third size of autozooids, oval, with smooth gymnocystal calcification but no cryptocyst; frontal surface equally divided between the frontal membrane and a large, semicircular mandible. Ovicell convex, with smooth ectooecium, and with granular entooecium exposed over much of the frontal surface.

The extremely thin, lightly calcified colonies of this species are very inconspicuous. It has been reported from Wilhelm II Land, and on the basal surfaces of *Lageneschara lyrulata* colonies from the Ross Sea.

Valdemunitella Canu, 1900

Colony encrusting, or developing erect, bilaminar or unilaminar sheets. Frontal surface of autozooids with extensive opesia; gymnocyst variably developed, sometimes very reduced; cryptocyst typically forming a narrow granular border to the opesia. Spines present or absent. Avicularia vicarious, sometimes absent. Ovicell bipartite, with a median longitudinal suture; with a distinctive frontal fenestra on each side of the suture.

Type species: *Membranipora valdemunita* Hincks, 1885.

Gordon (1986) considered *Valdemunitella* as a subgenus of *Crassimarginatella* Canu. However, as Gordon noted (1986: 33), the ovicell of the type and other species of *Valdemunitella* is quite different from that of all species of *Crassimarginatella*, developing as paired folds, rather than a single fold, which fuse medially to give a characteristic bipartite, bifenestrate ovicell. Brown (1952) regarded this feature as sufficiently distinctive to maintain *Valdemunitella* as a separate genus, and his opinion is followed here.

Valdemunitella lata (Kluge) Fig. 66D

Membranipora lata Kluge 1914: 661, pl.34, fig.4

Ogivalina lata: Livingstone 1928: 12, pl.5, fig.1, pl.7, fig.5, text fig.1

Crassimarginatella (Valdemunitella) lata: Hayward and Thorpe 1989b: 920, Fig.4C,D

Colony encrusting, forming flat, loosely attached sheets, or developing erect unilaminar or bilaminar lobes. Autozooids elongate, hexagonal to rectangular, rounded distally, separated by narrow grooves; 0.9–1.1 × 0.5–0.65 mm. Vertical walls deep, thinly calcified, with multiporous septula; frontal surface entirely membranous, without gymnocyst, cryptocyst developed in proximal half of autozooid as a narrow, coarsely granular rim to the opesia. No spines or avicularia. Ovicell wider than long, partially immersed, convex, with median longitudinal suture pronounced; frontal fenestrae narrow, immediately distal to aperture, extending across whole width of ovicell, separated by a thickened median septum.

Valdemunitella lata seems to be widespread in Antarctic waters, having been reported from Wilhelm II Land, Adelie Land, the Ross Sea, Palmer Archipelago, Graham Land and South Georgia. A single specimen was reported by Hayward and Thorpe (1989b) from the southern Patagonian Shelf.

Xylochotridens Hayward and Thorpe, 1989

Colony encrusting. Autozooids with well developed gymnocyst, and narrow granular cryptocyst. Opesia occupying larger part of frontal surface, surrounded by erect, spatulate spines, each jointed basally and with a distinct lumen. Vertical walls deep, with large multiporous septula. Ovicell hyperstomial, closed by autozooidal operculum; with a large frontal fenestra, bounded by a raised ectooecial rim. No avicularia.

Type species: *Xylochotridens rangifer* Hayward and Thorpe, 1989

Xylochotridens rangifer Hayward and Thorpe Fig. 66E,F

Xylochotridens rangifer Hayward and Thorpe 1989b: 936, Fig.5E,F

Colony forming broad, irregular sheets on hard substrata. Autozooids irregularly hexagonal, separated by shallow grooves, occasionally partly disjunct; 0.8–1.00 × 0.5–0.6 mm. Opesia oval, constituting larger part of frontal surface, with a narrow, finely granular cryptocystal rim, broadest proximally, enclosed by a thickened mural rim. Gymnocyst comprising one-quarter total autozooid length, continuous distally with incurved lateral walls; smooth, or with a few transverse corrugations. Eight to ten stout spines evenly spaced around opesia, straight or slightly incurved; some or all broadened, flat-sectioned and branching at their distal ends, the four distalmost spines distinctly palmate. Ovicell hemispherical, rather small, recumbent on distally succeeding autozooid; ectooecium smooth; entooecium smooth, at first exposed over the entire frontal surface of the ovicell, later limited to a transversely oval area as ectooecium calcifies in a band distal to the ovicell aperture; the ectooecial rim distal to the entooecium is typically produced as a projecting peak.

X. rangifer is presently known only from the South Shetland Islands, where, however it seems to be quite common.

CHAPERIIDAE Jullien, 1888

Colony encrusting or erect; unilaminar, bilaminar or vinculariiform. Autozooids with large opesia, sometimes obscured by scutiform shield incorporating avicularia, or by pedunculate avicularia, or overarched spines; gymnocyst generally small, often very reduced; cryptocyst typically well developed. Calcified occlusor laminae, associated with the insertions of the opercular occlusor muscles, often conspicuously developed at the distal ends of the autozooids, between the inner surfaces of the lateral and distal walls. Avicularia sessile or pedunculate; absent in a minority of species, more usually abundant, and of several types. Ovicell hyperstomial, or immersed, or, rarely, lacking. Vertical walls with multiporous septula.

The genera of Chaperiidae have been reviewed and clarified by Gordon (1982).

Chaperiopsis Uttley, 1949

Colony encrusting; or developing partly erect, folded, unilaminar sheets, or erect, rigid, bilaminar sheets, or slender, branching, vinculariiform growths; always attached to the substratum by encrusting sheets of autozooids. Gymnocyst reduced; cryptocyst generally well developed; opesia occupying larger part of frontal surface, sometimes obscured by palmate processes arising from proximal avicularia. Spines distributed around distal opesial rim, often richly branched, or broadly palmate; subopercular occlusor laminae conspicuous at distal end of autozooid cavity. Avicularia typically numerous and various: a sessile avicularium frequently present at base of distal terminal wall; sessile or pedunculate avicularia associated with ovicell, attached to gymnocyst, or replacing distal spines. Ovicell hyperstomial, with frontal fenestra banded by ectooecial ridge, sealed by a conspicuous ooecial fold. Vertical walls with large multiporous septula.

Type species: *Membranipora galeata* Busk, 1854.

Chaperiopsis is a richly speciose genus, widely distributed in southern hemisphere temperate and polar waters. Gordon (1982) redefined *Chaperiopsis* Uttley in a systematic review of the chaperiid genera, and subsequently (Gordon 1984, 1986) produced descriptions and illustrations of numerous New Zealand species. Sixteen Antarctic and Subantarctic species collected by *Discovery* Investigations were described and figured by Hayward and Thorpe (1988d).

Key to Antarctic species

1. Ovicell smooth, without a frontal fenestra. Spines thick, fusiform, curved; as long as autozooid .... *C. quadrispinosa*
   Ovicell with a frontal fenestra. Spines cylindrical, branched, or short and thick 2
2. Ovicell with coarsely granular frontal area. Distal sessile avicularium tiny, occlusor laminae not converging .... *C. patulosa*
   Ovicell with smoothly calcified frontal area 3
3. Occlusor laminae intersecting distal autozooid wall independently. Two or three pairs of short, thick spines, cylindrical or forked, all of equivalent length......................... 4
   Occlusor laminae fusing just short of distal autozooid wall. Two or more pairs of spines, of differing length, usually slender 6
4. Spines bifurcate or trifurcate. A small distal sessile avicularium present........................ *C. orbiculata*
   Spines cylindrical. No distal sessile avicularium 5
5. Two pairs of spines present. Opesia as wide as long. No columnar avicularia .... *C. rotundata*
   Three pairs of spines present. Opesia longer than wide. Columnar avicularia sporadic, but one almost invariably associated with ovicell, its rostrum proximally directed....................... *C. signyensis*
6. Two pairs of spines on distal rim of opesia, plus two or more pairs of more slender spines rising from distal wall of autozooid; all branched, often many times .... *C. cervicornis*
   Two pairs of spines only, none of them branched 7
7. No distal sessile avicularium. One avicularium on gymnocyst, transversely orientated (rarely twinned and proximally orientated); directed proximally if succeeding an ovicell.............................. *C. galeata*
   Distal sessile avicularium present. One or two gymnocystal avicularia, proximally orientated, with pointed processes projecting over frontal membrane .... *C. protecta*

Chaperiopsis cervicornis (Busk) Fig. 67A,B

Membranipora cervicornis Busk 1854: 60, pl.100, fig.3

Chaperia cervicornis: Waters 1904: 33; Calvet 1909: 18

Chaperiopsis cervicornis: Gordon 1986: 41, pl.11,B–E; Hayward and Thorpe 1988d: 48, Fig.1A,B

Colony encrusting. Autozooids broadly oval, flat; 0.45–0.55 × 0.35–0.45 mm. Opesia as wide as, or slightly wider than, long; proximal edge deeply concave, distal edge almost straight. Two pairs of spines on distal rim of opesia, erect, straight, of variable thickness, proximal

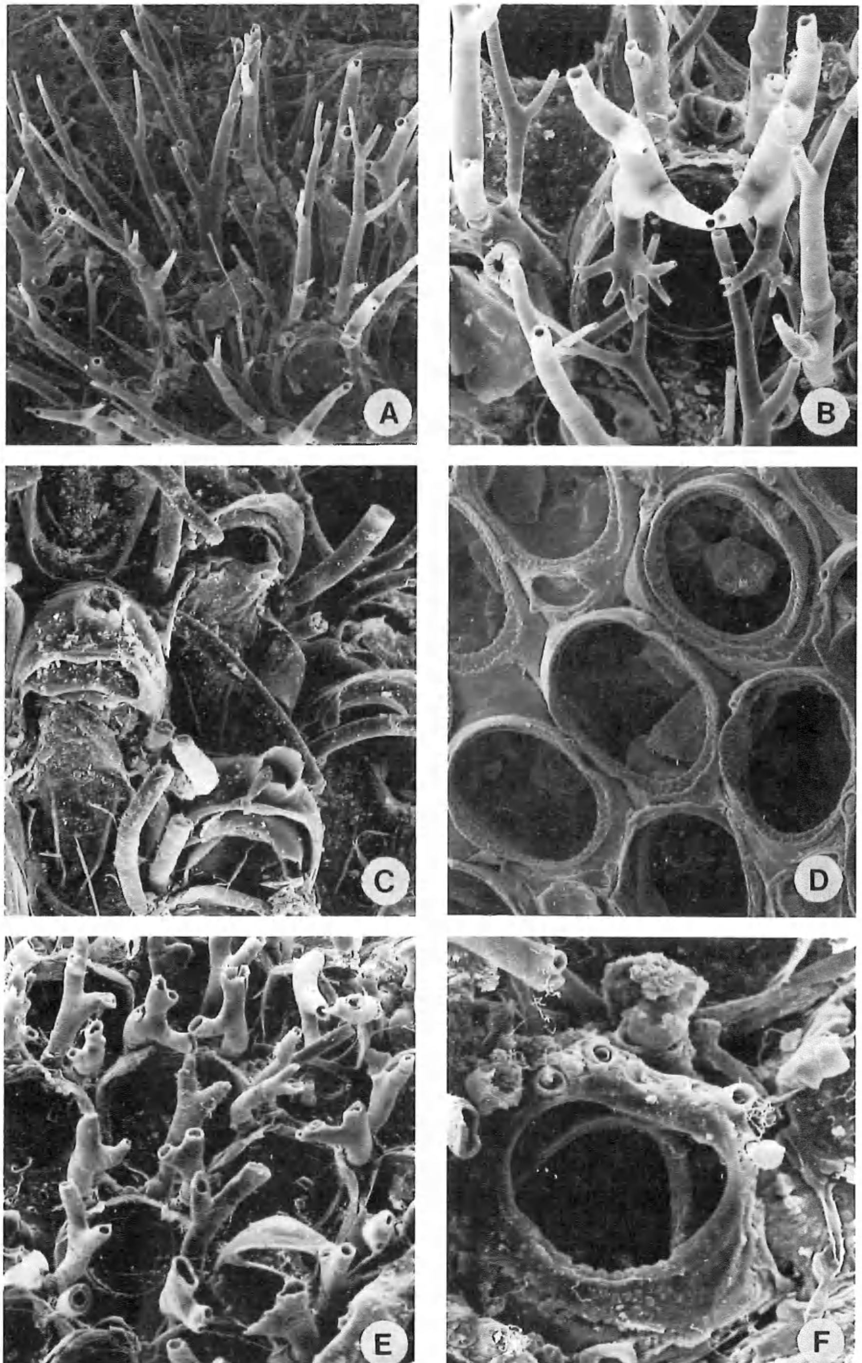


Fig. 67. A, B. *Chaperiopsis cervicornis;* Discovery Stn. 1321, W. end of Magellan Strait. A. Group of autozooids; ×45. B. Detail showing branched spines and distal avicularium; ×100. C, D. *Chaperiopsis galeata;* Discovery Stn. 45, South Georgia. C. With spines intact; ×70. D. Group of cleaned autozooids; ×50. E, F. *Chaperiopsis orbiculata;* Discovery Stn. WS228, off Patagonian Shelf. E. Group of autozooids with intact spines, and an ovicell; ×45. F. Detail of a single autozooid; ×85.

pair usually thicker than distal; both pairs branching apically, and often with short processes on proximal edges of shaft. Additional, delicate, branching spines develop from the distal, terminal wall of the autozooid, four or more per autozooid, erect, or distally directed and inclining over the frontal membrane of the next autozooid. Occlusor laminae conspicuous, commencing halfway along length of opesia, converging and fusing below distal pair of spines. Cryptocyst finely granular, extensive, often as long as opesia, narrowing towards proximal spine pair; gymnocyst reduced and inconspicuous. Distal sessile avicularium small, often absent, always transversely orientated; mandible bluntly triangular. Ovicell helmet-shaped, recumbent on distally succeeding autozooid; smooth surfaced, with a narrow, crescentic frontal fenestra extending across its whole width.

Chaperiopsis cervicornis is distributed from southern New Zealand to Tasmania, and has been reported also from Gough Island, the Magellan Strait and Cape Horn (Hayward and Thorpe 1988d). It was erroneously recorded from the Ross Sea; Antarctic records cited by Hayward and Thorpe (1988d) actually refer to *Icelozoon lepralioides*, and it is probable that this species does not occur at all in Antarctic Seas.

Chaperiopsis galeata (Busk) Fig. 67C,D

Membranipora galeata Busk 1854: 62, pl.65, fig.5
Membranipora galeata: Jullien 1888: 75, pl.5, figs.6–8
Chaperia galeata: Calvet 1904b: 10; 1909: 17
Chaperiopsis galeata: Gordon 1982: 4; Hayward and Thorpe 1988d: 53, Figs 2A,3A

Colony encrusting, developing broad, irregular sheets, reddish coloured. Autozooids elongate, rectangular; 0.55–0.8 × 0.35–0.45 mm. Opesia elongate oval, occupying about four-fifths total autozooid length, straight-edged distally, concave proximally; two pairs of slender, cylindrical spines: a single pair developed in early ontogeny, a second pair developing later, distal to the first and widely spaced, leaving much of the distal edge of the autozooid as a straight, unarmed rim. Occlusor laminae poorly developed, inconspicuous. Cryptocyst present as a narrow, granular rim, extending proximally on each side from the distalmost spine pair; gymnocyst similarly reduced, represented only by small areas of smooth calcification in disto-proximal corners of the autozooid. No distal, sessile avicularium. A single, shortly pedunculate avicularium present at proximal end of most autozooids, transversely orientated, extending across whole width of autozooid; cystid broadened apically, rostrum parallel–sided, bluntly pointed. Rarely, the avicularium is twinned, with the two rostra directed proximo-laterally; occasionally it may be replaced by a slender, columnar type, with a small, acute triangular mandible, proximally directed. Ovicell with a narrow crescentic fenestra extending across its whole width; avicularium of the distally succeeding autozooid always re-orientated, the rostrum extending proximally over the crest of the ovicell, almost reaching the fenestra.

G. galeata is characterized by its elongate oval opesia, minimal cryptocyst and poorly developed occlusor laminae. The lack of a distal, sessile avicularium, and the orientation of the single, proximal avicularium also serve to distinguish it from other species of the genus. This species is limited to the south-west Atlantic. It is common around the Falkland Islands and across the southern Patagonian Shelf, and probably extends westwards to Tierra del Fuego. It ranges southwards to South Georgia and the South Sandwich islands, but does not extend further into Antarctic waters.

Chaperiopsis erecta (Busk) is another south–west Atlantic species (Hayward and

Thorpe 1988d). It is distinguished from *C. galeata* by the raised distal end of the opesial rim, by its well developed occlusor laminae, and by the presence of a distal sessile avicularium. Further, *C. erecta* lacks a proximal avicularium, and its prominent ovicell consequently has no avicularium associated with it.

Chaperiopsis orbiculata Hayward and Thorpe Fig. 67E,F

Chaperiopsis orbiculata Hayward and Thorpe 1988d: 58, Fig.4A,B

Colony encrusting. Autozooids broadly hexagonal, with rounded distal ends; 0.55–0.7 × 0.4–0.5 mm. Opesia comprising less than half total autozooid length, wider than long; proximal edge smoothly concave, distal edge almost straight. Two pairs of thick spines present, of about equal length, both bifurcate or trifurcate, the proximal pair slightly incurved; both spine pairs persist in ovicelled autozooids. Occlusor laminae well developed, thick; emerging in proximal half of autozooid, extending obliquely distally, intersecting rim of opesia between distal spine pair, with only a small gap between them. Cryptocyst finely granular, relatively broad proximally, narrowing abruptly towards proximal spine pair; gymnocyst smooth, comprising less than one-third of total autozooid length. Distal sessile avicularium small, with acute triangular rostrum; sporadically developed, often absent. Other avicularia not observed. Ovicell hemispherical, fenestra occupying whole width of frontal surface.

This species is presently known only from a few localities to the north of South Georgia. It is distinguished by its four thick, branched spines, its transversely oval opesia, and stout occlusor laminae. Pedunculate avicularia have not been recorded, and perhaps do not occur, but few specimens have so far been collected, and the morphology of the species is perhaps incompletely known.

Chaperiopsis patulosa (Waters) Fig. 68A,B

Chaperia patulosa Waters 1904: 33, pl.2, fig.5

Chaperia patulosa: Kluge 1914: 666; d'Hondt and Redier 1977: 217

Chaperiopsis patulosa: Gordon 1984: 4; Hayward and Thorpe 1988d: 60, Fig.4D,F

Colony encrusting. Autozooids broadly oval, rounded distally, 0.55–0.7 × 0.3–0.4 mm. Opesia oval, slightly wider than long; four distal spines present, cylindrical, straight and short; proximal spine pair persists in ovicelled autozooids, the distal pair reduced and closely applied to sides of ovicell. Occlusor laminae characteristic: emerging abruptly just distal to proximal edge of opesia, slightly inclined medially but not converging, intersecting distal rim of opesia independently below each of the two distal spines, linked by a narrow transverse ridge below distal rim of opesia. Cryptocyst coarsely granular, proximally equivalent to half length of opesia, scarcely developed laterally, but present distally as a narrow granular band between the bases of the proximal spine pair. Gymnocyst reduced. Distal sessile avicularium tiny, with acute triangular mandible; sporadic in occurrence, often absent. One or two stout, columnar avicularia developed on gymnocyst; small, with acute triangular rostrum distally directed, or larger with parallel-sided, distally rounded rostrum directed proximally or proximo-laterally. Ovicell elongate, with large, triangular frontal fenestra exposing a granular area of entooecium; distal edge of fenestra often peaked medially, columnar avicularia of succeeding autozooid usually fused with distal edge of ovicell.

This distinctive species was originally described from the Bellingshausen Sea, and has been reported since from Wilhelm II Land (Kluge 1914), the southern Patagonian Shelf (Hayward and Thorpe 1988d), and from Kerguelen (d'Hondt and Redier 1977).

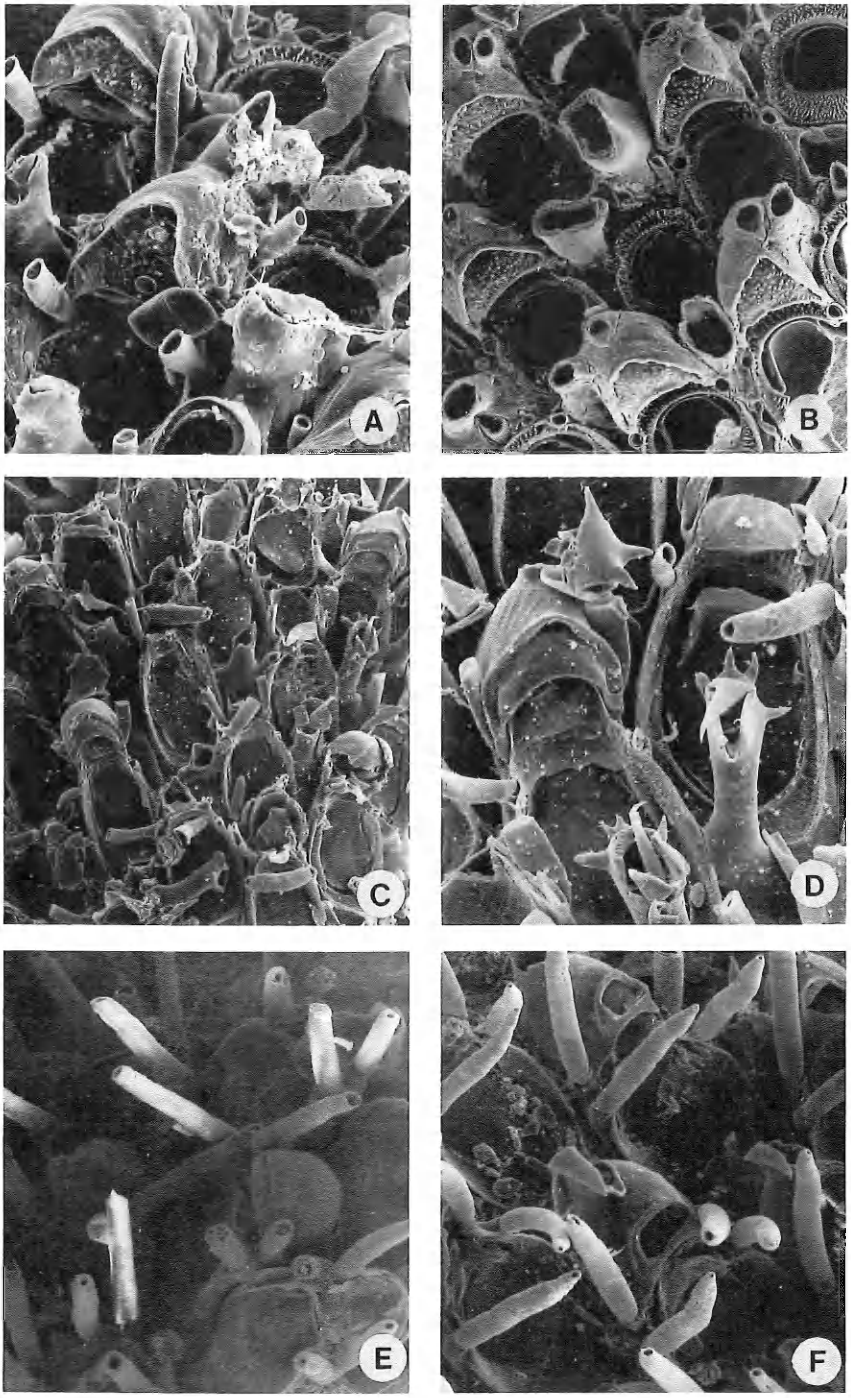


Fig. 68. A, B. *Chaperiopsis patulosa;* Discovery Stn. WS84, East Falkland. A. Ovicelled autozooids with spines intact; ×55. B. Group of cleaned autozooids; ×40. C, D. *Chaperiopsis protecta;* Discovery Stn. 366, South Sandwich Is. C. Portion of colony; ×26. D. Ovicelled autozooids, with characteristic avicularia; ×60. E. *Chaperiopsis rotundata;* Discovery Stn. 27, South Georgia; ×30. F. *Chaperiopsis signyensis;* Signy Id., BAS, ×45.

Chaperiopsis protecta (Waters) Fig. 68C,D

Chaperia cylindracea var. *protecta* Waters 1904: 34, pl.2, fig.3

Chaperia gaussi Kluge 1914: 667, pl.34, fig.8

Chaperiopsis protecta: Hayward and Thorpe 1988d: 61, Fig.5A,B

Colony encrusting. Autozooids oblong, rounded proximally, truncate distally; 0.5–0.65 × 0.35–0.4 mm. Opesia elongate oval, comprising two-thirds autozooid length, proximal edge concave, distal edge straight; two pairs of spines: distal pair short, straight, cylindrical; proximal pair larger, cylindrical, or slightly flattened and curving medially. Occlusor laminae short but distinct: emerging in distal third of opesia, curving disto-medially, fusing close to distal wall. Cryptocyst coarsely granular, relatively narrow; gymnocyst reduced, scarcely longer than cryptocyst. Distal sessile avicularium slender, with acute triangular mandible. One or two stout, columnar avicularia on gymnocyst of each autozooid, rostrum acute triangular, with hooked tip, oblique to frontal plane, directed proximally; distal edge of avicularian cystid produced as a series of sharply pointed, curved processes, projecting over frontal membrane of autozooid. Ovicell elongate, with almost triangular frontal fenestra, the ectooecial rim peaked medially; distal spine pair closely applied to sides of ovicell, avicularium of the distally succeeding autozooid partly fused to distal edge of ovicell and projecting proximally over it.

Chaperiopsis protecta has been reported only from the South Sandwich Isles and the Bellingshausen Sea, and from Wilhelm II Land (Kluge 1914, as *C. gaussi*).

Chaperiopsis quadrispinosa (Kluge) Fig. 69E,F

Chaperia quadrispinosa Kluge 1914: 668, pl.3, fig.5

Chaperia quadrispinosa: Moyano 1966a: 116; Androsova 1972b: 332; Hayward and Taylor 1984: 72

Chaperiopsis quadrispinosa: Hayward and Thorpe 1988d: 63, Fig.2D

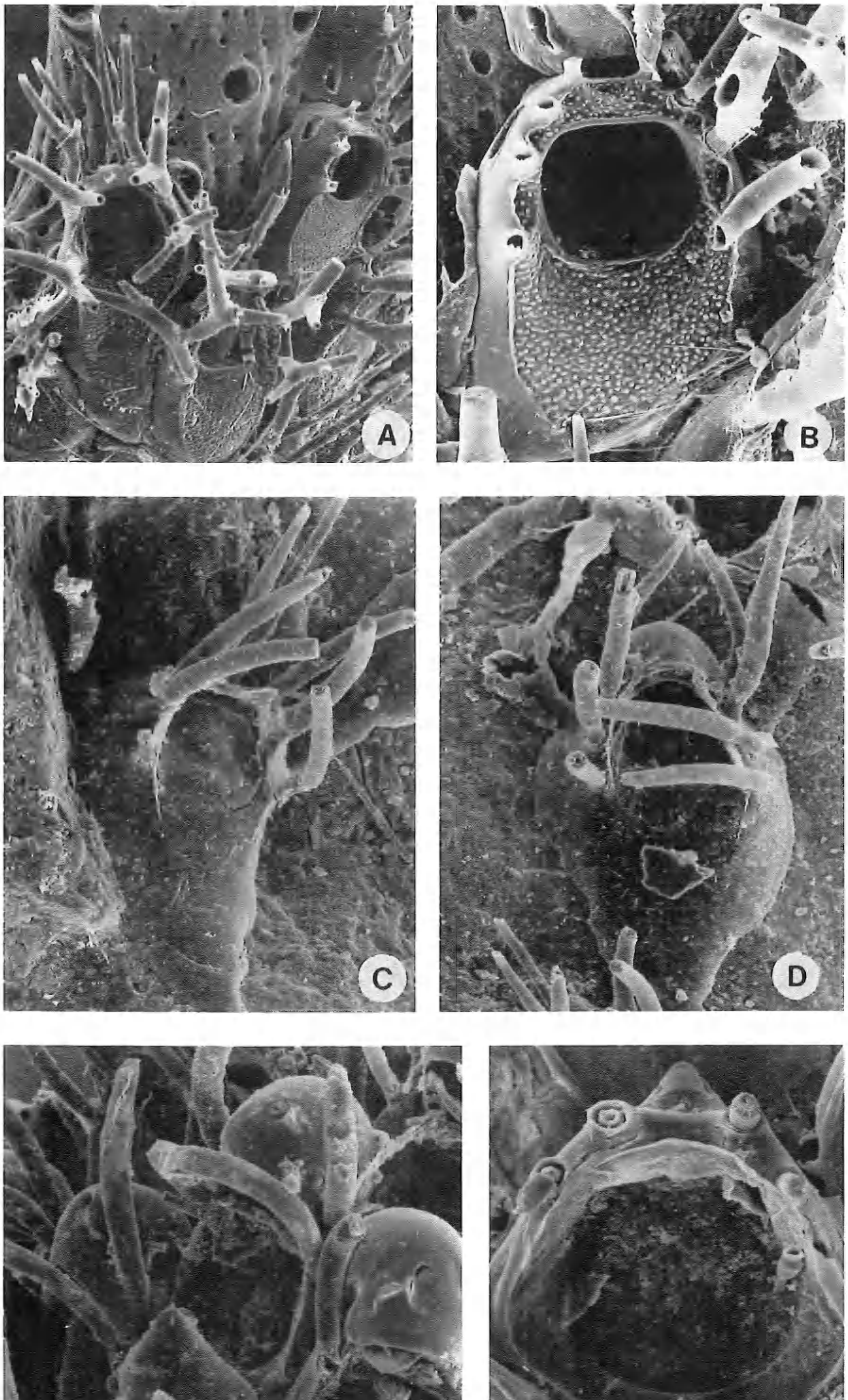
Colony encrusting. Autozooids large, oval, separated by distinct grooves; 0.6–0.75 × 0.5–0.6 mm. Opesia comprising about three-fifths total autozooid length, oval, proximal edge shallowly concave; two pairs of stout, bluntly tapered, fusiform spines present, proximal pair curving medially and overlapping above distal part of frontal membrane, distal pair curving distally to overarch proximal part of next autozooid. Occlusor laminae well developed, thick, arising in proximal half of opesia, converging distally and fusing midway between distal spine pair, forming a curved, thickened shelf. Cryptocyst a narrow, granular rim, with crenellate edge, tapering abruptly towards bases of proximal spine pair; gymnocyst reduced, inconspicuous. Distal sessile avicularium with rounded, swollen cystid and hooked rostrum; mandible broadly triangular. A sessile avicularium present on the gymnocyst of many autozooids, variably sized, with rounded cystid and hooked rostrum, mandible broadly triangular; less frequently, replaced by a slender, columnar avicularium, with distally expanded cystid. Ovicell prominent, spherical, smooth surfaced, without a fenestra.

This distinctive species is immediately recognized by its thick, curved spines. At present it is known only from Wilhelm II Land, McMurdo Sound (Ross Sea) and Marguerite Bay.

Chaperiopsis rotundata Hayward andThorpe Fig. 68E

Chaperiopsis rotundata Hayward and Thorpe 1988d: 64, Fig.5C,D

Colony encrusting. Autozooids broadly oval, raised distally; 0.6–0.75 × 0.5–0.6 mm. Opesia comprising one-half total autozooid length, as wide as long, shallowly concave proximally, almost straight


A
B
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distally; two pairs of short, thick, cylindrical spines, of equal length, both pairs persisting in ovicelled autozooids. Occlusor laminae distinct, emerging close to proximal corners of autozooids, joining terminal wall independently. Cryptocyst finely granular, relatively short, narrowing abruptly towards proximal spine pair, bounded proximally by a well marked mural rim; gymnocyst reduced, comprising less than one-third autozooid length. No distal sessile avicularium; columnar avicularia have not been observed. Ovicell hemispherical, smooth, with a small, transversely oval fenestra.

This species is known only by the type specimen, from South Georgia. It is distinguished from other species of *Chaperiopsis* by its rounded opesia and four stout spines, all of which persist in the presence of an ovicell, and in lacking a distal sessile avicularium. No other kinds of avicularia were observed in the type material of *C. rotundata*, but further specimens are required before this is accepted as a specific characteristic.

Chaperiopsis signyensis Hayward — Fig. 68F

Chaperiopsis signyensis Hayward 1993: 286, Fig.1A,B

Colony encrusting. Autozooids elongate oval, 0.6–0.8 × 0.35–0.45 mm. Opesia comprising three-fifths total frontal length, oval. Three pairs of stout, cylindrical, tapered spines along distal rim of opesia, all of equal size; two pairs persist in ovicelled autozooids. Occlusor laminae emerging midway along length of opesia, not converging sharply, intersecting distal wall of autozooid independently, below the middle spine pair. Cryptocyst relatively narrow, finely granular; gymnocyst smooth, minimally developed, scarcely visible in frontal view. No distal sessile avicularium. Pedunculate avicularia sporadic, at proximal ends of autozooids; rostrum triangular, 0.15 mm long, directed proximally. Ovicell elongate oval, smooth, frontal fenestra transversely oval, with thickened rim; distal edge of ovicell almost invariably fused with an enlarged pedunculate avicularium, with lanceolate rostrum, 0.25 mm long, directed proximally over the ovicell frontal surface.

This species is known only from Signy Island, where it was collected at 140 m depth, encrusting non-calcareous polychaete tubes.

Icelozoon Gordon, 1982

Colony encrusting. Autozooids with extensive, granular cryptocyst; gymnocyst narrow, smooth; opesia comprising less than half autozooid length. Occlusor laminae well developed. Spines present around distal and lateral borders of opesia. Avicularia absent. Ovicell hemispherical, with narrow frontal fenestra. Small multiporous septula present.

Type species: *Chaperia dichotoma* Kluge, 1914.

Key to Antarctic species

1. Autozooids in branching, uniserial chains. Opesia and cryptocyst of equal length .... *I. dichotomum*
   Autozooids in multiserial sheets. Cryptocyst twice length of opesia .... *I. lepralioides*

Icelozoon dichotomum (Kluge) — Fig. 69C,D

Chaperia dichotoma Kluge 1914: 668, pl.33, fig.6

Icelozoon dichotomum: Gordon 1982: 16, figs.8B,E

Fig. 69. A, B. *Icelozoon lepralioides;* Ross Sea, NZOI, Stn. E185. A. Group of autozooids with spines intact; ×44. B. Detail of a single autozooid; ×90. C, D. *Icelozoon dichotomum;* Discovery Stn. WS482, South Shetland Isles. C. Single autozooid; ×85. D. Ovicelled autozooid; ×70. E, F. *Chaperiopsis quadrispinosa;* Ross Sea, NZOI, Stn. A533. E. Ovicelled autozooids with intact spines; ×45. F. Detail of a single autozooid; ×90.

Autozooids in branching, uniserial chains; distinctly clavate, with proximal portion tapered; 0.55–0.65 × 0.38–0 .43 mm. Opesia transversely oval, comprising about one-third total autozooid length; four pairs of long, curved spines around distal and lateral borders of opesia, all persisting in ovicelled autozooids; occlusor laminae stout, not markedly converging, meeting distal wall of autozooid independently. Cryptocyst granular, about as long as opesia; gymnocyst smooth, comprising the tapered, proximal one-third of the autozooid. Ovicell hemispherical, not very prominent; smooth-surfaced, with a narrow, slit-like fenestra just distal to its aperture.

This species is presently known only from Wilhelm II Land, and from a single station in the South Shetland Islands.

Icelozoon lepralioides (Kluge) Fig. 69A,B

Chaperia lepralioides Kluge 1914: 669, text fig.41

Icelozoon lepralioides: Gordon 1982: 16, fig.8C

Autozooids forming coherent sheets, oval to hexagonal, 1.0–1.1 × 0.6–0.8 mm. Opesia transversely oval, comprising less than one-third total autozooid length; four pairs of long, cylindrical spines around distal and lateral borders of opesia, all persisting in ovicelled autozooids; in many autozooids some or all of the spines may be forked or branched. Occlusor laminae well developed, converging and fusing midway along distal rim of opesia. Cryptocyst granular, twice length of opesia; gymnocyst reduced, forming a narrow, proximal border, continuous distally with the incurved lateral walls. Ovicell hemispherical, partly immersed; smooth surfaced, with a slit-like fenestra just distal to its aperture.

Icelozoon lepralioides was described from Wilhelm II Land. It has also occurred on pebbles from two stations in the South Shetland Islands, and from a single locality off Enderby Land. The *Chaperiopsis cervicornis* recorded from the Ross Sea by Hayward and Thorpe (1988d) also refers to *I. lepralioides*

Exallozoon Gordon, 1982

Colony encrusting. Frontal wall of autozooids almost entirely membranous: cryptocyst reduced to a narrow proximal rim around the opesia; gymnocyst consisting of a narrow border of smooth calcification at proximal end of autozooid. No spines or avicularia. Occlusor laminae represented by a short shelf at the distal end of the opesia. Ovicell with large frontal fenestra. Vertical walls with multiporous septula.

Type species: *Chaperia simplicissima* Kluge, 1914.

Exallozoon simplicissimum (Kluge) Fig. 70

Chaperia simplicissima Kluge 1914: 666, pl.34, fig.7

Exallozoon simplicissimum: Gordon 1982: 16, fig.8A

Autozooids oval to hexagonal, 0.55 × 0.45 mm. Opesia oval, somewhat narrowed proximally, occupying greater part of frontal surface of autozooid; cryptocyst present as a very narrow, smooth border around the proximal half of the opesia;

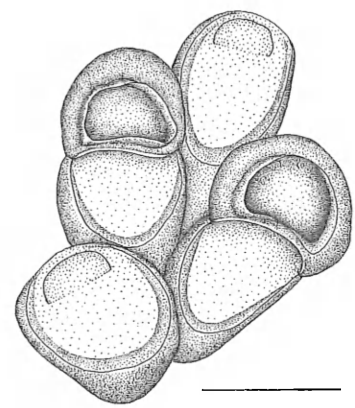


Fig. 70. *Exallozoon simplicissimum*, Discovery Stn. 1660, Ross Sea. Scale = 0.5 mm.

gymnocyst most developed in proximolateral corner, smooth. Occlusor laminae fused with lateral and distal walls of autozooids, developed as narrow ledge around the distal half of the autozooid. Ovicell as wide as long, convex, with an extensive fenestra occupying most of its frontal surface, bordered by a slightly flared rim of ectooecium.

This species is still only poorly known. The type material (recently refigured by Gordon 1982) was collected from Wilhelm II Land, the specimen described and figured here was collected from the Ross Sea (Discovery Stn. 1660).

BUGULOIDEA Gray, 1848

BUGULIDAE Gray, 1848

Colony typically erect (rarely encrusting), branching, unilaminar, without joints; usually arising from an erect ancestrula, and always attached by bundles of chitinous rhizoids. Autozooids in uniserial to multiserial rows; elongate and parallel-sided; or trumpet-shaped, with the proximal portion tapered, and the distal portion broadly expanded. Frontal membrane occupying greater part of frontal surface; operculum distinct in some genera, absent in others. Calcification delicate, cryptocyst absent or only minimally developed. Spines typically present at the distal ends of autozooids, sometimes reduced or lacking. Avicularia pedunculate, the peduncle short and rigid, or long and flexible; bird's head avicularia characteristic of many genera. Ovicell hyperstomial, usually prominent: often globular, but reduced and cap-like in some species; ectooecium partly or wholly uncalcified.

The most recent discussion of the Bugulidae is that of Gordon (1984), who considered it to include Bicellariellidae Levinsen, 1909. Gordon's argument was well justified, and his classification is accepted here.

Bugula Oken, 1815

Colony erect, branching, attached by rhizoids; branches unilaminar, dichotomizing at regular intervals, unjointed. Autozooids in biserial to multiserial rows, elongate, overlapped basally, with proximal ends distinctly forked. Basal and lateral walls lightly calcified, frontal wall almost entirely membranous, orifice lacking a defined operculum. One or more spines usually present at each distal corner of the autozooid, lacking in some species, when the distal corners may be acute or rounded. Ovicell hyperstomial, frequently globular but reduced in some species; entooecium calcified, ectooecium membranous; typically closed by an ooecial vesicle. Avicularia pedunculate, resembling a bird's head, attached to the lateral wall of the autozooid; absent in a few species.

In biserial species of *Bugula*, the arrangement of autozooids at a branch bifurcation conforms to one of three patterns, described by Harmer (1923) as types 3, 4 and 5. These patterns are described and figured by Ryland and Hayward (1977).

Type species: *Sertularia neritina* Linnaeus, 1758.

Species of *Bugula* occur in shallow temperate and tropical waters throughout the world. *Bugula longissima* Busk is known from Heard Island, Marion Island and Kerguelen, and was reported by Hastings (1943) from the Ross Sea, but there is at present no other known Antarctic representative of the genus. The Magellanic species *B. hyadesi* Jullien (Hastings 1943: 430, Fig. 38D) is distributed from Cape Horn to the Falkland Islands, but is not known to extend further south.

Bugula longissima Busk Fig. 71

Bugula longissima Busk 1884: 42, pl.31, fig.7

Bugula longissima: Hastings 1943: 431, Fig.39C,D; d'Hondt 1984: 98.

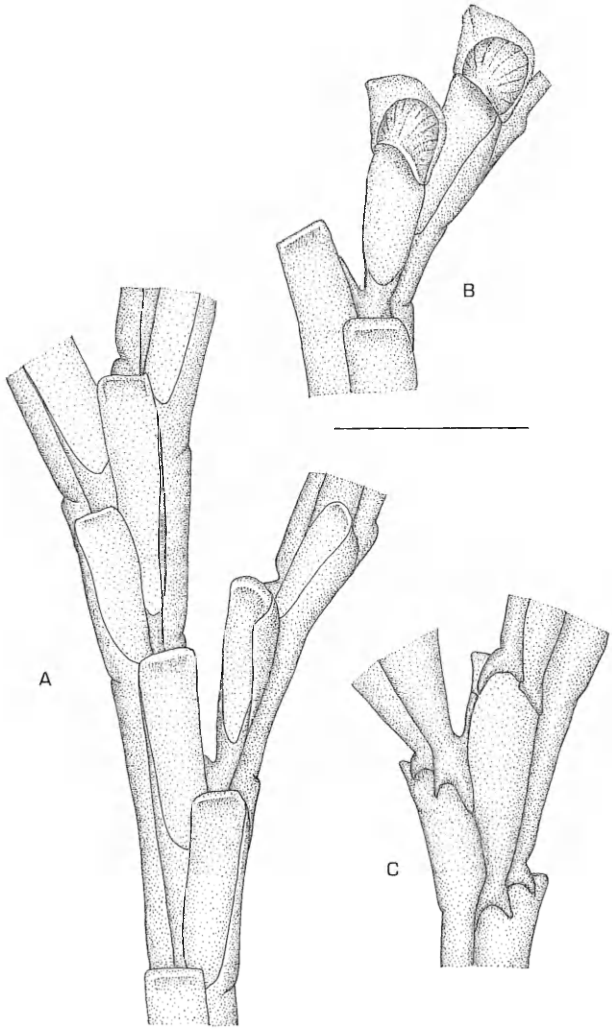


Fig. 71. *Bugula longissima.* Astrolabe Point, Antarctic Peninsula. A. Autozooids at a dichotomy. B. Ovicelled autozooids. C. A dichotomy in basal view. Scale = 1 mm.

Colony large, diffusely branched, up to 14 cm high (Hastings 1943), but commonly less. Branches slender, producing acute dichotomies at intervals of 2–3 mm at actively growing tips. Autozooids elongate, in alternating biserial sequence, 1.0–1.8 × 0.2–0.3 mm; frontal surface entirely membranous, outer distal corner bluntly pointed, or developed as a short process, inner distal corner rounded; no other spines present. The proximal portions of those autozooids forming the outer, proximal parts of each ramus above a dichotomy are typically slender and tubular, often with slight transverse constrictions. Avicularia absent. Ovicell globular, 0.4 mm wide, entooecium with fine radiating striations, ectooecium with a lightly calcified basal rim.

Bugula longissima was founded on *Challenger* material from Kerguelen and Heard Island (Busk 1884). Further material was described by Hastings (1943) from the Ross Sea, and it was listed by d'Hondt (1984) from Marion Island, but there are no other Antarctic records.

Bugulella Verrill, 1879.

Colony erect or creeping, branching dichotomously; uniserial, each internode consisting of a single autozooid, with additional tubular kenozooidal units contributing to the dichotomy. Autozooids slender, clavate, comprising a tubular proximal portion, and an expanded distal portion bearing the frontal membrane. Opesia oval, with a narrow cryptocystal rim, surrounded by slender, incurved spines. Avicularia pedunculate, shaped like birds' heads. Ovicell hyperstomial, globular, with calcified ectooecium.

Type species: *Bugulella fragilis* Verrill 1879.

Gordon (1984) discussed the systematic relationships of *Bugulella*, and subsequently (Gordon 1986) listed presently known species. Only one species, *B. klugei* (Hastings), has been described from Antarctic waters. The *Erymophora* sp. described and figured by Hastings (1943: 469) was considered to belong to *Bugulella gracilis* (Nichols); unfortunately, the specimen consisted of a few autozooids only, from an unknown Antarctic locality. What seems to be the same species was recently collected by the New Zealand Oceanographic Institute from the Ross Sea (Fig. 72). This specimen was also fragmentary and more material is needed before the identity of this species can be resolved.

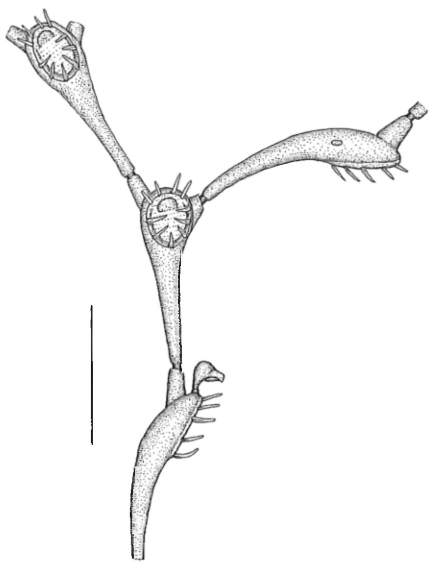


Fig. 72. *Bugulella* cf. *gracilis*. Ross Sea, NZOI Stn. A522. Scale = 0.5 mm.

Bugulella klugei (Hastings)

Brettia sp. Kluge 1914: 642, text–fig.24
Erymophora klugei Hastings 1943: 470.

Colony creeping, diffuse. Autozooids 0.8–1.3 mm long, the clavate distal portion comprising less than half total length; proximal portion slender, *c.* 0.05 mm wide, distal portion 0.2 mm wide. Opesia with a distinct, smooth cryptocystal rim, widest proximally; two (perhaps four) short spines present at the distal end of the opesia. Avicularia and ovicells unknown. Each autozooid arises from the disto-terminal wall of its predecessor; at a dichotomy, a second bud is produced which develops as a slender tubular structure parallel with the proximal portion of the new autozooid. At its distal end a septum separates this unit from the proximal part of a second autozooid, developed at a right angle to the first, and a short crossmember links it to a rosette plate in the distolateral wall of the first autozooid.

Very little material of this species has ever been collected and its morphology is thus incompletely known. Kluge's specimen originated from Wilhelm II Land, while the few fragments reported by Hastings (1943) were from near Elephant Island, and from Oates Land. It is possible that *B. klugei* is the same species as *B.* cf. *gracilis* from the Ross Sea (Fig. 72), Kluge's and Hasting's specimens perhaps having lost the opesial spines after death.

Camptoplites Harmer, 1923

Colony erect, tufted or fan-shaped, attached by slender rhizoids; branches unilaminar, dichotomizing at regular intervals, in some species arising, additionally, from lateral or axial kenozooid polymorphs. Autozooids in biserial or multiserial rows; elongate and slender, each budded from the disto-basal surface of its predecessor; proximal end straight, distal end broadened, truncate or rounded, or with the distal corners variably produced as spinous processes. Frontal surface of autozooid with lightly calcified gymnocyst extending for up to one-half its length, distal membranous portion with defined operculum. Ovicells hyperstomial, globular, with characteristic striated or punctate calcification, closed by zooidal operculum. Avicularia characteristic: typically bird's head form, with shape and size varying widely throughout the genus, each supported by a very long, flexible and mobile stalk arising from the gymnocysts of the autozooids. One or two avicularia associated with each autozooid; several different types of avicularia are known for each species. Kenozooidal polymorphs present at the axil of each bifurcation, and at the latero-proximal corner of each autozooid giving rise to a variety of tubular rhizoids and, in some species, to additional, secondary branches.

Type species: *Bugula bicornis* Busk, 1884.

Colonies of *Camptoplites* species may exceed 5 cm in height, developing slender, open branched forms, or dense feathery tufts, or richly branched, fan-shaped growths. This latter form is particularly associated with species displaying adventitious, or secondary, branches, in which additional rami spring from the axils of dichotomies, or from the edges of branches. The polymorphic structures from which secondary branches develop are particularly characteristic of the genus. Not all species develop secondary branches, but all display a variety of kenozooidal rootlet-like structures, or rhizoids, which contribute to the architecture of the colony. Lateral polymorphs, budded from septula at the proximo-lateral end of each autozooid give rise to slender rhizoids which cross the basal surface of the branch, and extend beyond its margin, forming cross-connections with neighbouring branches. Axial kenozooids produce particularly elongate rhizoids which extend basally in some species, frontally in others, and serve to attach the colony to its substratum. These axial polymorphs may also give rise to slender units which extend distally along the basal surface of one or both rami of the dichotomy. In some species the axillary rhizoids of the lowest dichotomies of a colony run proximally, closely applied to the basal surface of the colony, to form a thickened, stalk-like bundle firmly anchoring the colony to the substratum. The ancestrula, in all *Camptoplites* species, is an upright, narrow, horn- or slipper-shape, with a slender proximal portion attached to the substratum by a radiating series of rhizoids.

The bird's head avicularia are also very characteristic, and the form and variety of avicularia are important in the taxonomy of the genus. The flexible stalk is turgid in life, and has been observed to make irregular, substantial movements (P.J. Chimonides, *pers. comm.*) although no author has yet described a muscular system associated with it.

Camptoplites was introduced by Harmer (1923) for *Bugula bicornis* Busk, and several other abyssal species. The most complete systematic treatment is that of Hastings (1943), who showed that most of the Antarctic species of *Bugula* described by Kluge (1914) could be assigned to *Camptoplites*. Although species of *Camptoplites* are known from abyssal records in the Indian, Atlantic and Pacific Oceans, it is in the Antarctic Shelf areas that the genus achieves its greatest diversity, and several species seem to be very common components of the Antarctic coastal benthos in the Ross Sea, throughout the Palmer Archipelago and along the Scotia Arc to South Georgia.

C. atlanticus Hastings and *C. asymmetricus* Hastings seem to be essentially Subantarctic species; both were originally described from off the southern Patagonian Shelf, and the latter has recently been reported from South Island, New Zealand (Gordon 1986). *Camptoplites reticulatus* (Busk) was founded on Challenger specimens from abyssal stations off Valparaiso and the Crozet Islands; it has since been listed from Kerguelen by d'Hondt (1984). Antarctic records of *Bugula reticulata* (Waters 1904; Calvet 1909) were assigned to *B. areolata* (= *Camptoplites areolatus*) by Kluge (1914), but Hastings (1943: 441) considered that *Bugula reticulata* var. *spinosa* Waters, 1904, represented a distinct, as yet unknown, species of *Camptoplites*. *Bugula multispinosa* Kluge (1914: 628) is clearly a species of *Camptoplites*, but it was described from juvenile colonies only and the characters of the species are thus incompletely known (Hastings 1943: 440). It may prove to belong to one of the species described here. *C. antarcticus* Liu and Hu (1991) and *C. notoscolophorus* Liu and Hu (1991) perhaps belong to *C. retiformis* (Kluge).

Key to Antarctic Species

1. Branches of colony with commonly two or three longitudinal series of autozooids; sometimes quadriserial prior to a dichotomy, and occasionally six-serial in large specimens 2
   Branches of colony multiserial, with never less than four to 12 autozooid series 5
2. Branches strictly biserial 3
   Branches biserial or triserial, quadriserial prior to dichotomy, and sometimes six-serial in large colonies. Secondary branches present. Three types of avicularia, including a gigantic globular form with long, pointed rostrum .... *C. giganteus*
3. Branches with distinct chitinous nodes at each dichotomy; no axial autozooid below the dichotomy. Axial kenozooid with only one distal prolongation (Fig. 78A). Autozooid with a small cryptocyst. No secondary branches .... *C. asymmetricus*
   Branches without nodes, each dichotomy with an axial autozooid. Axial kenozooid with a distal prolongation along each ramus of the dichotomy, or lacking them altogether. Autozooid without cryptocyst 4
4. Axial kenozooid with paired distal prolongations (Fig. 77C). No secondary branches. Ovicell large and conspicuous. Avicularia of two kinds only, both small .... *C. areolatus*
   Axial kenozooid small, without conspicuous distal prolongations (Fig. 73C). Secondary branches occur. Ovicell small, cap-like, inconspicuous. Avicularia of four kinds, including a gigantic, globular type .... *C. bicornis*
5. Each autozooid with a pair of distolateral spines, generally large, and a single, larger medio-distal spine .... *C. tricornis*
   Autozooids with or without distolateral spines, but without a single medio-distal spine 6
6. Secondary branches present 7
   Secondary branches do not occur 8
7. Ovicell large and conspicuous. Three types of avicularia present, the largest being a long-headed type .... *C. angustus*
   Ovicells small and caplike. Three types of avicularia, including a large long-headed type, and an equally large, globular, round-headed type with short, hooked rostrum .... *C. lewaldi*
8. Distal ends of autozooids rounded, the corners sometimes bluntly pointed, but developed as slender spines only in ovicelled autozooids 9

All autozooids with a pair of distal spines, thickened and more prominent in ovicelled autozooids .... *C. retiformis*

9. Axial kenozooid budding a rhizoid from its basal surface. Two types of avicularia present; smallest 0.15–0.18 mm long, largest up to 0.35 mm long .... *C. latus*

   Axial kenozooid budding a rhizoid from its frontal surface. Smallest avicularium only 0.12 mm long, largest up to 0.3 mm .... *C. rectilinearis*

Camptoplites bicornis (Busk) Figs 73–75

Bugula bicornis Busk 1884: 40, pl.9, figs.1a–e

Bugula bicornis: Kluge 1914: 619–625, pl.29, figs.1–4; text figs 7–11; Waters 1904: 21, pl.1, figs.4a–k; Livingstone 1928: 27

Camptoplites bicornis: Hastings 1943: 443 *et seq.*, pl.10, figs.1–3, pl.11, figs.1–3; text figs. 43A–G,M,N, 44A–E, 45A,B

Camptoplites bicornis: Androsova 1972b: 324; Hayward and Taylor 1984: 72

Colony formed from slender, biserial branches, bifurcating frequently at intervals of 2–5 mm; short, fan-shaped secondary branches frequent, budded from proximo-lateral kenozooids. Autozooids elongate, 1.2–1.6 × 0.15–0.20 mm, narrow proximally, broadly expanded distally, with distal corners variably produced as short spine-like processes. Opesia occupying more than half total frontal length; overlapping in alternate series along branch. Distal quarter of autozooid free, projecting at a slight angle from frontal plane and long axis of branch. Autozooids of secondary branches typically short, as much as half length of those of main branches. Avicularia numerous, typically with very long stalks; small long-headed type constant and frequent; large long-headed type variable, from 0.35 to 0.85 mm long, with rostrum markedly curved in largest examples; round-headed type often in two sizes. Ovicell reduced, inconspicuous, developed as a hemispherical cap attached to disto-basal surface of autozooid; entooecium with very faint radiating striations. Axial kenozooids small and inconspicuous, without distal prolongations, giving rise to stout anchoring rhizoids basally. Proximo-lateral kenozooids give rise to secondary branches, and to lateral connecting processes, which also bud from septula at other, distal regions of the lateral and basal walls of the autozooid.

Camptoplites bicornis was described by Busk (1884) from a single abyssal locality in the Southern Ocean (53°55′S, 108°35′E, 3568 m). Waters (1904) described material from the Bellingshausen Sea, and drew attention for the first time to the secondary branches, characteristic of the genus. Kluge (1914) reported abundant material from Kaiser Wilhelm II Land and showed *C. bicornis* to be a very variable species. Kluge attempted to systematize observed variation, introducing three new taxa: var. *compacta*, var. *elatior* and var. *magna*, the last divided into a forma *elongata* and a forma *ventricosa*. Hastings (1943) accepted Kluge's taxonomic categories and introduced a new variety, *quadriavicularis*. These four varieties are distinguished principally by the relative sizes of their avicularia, and by the width of the ovicell in relation to autozooid width. In var. *compacta* the ovicell is shown (Hastings 1943, fig. 44C) to be less than two-thirds the width of the autozooid, the distal wall of which is deeply concave where it joins the ovicell. The large long-headed avicularia are up to 0.4 mm long, with the rostrum edge moderately curved. In var. *elatior* the ovicell exceeds two-thirds of the autozooid's width, the distal wall of which is only shallowly concave, and in the other two varieties it occupies the entire width of the autozooid. The long-headed avicularia of vars. *elatior*, *magna* and *quadriavicularis* are closely similar in size and morphology. They are largest in var. *quadriavicularis*, up to 0.85 mm, in which,

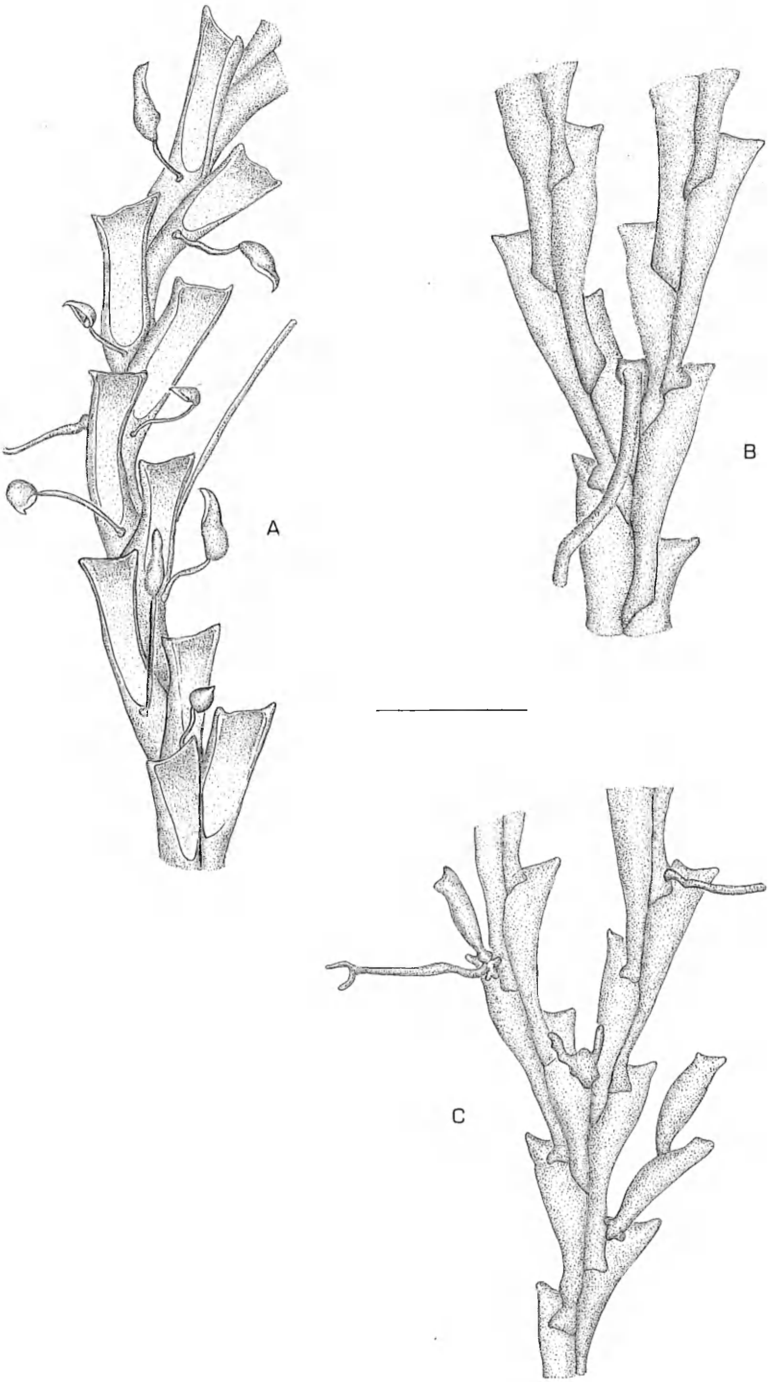


Fig. 73. *Camptoplites bicornis.* A. Portion of a branch; Challenger Stn. 157, 53°55′S, 108°35′E (type locality). B. var. *compacta,* basal view of a dichotomy; Discovery Stn. 1652, Ross Sea. C. var. *elatior,* basal view of a dichotomy; Discovery Stn. 190, Bismarck Strait. Scale = 1 mm.

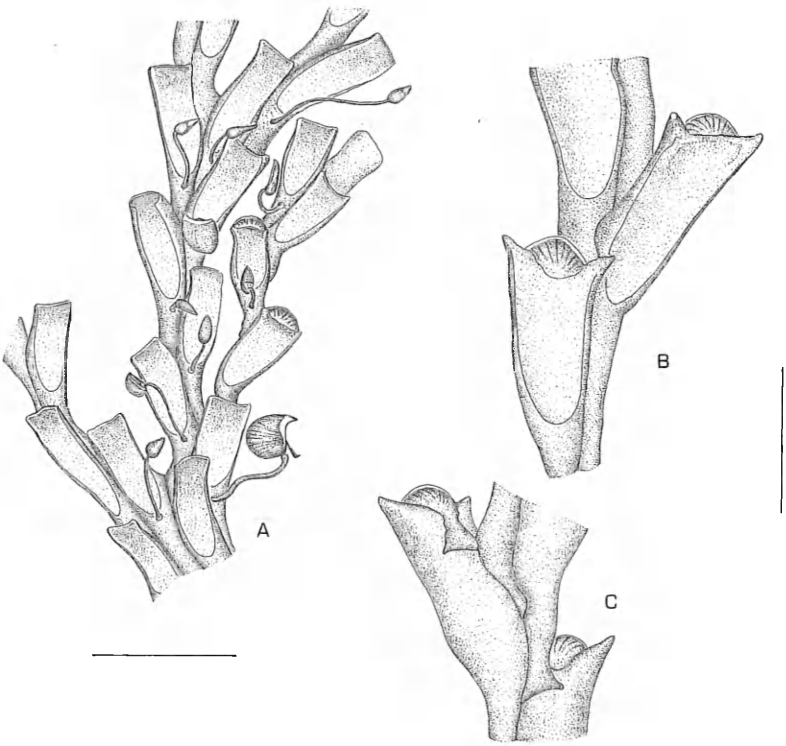


Fig. 74. *Camptoplites bicornis.* A. var *quadriavicularis,* Discovery Stn. 160, Shag Rocks, a dichotomy, with adventitious branch on right including two ovicelled autozooids. Scale = 1 mm. B, C. var. *elatior,* Discovery Stn. 190, Bismarck Strait, ovicelled autozooids in frontal and basal view. Scale = 0.5 mm.

also, the round-headed avicularia occur in two sizes, with a gigantic, globular type being almost as frequent as the smaller type.

The differences between these four varieties seem trivial, and it is possible that they will eventually be found to intergrade. It should be remarked that, with the exception of var. *quadriavicularis,* the geographical distributions of the varieties are coextensive. Hastings (1943) reported var. *quadriavicularis* from two localities, at Challenger Stn. 320, off the Patagonian Shelf, below 300 m, and from Discovery Stn. 160, Shag Rocks.

Camptoplites angustus (Kluge) Fig. 76

Bugula angusta Kluge 1914: 631, pl.30, fig.5, text fig.17

Camptoplites angustus: Hastings 1943: 452, pl.12, fig.3, Fig. 46A,D,E

Camptoplites angustus: Vigeland 1953: 11; Moyano 1966a: 116; Androsova 1972b: 321

Colony branches flat and strap-like, comprising up to 12 series of autozooids, exceeding 10 mm between dichotomies. Axial and lateral secondary branches present, broadening rapidly distal to their origin to give a characteristic fan-like shape. Autozooids up to 2 mm long with maximum width of 0.2 mm, first members of secondary branches usually only 0.6–0.8 mm long; frontal membrane occupying distal half of frontal surface of autozooid. Distal corners of autozooid rounded, bluntly pointed, or developed as slender, cylindrical spinous processes up to 0.8 mm long which may be subse-

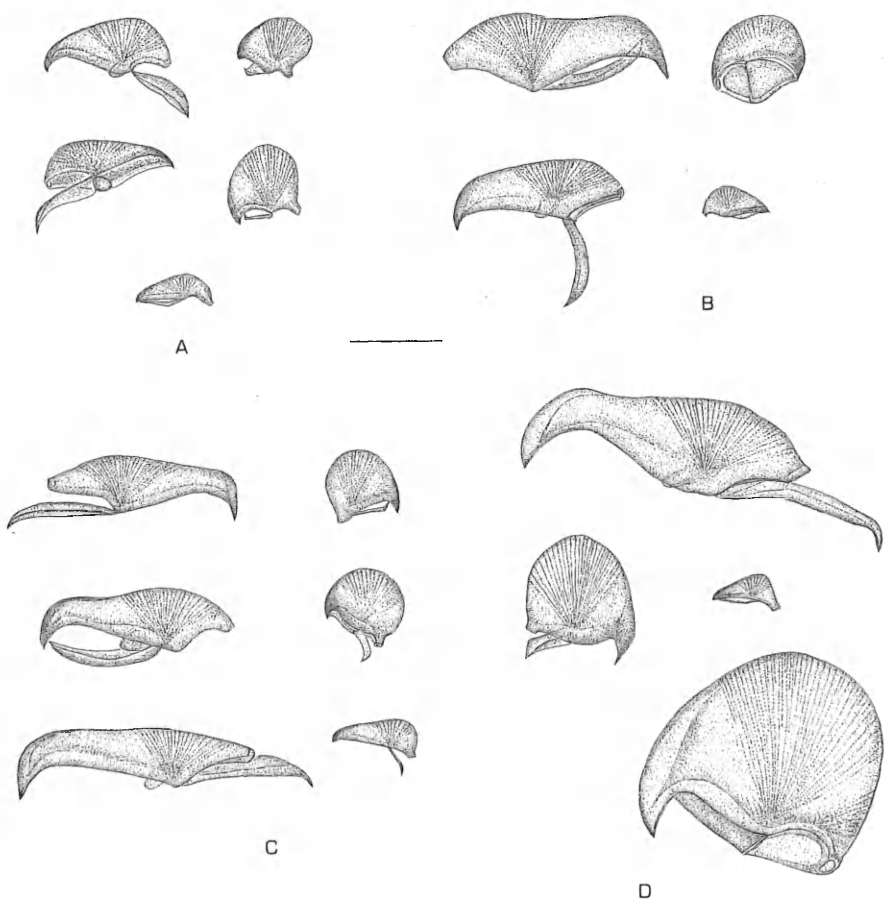


Fig. 75. *Camptoplites bicornis:* types of avicularia. A. var. *compacta,* Discovery Stn. 1652, Ross Sea. B. var *magna,* Discovery Stn. 164, South Orkney Is. C. var. *elatior,* Discovery Stn. 190, Bismarck Strait. D. var. *quadriavicularis,* Discovery Stn. 160, Shag Rocks. Scale = 0.25 mm.

quently broken short; in some autozooids, particularly those of secondary branches, a second, shorter pair of spines may be present, distal to the first and more nearly perpendicular to the frontal plane of the autozooid. Avicularia typically numerous, and of usually three distinct sizes, from 0.1 to 0.35 mm long; they are intermediate between the long-headed and round-headed varieties, with the rostrum distinct but forming a continuous curve with the upper surface of the avicularium, and with a markedly sinuous lower edge. Ovicell slightly wider than long, tilted basally, the entooecium with fine radial sculpture. Axial kenozooids give rise to slender tubes which run distally for a short distance along the basal surfaces of each ramus, and to thick, free rhizoids from the basal side, which are not applied to the colony basal surface. Additionally, secondary branches are budded from the frontal surfaces of the axial kenozooids. Lateral kenozooids produce both secondary branches and tubular cross-connecting rhizoids with dendritic ends.

C. angustus has been widely reported in Antarctica, from the Ross Sea, the Palmer Archipelago and northwards as far as the South Orkney Islands.

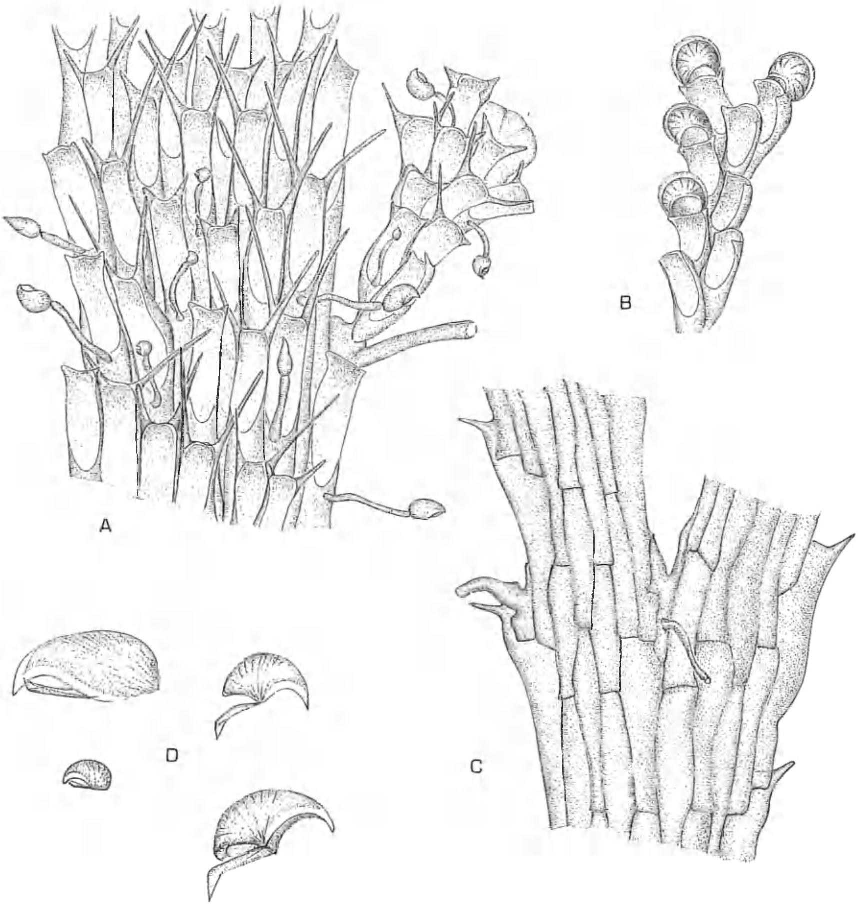


Fig. 76. *Camptoplites angustus*, Terra Nova Stn. 339, Ross Sea. A. Portion of colony, with adventitious branch on right. B. Ovicelled autozooids from an adventitious branch. C. Basal view of a dichotomy. D. Types of avicularia. Scale = 1.0 mm (A–C) or 0.4 mm (D).

Camptoplites areolatus (Kluge) Fig. 77

Bugula areolata Kluge 1914: 627, pl.28, fig.3, text fig.13

Camptoplites areolatus: Hastings 1943: 465, figs.54A,B, 55A,B

?*Bugula* sp. var. *variospinosa* Kluge 1914: 628, pl.28, fig.4

Colony formed from slender, biserial branches, bifurcating frequently, at intervals of about 2–4 mm; secondary branches not developed. Autozooids small and slender, 0.9 × 0.4 mm, the oval opesia comprising half total frontal length, bordered by a narrow proximal cryptocyst; autozooids not in strictly opposite pairs but alternating along branch length, with right and left opesiae just overlapping. One inner and one or two outer distal spines present, the largest outer spine up to 0.6 mm long. Avicularia small and only sparsely developed, of two kinds: a round-headed type, 0.1 mm long, and a less frequent long-headed type, 0.15 to 0.2 mm long. Ovicell longer than wide, orientated parallel to the long axis of the branch; entooecium lightly calcified at first, with

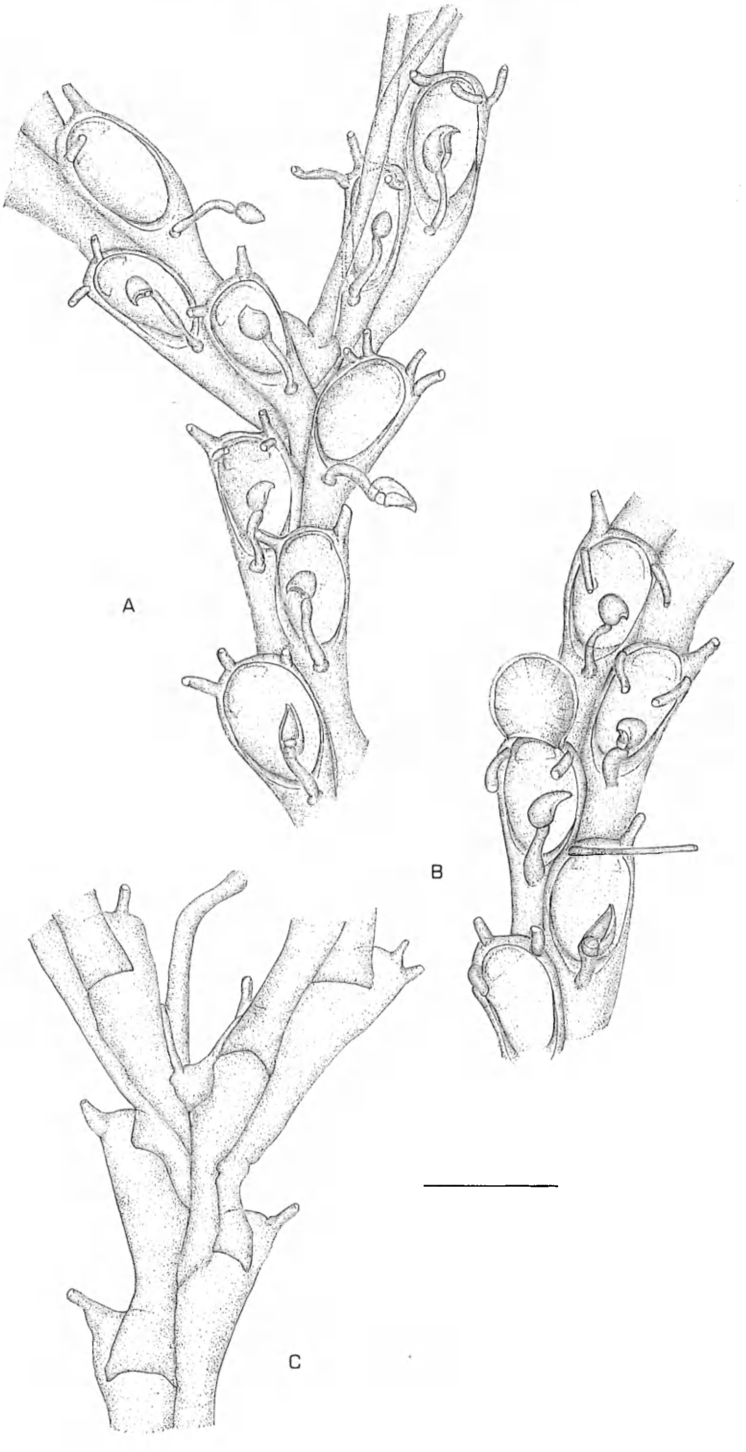


Fig. 77. *Camptoplites areolatus*, Discovery Stn. 175, South Shetland Is. A. Part of colony at a dichotomy, showing frontal rhizoid issuing from axial kenozooid. B. Branch with ovicelled autozooid. C. Basal view of a dichotomy. Scale = 0.5 mm

faint radial striations, but developing a more dense, granular or reticulate surface in later ontogeny. Axial kenozooids with slender distal prolongations, extending along the edges of the inner autozooids forming the base of each ramus of the dichotomy; giving rise to long, thick, frontally directed rhizoids, with broad, dendritic tips. Proximolateral kenozooids infrequent; when present, giving rise to elongate rhizoids identical to the axial type.

Camptoplites areolatus develops loose, straggling colonies, and with its biserial arrangement of alternating autozooids is reminiscent of a species of *Scrupocellaria* (q.v.). The *Bugula reticulata* Busk reported from the Antarctic by Waters (1904) and Calvet (1909) possibly belongs to *C. areolatus*, and Kluge's (1914) *Bugula* sp. var. *variospinosa* is perhaps merely a juvenile stage of the nominal species (see Hastings 1943).

This species is known with certainty from the Kaiser Wilhelm II coast, the South Shetland Isles, and from Oates Land. Waters' (1904) and Calvet's (1909) records of '*B. reticulata*' were from the Bellingshausen Sea and the Palmer Archipelago. *C. areolatus* is thus a poorly known and infrequently reported species, but is perhaps widely distributed around the Antarctic Continent.

Camptoplites asymmetricus Hastings — Fig. 78

Camptoplites asymmetricus Hastings 1943: 466, figs.53D, 54C,D, 55C–F

Camptoplites asymmetricus: Gordon 1986: 49, pl.16, fig.D, text fig.18

Colony with slender biserial branches, bifurcating regularly at intervals of 2–16 mm; there is no axial autozooid (cf. *C. areolatus*); the proximal portions of each ramus of a dichotomy are uncalcified, and thickened by chitinization to form distinct, brown-coloured nodes. Secondary branches do not occur. Autozooids slender, 0.9–1.1 × 0.25 mm, with oval opesia comprising almost one-third total frontal length, bordered by a distinct cryptocyst proximally. Opesiae overlapping for about one quarter of their length; distal ends of autozooids truncate, with rounded corners, typically with a single short spine on the inner distal corner, less frequently with one (rarely two) outer distal spine. Avicularia of two kinds: small, round-headed, 0.1 mm long, and larger, long-headed up to 0.25 mm long; one to two avicularia occur on each autozooid. Ovicell slightly longer than wide, orientated parallel to long axis of autozooid, entooecium with a few faint radial striations, ectooecium smooth, and apparently remaining incomplete frontally. Axial kenozooids asymmetrically situated at the proximal end of autozooid E (Fig. 78A), with only a slender prolongation extending onto the other ramus of the dichotomy; giving rise to a stout, frontally or basally directed rhizoid; proximo-lateral kenozooids less frequently developed, giving equally stout cross-connecting struts, and also anchoring rhizoids.

Camptoplites asymmetricus is similar to *C. areolatus*, but is distinguished by the asymmetrical development of its axial kenozooid, and by the formation of its dichotomies, in which autozooid E forms the basal autozooid of one ramus, rather than assuming an axial position. The opesia of *C. asymmetricus* is proportionately more elongate than that of *C. areolatus*, and the ovicell does not display reticulate frontal calcification of the ectooecium in later ontogeny.

Essentially a Subantarctic species, *C. asymmetricus* was described by Hastings (1943) from depths greater than 400 m off the south Patagonian Shelf, at 1098 m in the South Atlantic Ocean, and off South Georgia at 200–236 m. Gordon (1986) subsequently reported it from south-western New Zealand and the Fouveaux Strait.

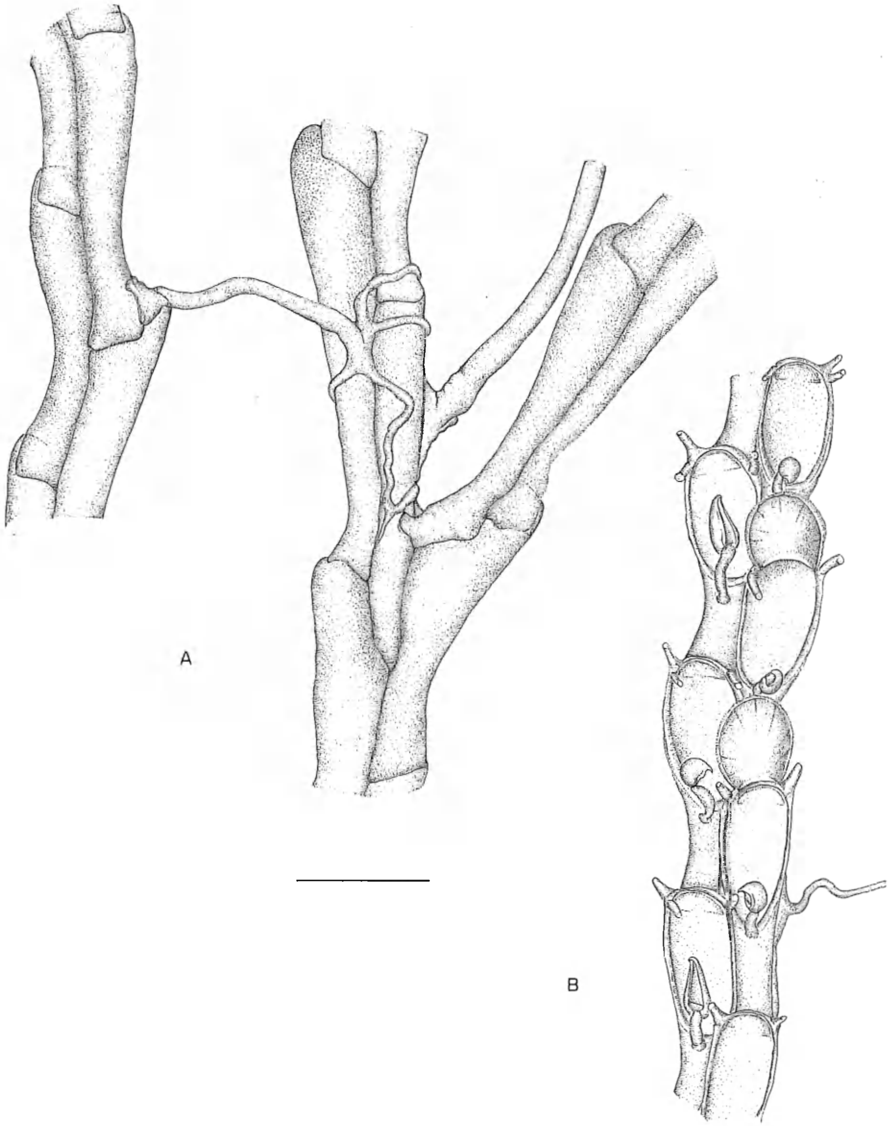


Fig. 78. *Camptoplites asymmetricus*, Discovery Stn. WS840, off Patagonian Shelf. A. Basal view of dichotomy, and portion of an adjoining branch, with linking rhizoids. B. Part of a branch, including ovicelled autozooids. Scale = 0.5 mm.

Camptoplites giganteus (Kluge) Fig. 79

Bugula gigantea Kluge 1914: 630, pl.30, fig.4, text-fig.16
Camptoplites giganteus: Hastings 1943; 451, pl.11, fig.4, Figs.43H–L, 45E,F

Colony branches biserial or triserial, becoming quadriserial prior to bifurcation, which occurs frequently at intervals of 2–4 mm; typically with numerous, richly branched, fan-shaped secondary branches, giving the colony a dense, tufted appearance. Autozooids elongate

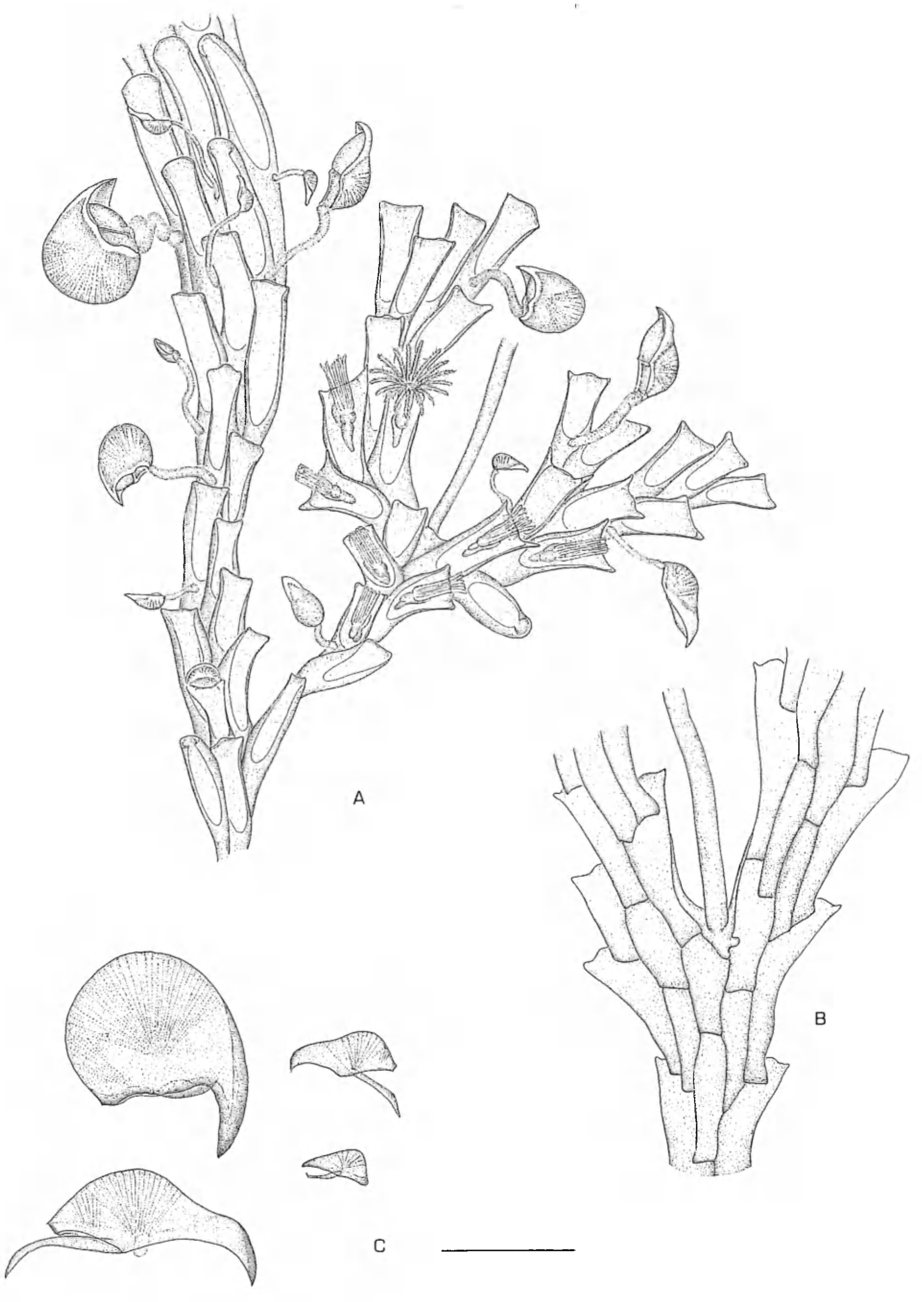


Fig. 79. *Camptoplites giganteus,* Discovery Stn. WS33, South Georgia. A. Portion of a colony, with dichotomizing adventitious branch on right. B. Basal view of a dichotomy. C. Types of avicularia. Scale = 1.0 mm (A, B) or 0.5 mm (C).

and slender, 1.4–1.6 × 0.2–0.3 mm; distal portion truncate, with a short process at each corner, projecting from plane of branch; opesia occupying almost entire frontal surface. Secondary branches short, fan-shaped, with bifurcations at intervals of only 1–1.5 mm, autozooids slightly smaller than those of main branches with distal processes often developed as pronounced spines. Avicularia numerous and various; most frequent is a large, long-headed type, with sinuate upper edge and down-curved mandible, 0.6–0.9 mm long; less frequent, but characteristic is a giant round-headed type, 0.5–0.7 mm long, almost globular, with a slender, elongate, curved rostrum; small long-headed avicularia, 0.2–0.25 mm long, with almost straight palate and abruptly hooked rostrum, occur on most autozooids. Ovicell reduced, developed as a hemispherical structure on the disto-basal surface of the autozooid, generally indistinct; entooecium lightly calcified, with a faint reticulate pattern. Axial kenozooids with slender distal prolongations extending along each arm of the bifurcation; giving rise basally to thickened anchoring rhizoids. Proximo-lateral kenozooids give rise to the numerous secondary branches, and less frequently to cross-connecting kenozooids.

This species is particularly characterized by its giant, round-headed avicularia, and by the profusion of fan-shaped secondary branches, which give the whole colony a dense, bushy appearance. Described by Kluge (1914) from the Kaiser Wilhelm II coast, *C. giganteus* was reported from South Georgia, and from the Ross Sea by Hastings (1943) but does not seem to have been reported since.

Camptoplites latus (Kluge) Fig. 80

Bugula lata Kluge 1914: 634, text fig.20
Camptoplites latus: Hastings 1943: 458, Figs.48F, 49A

Colony with long, flat, straight branches, bifurcating at intervals of 5 to 15 mm. Autozooids in five alternating longitudinal series, increasing to eight or more prior to bifurcation; elongate and slender, 1.6–1.9 × 0.25–0.3 mm; distal end truncate, with pointed corners variably developed as spines, projecting slightly from plane of branch; opesia occupying slightly more than half frontal surface. Secondary branches do not occur. Avicularia of two kinds, both sparsely developed: most frequent is a small type, 0.15–0.18 mm long, with smoothly rounded upper margin continuous with a slender downcurved rostrum, its stalk is characteristically two to four times length of the avicularium. A larger, more elongate avicularium is less common; up to 0.35 mm long, it has a short stalk, equivalent to only one-third its length, but is otherwise similar to the small type. Ovicells slightly wider than long, 0.30 × 0.35 mm, almost spherical, the lightly calcified entooecium at first marked with distinct radial striations, later overlain by granular or reticulate calcification. Axial kenozooids large and obvious, with a stout distal prolongation extending along the basal surface of each ramus; giving rise to thick anchoring rhizoids from their basal surfaces. Proximo-lateral kenozooids give rise to thick cross-connecting rhizoids.

Camptoplites latus develops loose straggling colonies with relatively broad, flat and straight branches. It is particularly characterized by its avicularia, both types of which are comparatively small, and the larger of which has a very short peduncle. It was originally described from the Kaiser Wilhelm II coast by Kluge (1914) and was reported also from the Ross Sea by Hastings (1943). Populations of *C. latus* from the Palmer Archipelago were denoted var. *striata* by Hastings (1943), who distinguished it from the nominal species by its slightly broader ovicell (0.40 mm) and slightly more elongate large avicularia. South

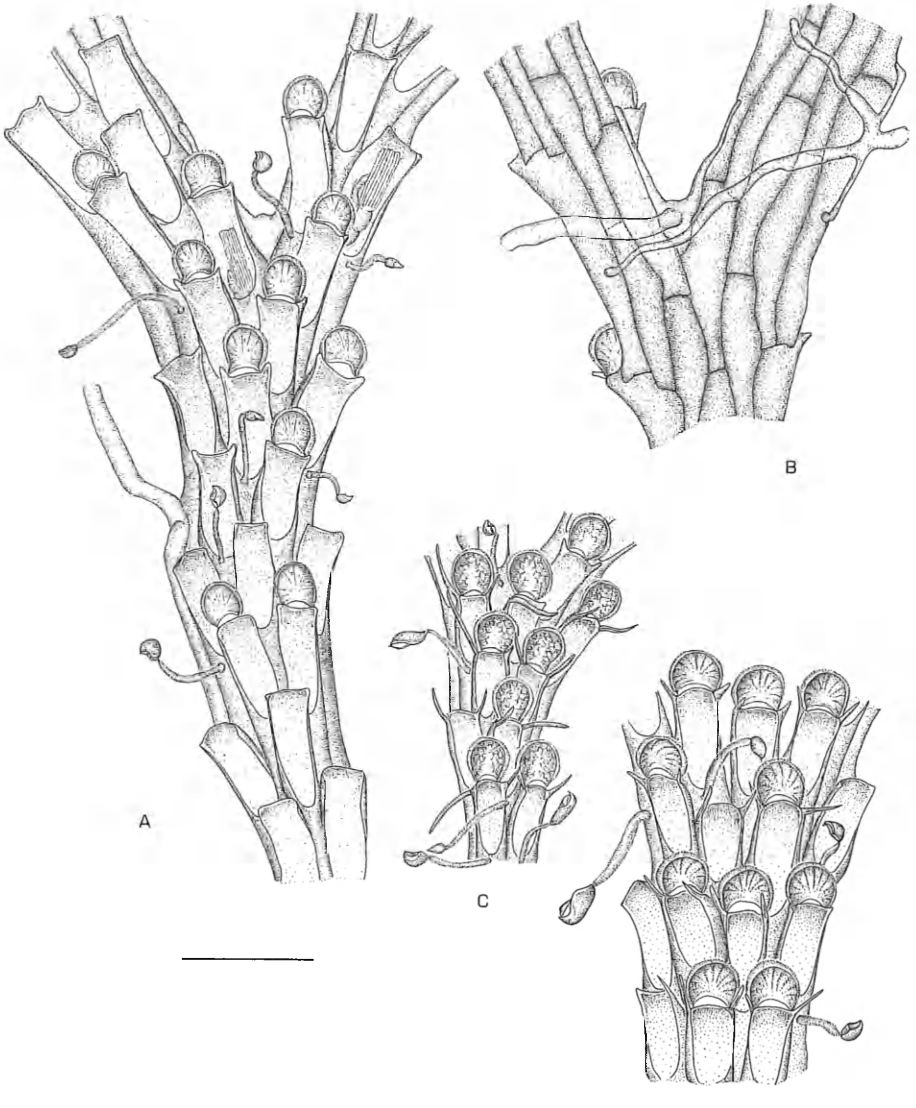


Fig. 80. *Camptoplites latus.* A. Terra Nova Stn. 316, Ross Sea; part of colony at a dichotomy. B. Terra Nova Stn. 316; basal view of a dichotomy. C. Discovery Stn. WS42, South Georgia; part of the holotype of var. *aspera.* D. Discovery Stn. 190, Bismarck Strait; var. *striatus.* Scale = 1.0 mm.

Georgia populations were denoted var. *aspera,* distinguished by a coarse, reticulate secondary calcification of the entooecium, by more elongate avicularia, and by more pronounced development of the distal autozooid spines. In all other respects examples of the three taxa are identical, and a more complete series of specimens, over the whole geographical area from the Ross Sea to South Georgia may show such variation to occur in all populations.

Camptoplites lewaldi (Kluge) Fig. 81

Bugula lewaldi Kluge 1914: 630, pl.30, fig.3, text fig.15
Camptoplites lewaldi: Hastings 1943: 449, pl.11, figs.5,6, Figs.45C,D,G

Colony with long, flat, straight branches, bifurcating at intervals of 5–15 mm. Short, fan-shaped secondary branches sparsely developed. Autozooids in four to six alternating longitudinal series; elongate and slender, 1.6–2.1 × 0.25–0.3 mm; distal end projecting slightly from plane of branch, truncate, with its corners distinctly pointed, and sometimes developed as spines up to 0.4 mm long; opesia occupying approximately half frontal surface. Secondary branches with autozooids as much as half the size of main branch autozooids. Avicularia typically numerous, of three kinds; most frequent is a small long-headed type, 0.20 mm long, with straight palate and abruptly hooked rostrum; a large long-headed type, 0.4–0.55 mm long, with a downcurved rostrum constituting about half its length, is common; finally, most characteristic is a large round-headed type, deeper than long and thus appearing as a semi-ovoid, 0.3 × 0.35 mm, with a short, pointed, downcurved rostrum. Ovicells reduced and rather inconspicuous, developed as a shallow cap on the disto-basal surface of the autozooid; entooecium with faint radial striations. Axial kenozooids comparatively small, indistinct, with a slender, short distal prolongation extending up each ramus; giving rise to stout rhizoids from their basal surfaces. Proximo-lateral kenozooids give rise to the sparse secondary branches, and to cross-connecting processes.

Camptoplites lewaldi is distinguished by its elongate branches and open colony form, with rather short and infrequent secondary branches. The large round-headed avicularia are also distinctive; similar in shape to those of *C. giganteus*, they are distinguished by the much shorter, less obvious rostrum. Originally described from the Kaiser Wilhelm II coast (Kluge 1914), this species has been reported on a number of occasions from the Ross Sea (Hastings 1943; Moyano 1966a, 1984a; Hayward and Taylor 1984). The *Bugula bicornis* reported by Calvet (1909) from Schollaert Bay may have included material of *C. lewaldi*.

Camptoplites rectilinearis Hastings Fig. 82

Camptoplites rectilinearis Hastings 1943: 462, pl.12, fig.4, Figs.51D,52A–D

Colony with long, flat, straight-sided branches, bifurcating regularly at intervals of 5–15 mm. Secondary branches do not occur. Autozooids in six to 12 alternating longitudinal series; elongate and very slender, 2.3–2.5 × 0.2 mm; distal end smoothly rounded, corners bluntly pointed, the outer corner of marginal autozooids often projecting, but not developed as spines; opesia occupying about two-thirds total frontal length. Avicularia of two kinds, both small and sparsely developed, on slender peduncles often longer than the autozooids: a small long-headed type, 0.25–0.3 mm long, with slender, downcurved rostrum; a minute round-headed type, 0.12 mm long. Ovicell prominent, longer than wide, broadest distally; entooecium with delicate radial striations, later partly overlain by fine granular or reticulate calcification. Axial kenozooid large and conspicuous, with equally conspicuous distal prolongations extending for up to 1 mm along the inner edge of each dichotomy; giving rise to a stout, frontally directed rhizoid. Proximo-lateral kenozooid with a short distal prolongation, and sometimes with a longer proximal extension; giving rise to slender, cross-connecting rhizoids.

Camptoplites rectilinearis is particularly characterized by its long, multiserial branches, and its elongate, spineless autozooids. At present it is known only from three stations in the Ross Sea, and

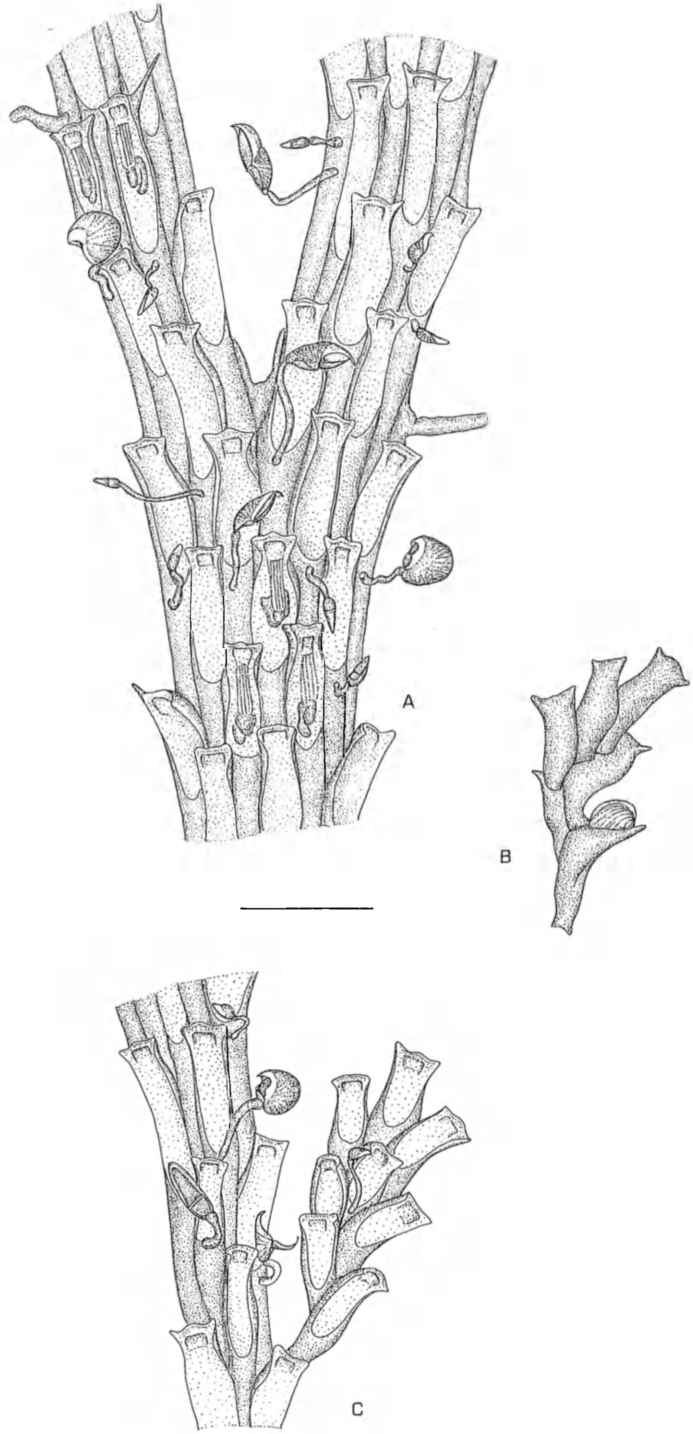


Fig. 81. *Camptoplites lewaldi.* Discovery Stn. 1652, Ross Sea. A. Part of colony at a dichotomy. B. Adventitious branch in basal view, showing ovicelled autozooid. C. Part of colony, with adventitious branch on right. Scale = 1.0 mm.

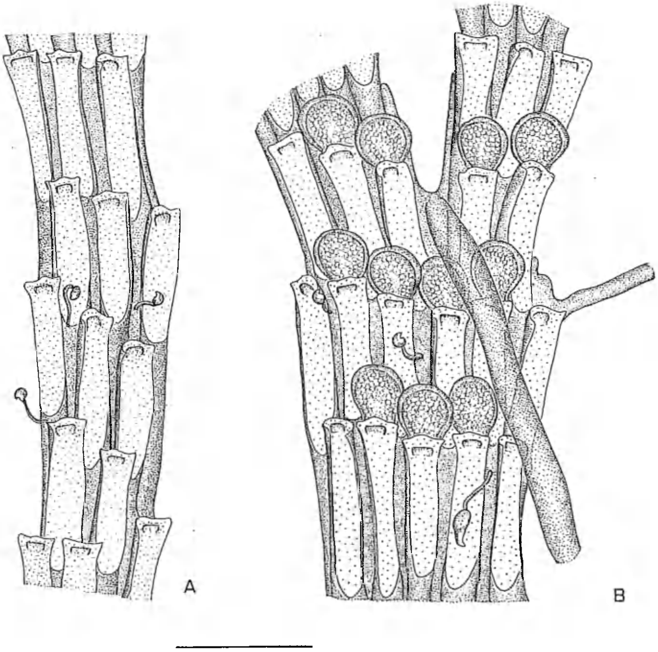


Fig. 82. *Camptoplites rectilinearis*. Terra Nova Stn. 314, Ross Sea. A. Part of branch from near growing tip. B. Branch at a dichotomy, showing frontal rhizoid developed from axial kenozooid. Scale = 1.0 mm.

has not been recorded since Hastings' (1943) original account.

Camptoplites retiformis (Kluge) Fig. 83

Bugula retiformis Kluge 1914: 629, pl.28, fig.5, text fig.14
Bugula retiformis: Livingstone 1928: 27
Camptoplites retiformis: Hastings 1943: 453, pl.9, fig.3, Figs.47A–H, 48A,B
Camptoplites retiformis: Moyano 1966a: 116; 1984a, 80; Androsova 1972b: 325; d'Hondt 1984: 107

Colony formed of long branches, bifurcating at intervals of 2–7 mm, the interval decreasing distally to give an open, broad, fan shape. Secondary branches do not occur. Autozooids commonly in four to seven alternating longitudinal series (up to 15, according to Hastings 1943); 1.2–1.4 × 0.2–0.3 mm, twice as wide distally as proximally, the distal end rounded, with a frontally projecting spine at each corner, particularly stout in ovicelled autozooids. Opesia occupying about half total frontal length. Avicularia of two kinds, generally numerous, but very small and attached to relatively short peduncles: long-headed type 0.15–0.25 mm long, with slender, downcurved rostrum; round-headed type minute, 0.08–0.1 mm long, highly domed. Ovicell prominent, about as wide as long; entooecium with faint radial sculpture, later overlain by thicker, conspicuously reticulate calcification. Axial kenozooid large, with a short distal prolongation extending along each limb of the dichotomy, giving rise to a stout kenozooid from its basal surface. Proximolateral kenozooids particularly well developed towards distal ends of branches, giving rise to richly branched cross-connecting rhizoids.

Specimens of *C. retiformis* from the South Shetland and South Sandwich Islands were distinguished by Hastings (1943) from other *Discovery* specimens in having more slender spines and less

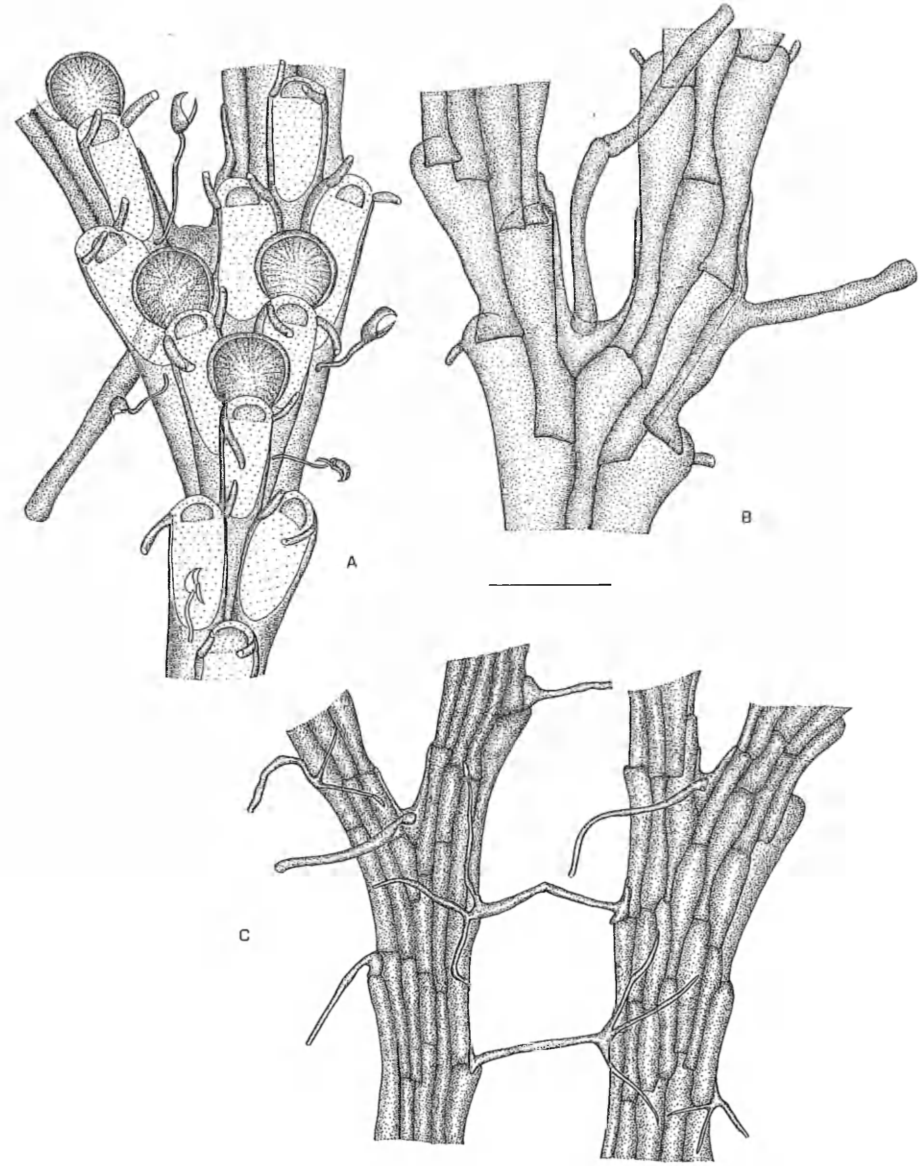


Fig. 83. *Camptoplites retiformis.* Discovery Stn. 156, South Georgia. A. Part of colony at a dichotomy, including ovicelled autozooids. B. Basal view of dichotomy, showing basal rhizoid developed from axial kenozooid. C. Parts of adjacent branches, with kenozooidal cross-connections. Scale = 0.5 mm (A, B) or 1.0 mm (C).

regular reticulations on the ovicell. In all other respects these specimens, denoted var. *tenuispina* by Hastings, are identical to nominal *C. retiformis* and there seem to be only slight grounds for maintaining a taxonomic distinction between them. *Camptoplites retiformis* has been widely reported in Antarctic waters from Wilhelm II Land, Queen Mary Land, Oates Land, and the Ross Sea, from the

Palmer Archipelago, South Georgia and Bouvet Island.

Camptoplites tricornis (Waters) Fig. 84

Bugula tricornis Waters 1904: 23, pl.1, fig.9a–d, pl.8, fig.3

Bugula tricornis: Kluge 1914: 625, pl.29, figs.5,6; text fig.12; Livingstone 1928: 27

Camptoplites tricornis: Hastings 1943: 451, pl.13, fig.3; Figs.46B,C

Camptoplites tricornis: Moyano 1966a: 116; Androsova 1972a: 92; 1972b: 322; Hayward and Taylor 1984a: 72; Moyano 1984a: 80

Colony typically developing dense clumps, formed from rather short branches, bifurcating at intervals of 5–15 mm, and with often numerous, short, fan-like secondary branches. Autozooids in six to 12 alternating longitudinal series; 1.0–1.2 × 0.3 mm, broadest medially, the distal end arched, with a stout, curved, frontally projecting spine at each corner, and an even larger distally directed spine rising from the middle of the distal margin. Opesia occupying about half total frontal length. Avicularia numerous, of four kinds: a large long-headed type, with downcurved rostrum, 0.35–0.4 mm long; a small long-headed type, usually less than 0.2 mm long; a small round-headed type, 0.08–0.1 mm long; gigantic round-headed, 0.5 mm long, with elongate, downcurved rostrum. Ovicell prominent, tilted backwards so that aperture is clearly visible in frontal view; about as long as broad; entooecium at first with faint radial striations, developing a distinctly chequered sculpture. Axial kenozooid small and inconspicuous, without distal prolongations; giving rise to a slender rhizoid from its basal surface, and frequently a short secondary branch from its frontal surface. Lateral kenozooids typically situated midway along the length of the marginal autozooids, tapered distally and proximally, giving rise to cross-connecting rhizoids, and to the secondary branches.

This widespread and common Antarctic species is immediately recognized by the conspicuous medio-distal

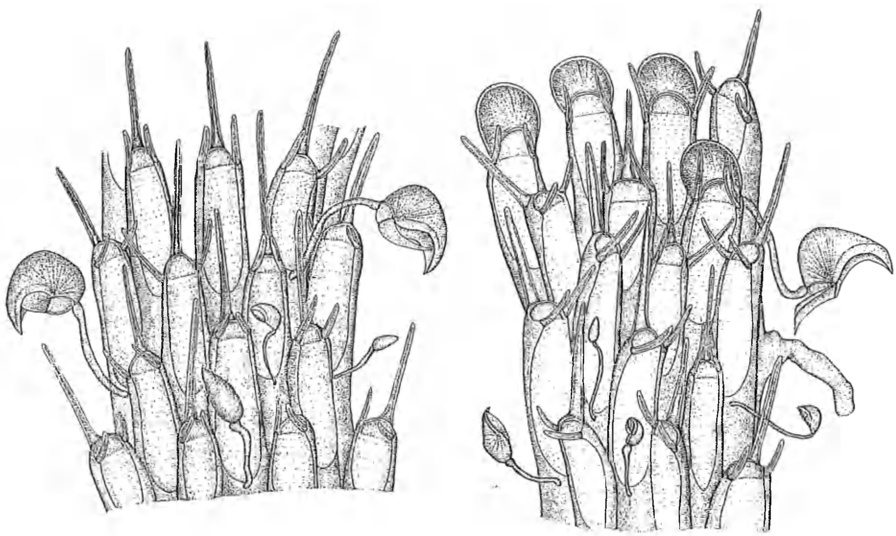


Fig. 84. *Camptoplites tricornis*. Discovery Stn. 42, South Georgia. A. Autozooids from the branch tip. B. Ovicelled autozooids. Scale = 0.5 mm.

spine borne by all autozooids. Secondary branches occur with varying frequency; those colonies in which they are most abundant develop a dense bushy tuft or mat. *Camptoplites tricornis* was first described from the Bellingshausen Sea; it has since been reported from Adelie Land, Wilhelm II Land, Oates Land, the Ross Sea, and as far north as South Georgia.

Cornucopina Levinsen, 1909

Colony erect, diffuse or forming dense clumps; branching dichotomously, unjointed, attached to substratum by bundles of rhizoids. Autozooids in two longitudinal series, club-shaped: the elongate, slender proximal portions forming the main axis of the branch, the oval distal portions projecting at right angles to the axis, in alternating sequence; disto-basal part of autozooid projecting, often produced as a slender, tubular process, bearing few to many, long, basally jointed spines. Opesia occupying entire frontal surface of distal portion of autozooid; no cryptocyst; frequently a single short spine proximolateral to the opesia, close to the branch axis. Avicularia pedunculate, frequently trumpet-shaped, sometimes very elongate. Embryos brooded in hyperstomial ovicells, or in specialized gonozooids. Ovicell at distal end of autozooid, elongate, globular, ectooecium membranous, entooecium calcified, typically with radiating striations. Gonozooid pedunculate, shaped like a tobacco pipe, budded from the basal wall of an autozooid.

Type species: *Bicellaria grandis* Busk, 1852.

Species of *Cornucopina* have been described from all of the principal abyssal regions of the oceans. A minority of species occurs in shallow, shelf waters, and four species appear to be endemic to Antarctic seas. *Bicellaria dubitata* Calvet, 1909, described from Biscoe Island, Grahamland, was provisionally referred to *Cornucopina polymorpha* (Kluge) by Hastings (1943). *C. moluccensis* (Busk), a deep water species known from the Indian Ocean, the Malay Archipelago and New Zealand, was reported from Kerguelen, Marion Island and Bouvet Island by d'Hondt (1984). A key to 17 described species of *Cornucopina* was presented by d'Hondt (1975); additional species have been described by Hayward (1981) and Gordon (1986).

Key to Antarctic Species

1. Avicularia include elongate type, up to 3 mm long, resembling a coachhorn 2
   Avicularia all shortly pedunculate . 3
2. Autozooids with six to nine spines, arranged in a series from the distal process across the basal surface of the autozooids. All avicularia coach-horn shaped. Embryos brooded in hyperstomial ovicells .... *C. pectogemma*
   Autozooids with one to three spines (more on basal autozooids of colony). Three types of avicularia present: one coach-horn shaped, two shortly pedunculate. Ovicells brooded in specialized gonozooids .... *C. polymorpha*
3. Distal portion of autozooid large (0.6–0.7 mm). Avicularia on basal surface of autozooids, stout, up to 0.5 mm high .... *C. lata*
   Distal portion of autozooid small (<0.5 mm). Avicularia on basal surface of autozooids up to 0.25 mm high; smaller frontal avicularia also present .... *C. ovalis*

Cornucopina lata (Kluge) Fig. 85

Bicellaria lata Kluge 1914: 639, pl.33, fig.1
Cornucopina lata: Hastings 1943: 402

Colony form unknown. Distal portion 0.6–0.7 × 0.3–0.35 mm, with broadly oval opesia 0.4 mm long; proximal (axial) portion 0.6–1.3 mm long. Disto-basal process reduced to a low mound bearing one or two stout, cylindrical, blunt-ended, curved spines, up to 1.3 mm long;

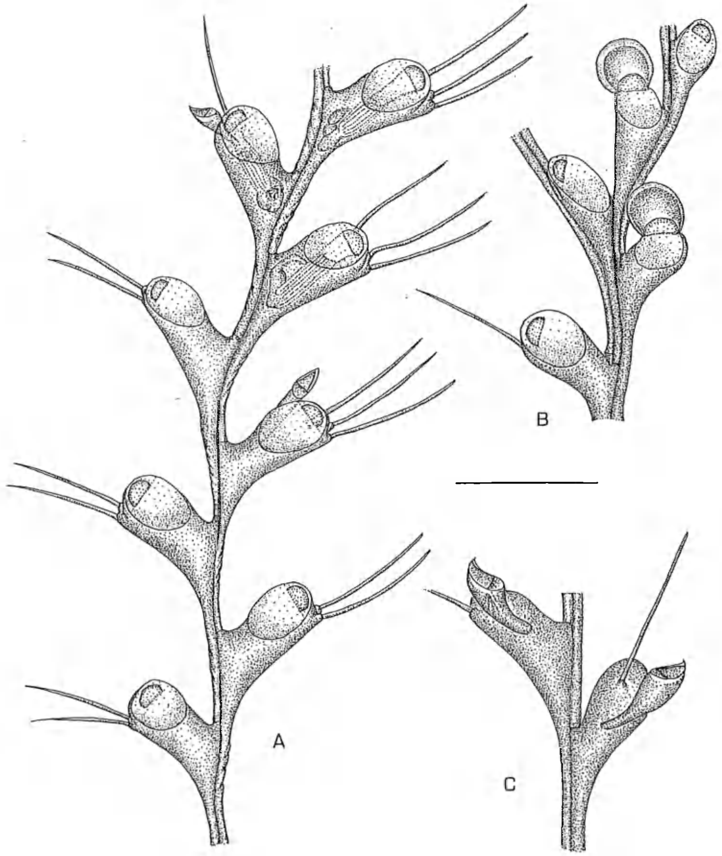


Fig. 85. *Cornucopina lata.* Terra Nova Stn. 194, Ross Sea. A. Part of a branch. B. Ovicelled autozooids. C. Autozooids with avicularia, in basal view. Scale = 1.0 mm.

one or two additional spines arise from the basal surface of the autozooid, adjacent to the disto-basal process. A single, thinner, pointed spine, 0.5 mm long, present on basal surface of autozooid, close to branch axis. Avicularia sporadic, attached midway along basal surface of autozooid, 0.5 mm long, with sharply hooked rostrum and elongate triangular mandible. Ovicell wider than long, with faint radiating striae.

This species was described from Wilhelm II Land by Kluge (1914), and some fragments were reported from Oates Land by Hastings (1943). It has not been collected since these two records, and its morphology, and geographical distribution, remain incompletely known.

Cornucopina ovalis Hastings — Fig. 86

Cornucopina ovalis Hastings 1943: 402, pl.7, fig.2, Figs.29A–C

Colony developing dense bushy tufts, exceeding 7 cm high, with equivalent spread. Branches bifurcating at frequent, irregular intervals, developing a broad fan shape; rhizoids gathered basally to form a stout stalk. Distal portion of autozooid 0.35–0.40 × 0.15–0.2 mm; proximal (axial) portion 0.6–0.95 mm; opesia elongate oval, occupying whole of frontal

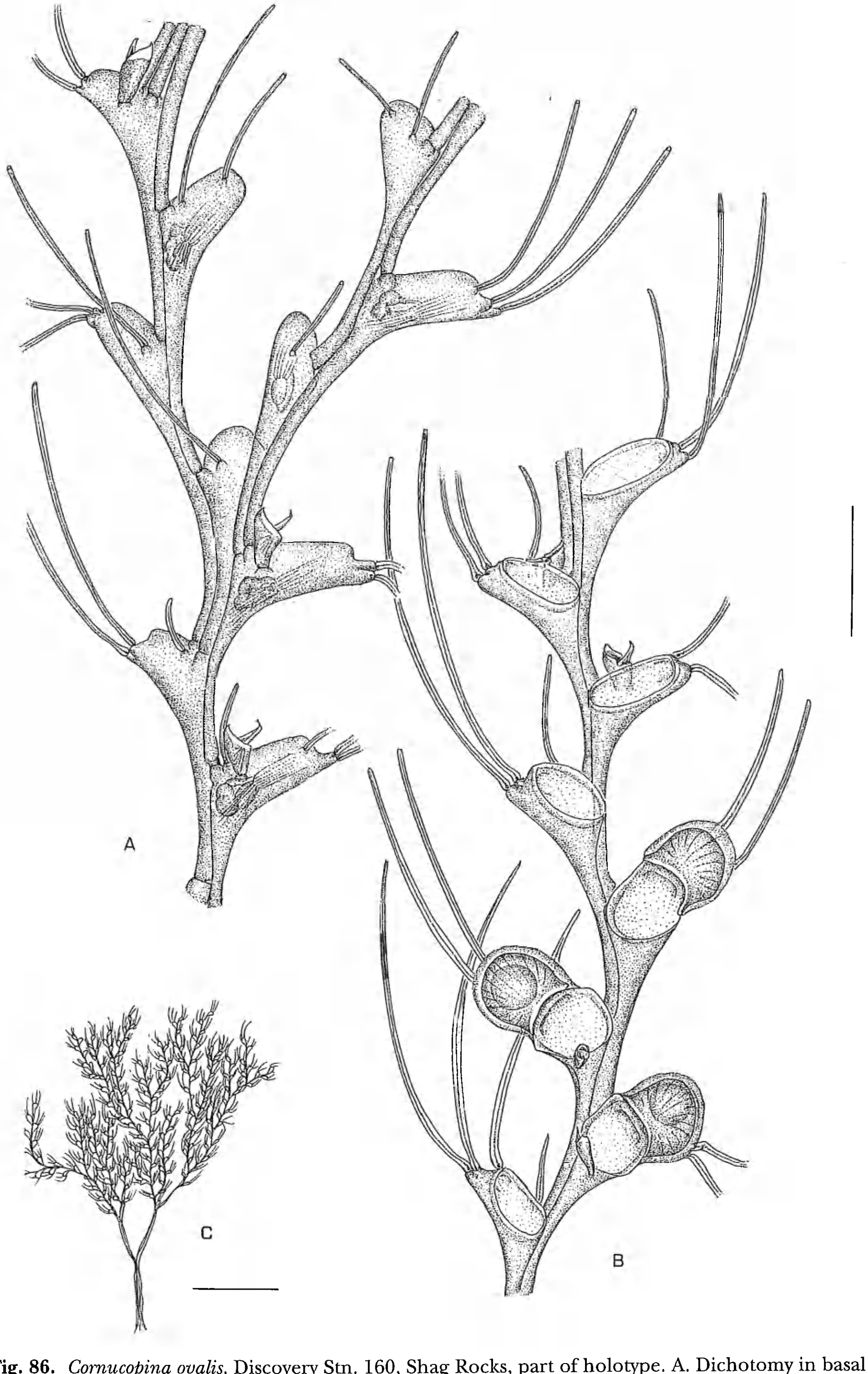


Fig. 86. *Cornucopina ovalis.* Discovery Stn. 160, Shag Rocks, part of holotype. A. Dichotomy in basal view. B. Part of colony, including ovicelled autozooids. C. Entire colony. Scale = 0.5 mm (A, B); 5 mm (C).

surface. Disto-basal process a prominent mound, with two stout, cylindrical spines, blunt ended and curved, up to, or exceeding, 2 mm long; a third, identical spine usually present adjacent to the process, with a fourth, slightly shorter, in the middle of the basal surface, and a slender spine, up to 0.5 mm long, close to the branch axis. Avicularia 0.15–0.25 mm long, with hooked rostrum and triangular mandible; sporadic, the largest attached to the basal surface of the autozooid, close to the branch axis, the smallest on the frontal surface, proximo- lateral to the opesia. Ovicell about as wide as long; entooecium with coarse radial striations and a pronounced frontal lip.

This species is still known only from the type locality, Shag Rocks, South Georgia, although Hastings (1943) considered that Waters' (1904) record of *Bicellaria grandis* Busk from the Magellan Strait probably referred to *C. ovalis*. Specimens of *C. ovalis* from the southern Patagonian Shelf had slightly stouter basal avicularia than seen in the type series, and were denoted var. *versa* by Hastings (1943), who also considered material from Kerguelen to belong to the variety. The geographical distribution of *Cornucopina ovalis* is thus unclear, but it seems unlikely to be primarily an Antarctic species.

Cornucopina pectogemma (Goldstein) Fig. 87

Bicellaria pectogemma Goldstein 1882: 42, pl.1, figs.2, 2a; Busk 1884: 33, pl.7, fig.1; Kluge 1914: 637

Cornucopina pectogemma: Hastings 1943: 397, Figs.28C, 32C; d'Hondt 1984: 107; Gordon 1984: 51, pl.16, figs.E–H.

Colony forming dense, feathery tufts up to 10 cm high. Autozooids rather small: distal portion 0.35–0.4 × 0.15–0.2 mm; proximal (axial) portion 0.5–0.65 mm long; opesia elongate oval, occupying entire frontal surface of distal portion. Disto-basal process prominent, with two

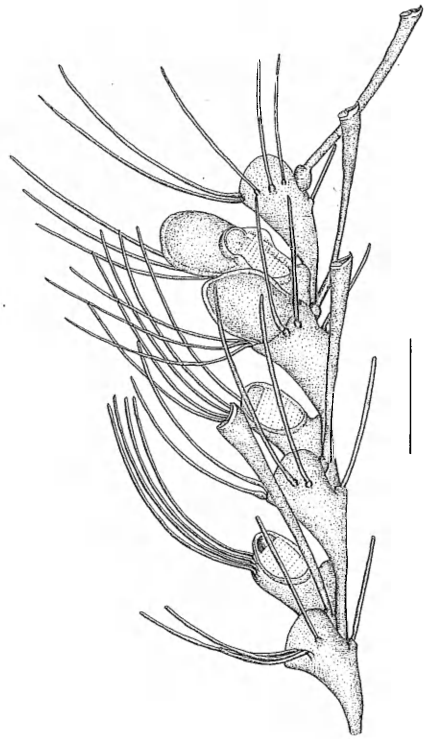


Fig. 87. *Cornucopina pectogemma.* Discovery Stn. 175, South Shetland Isles. Scale = 0.5 mm.

or three stout, curved, cylindrical spines, up to, or exceeding, 2 mm long; three to six additional spines, as long as, or longer than, the disto-basal group, occur in a line across the basal surface of the autozooid, that closest to the axis typically very short. Avicularia attached to basal surface of autozooids, within the lower series of spines; slender basally, very elongate, abruptly widened distally and thus resembling a straight coach-horn; up to 3 mm long and 0.1 mm across the top, with a hooked rostrum. Ovicell longer than wide, with a finely striated entooecium, with a marked frontal lip.

The slender, horn-like avicularia are very characteristic for this species; they vary greatly in length, even within a single colony. Spine number is also very variable, from five to nine in total. *Cornucopina pectogemma* has a circumpolar distribution in the southern hemisphere. It has been reported from Oates Land, the Ross Sea and Wilhelm II Land, and from the South Shetland and South Sandwich Islands, South Georgia, Bouvet Island, Tristan da Cunha, Marion Island, Prince Edward Island, Crozet Island, Kerguelen, and Heard Island, and from southern New Zealand.

Cornucopina polymorpha (Kluge) Fig. 88

Bicellaria polymorpha Kluge 1914: 638, pl.30, fig.1

Cornucopina polymorpha: Hastings 1943: 399, pl.7, fig.3 Figs. 28A,D; Moyano 1966a: 116; Androsova 1972b: 325.

Colony forming dense, bushy tufts, exceeding 10 cm high. Branches dividing frequently and irregularly. Distal portions of autozooids relatively short, 0.35–0.5 × 0.25–0.30 mm, opesia oval, oblique to branch axis; proximal portion 1.0–1.2 mm long. Disto-basal process reduced, inconspicuous, with one or two short, curved, cylindrical spines, often more than 2 mm long. Avicularia of three kinds: frontal, attached proximo-lateral to opesia, 0.25 mm long, curved distally, with the palate parallel to the long axis, rostrum oval, with a slight apical hook, mandible broadly triangular; basal, attached close to axis of branch, 0.7 mm long, with slender peduncle and abruptly swollen head, rostrum sharply hooked, mandible elongate triangular; basal, attached close to spines, elongate, coach-horn shape, commonly 1–2 mm long, but up to 4 mm. Gonozooids budded from basal surface of autozooids; 0.7 mm long, with oval opesia 0.3 mm long; narrowly pedunculate, with a shape reminiscent of a tobacco pipe.

Cornucopina polymorpha is an endemic species, widespread and common in Antarctic waters. It has been reported from the Ross Sea, from Oates Land, Wilhelm II Land, the Bellingshausen Sea, the Palmer Archipelago, the South Sandwich Isles, South Shetland Isles and as far north as South Georgia.

Himantozoum Harmer, 1923

Colony erect, branching dichotomously, attached by bundles of rhizoids budded from the lateral surfaces of the most basal autozooids. Branches biserial to multiserial, flat, or convex frontally, unilaminar, unjointed. Autozooids almost entirely membranous frontally, with only a reduced gymnocyst, operculum well defined; distal corners rounded, or produced as spinous processes, marginal autozooids typically asymmetrical, with only one distal process; lateral walls of autozooids lobed or dentate in some species. Avicularia adventitious, situated on the gymnocyst, immediately proximal to the frontal membrane; clavate, the base frequently narrowed and appearing shortly pedunculate, but not truly stalked and not movable; rostrum terminal, hooked; absent in a minority of species. Ovicells reduced, vestigial, or completely lacking in some species; ectooecium membranous, entooecium highly calcified, with faint striations.

Type species: *Bugula mirabilis* Busk, 1884.

Himantozoum is principally distributed in the abyssal regions of the oceans. Some species occur in continental slope habitats, in both the northern and southern hemispheres, and in Antarctic and Subantarctic waters two species have been described from shelf habitats. D'Hondt (1977) presented a key to the described species of *Himantozoum*, but relegated the taxon to the status of a subgenus within *Dendrobeania* Levinsen, 1909. This latter genus is characterized by pedunculate, bird's head avicularia, globular hyperstomial ovicells, and basally jointed distal and marginal spines. Species of *Dendrobeania* occur in shallow coastal habitats in boreal circumpolar waters. Additional species of *Himantozoum* were described by Hayward (1981) and Gordon (1986).

Himantozoum sinuosum (Busk) (described and figured by Hayward (1982)) is distributed throughout the deep Indian Ocean and reaches its

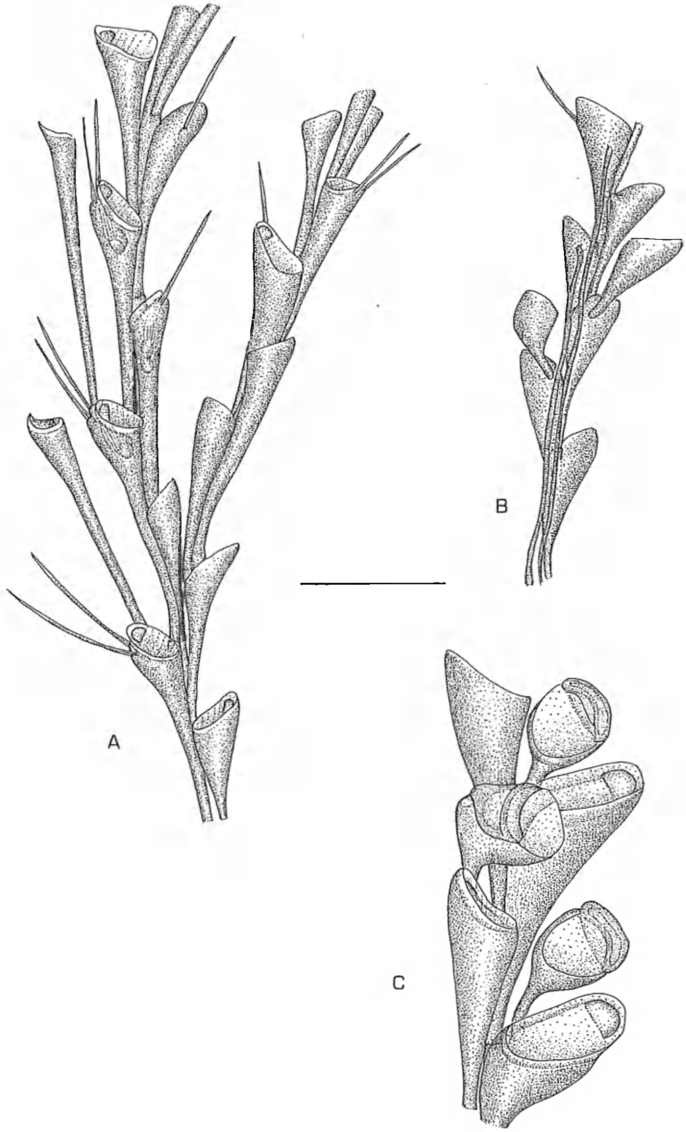


Fig. 88. *Cornucopina polymorpha.* Discovery Stn. 190, Bismarck Strait. A. Branch dichotomy, with two avicularia on left. B. Basal view of a branch, with a gonozooid. C. Part of branch, with gonozooids. Scale = 1.0 mm (A, B) or 0.5 mm (C).

southernmost limits at Kerguelen and Marion Island.

Key to Antarctic species

1. Branches with three to six series of autozooids. Ovicells conspicuous; ovicelled autozooids with paired distal spines .... *H. antarcticum*

Branches with two to three series of autozooids. Ovicells shallow, inconspicuous; ovicelled autozooids without spines .... *H. obtusum*

Himantozoum antarcticum (Calvet) Fig. 89

Flustra antarctica Calvet 1909: 11, pl.1, figs.4–6; Livingstone 1928: 22, pl.3, fig.9; Kluge 1914: 651, text fig. 30

Himantozoum antarcticum: Hastings 1943: 422, Fig.37B; Moyano 1966a: 116; Androsova 1972a: 92; 1972b: 319; Hayward 1980: 702; Hayward and Taylor 1984: 72; Winston and Bernheimer 1986: 370; Winston and Heimberg 1988: 188.

Colony forming dense bushy tufts, exceeding 10 cm high. Branches narrow, strap-like, up to 1.0 mm wide, bifurcating at intervals of 3–5 mm. Autozooids in three to six alternating longitudinal series, 0.85–1.0 × 0.2–0.3 mm; gymnocyst inconspicuous, except in marginal autozooids; distal corners produced as short blunt processes, the outer corner more pronounced in marginal autozooids. No avicularia. Ovicell hemispherical, fitting closely over distal end of autozooid, lightly calcified, with faint striations; ovicelled autozooids with the distal corners developed as stout cylindrical processes, curving medially in front of the ovicell.

H. antarcticum is an endemic Antarctic species, ranging northwards as far as South Georgia and Bouvet Island. It seems to be widespread and common throughout the Antarctic Shelf seas. At Low Island, South Shetlands Winston and Heimberg (1988) reported it as one of five dominant species in the bryozoan benthic community, which comprised 14.6% of the benthic biomass between 80 and 110 m depth.

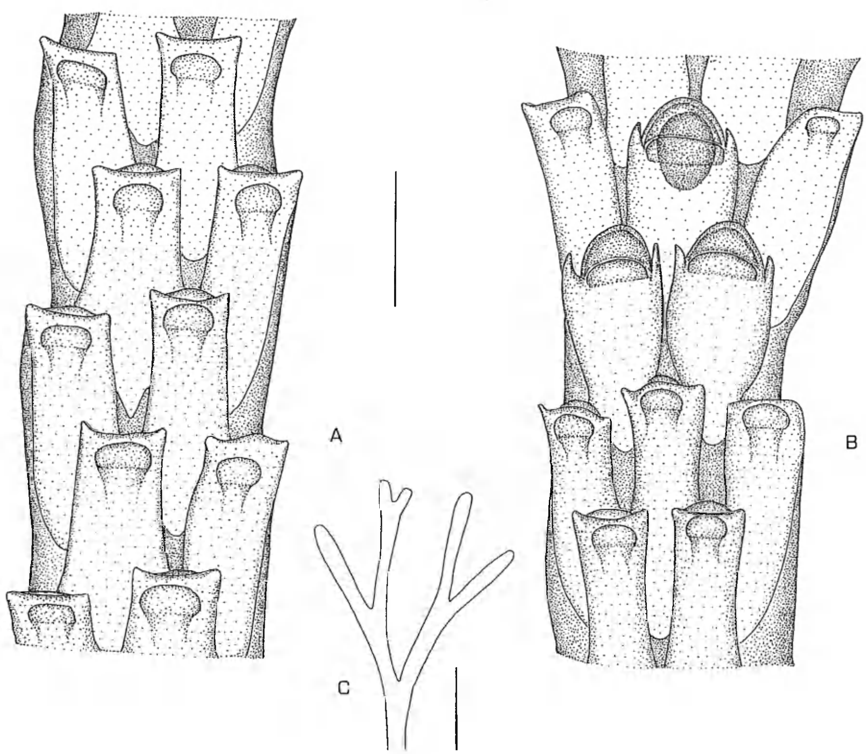


Fig. 89. *Himantozoum antarcticum.* Discovery 42, South Georgia. A. Autozooids from close to branch tip. B. Part of branch with ovicelled autozooids. C. Outline diagram of colony. Scale = 0.5 mm (A, B); 5 mm (C).

Himantozoum obtusum Hastings — Fig. 90

Himantozoum obtusum Hastings 1943: 424, Figs.37A,C

Colony form unknown. Branches slender, 0.25–0.5 mm wide, bifurcating at intervals of 2.0–3.0 mm. Autozooids in two or three alternating longitudinal series, 0.6–0.8 × 0.15–0.2 mm; gymnocyst reduced, conspicuous only in marginal autozooids; distal ends rounded, without projecting processes. No avicularia. Ovicell reduced to a shallow, caplike structure, the embryo brooded within the maternal autozooid.

This species was described by Hastings (1943) from 11 stations around the Falkland Isles, and off the southern Patagonian Shelf. It has not been reported since and its distribution is thus incompletely known, but it perhaps does not extend southwards into Antarctic waters.

Klugella Hastings, 1943

Colony erect, flustrine, with broad, divided lobes; unilaminar or bilaminar. Autozooids almost entirely membranous frontally, operculum conspicuous, with heavily sclerotized edge; gymnocyst reduced to a minimal area proximally, no cryptocyst. Spines present at distal end of autozooid, present or absent along lateral margins. Avicularia sessile, with terminal rostrum, situated on gymnocyst, infrequent. Ovicells hyperstomial, closed by autozooid operculum, entooecium calcified, ectooecium partly or largely membranous. Inconspicuous kenozooids present along branch margins. Vertical walls of autozooids with uniporous (distal) and multiporous (lateral) septula.

Type species: *Flustra echinata* Kluge, 1914.

The genus *Guilleia* d'Hondt and Redier, 1977 was founded on *G. kerguelensis* d'Hondt and Redier, 1977, which is

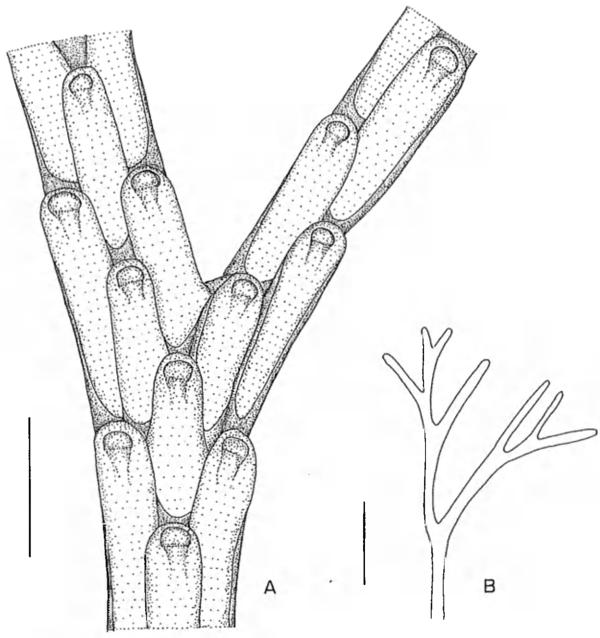


Fig. 90. *Himantozoum obtusum.* Discovery Stn. WS85, East Falkland. A. Part of colony at a dichotomy. B. Outline diagram of colony. Scale = 0.5 mm (A); 5 mm (B).

clearly the same species as *Flustra crassa* Busk, 1884 (= *Klugella buski* Hastings, 1943), the type locality of which is also Kerguelen. *Guilleia* is thus a junior subjective synonym of *Klugella* Hastings.

Key to Antarctic species

1. Colony bilaminar, autozooids with distal spines only .... *K. buski*
   Colony unilaminar, autozooids with distal and lateral, marginal spines .... *K. echinata*

Klugella buski Hastings Fig. 91

Flustra crassa Busk 1884: 53, pl.16, figs.6,6a,6b

not *Flustra crassa* Desmarest and Lesuer 1814: 53

Klugella buski Hastings 1943: 422, Fig.36C

Guillea kerguelensis d'Hondt and Redier 1977: 219, pl.2, figs.1–3; d'Hondt 1984: 99.

Colony forming short, broad lobes; bilaminate. Autozooids in numerous, alternating longitudinal series; rectangular, 1.0–1.6 × 0.3–0.4 mm; lightly calcified, a single short spine at each distal corner, often with an additional pair of short spines proximal to these. Avicularium situated at proximal end of autozooid, frontal in position; columnar, 0.3 mm high, rostrum terminal, acute to frontal plane, directed laterally, downcurved, with elongate triangular mandible; infrequent, absent from a majority of autozooids. Ovicell about as wide as long, entooecium calcified, with a conspicuous reticulate pattern in later ontogeny; ectooecium entirely membranous frontally. Inconspicuous kenozooids present along margins of the colony, wedged in between the distal borders of one autozooid and the proximo-lateral borders of the next.

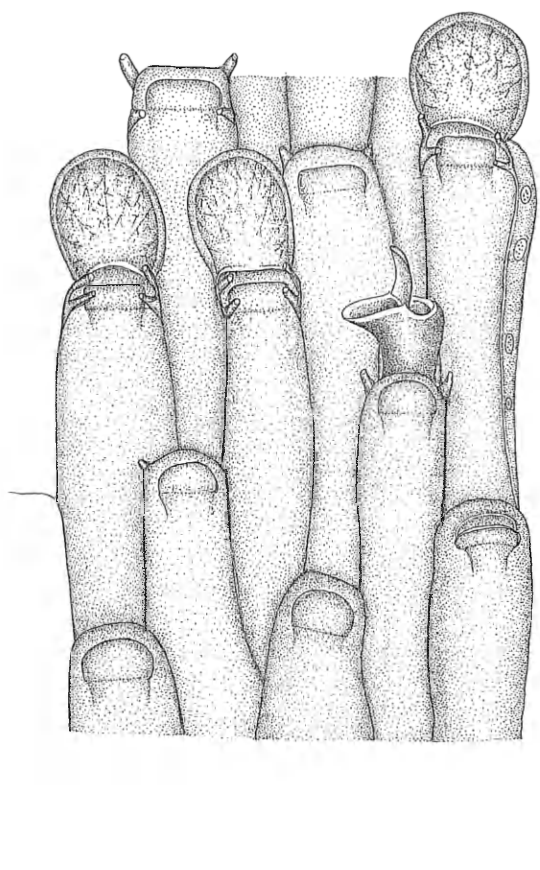


Fig. 91. *Klugella buski.* Challenger Stn. 149D, Kerguelen. Scale = 1.0 mm.

This species is presently known only from Kerguelen, and current knowledge of it is founded on the original *Challenger* material described by Busk (1884) and Hastings (1943), together with the few specimens described by d'Hondt and Redier (1977) and d'Hondt (1984), as *Guillea kerguelensis*. Details of its colony size and morphology are still lacking.

Klugella echinata (Kluge) Fig. 92

Flustra echinata Kluge 1914: 658, pl.32, fig.6, text fig.38

Klugella echinata: Hastings 1943: 421, Fig.36A; Redier 1965: 18; Androsova 1972b: 320, figs.3,4.

Colony developing broad, unilaminar, dichotomously branching fronds, up to 10 mm wide, branching at intervals of 3–5 cm; exceeding 15 cm high, attached by bundles of rhizoids. Autozooids in alternating longitudinal series, rectangular, 1.6–2.4 × 0.4–0.5 mm; distal ends projecting slightly and overlapping proximal portions of next autozooids. Two pairs of short, thick, erect, sharply pointed spines at distal end of autozooid; frontal membrane overarched by a variable number of flat, curved, pointed, marginal spines, typically three to five pairs in distal half of autozooid and five to nine others along one margin in proximal half of autozooid. Avicularia frequent; situated at proximal end of autozooid, slightly overhanging the distal edge of the preceding autozooid; cystid stout, columnar; rostrum terminal, acute to frontal plane, directed obliquely proximally, tapered to a blunt spout distally; mandible slender, almost setiform, 0.6 mm long. Ovicell hemispherical, twice as wide as long; entooecium with faint radiating sculpture, ectooecium entirely membranous frontally. Branch margins with slender, inconspicuous kenozooids linking distal end of each autozooid with lateral edges of next. Basal face of colony thickly covered with numerous branching, spinous processes.

Klugella echinata has been reported from Wilhelm II Land, Oates Land,

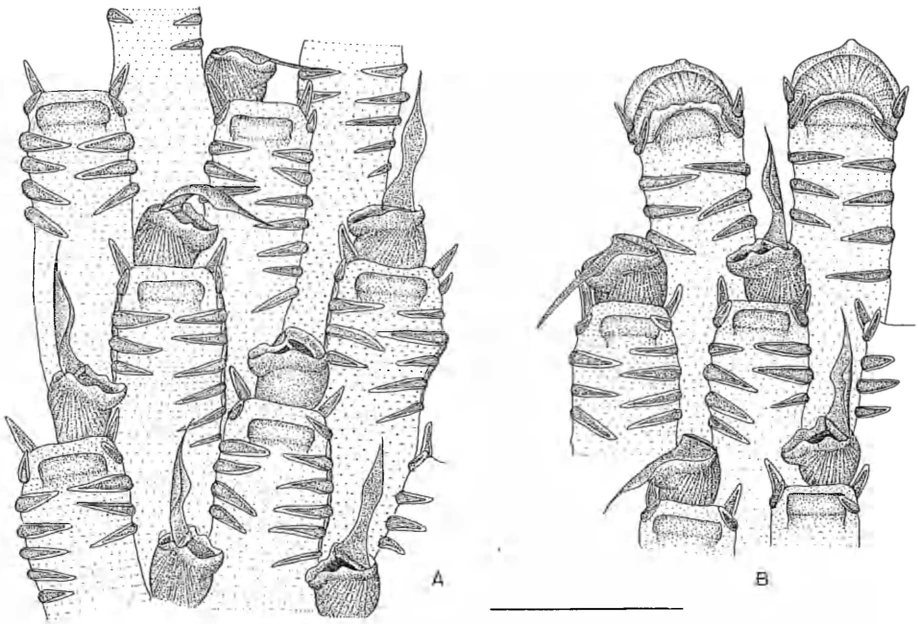


Fig. 92. *Klugella echinata.* Terra Nova Stn. 316, Ross Sea. A. Autozooids from close to frond tip. B. Ovicelled autozooids. Scale = 1.0 mm.

Adelie Land and the Ross Sea. It is apparently quite widespread in Antarctic coastal waters, although there have been relatively few records of it.

CABEREIDAE Busk, 1852

Colony erect, branching, unilaminar, jointed; attached by bundles of chitinous rhizoids. Autozooids in uniserial to multiserial rows; typically well calcified, with the frontal membrane occupying about half total length, and a rim of cryptocystal calcification variably developed. Spines most usually present at the distal ends of the autozooids, sometimes greatly enlarged and thickened; a laterally situated, flattened, and often branched, spine, the scutum, curving over the frontal membrane, characteristic of many genera. Avicularia sessile; vibracula present in many species. Ovicell hyperstomial, usually conspicuous; ectooecium typically with an uncalcified frontal fenestra.

Thickly chitinized joints are characteristic of this family. The joints divide the basal autozooids of each of the two rami at a branch dichotomy into two, and the arrangement of the autozooids at a dichotomy may be characteristic in some genera.

Caberea Lamouroux, 1816

Colony erect, branching dichotomously, typically forming a short, stiff fan; anchored by bundles of rhizoids. Branches stout, cylindrical, typically with a keeled basal surface; apparently unjointed, the joints hidden by calcification. Autozooids in two or more longitudinal series, often angled to face away from each other; frontal membrane occupying most of frontal surface, gymnocyst reduced, cryptocyst often well developed. Distal oral spines present; scutum present or absent. Avicularia adventitious, frontal and lateral in position, frequently grossly enlarged. Large vibracula present on basal surface of branch, chambers frequently occupying much of its area, orientated obliquely medially to form the longitudinal keel. Ovicell hyperstomial, globular, usually with a frontal fenestra.

Type species: *Caberea dichotoma* Lamouroux, 1816

Caberea is a richly diverse genus, with numerous species described from shallow shelf and coastal waters throughout the world. Many southern cold water species are described and figured by Gordon (1984, 1986). At present only one species, *C. darwinii* Busk, is recognized from the Antarctic, where it is both widespread and common.

Caberea darwinii Busk — Fig. 93

Caberea darwinii Busk 1884: 29 (part), pl.32, figs.6c–f
Crisia boryi: Jullien 1888: 75, pl.13, fig.5
Caberea boryi: Calvet 1904b: 7
Caberea darwinii: Kluge 1914: 618; Hastings 1943: 374, pl.6, figs.1–3; Figs.21A–C, 22A–C, 23A–D, 24A; d'Hondt and Redier 1977: 217; Moyano 1984a: 80; Gordon 1984: 50, pl.14, fig.A.

Colony forming a stiff, compact tuft, 1–2 cm high, the branches spreading to give open fan-shapes. Branches cylindrical, 0.25–0.5 mm wide, bifurcating at intervals of 1.0–5.0 mm. Autozooids in two alternating series, 0.4–0.5 × 0.2 mm; gymnocyst comprising less than one-quarter total frontal length, cryptocyst well developed, granular, longer than gymnocyst proximally, but narrowing towards distal end; operculum almost terminal, closely rimmed distally and laterally by the incurved distal walls of the autozooid. Two or three spines at the outer distal corner of the autozooid, one or two at the inner distal corner; scutum irregularly oval, the proximal lobe larger than the distal. Small frontal avicularia numerous, situated on the gymnocyst, and the lateral margins of the autozooids, with varying orientation, mandible bluntly triangular; each autozooid with a single lateral avicularium on

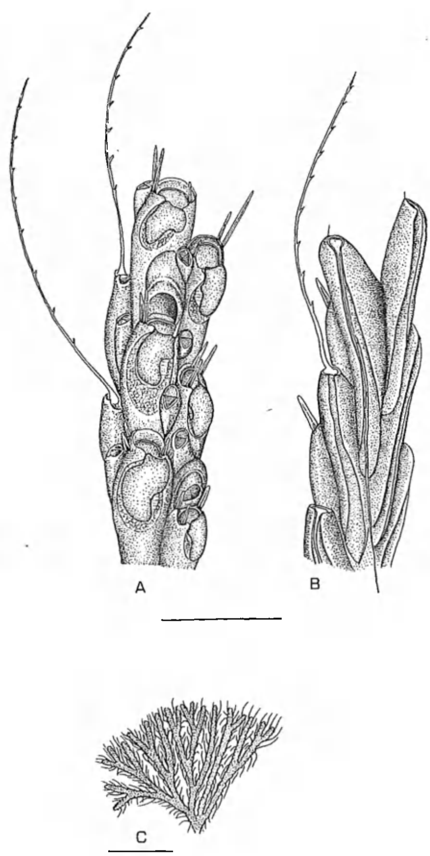


Fig. 93. *Caberea darwinii.* Discovery Stn. 195, South Shetland Islands. A. Part of branch in frontal view. B. Part of branch in basal view. C. Entire colony. Scale = 0.5 mm (A, B); 5 mm (C).

its outer margin, level with the lower edge of the operculum, the rostrum at a right angle to the branch axis. Basal vibracular chambers fusiform, longer than the autozooids, tapered proximally, with the setal grooves converging medially to form the branch keel; setae thick, up to 2.0 mm long, distinctly toothed along one edge. Ovicell broader than long, frontally flattened, with a large area of uncovered entooecium; inclined towards middle of branch.

This widely reported species is distributed throughout cold temperate and polar waters of the southern hemisphere. Hastings (1943) selected a lectotype and surveyed the variation of the species over its whole geographical range, and discussed its synonymy at length. Generally, Antarctic specimens tended to have stouter colonies, with thicker branches and larger autozooids than those from adjacent waters. *C. darwinii* var. *guntheri* was distinguished by Hastings by the presence of a grossly enlarged avicularium situated immediately proximal to each dichotomy, but otherwise it was evident that only a single, variable species could be recognized.

Amastigia Busk, 1852

Colony erect, dichotomously branching, secured by bundles of rhizoids, developing open, fan-shaped tufts. Dichotomies jointed or unjointed. Branches biserial in some species, more usually pluriserial, flat, or curved, with the frontal surface convex and the basal concave; median series of autozooids often narrowed basally, wedged in between adjacent series and partly or wholly excluded from basal surface of branch. Autozooids with oval opesiae, bordered by a narrow cryptocyst. Distal spines and scuta typically present, lacking in some species. Lateral and frontal avicularia present or absent; basal heterozooids usually present, as avicularia, setiform avicularia or vibracula, generally small and occupying only part of the basal surface of the autozooid. Tubular rhizoids bud from the basal heterozooids and from marginal autozooids, and trend proximally closely applied to the outer basal surface of the branch. Ovicell with a single frontal fenestra, or with the ectooecium entirely uncalcified frontally.

Type species: *Amastigia nuda* Busk, 1852.

Amastigia is a large genus with a southern circumpolar distribution. Numerous species are known from Antarctic coastal waters, along the Scotia Arc, off the southern Patagonian shelf and from the Magellanic region generally. Others occur at Marion Island and Kerguelen, and a number of species have been newly described from New Zealand by Gordon (1984, 1986). Beyond the subtropical convergence a few species are known from abyssal localities, but the genus seems to be limited to the southern hemisphere.

Seven species are described and figured here, two of which probably occur only in Subantarctic habitats. *Amastigia abyssicola* (Kluge) is incompletely described, and perhaps of doubtful validity. It was first described by Waters (1904, as *Scrupocellaria funiculata* (MacGillivray)) from a single abyssal locality in the Bellingshausen Sea, and later reported, but not figured, by Kluge (1914), who introduced for it the *nomen novum Scrupocellaria abyssicola.* Both records were founded on poor material. Hastings (1943) did not manage to see the original specimens, and did not discover any further specimens. Liu and Hu (1991) described a new species, *A. lanceolata,* from the Antarctic Peninsula characterized by biserial to quadriserial branches, and moderately large basal avicularia. There are two frontal avicularia per autozooid; scuta are lacking, but marginal autozooids bear two short spines. Unfortunately, it has not been possible to examine material of this species.

Key to Antarctic species

1. Colony branches cylindrical; strictly biserial, except for a single additional autozooid immediately proximal to the dichotomy. Scutum large, shield-like, completely hiding frontal membrane .... *A. crassimarginata*
   Colony branches flat or concave/convex; triserial to multiserial, sometimes with basal part of ramus (**only**) biserial 2
2. Autozooids without scuta 3
   Autozooids with scuta 4
3. Branches multiserial. Autozooids without spines; basal heterozooid an avicularium with slender, triangular mandible .... *A. antarctica*
   Branches triserial. Autozooids with spines; basal heterozooid a vibraculum with long seta. Gigantic frontal avicularia occur .... *A. kirkpatricki*
4. Scutum large, shield-like, completely hiding frontal membrane 5
   Scutum small, oval, tapered or toothed, not hiding whole of frontal membrane 6
5. Branches multiserial. Basal avicularia with setiform mandible. Subantarctic only .... *A. benemunita*
   Branches triserial to five-serial. Basal avicularia with slender triangular mandible. Antarctic only *A. gaussi*
6. Branches triserial. Scutum small, oval. Basal heterozooid a vibraculum, orientated disto-proximally, with slender seta ...... *A. cabereoides*
   Branches triserial to five-serial. Scutum elongate, tapered at both ends, with toothed edge. Basal heterozooid an avicularium, orientated transversely, with slender triangular mandible .... *A. solida*

Amastigia antarctica (Kluge) Fig. 94

Anderssonia antarctica Kluge 1914: 618, pl.33, figs.3,4

Amastigia antarctica: Hastings 1943: 329, Fig.5A; Moyano 1966a: 117; Androsova 1972b: 317

Colony form unknown, but comprising stout, cylindrical branches up to 1.5 mm thick, consisting of up to eight longitudinal series of autozooids. Basal surface occupying only one-third of the periphery of the branch, consisting almost entirely of the latero-basal walls of the two outermost series of autozooids; rarely, parts of the basal walls of median or intermediate autozooids are also apparent. Autozooids in alternating longitudinal series, distinctly rectangular, 0.65–0.9 × 0.35–0.45 mm; opesia narrowly oval, occupying three-quarters of total autozooid length, surrounded by a thin mural rim, with just a narrow border

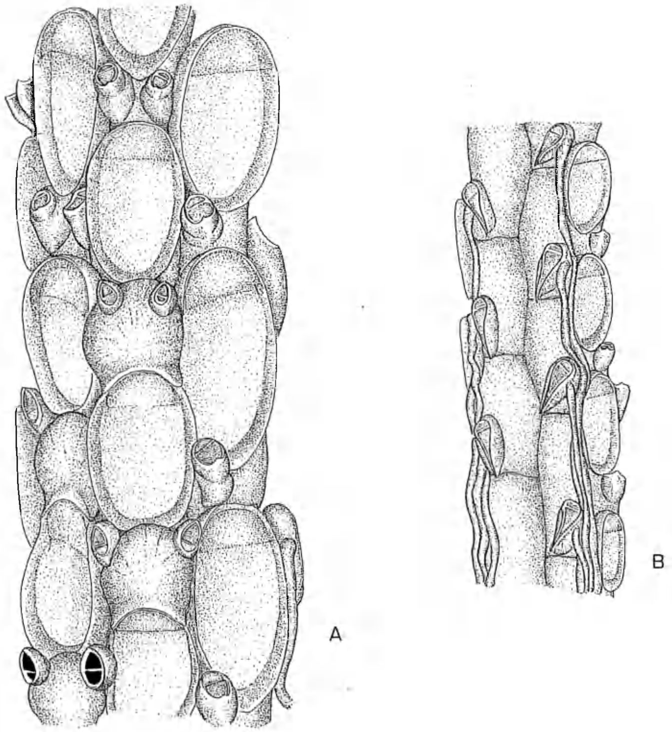


Fig. 94. *Amastigia antarctica.* McMurdo Sound, Ross Sea. A. Frontal view of part of branch, including ovicells. B. Basal view of branch. Scale = 0.5 mm (A) or 1.0 mm (B).

of cryptocyst proximally. No spines or scuta. Two small frontal avicularia at the proximal end of each autozooid (sometimes only one in marginal autozooids), the rostrum acute to frontal plane, hooked, supporting a broadly triangular mandible, directed proximo-medially. A single, larger, avicularium on the latero-basal wall of each marginal autozooid; cystid pyriform, 0.45 mm long, directed towards branch axis, with slender, almost setiform, mandible. A single rhizoid originates from each basal avicularium, passing proximally along the outer edges of the basal surface of the branch. Ovicell as broad as long, appearing almost quadrangular, partly immersed, with only the border of the ectooecium calcified.

This species has been reported on only four occasions, and remains imperfectly described. It seems, however, to be widely distributed in Antarctic waters, from Wilhelm II Land, Oates Land, the Ross Sea, and the Palmer Archipelago. Hastings (1943) noted its similarity to *A. pateriformis* (Busk), presently known from a single abyssal locality off Valparaiso, Chile. Material of both species is still limited and the question of their possible synonymy is no nearer solution. Recently, Gordon (1984) has described a subspecies, *A. antarctica subtropicalis,* from Curtis Island, New Zealand.

Amastigia benemunita (Busk) Fig. 95

Menipea benemunita Busk 1884: 19, pl.4, figs.4,4a

Menipea benemunita: Jullien 1888: 69, pl.8, figs.1–3

Amastigia benemunita: Hastings 1943: 325, Figs.2A–C, 3A,B; Hayward 1980: 702.

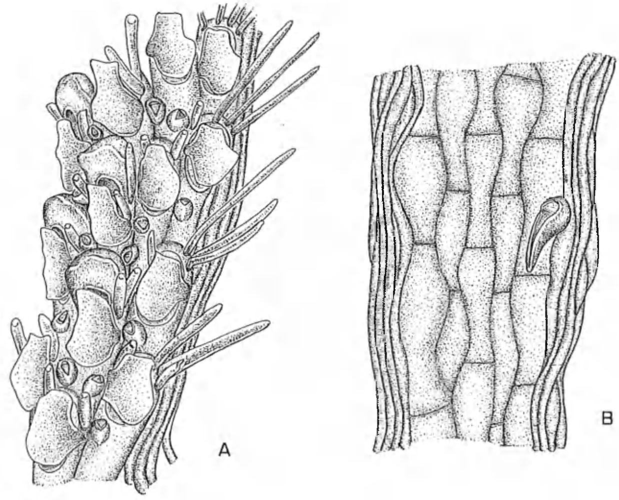


Fig. 95. *Amastigia benemunita.* Discovery Stn. WS755, Falkland Islands. A. Part of branch, including ovicelled autozooids. B. Basal surface of branch, with marginal rhizoids and an avicularium. Scale = 0.5 mm.

Colony with flat, rather broad branches, up to 1.25 mm broad, comprising five to seven longitudinal series of autozooids. Basal surfaces of median autozooids visible on basal surface of branch, but occupying relatively less space than those of outer and intermediate series. Autozooids in alternating longitudinal series, more or less rectangular, approximately 0.40 × 0.20 mm; the oval opesia occupying most of the frontal surface, completely covered by a prominent scutum with semielliptical proximal lobe, and angular, truncated distal lobe. Marginal autozooids with three stout spines on the outer distal angle, one on the inner; other autozooids with one plus one, or one plus two. Frontal avicularia small and inconspicuous, one or two proximally on most autozooids, frequently only one on marginal autozooids; rostrum perpendicular to frontal plane, hooked, with broadly triangular mandible. Basal avicularia on some, not all, marginal autozooids; cystid variable in size and shape, mandible slender, setiform. Rhizoids arise from cystids of basal avicularia, or directly from disto-basal wall of marginal autozooids. Ovicell broader than long, prominent, ectooecium only calcified marginally, forming a distinct rim around the entooecium.

This is a common Subantarctic species widely distributed from the Straits of Magellan, across the southern Patagonian Shelf, to the Falkland Isles, and as far east as Gough Island. Hastings (1943) recorded it from as deep as 339 m, but it is probably more abundant at lesser depths; its southernmost limit appears to be around 54°S, in the southwest Atlantic. The genus type, *A. nuda* (Busk), which ranges from the Magellanic region to Kerguelen, is similar to *A. benemunita,* but is distinguished by its more slender branches, usually only three to five series of autozooids, and by its basal avicularia, which have shorter, distinctly triangular mandibles.

Amastigia cabereoides (Kluge) Fig. 96

Scrupocellaria cabereoides Kluge 1914: 612, pl.27, figs.3,4 (not figs.9,10)

Amastigia cabereoides: Hastings 1943: 327, Fig.4D.

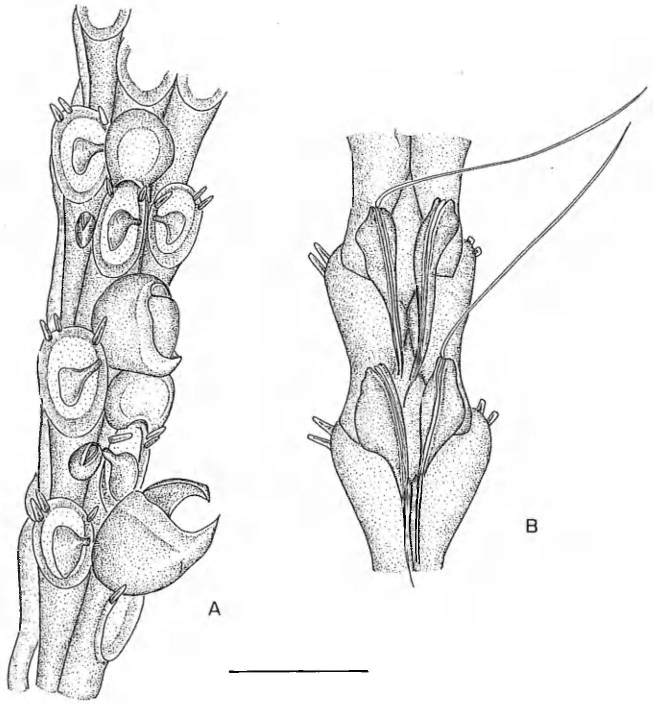


Fig. 96. *Amastigia cabereoides.* Terra Nova Stn. 194, Ross Sea. A. Part of branch in frontal view, with ovicells and gigantic avicularia. B. Basal view of branch. Scale = 0.5 mm.

Colony form unknown; branches slender, biserial proximally, triserial distally; convex frontally; only a small part of the basal wall of each median autozooid visible in basal view. Autozooids slender, elongate, 0.60–0.70 × 0.2 mm; opesia 0.35 mm long, with a distinct, slightly flared cryptocystal rim. Marginal autozooids with two slender spines on outer distal margin, one on inner, median autozooids with one plus one; scutum narrowly oval, obscuring less than half area of frontal membrane. One (sometimes two) frontal avicularium present on the gymnocyst of most autozooids, with narrow, proximally directed mandible; occasionally replaced by a gigantic type, with the globular cystid almost completely hiding the autozooid bearing it. Ovicell longer than broad, the ectooecium entirely uncalcified frontally. Basal vibracula variably developed, sometimes lacking; with a slender seta, often twice as long as the autozooid, and an indistinct setal groove directed proximomedially.

This species is presently known only from the description of Kluge (1914), and a few fragments reported by Hastings (1943) from Oates Land, figured here. Note that Kluge (1914) confused the notation of his pl.27, so that figs. 3 and 4 depict *A. cabereoides*, while figs. 9 and 10 depict *A. gaussi.*

Amastigia vibraculifera Hastings, known only from two localities off the Falkland Islands, is similar to *A. cabereoides.* It is distinguished by its smaller autozooids, with more numerous spines (four plus one on marginal autozooids, two or three plus one on median autozooids), and its more rounded scutum. Further, the branches of *A. vibraculifera* are multiserial, with three to six longitudinal series of autozooids, giving the colony a distinctly shrubby appearance.

Amastigia crassimarginata (Busk) Fig. 97

Caberea crassimarginata Busk 1884: 28, pl.11, fig.1

Amastigia crassimarginata: Hastings 1943: 331, Fig.4C

Colony forming dense, richly branched tufts, up to 3 cm long. Branches cylindrical, of constant width, stout, with acute dichotomies at intervals of 1.5–5.0 mm; each ramus forming a simple fracture joint at the dichotomy, reinforced by numerous rhizoids. Autozooids in strict, alternating, biserial sequence, except at the dichotomy where a third autozooid is intercalated at the axil; each facing laterally, away from the opposite autozooid series. Autozooids 0.5–0.65 × 0.2 mm; opesia 0.3 mm long, very narrow, completely surrounded by a broad, flared, granular cryptocyst. Two spines on outer distal corner, one on inner; scutum well developed, elongate, with slender, tapered proximal lobe and broadly quadrate distal lobe. Each autozooid with one or two frontal avicularia, and a single disto-lateral avicularium; basal avicularia vibraculiform, with a proximo-medially directed setal groove, almost as long as an autozooid. Ovicell broader than long, slightly flattened frontally, the ectooecium calcified only around the margins.

Amastigia crassimarginata is easily mistaken for a species of *Caberea*, only its simpler scutum, without the opposing process or bar characteristic of *Caberea*, and the regular lateral series of basal rhizoids indicating its correct generic affinity. It has been reported just twice, from deep water off the southern Patagonian Shelf, but Busk's original material is in sufficiently good condition to demonstrate the distinctive features of the species. It is quite possible that it may occur at shallower depths in Antarctic waters.

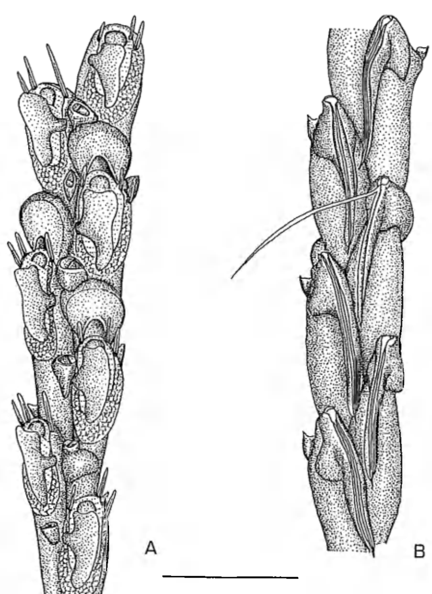


Fig. 97. *Amastigia crassimarginata.* Challenger Stn. 320, Patagonian Shelf. A. Branch in frontal view. B. Branch in basal view. Scale = 0.5 mm.

Amastigia gaussi (Kluge) Fig. 98

Scrupocellaria gaussi Kluge 1914: 609, pl.27, figs.9,10 (not figs.3,4)

Amastigia nuda: Hasenbank 1932: 362

Amastigia gaussi: Hastings 1943: 322, Figs.1A,C; d'Hondt 1984: 106

Colony developing stout, fan-shaped tufts up to 20 mm high. Branches triserial basally, increasing to five-serial prior to dichotomies, with acute bifurcations at irregular intervals of 1.0–5.0 mm; frontal surface markedly convex, with the distal, marginal autozooids directed laterally; basal surface of branch consisting almost entirely of the basal walls of the marginal autozooids. Autozooids slender, 0.5–0.6 × 1.5 mm; opesia 0.15 mm long, narrowly oval, with a raised mural rim, and only a narrow cryptocystal border. Spines variable, marginal autozooids with two or three on outer distal corner, one on inner; median autozooids with one plus one, or sometimes lacking them altogether; infrequently, one or more median autozooids per ramus may bear a gigan-

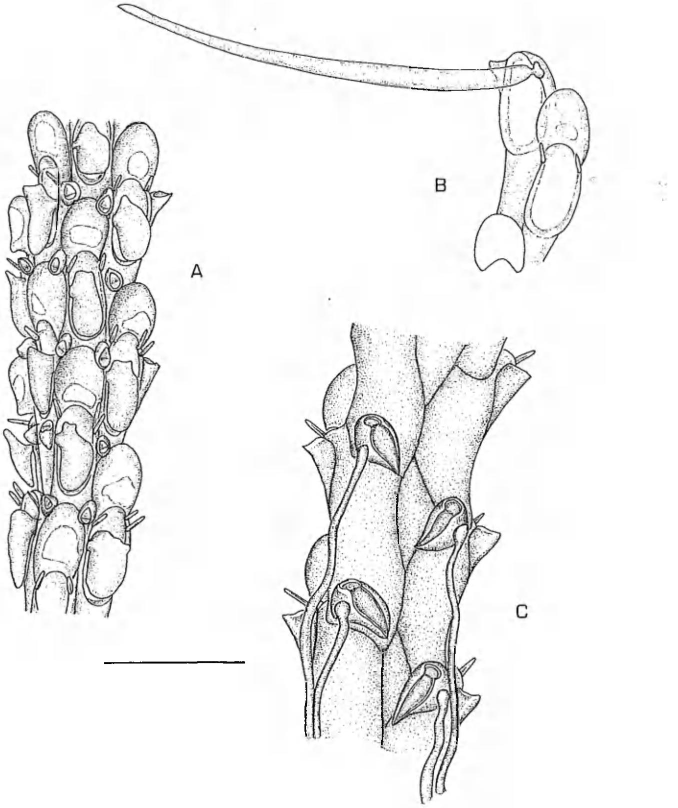


Fig. 98. *Amastigia gaussi.* A. Discovery Stn. WS42, South Georgia; part of branch in frontal view. B. Discovery Stn. WS42; detail of autozooid with gigantic spine. C. Discovery Stn. 140, South Georgia; basal view showing avicularia and rhizoids. Scale = 0.5 mm.

tic, distally pointed spine, up to 1.5 mm long; scutum broadly oval, distal lobe tapered or truncate, obscuring most of frontal membrane. One or two frontal avicularia present on each autozooid, with short, triangular mandible; marginal autozooids with a similar avicularium on the outer distal corner; basal avicularia with elongate triangular mandibles, medially directed. Ovicell longer than wide, smooth surfaced; ectooecium calcified distally, laterally and above the aperture, leaving an irregular frontal fenestra.

This species is perhaps quite widespread in Antarctic waters. It has been reported from Wilhelm II Land, Oates Land, the Palmer Archipelago, the South Orkneys and South Georgia. Hastings (1943) recorded it from depths greater than 300 m off the Southern Patagonian Shelf, and assigned Hasenbank's (1932) record of *A. nuda* from Bouvet Island to this species. D'Hondt (1984) reported it from Crozet Island, and it may prove to have a wider distribution within the Subantarctic regions.

Amastigia kirkpatricki (Levinsen MS, in Harmer) Fig. 99

Menipea marionensis Busk 1884: 21 (part), pl.14, fig.9

Caberea kirkpatricki Levinsen MS

Amastigia kirkpatricki (Levinsen MS): Harmer 1923: 335, pl.17, fig.20, pl.19, figs.46–48; Hastings 1943: 327

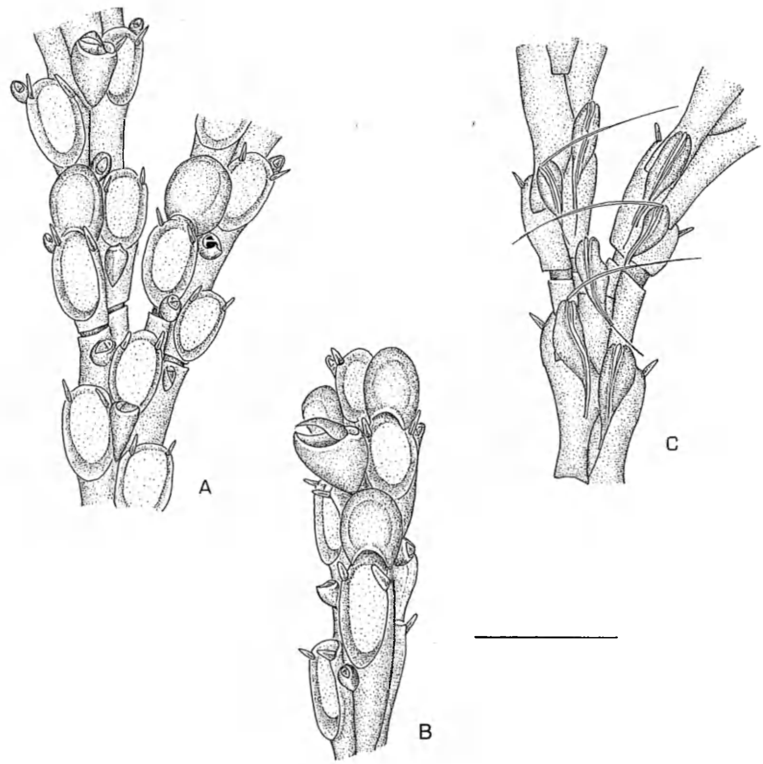


Fig. 99. *Amastigia kirkpatricki.* Challenger Stn. 144A, Marion Id. A. Colony branch at a dichotomy. B. Part of branch with gigantic avicularium. C. Basal view of dichotomy. Scale = 0.5 mm.

Colony developing slender tufts, exceeding 10 mm height. Branches narrow, straight, flat, becoming slightly convex distally; bifurcating at intervals of 2.0–4.0 mm, the dichotomies acute, and jointed, with the autozooids at the dichotomy conforming to the pattern denoted Type 20 by Harmer (1923); rami biserial proximally, triserial distally. Autozooids small, elongate, 0.5–0.55 × 0.15 mm; opesia 0.25 mm long, with a narrow, slightly flared, cryptocystal rim. Usually one short spine at each distal corner, sometimes two on the outer; scuta absent. Frontal avicularia frequent, one or two per autozooid, situated on the proximal gymnocyst, rostrum perpendicular to frontal plane with broadly triangular mandible; often enlarged, with an elongate cystid and proportionately larger mandible, and less frequently gigantic, with a globose cystid almost obscuring the autozooid bearing it. Additionally, some autozooids may bear a disto-lateral avicularium, situated just basal to the disto-lateral spine. Basal surface with true vibracula; one in the axil of each dichotomy, one at the basal end of each autozooid; cystid oval in outline, with setal groove directed proximo-medially, seta as long as, or just longer than, the autozooid. Ovicell longer than broad, the ectooecium entirely uncalcified frontally.

A. kirkpatricki is a Subantarctic species, presently known only from Marion Island and Prince Edward Island. Harmer (1923) showed that Busk's (1884) material of *Menipea marionensis* comprised two species; unfortunately the holotype was from the Cape of Good Hope, while the Marion Island specimen was recognized by Levinsen as a distinct species and referred to *Amastigia* by Harmer.

Amastigia solida (Kluge) Fig. 100

Scrupocellaria solida Kluge 1914: 611, pl.27, figs.7,8

Amastigia solida: Hastings 1943: 330, Figs.4A,B; Moyano 1966a: 117; Androsova 1972b: 317

Colony form unknown, composed of stout, bifurcating branches, convex frontally, each with three to five longitudinal series of autozooids. Median autozooids only partly excluded from basal surface of branch, their basal walls showing as elongate lozenges. Autozooids rather large, 0.65–0.75 × 0.2 mm; opesia narrowly oval, 0.3 mm long, with a broad cryptocystal border, flared widely and raised to form a distinct rim around the whole opesia. Marginal autozooids with three short, thin spines on outer distal corner, two on inner, median autozooids with two plus two. Scutum narrow, tapered distally and proximally, with toothed edge, obscuring about half total area of frontal membrane. One or two frontal avicularia present on the gymnocyst of most autozooids; basal avicularia orientated transversely, with slender, triangular mandible. Ovicell as long as, or slightly longer than, wide; ectooecium calcified marginally, entooecium with faint radial striations.

This distinctive species is still known from very few specimens, from few localities. It was originally described from off Wilhelm II Land, and has been reported subsequently from Oates Land and the Palmer Archipelago.

Notoplites Harmer, 1923

Colony free and branching, erect or recumbent, attached to the substratum by rhizoids which may be separate, or gathered into a bundle to form a supporting stalk. Branches biserial, the autozooids in overlapping, alternating sequence, bifurcating frequently, with each new branch jointed at the base; the basal surfaces of joints and dichotomies may be strengthened by tubular rhizoids, which also tend to form cross-connections between branches. Autozooids elongate, with an oval opesia constituting about half total length; tapered proximally. Opesia with a narrow proximal and lateral cryptocystal border. Spines typically present around the distal border

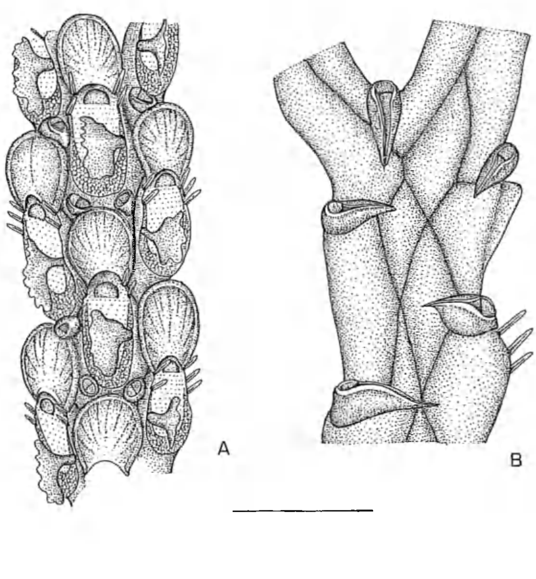


Fig. 100. *Amastigia solida*. Terra Nova Stn. 194, Ross Sea. A. Part of branch in frontal view. B. Basal view of a dichotomy. Scale = 0.5 mm.

of the opesia, and a flattened, branched or palmate, spine — the scutum — often present on the lateral border, overarching the frontal membrane. Avicularia sessile, disto-lateral and frontal in position, and often present additionally on basal surface of each autozooid. Ovicell usually prominent, enlarged and globular, typically with a frontal fenestra.

In all species of *Notoplites* (with the exception of the aberrant *N. tenuis* var. *uniserialis*) the disposition of autozooids at a dichotomy conforms to the Type 8 of Harmer (1923). Of the twin buds produced by autozooid A (Fig.102), the inner — E — assumes an axial position, flanked by autozooids C and D, proximal to the plane of jointing. The two buds produced by autozooid E develop as the inner basal autozooids of the two new rami, G and F, and the joint passes through the proximal parts of these autozooids, proximal to the opesia in each case. The dichotomy is secured by basal rhizoids arising from the outer basal autozooid of each new branch (autozooids J and K) and from the inner autozooids distal to autozooids F and G.

Type species: *Notoplites rostratus* Harmer, 1923.

Species of *Notoplites* occur below the continental shelf edge, and at abyssal depths, in all oceans. In polar waters they are found at much lesser depths, and the Antarctic shelf seas have a particularly diverse fauna. The colonies of most species are diffuse and rather straggly, although *N. drygalskii* (Kluge) may develop dense tufted growths.

Scrupocellaria perdita Kluge (1914), referred to *Notoplites* by Hastings (1943), was founded on a fragmentary specimen, now lost, from a single abyssal station in the Southern Ocean. *N. crateriformis* (Busk), described from abyssal depths in the south-west Atlantic, has since been reported from deep water off Kerguelen by d'Hondt (1984). A key to all described species of *Notoplites* was presented by d'Hondt (1981).

Key to Antarctic species

1. Colony uniserial, each internode consisting of a single autozooid. No spines, scuta or avicularia .... *N. uniserialis*
   Colony biserial, internodes always of several to many autozooids 2
2. Autozooids lacking both spines and scuta. Disto-lateral avicularium minute, often absent .... *N. klugei*
   Autozooids with spines and/or scuta 3
3. Autozooids lacking spines, except at bifurcations, where the two outermost autozooids proximal to the bifurcation have a single small spine. Scutum covering whole of frontal membrane, except for area of operculum 4
   Most or all autozooids with spines. If absent, then scutum covering only one-third of frontal membrane . 5
4. Distal edge of scutum oblique to long axis of branch (Fig.103). Disto- lateral avicularium small .... *N. drygalskii*
   Distal edge of scutum at a right angle to long axis of branch. Disto-lateral avicularium large, its cystid almost as long as opesia .... *N.vanhoffeni*
5. Three short spines present on outer distal edge of opesia, one or two on inner edge 6
   Each autozooid with no more than one spine 7
6. Scutum with distal and proximal lobes equally developed, together obscuring most of frontal membrane. Two spines on inner distal edge of opesia .... *N. elongatus*
   Scutum coarse-surfaced, consisting largely of an expanded proximal lobe, covering up to two-thirds of frontal membrane. One spine on inner distal edge of opesia .... *N. crassiscutus*
7. One small, inconstant spine at distal end of autozooid. No disto-lateral avicularia .... *N. tenuis*

One stout spine constantly present at distal end of autozooid. Disto-lateral avicularia present 8

8. Scutum crescent-shaped, with tapered distal and proximal lobes, together covering about one-third of frontal membrane .... *N. antarcticus*

Scutum rounded, with straight distal edge, covering proximal two-thirds of frontal membrane .... *N. watersi*

Notoplites antarcticus (Waters) Fig. 101

Scrupocellaria antarctica Waters 1904: 25 (in part), pl.1, figs.5a–e
Scrupocellaria antarctica: Kluge 1914: 606, pl.28, fig.1
Notoplites antarcticus: Hastings 1943: 341, Figs.9D,10C,11B

Colony erect, supported by a stalk formed from a bundle of chitinized rhizoids; slender, diffuse, bifurcating at intervals of 1.5–2.0 mm, each internode thus consisting of six autozooids. Autozooids elongate, slender, 0.7–1.0 × 0.2 mm; opesia 0.3 mm long, with a narrow cryptocystal border proximally and laterally. A single, stout spine present on the external disto-lateral border of the opesia, up to 4 mm long, present on distalmost autozooids of terminal branches, but usually broken short in most basal parts of colony. Scutum well developed, covering about one-third of frontal membrane; proximal and distal lobes equally developed, both tapered to a blunt tip. A small disto-lateral avicularium present on most autozooids, but not infrequently absent from some; frontal avicularia sporadically present proximal to opesia, sometimes enlarged; mandible elongate triangular; no basal avicularia. Basal surface of colony traversed by rhizoids, each originating from a budding point at the proximal end of the basal wall of an autozooid; converging proximally to form the colony stalk. Ovicell longer than wide, with a small fenestra in the frontal surface of the ectooecium; finely granular around the periphery.

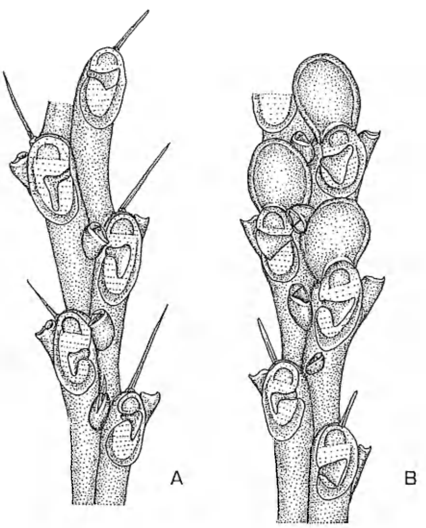


Fig. 101. *Notoplites antarcticus*. Discovery Stn. 39, South Georgia. A. Autozooids from near branch tip. B. Ovicelled autozooids. Scale = 0.5 mm.

Notoplites antarcticus seems to be a common Antarctic species. It has been reported from Wilhlem II Land, Oates Land, the Bellingshausen Sea, from several localities along the Palmer Archipelago, and as far north as South Georgia.

Notoplites crassiscutus Hastings Fig. 102

Notoplites crassiscutus Hastings 1943: 353, Figs.12E,15A,B,16A,B

Colony erect, diffuse, attached by a stalk of rhizoids; bifurcating at intervals of 2.0–2.5 mm, with six or eight autozooids per internode. Autozooids slender, 0.6–0.8 × 0.15–0.18 mm; opesia 0.2 mm long, with a relatively broad proximal and lateral border of granular cryptocyst. Three spines present on outer disto-lateral border of opesia, one on inner disto-

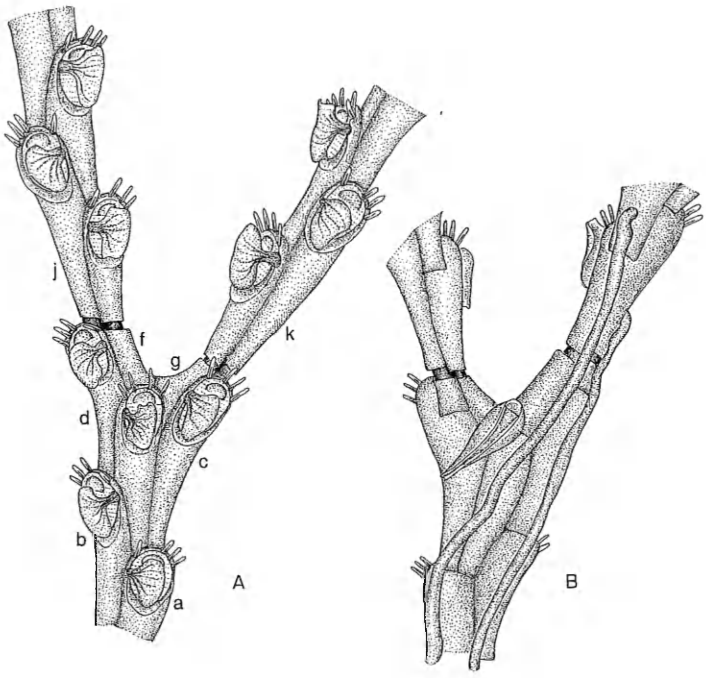


Fig. 102. *Notoplites crassiscutus.* Discovery Stn. 160, Shag Rocks. A. Frontal view of dichotomy. B. Dichotomy in basal view, showing axial avicularium. Scale = 0.5 mm.

lateral border. Scutum well developed and conspicuous, covering about two-thirds of frontal membrane; markedly convex, with thickened stalk and striated surface, proximal lobe larger than distal, and slightly tapered. No disto-lateral avicularia; a small frontal avicularium present on some autozooids, and a single enlarged avicularium, with narrow, curved mandible, present in the axil of each bifurcation, on the basal surface; no other basal avicularia occur. Ovicell undescribed.

This species is presently known only from a few specimens from Shag Rocks, west of South Georgia. The large axillary avicularium, and the coarse-surfaced scutum distinguish it immediately from other Antarctic species of *Notoplites,* but it is still incompletely described.

Notoplites drygalskii (Kluge) Fig. 103

Scrupocellaria drygalskii Kluge 1914: 609, pl.27, fig.5

Menipea funiculata: Thornely 1924: 6

Notoplites drygalskii: Livingstone 1928: 25; Hastings 1943: 342, pl.6, fig.6, Figs.9A–C,11A

Notoplites drygalskii: Moyano 1966a: 117; 1984a: 81; Androsova 1972a: 92; 1972b: 318; d'Hondt 1984: 107; López Gappa 1986: 103

Colony erect, forming dense, richly branched, bushy tufts exceeding 15 cm height, supported by a thickened stalk of rhizoids; distal bifurcations at intervals of 2–3 mm, with six, eight or ten autozooids per internode. Autozooids 0.7–1.1 × 0.25 mm, not markedly tapered proximally; opesia 0.5 mm long, with a relatively narrow cryptocystal border. Distal end of autozooid rounded, without spines, except immediately proximal to a bifurcation (very rarely elsewhere), where the two outermost autozooids have a single short spine on their

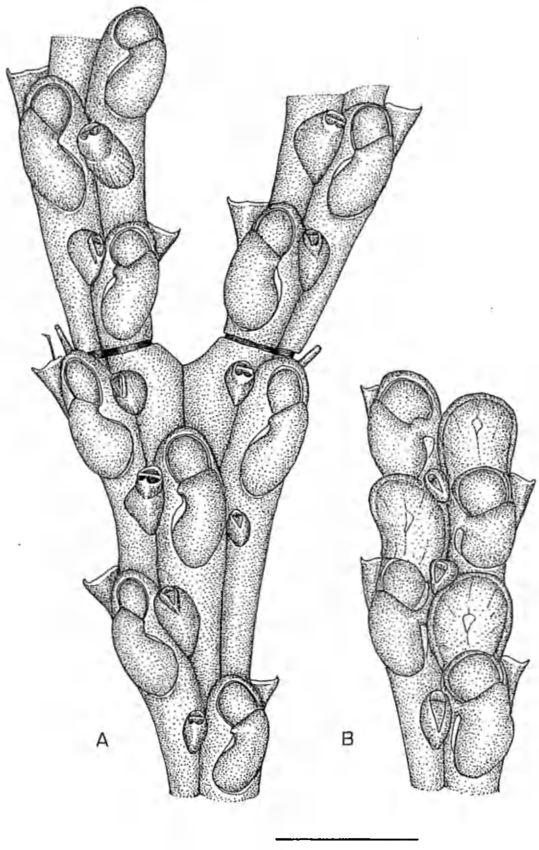


Fig. 103. *Notoplites drygalskii.* Terra Nova Stn. 339, Ross Sea. A. Frontal view of a dichotomy. B. Ovicelled autozooids. Scale = 0.5 mm.

external disto-lateral edges. Scutum well developed, fitting closely over the proximal two-thirds of the frontal membrane; distal edge oblique, surface faintly granular. Disto-lateral avicularium slender, rostrum with upturned tip, mandible triangular, sharply hooked; frontal avicularium present on some autozooids, situated just proximal to opesia, variable in size; no basal avicularia. Ovicell recumbent on distally succeeding autozooid, and partly immersed; elongate oval, globular, with a small central fenestra.

Notoplites drygalskii is widespread, and common, in all Antarctic waters, and has been reported as far north as South Georgia and Bouvet Island. Its large, densely grown colonies are conspicuous in benthic samples.

Notoplites elongatus (Busk) Fig. 104

Cellularia elongata Busk 1884: 19, pl.3, fig.3; Calvet 1904b: 5
Notoplites elongatus: Hastings 1943: 346, Figs.12A,B,13A; d'Hondt 1984: 107
Notoplites elongatus var. *calveti* Hastings 1943: 348, Fig.12C,D

Colony erect, anchored by a stalk of rhizoids; branches bifurcating at intervals of 2–3 mm, each internode with eight to 14 autozooids; internodes straight, parallel-sided, the angle of the dichotomy acute. Autozooids 0.6–0.8 × 0.15–0.18 mm; opesia 0.3 mm long, with only a narrow proximal and lateral cryptocystal border. Three spines on outer disto-lateral border of opesia, two on inner border. Scutum well developed, obscuring most

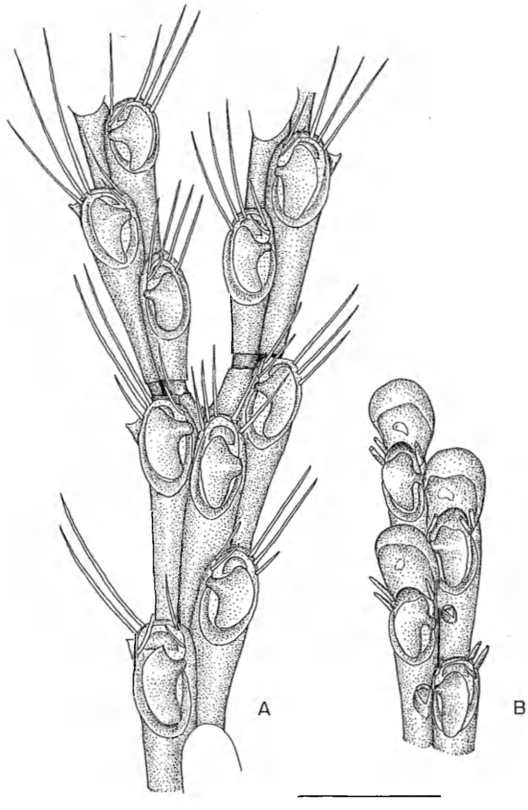


Fig. 104. *Notoplites elongatus.* Challenger Stn. 149D, Kerguelen. A. Frontal view of a dichotomy. B. Ovicelled autozooids. Scale = 0.5 mm.

of frontal membrane, except for the distal, opercular area, and a narrow proximal band; proximal lobe broadly rounded, distal lobe rounded or quadrate, projecting slightly from plane of branch. Disto-lateral avicularium small, inconspicuous, not developed on all autozooids; small frontal avicularia present or absent; no basal avicularia; with or without a prominent axillary avicularium. Ovicell elongate oval, with a few faint longitudinal striations, the frontal fenestra reduced to a slender suture.

N. elongatus var. *calveti* was introduced by Hastings (1943) for the southern Patagonian Shelf populations of this species, and was principally characterized by its prominent, though sporadically developed, axillary avicularium. She restricted *N. elongatus* to specimens from Kerguelen and Marion Island, but noted that these also varied in that specimens from the latter locality possessed frontal avicularia while those from Kerguelen, the type locality, did not. However, both types of avicularium are inconstant in occurrence; in all other respects specimens of *N. elongatus* are identical across its entire geographical range and there seems to be little utility in maintaining a taxonomic distinction between the different populations. D'Hondt (1984) has subsequently recorded this species from Crozet Island, but it has not been reported from Antarctic waters.

Notoplites klugei (Hasenbank) Fig. 105

Menipea klugei Hasenbank 1932: 369, text fig.33

Scrupocellaria simplex Kluge 1914: 607, pl.27, fig.1

Notoplites klugei: Hastings 1943: 352, Fig.13B

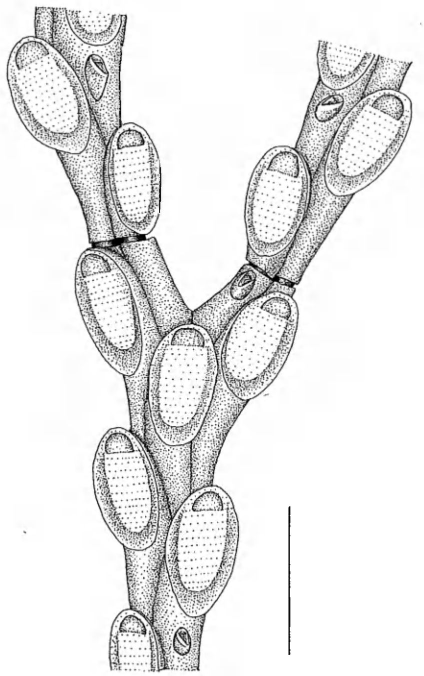


Fig. 105. *Notoplites klugei.* McMurdo Sound, Ross Sea. Scale = 0.5 mm.

Colony erect, branches bifurcating at intervals of 2.0–2.5 mm; internodes straight, with nine to 11 autozooids; nodes in the form of simple fracture planes passing proximal to the opesia of the proximal autozooid of each ramus. Autozooids 0.65–0.7 × 0.2 mm; opesia 0.35–0.4 mm long, with a well developed, slightly flaring opesial rim, broadest proximally. No spines or scuta. A minute disto-lateral avicularium present on some autozooids; frontal avicularium more frequent, situated immediately proximal to the opesia on most autozooids, rostrum elongate triangular, almost perpendicular to frontal plane, proximally orientated. Ovicell unknown.

This species has been reported on just three occasions, from Bouvet Island, Wilhelm II Land and the Ross Sea. Very little material has been collected on each occasion and its morphology thus remains incompletely known. The material described and figured here is the specimen reported by Hastings (1943) from the Ross Sea, which comprises an incomplete colony of just six internodes.

Notoplites tenuis (Kluge) Fig. 106

Scrupocellaria tenuis Kluge 1914: 608, pl.27, fig.2

Notoplites tenuis: Hastings 1943: 350, Figs. 13C,15C; Moyano 1966a: 118; 1984a: 81; Hayward and Taylor 1984: 72

Colony partly repent, attached to substratum by the erect proximalmost internode, and subsequently by rhizoids issuing directly from its basal surfaces; diffuse and straggling, bifurcating at intervals of 1.5–3.5 mm; internodes straight, diverging at acute angles, with up to 12 autozooids each. Autozooids very slender, 0.8–1.2 × 0.18–0.2 mm; opesia 0.3 mm long, with a slightly flared cryptocystal rim, broadest proximally. A single, short, disto-lateral spine present on some autozooids; scutum variably developed, arching above frontal membrane, equivalent to no more than one-third its area, usually much less, consisting of a variably shaped proximal lobe. Lateral and basal avicularia absent, but almost all autozooids with a single frontal avicularium, situated just proximal to opesia, with bluntly triangular rostrum acute to frontal plane. Ovicell longer than wide, with a single rather large frontal fenestra. A conspicuous proximo-lateral septulum present on most autozooids.

Notoplites tenuis appears to be a widespread and common, endemic, Antarctic species. It has been reported from Wilhelm II Land, Oates Land and the Ross Sea, from the Palmer Archipelago, and from South Georgia.

Notoplites uniserialis Hastings Fig. 107

Notoplites tenuis var. *uniserialis* Hastings 1943: 351, Figs. 14A–C

Colony diffuse, comprising uniserial chains of slender autozooids, each jointed proximally, so that each internode

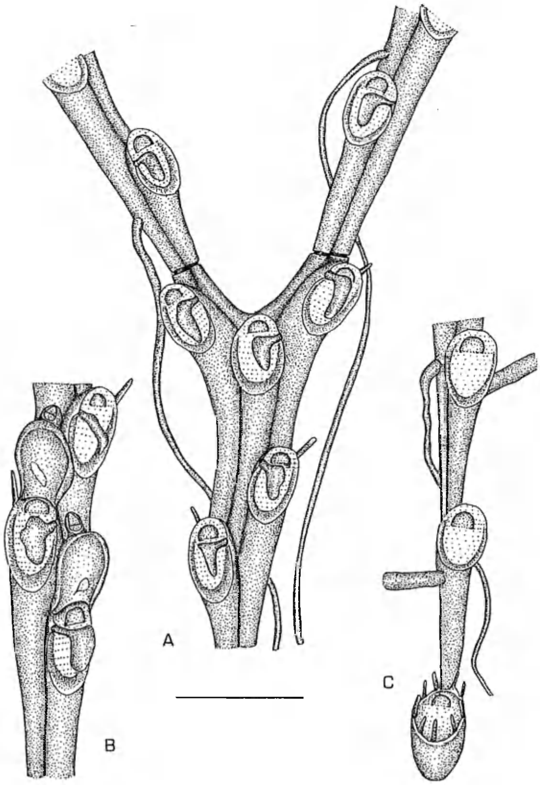


Fig. 106. *Notoplites tenuis.* McMurdo Sound, Ross Sea. A. Part of colony at a dichotomy. B. Ovicelled autozooids. C. Ancestrula and first few autozooids. Scale = 0.5 mm.

comprises just one autozooid. Branches arising dichotomously, from twinned buds produced by the preceding autozooid, or adventitiously from a septulum at the proximal end of an autozooid. Attachment to substratum unknown. Autozooids 1.0 × 0.15 mm; opesia 0.3 mm long, with a relatively broad, slightly flared cryptocystal rim. No spines, scuta or avicularia. Ovicells unknown.

N. uniserialis was regarded simply as a 'variety' of *N. tenuis* by Hastings (1943), who stated that she had observed one or two uniserial internodes in a specimen of the latter species. However, its simplified dichotomies, and the absence of spines, scuta and avicularia in the, admittedly sparse, samples which have so far been obtained, suggests that *N. uniserialis* is consistently different from *N. tenuis.* At present it has been reported from just two localities, from Oates Land, and the Ross Sea.

Notoplites vanhoffeni (Kluge) Fig. 108

Scrupocellaria vanhoffeni Kluge 1914: 610, pl.27, fig.6

Notoplites vanhoffeni: Hastings 1943: 346, Figs. 10A,B; Redier 1965: 17; Moyano 1966a: 118; 1984a: 81; Androsova 1972b: 318

Colony erect, attached by a stalk of rhizoids; branches stout, with relatively large disto-lateral avicularia giving them a distinctly serrated appearance; bifurcating at intervals of 3–4 mm, with up to 14 autozooids per internode. Autozooids 0.8–1.0 × 0.25–0.3 mm; opesia 0.4–0.45 mm long, with only a narrow proximal and lateral border of cryptocyst. No

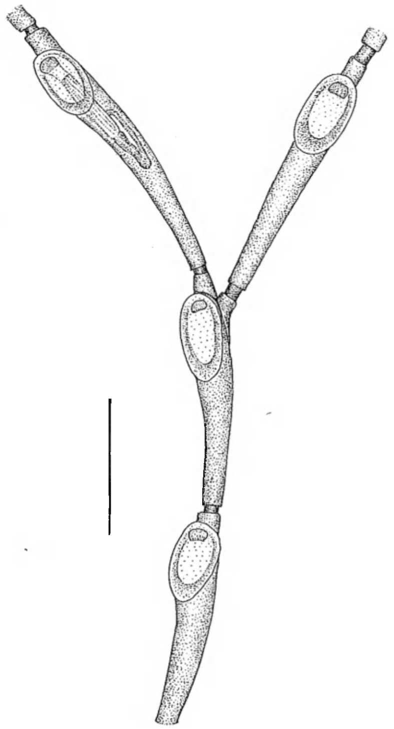


Fig. 107. *Notoplites uniserialis.* Terra Nova Stn. 194, Ross Sea; part of holotype. Scale = 0.5 mm.

spines. Scutum fitting closely over whole of frontal membrane, its distal edge straight; lateral walls of autozooid incurved distally, coinciding closely with the curved margin of the operculum. Each autozooid with a very prominent disto-lateral avicularium, with rostrum hooked at tip, supporting a sharply hooked, triangular mandible; a single frontal avicularium present on most autozooids; no basal avicularia. Ovicell wider than long, with a tessellate surface and a single frontal fenestra.

Notoplites vanhoffeni is readily recognized by its large, projecting disto-lateral avicularia, and by its straight edged scuta. It has been widely reported in Antarctic waters, from Wilhelm II Land, Oates Land, the Ross Sea and the Palmer Archipelago, but has not been recorded from South Georgia.

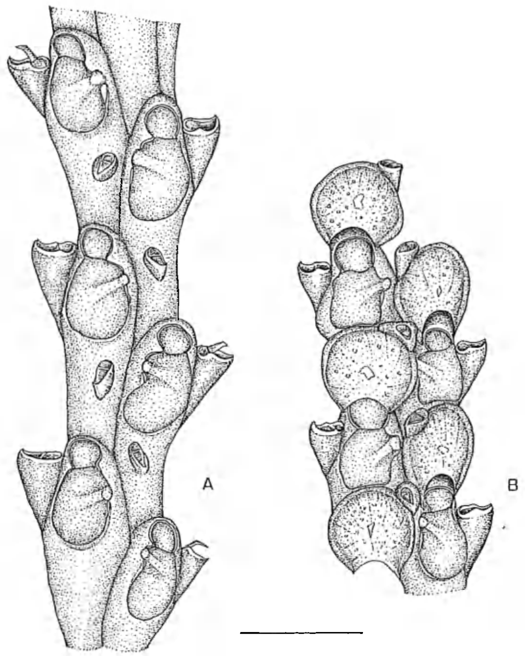


Fig. 108. *Notoplites vanhoffeni.* Terra Nova Stn. 339, Ross Sea. A. Part of branch in frontal view. B. Ovicelled autozooids. Scale = 0.5 mm.

Notoplites watersi (Kluge) Fig. 109

Scrupocellaria antarctica Waters 1904: 25 (in part)
Scrupocellaria watersi Kluge 1914: 607, pl.28, fig.2
Notoplites watersi: Hastings 1943: 342

Colony erect, attached by a stalk of rhizoids; branches bifurcating at intervals of 1.5–2 mm, with six to eight autozooids per internode. Autozooids 0.6–0.8 × 0.15–0.18 mm; opesia 0.3 mm long, with only a narrow cryptocystal border. A single, stout spine at the distal end of each autozooid, as long as autozooid when undamaged, but often broken short. Scutum closely covering proximal two-thirds of frontal membrane, its distal edge straight or with a small lobe; stalk of scutum divided. Disto-lateral avicularium relatively small, equivalent to one-third length of opesia; a small frontal avicularium present on most autozooids; basal avicularia absent. Ovicell longer than wide, with a tessellate surface and a small frontal fenestra.

Notoplites watersi is presently known only from four Antarctic localities, in the Bellingshausen Sea, the Ross Sea, and from Wilhelm II Land and Oates Land.

Tricellaria Fleming, 1828

Colony free and branching, attached to the substratum by rhizoids. Branches biserial, with autozooids in alternating series, bifurcating frequently, each ramus jointed at its base; internodes characteristically of three autozooids, but often more in distal rami of colony. Autozooids elongate, proximally tapered, the opesia usually occupying less than half of total frontal length. Spines usually present; scutum present in some species. Avicularia, when present, sessile, lateral or frontal in position; basal avicularia and vibracula absent. Ovicell hyperstomial, subglobular, typically with a single frontal fenestra.

The arrangement of autozooids at the bifurcation conforms to Types 9 or 11 of Harmer (1923). Autozooid A gives rise to the axillary autozooid E, and to the outer autozooid C (Fig. 110); B gives rise to the opposite outer autozooid D, while the two autozooids on the inner surfaces of the axil, G and F, are budded from autozooid E. Joints pass proximal to the opesiae of both autozooids of each new ramus.

Type species: *Cellaria ternata* Ellis and Solander, 1786.

Tricellaria species occur in shallow shelf waters, primarily in the Arctic and Subarctic regions. One species, *T. aculeata* (d'Orbigny) has a circumpolar Subantarctic distribution, and occurs also at South Georgia and Bouvet Island.

Tricellaria aculeata (d'Orbigny) Fig. 110

Bicellaria aculeata d'Orbigny 1847: 8
Menipea fuegensis Busk 1852: 21, pl.19, figs.1–3; Jullien 1888: 70, pl.7, figs.8–10, pl.12, figs.1,2; Calvet 1904b: 6
Menipea aculeata: Busk 1884: 20, pl.4, fig.2; Calvet 1904b: 6
Scrupocellaria fuegensis: Waters 1904: 24
Scrupocellaria bifurcata Kluge 1914: 614, text fig.3
Tricellaria aculeata: Hastings 1943: 356; d'Hondt and Redier 1977: 217; Gordon 1986: 60, pl.20, figs.A,B

Colony forming diffuse, feathery tufts, 2–3 cm high. Branches bifurcating at intervals of 1–2 mm, each internode with three autozooids, or from six to fifteen; longest internodes occur in distal parts of colony, and generally comprise ovicelled autozooids. Basal part of each ramus slender, the joint consisting of a single chitinous tube, through the suppression of the proximal parts of autozooids F and G, which now originate distal to the joint. Autozooids elongate, slender, tapered proximally, 0.7–1.3 × 0.15 mm; opesia less than half frontal autozooid length, elongate oval, with a narrow cryptocystal rim. Three to five slender, curved spines

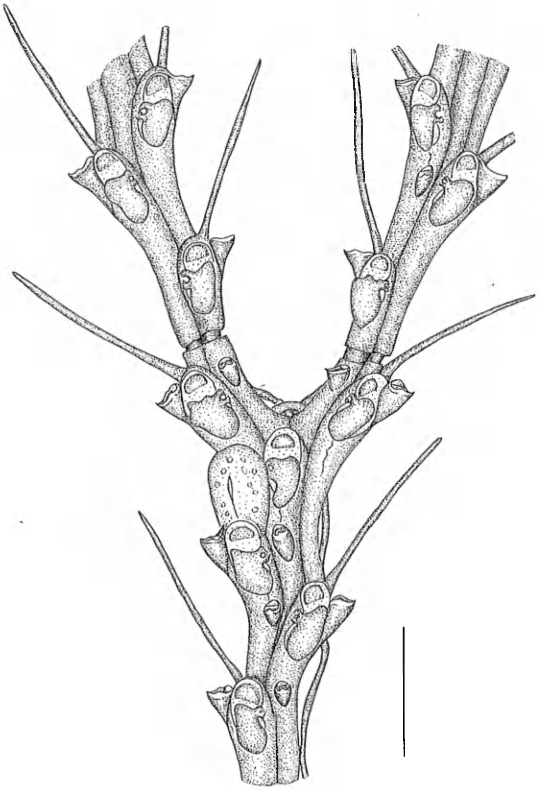


Fig. 109. *Notoplites watersi.* Terra Nova Stn. 194, Ross Sea. Scale = 0.5 mm.

at distal end of opesia, variable in length, but often as long as the autozooid; scutum narrow, lobed or branched, sometimes absent. Avicularia variable, often missing from many autozooids of a colony; lateral at outer distal corner of autozooid, frontal situated immediately proximal to opesia, both small, with bluntly triangular rostrum 0.05 mm long. Ovicell longer than wide, 0.2 mm long, recumbent on distally succeeding autozooid, subglobular, with an irregular frontal fenestra.

Tricellaria aculeata has a circumpolar Subantarctic distribution, from southern New Zealand to Tierra del Fuego, including Campbell and Auckland Islands, and Kerguelen. It occurs at Bouvet Island and South Georgia, but has so far not been reported from off the mainland of Antarctica.

Menipea Lamouroux, 1812

Colony erect, branching; bushy, diffuse or flabellate; attached by chitinous rhizoids, typically forming bundles along branch margins. Branches biserial to multiserial, dividing dichotomously, jointed or unjointed; bifurcations in jointed species conform to Types 17 or 18 of Harmer (1923), with the plane of the joint traversing the opesia of the inner basal autozooid of each ramus. Autozooids with variably developed gymnocyst; opesia extensive, oval, surrounded by a narrow, but distinct, rim of cryptocystal calcification; spines present at distal end of autozooid, scutum absent. Frontal and lateral avicularia typically present, in some species with setiform mandibles; basal heterozooids present or absent. Ovicells present, globular and

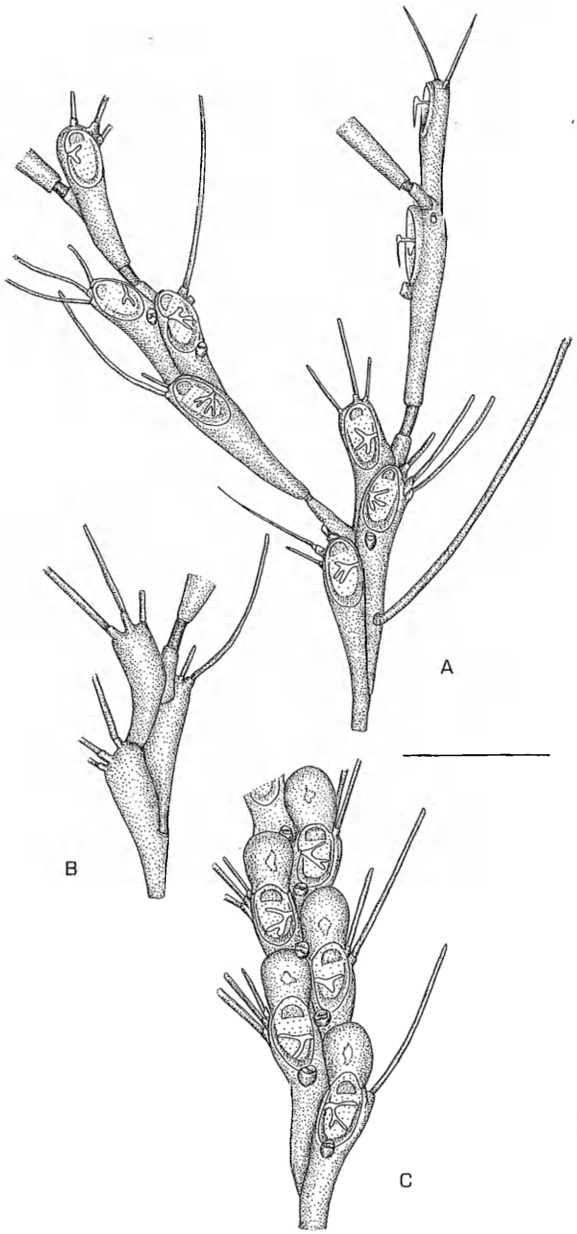


Fig. 110. *Tricellaria aculeata.* Patagonian Shelf. A. Portion of colony, comprising four internodes. B. A single internode in basal view. C. Ovicelled autozooids. Scale = 0.5 mm.

prominent, or reduced, cap-like, sometimes altogether absent.

Type species: *Cellularia crispa* Pallas, 1766.

The genus *Menipea* is widely distributed in the southern hemisphere, in shallow coastal waters. Two species have been described from abyssal depths: *Menipea undulata* Hasenbank,which is known from a single record only, and *M. ignota* Hayward, which was redescribed by Gordon (1986) as type species of his new genus *Penemia.* It is primarily distributed in cold temperate/Subantarctic seas. One species, *Menipea patagonica* Busk,has been reported from South Georgia and Bouvet Island, but no species have been described from Antarctic shelf seas. The few species described here, including *M. patagonica,* have been described or reported from the Subantarctic islands and the southern Patagonian Shelf only. *M. columnaris* d'Hondt,1984 is presently known only from Crozet Island. It is distinguished from other Subantarctic species of *Menipea* by its three distal spines, and by the frontal avicularium, which is columnar with an elongate, curved mandible.

Levinsen (1909) and Harmer (1923) reported anomalous structures in the cavity of the autozooid, in several species of *Menipea,* which they referred to as 'internal avicularia'. Harmer remarked 'The arrangement seems an inconvenient one', and could offer no explanation of their origin or functions. Gordon (1986) published SEM micrographs of short, tubular structures in the body cavity of *M. vectifera* Harmer, but again their function was not apparent.

Key to species described

1. Frontal avicularium large, conspicuous, with a setiform mandible at least as long as autozooid opesia .... *M. flagellifera*
   Frontal avicularium small, inconspicuous, absent from many autozooids; mandible short, triangular, no longer than rostrum 2
2. Each autozooid with a single, short, delicate spine distally or distolaterally. Lateral avicularium monomorphic. Small, cap-like ovicells occur .... *M. kempi*
   Each autozooid with one or two long, stout spines, often longer than the distally succeeding autozooid. Lateral avicularium dimorphic; frequently grossly enlarged. No ovicells................ *M. patagonica*

Menipea flagellifera Busk Fig. 111

Menipea flagellifera Busk 1884: 21, pl.4, fig.1

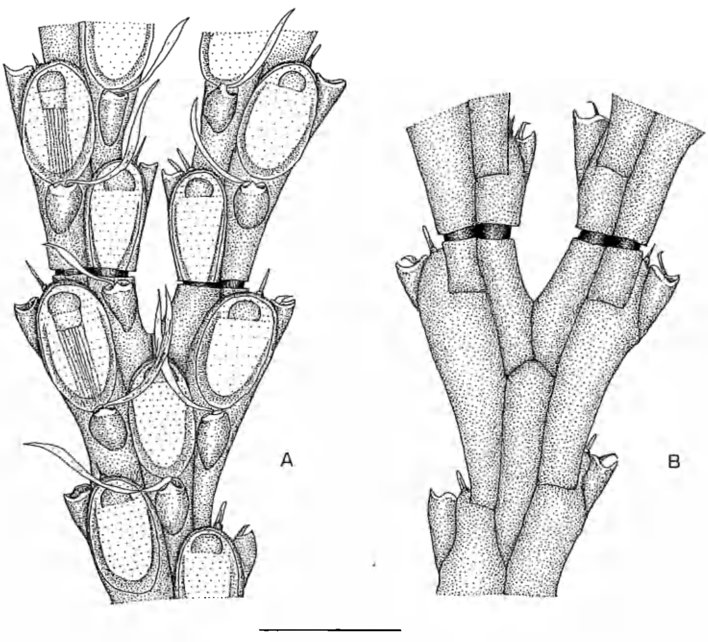


Fig. 111. *Menipea flagellifera.* Marion Island. A. Frontal view of a dichotomy. B. Dichotomy in basal view. Scale = 0.5 mm.

Menipea flagellifera: Calvet 1904b: 6; Hastings 1943: 335, Figs. 6B,C,7C; Androsova 1972b: 317; d'Hondt and Redier 1977: 217; d'Hondt 1984: 106
Scrupocellaria flagellifera: Kluge 1914: 615, text fig.5

Colony diffuse, tufted, 1–2 cm high. Branches biserial, jointed, bifurcating at intervals of 2–3 mm, each internode with six to eight autozooids. Autozooids 0.65–0.95 × 0.2–0.25 mm, tapered proximally, opesia occupying about half total length, with a distinct, granular cryptocyst rim. A single elongate spine on outer distal corner of autozooid, often small and inconspicuous. Lateral avicularium variable in size, often grossly enlarged; rostrum sharply hooked, mandible triangular; frontal avicularium situated immediately proximal to opesia, cystid oval, rostrum at distal end, perpendicular to frontal plane, transversely orientated, mandible setiform, equivalent to half length of autozooid. Basal surface of branch without heterozooids. Ovicell reduced to a shallow, cap-like structure at distal end of zooid, mature embryos largely enclosed within main body cavity of autozooid.

This species has been reported from the southern Patagonian Shelf, from Marion Island, Prince Edward Island, Crozet Island and Kerguelen. It does not extend into Antarctic Waters.

Menipea kempi Hastings Fig. 112

Menipea kempi Hastings 1943: 336, Fig. 7A,B

Colony diffuse, up to 3 cm high. Branches biserial, jointed, bifurcating at inter-

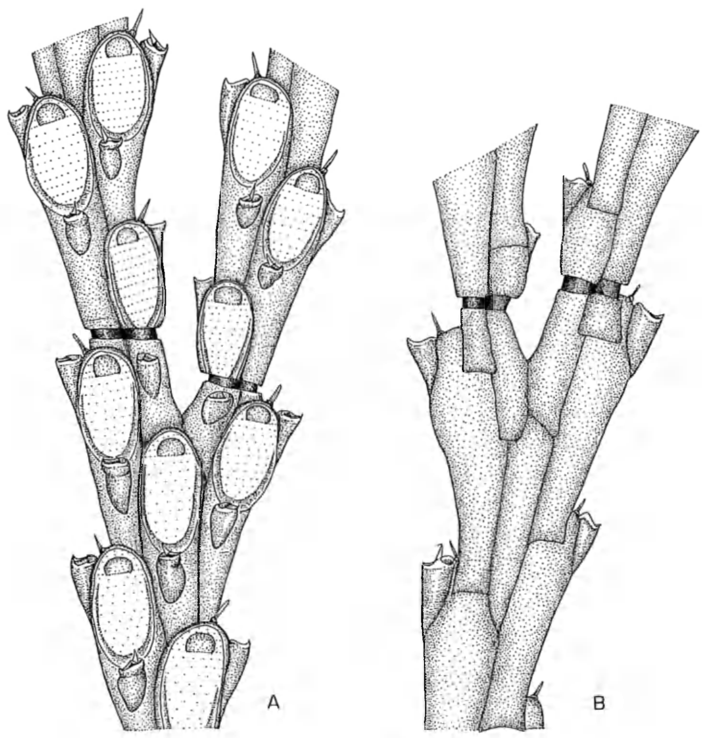


Fig. 112. *Menipea kempi.* Discovery Stn. 1562, Marion Island; part of holotype. A. Frontal view of a dichotomy. B. Dichotomy in basal view. Scale = 0.5 mm.

vals of 2–4 mm, with six to 14 autozooids per internode. Autozooids slender, tapered proximally, 0.65–0.95 × 0.25 mm, opesia occupying about half total frontal length, with distinct, granular rim of cryptocyst; a single short spine present at outer distal corner of autozooid. Lateral avicularia relatively small, not projecting conspicuously from margin of branch; frontal avicularium situated immediately proximal to opesia, cystid oval, rostrum acute to frontal plane, directed proximally, with short triangular mandible. Basal surface of branch without heterozooids. Ovicell reduced to an inconspicuous cap-like structure at distal end of brooding zooid.

Menipea kempi was described by Hastings (1943) from Marion Island. It was reported by d'Hondt (1984) from Kerguelen, together with other material which resembled *M. kempi* in all respects, except in that it lacked frontal avicularia.

Menipea patagonica Busk Fig. 113

Menipea patagonica Busk 1852: 22, pl.25, figs.1–3, pl.26, figs.1,2

Menipea patagonica: Jullien 1888: 71; Calvet 1904b: 5; Hastings 1943: 333, pl.5, figs.1,2, Fig. 6A; d'Hondt and Redier 1972: 217; Hayward 1980: 702

Scrupocellaria patagonica: Kluge 1914: 615, text fig.4

Colony developing dense or diffuse, bushy growths, up to 6 cm high. Branches flat and broad, jointed, consisting of short internodes, 2.0–2.5 mm long, with just six autozooids. In well grown colonies internodes may be longer towards the distal tips of the branches, but for the most part these dimensions are constant. Autozooids short and broad, longest at the proximal end of the internode, 0.5–0.7 × 0.25 mm; opesia

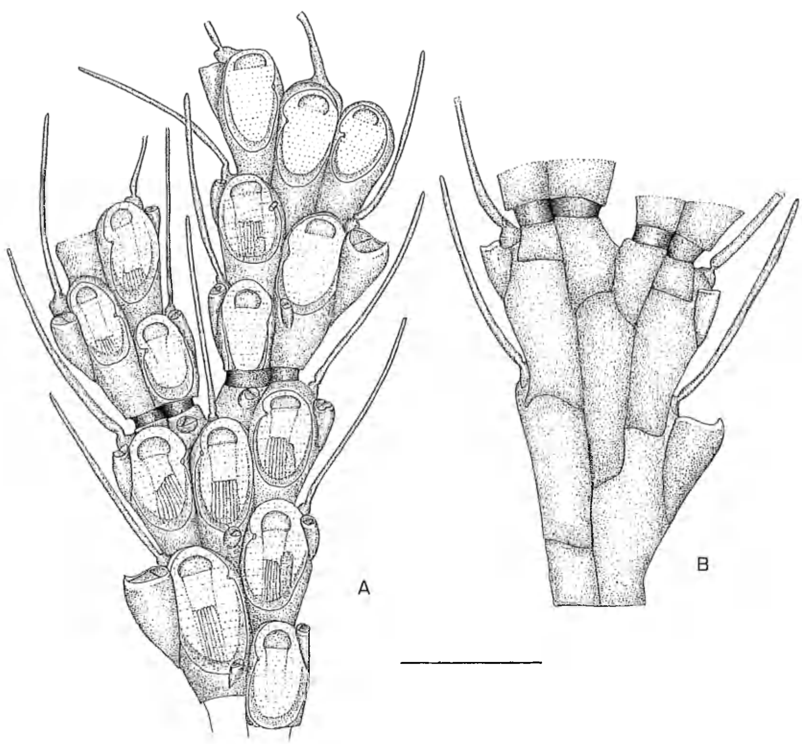


Fig. 113. *Menipea patagonica*. South Georgia. A. Frontal view of a dichotomy. B. Dichotomy in basal view. Scale = 0.5 mm.

occupying three-quarters of frontal length in proximal zooids, almost entire frontal surface in distal zooids of internode; cryptocyst broad, granular, edged by a raised mural rim. One or two spines on the outer distal corner of each zooid: up to 0.8 mm long, thick, curved, jointed proximally, bluntly rounded distally; the median autozooid proximal to a bifurcation has a single, short spine at each distal corner. Lateral avicularia variable in size, from small and inconspicuous, to grossly enlarged and occupying half of lateral margin of autozooid; rostrum hooked at tip, mandible triangular. Basal surface of branch without heterozooids. Ovicells do not occur; embryos are brooded in ovisacs within the maternal autozooid.

Menipea patagonica is common throughout the Magellanic-Patagonian region, from Cape Horn to the Southern Patagonian Shelf, the Falkland Islands and Burdwood Bank. It ranges eastwards to Bouvet Island and Kerguelen, and has been reported from South Georgia, where it perhaps reaches its southernmost limit.

BEANIIDAE Canu and Bassler, 1927

Colony loosely encrusting, or partially erect; unilaminar, attached to substratum by rhizoids. Autozooids more or less disjunct, linked by tubular extensions of the proximal region; lightly calcified, frontal surface entirely membranous, with an operculum. Distal and marginal spines typically present, sometimes numerous. Pedunculate avicularia usually present. Ovicells present or absent.

Beania Johnston, 1840

Colony encrusting, generally only loosely adherent to substratum; unilaminar, ramifying or reticulate, attached by rhizoids issuing from basal surface. Autozooids linked by tubular processes, in regular quincuncial series, or irregular, linear series; repent or partly erect, closely spaced or distant. Multiporous septula present at the proximal end of each tube. Frontal membrane occupying entire frontal surface of broad distal portion of autozooid; marginal spines variously developed. Avicularia, when present, pedunculate, of the bird's-head type. Ovicells present or absent, most usually vestigial and inconspicuous.

Type species: *Beania mirabilis* Johnston, 1840.

Species of *Beania* occur in all the world's seas. Some develop a substantial, conspicuous, brown crust, while others are diffuse and extremely inconspicuous. Two species are presently known to be endemic to Antarctic waters, but several more occur in Subantarctic regions, and others have perhaps still to be described. The genus is apparently limited to shallow seas; most species occur on a variety of substrata, including algae, shells, hydroids, other bryozoans, and a range of inorganic and organic hard substrata, and are often epizootic on macroinvertebrates. Three common Subantarctic species are described here, others are described by Hastings (1943). *B. fragilis* (Ridley) presently known only from the Magellan Strait and the Falkland Isles is distinguished by its erect autozooids, with four or six proximal connecting tubes, and by the long spines present on the basal surfaces of the autozooids.

Key to species described

1. Autozooids erect, with the connecting tubes closely grouped at the proximal ends 2
   Autozooids repent, with connecting tubes both distally and proximally, or evenly spaced around the margins 4
2. Autozooids with four proximal connecting tubes, and six distal spines .... *B. scotti*
   Autozooids with six proximal connecting tubes, and paired distal spines 3

3. Margin of autozooid slightly inflected on each side just proximal to operculum. Avicularium slender .... *B. erecta*
   Margin of autozooid strongly produced on each side just proximal to operculum. Avicularium humpbacked .... *B. challengeri*
4. Frontal membrane bordered by thin, flat spines, curving medially. Four stout spines at distal end of autozooid 5
   No spines bordering frontal membrane. Two short, stout spines at distal end of autozooid .... *B. magellanica*
5. Connecting tubes evenly spaced around edges of autozooid. Marginal spines variable in number, often sparse. Avicularia infrequent, directed towards basal surface of colony, which is supported above the substratum by short rhizoids .... *B. inermis*
   Connecting tubes in two groups of three, at distal and proximal ends of autozooid. Marginal spines well developed, abundant. Avicularia frequent, directed towards frontal surface of colony .... *B. costata*

Beania challengeri Hastings Fig. 114

Beania magellanica var. *distans* Busk 1884: 59, pl.16, figs.2,2A
Beania challengeri Hastings 1943: 415, Figs. 34A,B; d'Hondt 1984: 99

Colony diffuse, consisting of slender, erect autozooids, 0.8–0.95 × 0.2–0.25 mm, widely spaced, linked by slender, adnate connecting tubes; six tubes arising from the proximal end of each autozooid. Distal corners of autozooid each produced as a stout, spine-like process; immediately proximal to the operculum, the lateral wall of the autozooid, on each side, is produced as a short, medially directed spine. Avicularia paired, attached laterally, level with the hinge line of the operculum; 0.25 mm long, strongly hump-backed, with a short, hooked rostrum. Ovicell hemispherical, attached disto-basally, inconspicuous; linked via a tubular proximal process to a connecting tube at the proximal end of the maternal autozooid (Hastings 1943).

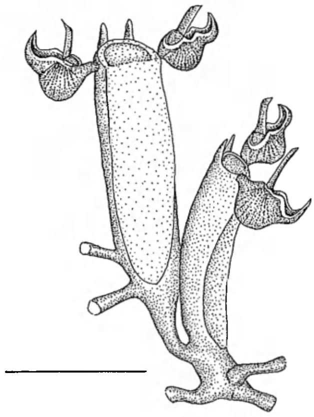


Fig. 114. *Beania challengeri.* Challenger Stn. 149D, Kerguelen; part of holotype. Scale = 0.5 mm.

This rather inconspicuous species is still known only from Heard Island and Kerguelen. The material described by Hastings (1943), was the original series of specimens examined by Busk (1884). D'Hondt's (1984) record from Kerguelen is the only subsequent report of *B. challengeri*.

Beania costata (Busk) Fig. 115

Diachoris costata Busk 1876: 116; 1879: 195, pl.10, figs.4–6
Diachoris costata: Jullien 1888: 73, pl.10, figs.2–8
Beania costata: Calvet 1904b: 8; Kluge 1914: 647, text fig.27; Hastings 1943: 408; d'Hondt and Redier 1977: 217; Hayward 1980: 703.

Colony forming a mat of closely packed, repent autozooids, 0.65–0.80 × 0.25–0.3 mm; each autozooid with six short connecting tubes: three at the proximal end and three at the distal end. Frontal membrane hidden by a basket-like arrangement of thin, flat, pointed or bifurcate,

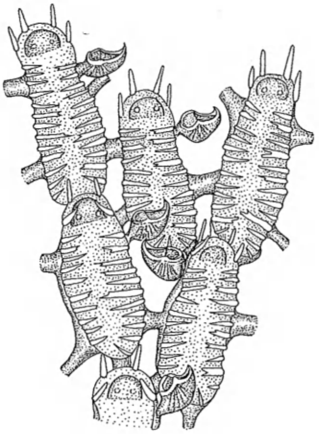


Fig. 115. *Beania costata.* Busk Collection specimen, from an unrecorded locality. Scale = 0.5 mm.

marginal spines, curving over the membrane and meeting or interdigitating along the midline of the autozooid. Operculum distinct at distal end of autozooid, with two curved, protuberant processes on its frontal surface; surrounded by four, thicker, cylindrical, upright spines, equally spaced around the rounded distal end of the autozooid. Avicularia budded disto-laterally, just proximal to operculum, frontally directed, one or two per autozooid; highly domed, as deep as long, the rostrum sharply hooked; variable in size, sometimes grossly enlarged. Brooding structures undescribed.

Beania costata is distributed throughout the Magellanic region, to the southern Patagonian shelf and the Falkland Isles, and eastwards to Marion Island and Kerguelen. Records from southern Australia were referred to *B. discodermiae* (Ortmann) by Kluge (1914) and Hastings (1943). *Diachoris maxilla* Jullien, 1888 was regarded by Hastings (1943) as a variety of *Beania costata*; it is distinguished by the frontal processes on the operculum, which tend to be branched or stellate, and in having six upright spines at the distal end of the autozooid. *B. costata* var. *maxilla* was reported from Tierra del Fuego by Jullien (1888), and from the Falkland Islands by Hastings (1943).

Beania erecta Waters Fig. 116

Beania erecta Waters 1904: 30, pl.1, figs.8a–e

Beania erecta: Calvet 1904b: 13; Hastings 1943: 416, pl.9, fig.2, Figs. 35A,F; Moyano 1966a: 116; Hayward 1980: 703; Hayward and Taylor 1984: 72

not *Beania erecta*: Kluge 1914: 649; Livingstone 1928: 26

Colony comprising a dense mat of closely packed, erect autozooids, 1.0–1.5 × 0.5 mm; each autozooid with six short connecting tubes, evenly spaced apart at its slightly broadened proximal end. Frontal membrane occupying whole frontal surface of autozooid; margin inflected just proximal to operculum, but lacking marginal spines, except for two closely spaced, short spines distal to the operculum. Avicularia budded disto-laterally, adjacent to proximal corners of operculum, paired, distally directed and facing frontally; up to 0.7 mm long, with the slender, sharply hooked rostrum constituting up to half its total length. Ovicell vestigial, in the form of a shallow, domed cap on the disto-basal edge of the autozooid, extending between the bases of the two spines.

Beania erecta appears to be widely distributed and common throughout Antarctica, including the South Shetlands, South Orkneys and South Sandwich Islands.

Beania erecta var. *livingstonei* Hastings

Beania erecta: Kluge 1914: 649, text fig.29b; Livingstone 1928: 26, pl.5, fig.4

Beania erecta var. *livingstonei* Hastings 1943: 417, pl.9, fig.1, Figs. 35B,E

Beania livingstonei: Androsova 1972a: 93, figs.1,2; Moyano 1984a: 80.

Hastings (1943) considered that the photograph of *B. erecta* published by Livingstone (1928) depicted a distinct

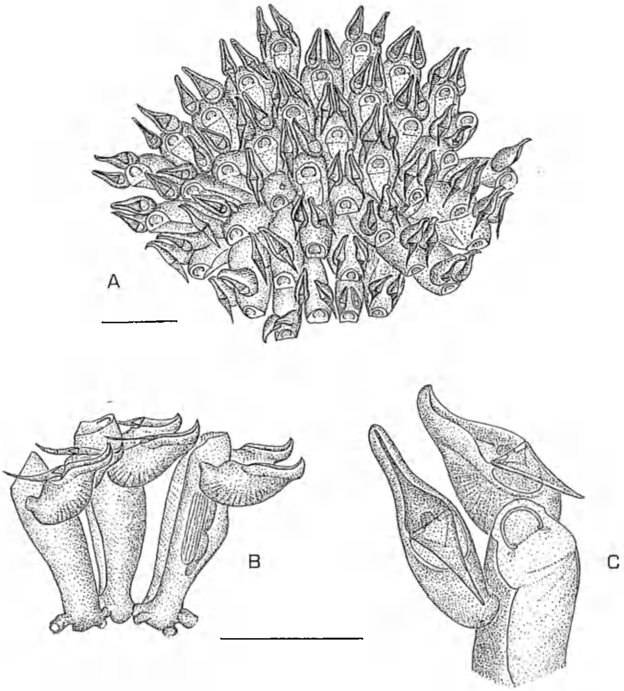


Fig. 116. *Beania erecta.* Ross Sea. A. Part of a colony. B. Autozooids and avicularia in lateral view. C. Distal end of an autozooid, with its avicularia. Scale = 1 mm (A, B), 0.5 mm (C).

variety of that species, distinguished by a closer spacing of the two distal spines, and a correspondingly narrower and more convex ovicell. Brooding and non-brooding autozooids thus appeared more different in the variety than in usual *B. erecta.* She indicated that the avicularia were stouter, with a less slender rostrum, and more distally situated in the variety, but stated that the degree of difference between the two taxa shown in her figures (Hastings 1943, Figs. 35A,B,E,F) was much less marked in other specimens. Androsova (1972a) elevated *B. erecta* var. *livingstonei* Hastings to specific rank, and assigned Kluge's (1914) record of *Beania erecta* to the synonymy of the new species, following re-examination of his material. Comparison of specimens assigned to *B. erecta* and to *B. erecta* var. *livingstonei* by Hastings shows that the morphological differences between the two are inconstant, as she herself implied, and they are certainly insufficient to support the retention of two distinct species. The utility of a 'varietal' distinction can only be tested by a comparative study of further material, from a larger series of population samples. It is worth noting that the geographical distribution of var. *livingstonei* parallels that of *B. erecta.*

Beania inermis (Busk) Fig. 117

Diachoris inermis Busk 1852: 54; 1854: pl.72, figs.1,2; Jullien 1888: 73, pl.10, fig.1
Diachoris hyadesi Jullien 1888: 74, pl.7, figs.1, 2
Beania hyadesia: Waters 1904: 30, pl.1, fig.7
Beania inermis: Hastings 1943: 411; Hayward 1980: 703

Colony comprising a loosely adherent, coherent sheet of closely packed repent

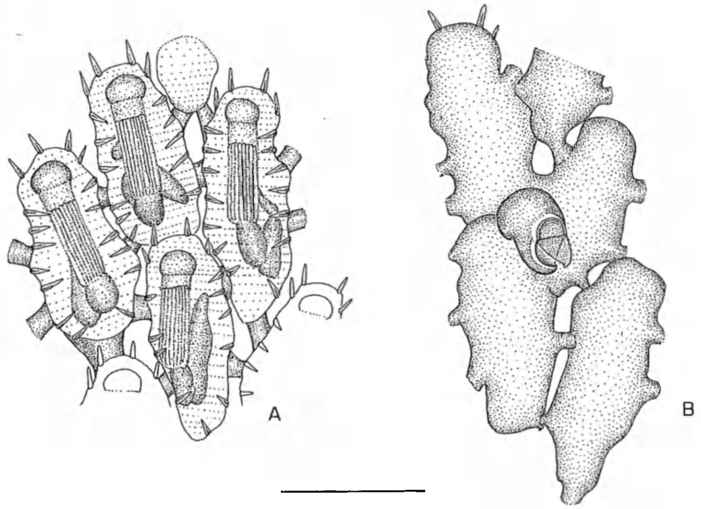


Fig. 117. *Beania inermis.* Discovery Stn. WS85, East Falkland. A. Group of autozooids in frontal view. B. Basal view, showing avicularium. Scale = 0.5 mm.

autozooids, supported above the substratum by short, stout rhizoids with branching apices. Autozooids oval, with six short connecting tubes evenly spaced around its basal periphery; 0.7–0.9 × 0.25–0.3 mm. Four stout spines present at the distal end of the autozooid; a variable number of short, slender, acute spines along lateral margins, curving inwards over the frontal membrane, often missing. Avicularia infrequent; budded disto-laterally and protruding through the spaces between the autozooids, to face the basal surface of the colony. Ovicell inconspicuous, on disto-basal edge of autozooid.

B. inermis is most often seen with the four distal spines well developed, and the marginal spines small or absent; its apparent lack of avicularia is also characteristic. *B. inermis* var. *unicornis* Hastings has slightly smaller autozooids (0.6–0.7 mm long); its marginal spines are usually well developed, curving over the frontal membrane and meeting or interdigitating medially, and it has only a single pair of erect spines at the extreme distal end. It is particularly characterized by a prominent chitinous spine arising from the free edge of the operculum.

B. inermis ranges throughout the Magellanic and Patagonian Shelf regions, and has been recorded eastwards as far as Kerguelen, and north to John Adams Bank, and South Africa. Calvet (1909) reported a *Beania* from the Palmer Archipelago which he identified with hesitation as *B. hyadesi* Jullien. If this determination proved correct it would constitute the only Antarctic record for *B. inermis* (Busk). *B. inermis* var. *unicornis* was reported by Hastings (1943) from the west end of Magellan Strait, from two stations off the Falkland Isles, and from a single station on the southern Patagonian Shelf.

Beania magellanica (Busk) Fig. 118

Diachoris magellanica Busk 1852: 54, pl.67, figs.1–3; Jullien 1888: 72, pl.11, figs.1–3, pl.12, fig.3
Beania magellanica: Calvet 1904b: 8; Waters 1904: 29, pl.8, figs.7a–c; Kluge 1914: 648, text fig.29a; Hastings 1943: 414, Figs. 34C,35G; d'Hondt and Redier 1977: 217

Colony forming an extensive, reticulate sheet of repent autozooids, each with six connecting tubes equally spaced around

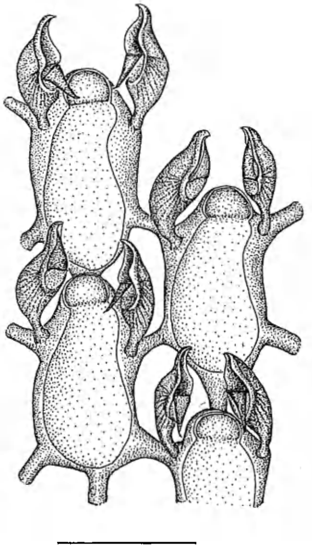


Fig. 118. *Beania magellanica.* Discovery Stn. 58, East Falkland. Scale = 0.5 mm.

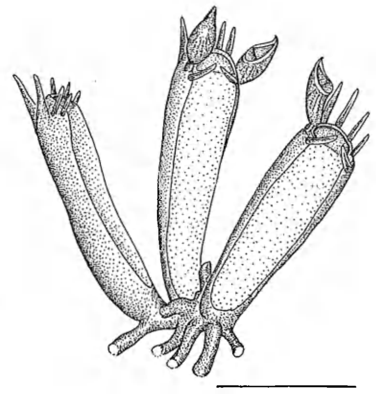


Fig. 119. *Beania scotti.* Terra Nova Stn. 194, Ross Sea; part of holotype. Scale = 0.5 mm.

their basal periphery, widely spaced apart so that all tubes are clearly visible; 0.6–0.7 × 0.3 mm. No marginal spines, except for two short processes distal to the operculum. Avicularia budded disto-laterally, just proximal to operculum, paired, distally directed and facing frontally; 0.4–0.45 mm long, with slender, hooked rostrum. Ovicell an inconspicuous cap-like structure on the disto-basal wall of the autozooid.

This species, probably the most widespread and familiar species of *Beania,* is generally distributed in the Atlantic, Indian and western Pacific Oceans between approximately 40°N and 55°S. It has a circumpolar distribution in Subantarctic regions, but does not extend into Antarctic waters.

Beania scotti Hastings Fig. 119

Beania scotti Hastings 1943: 418, Fig. 35C,D

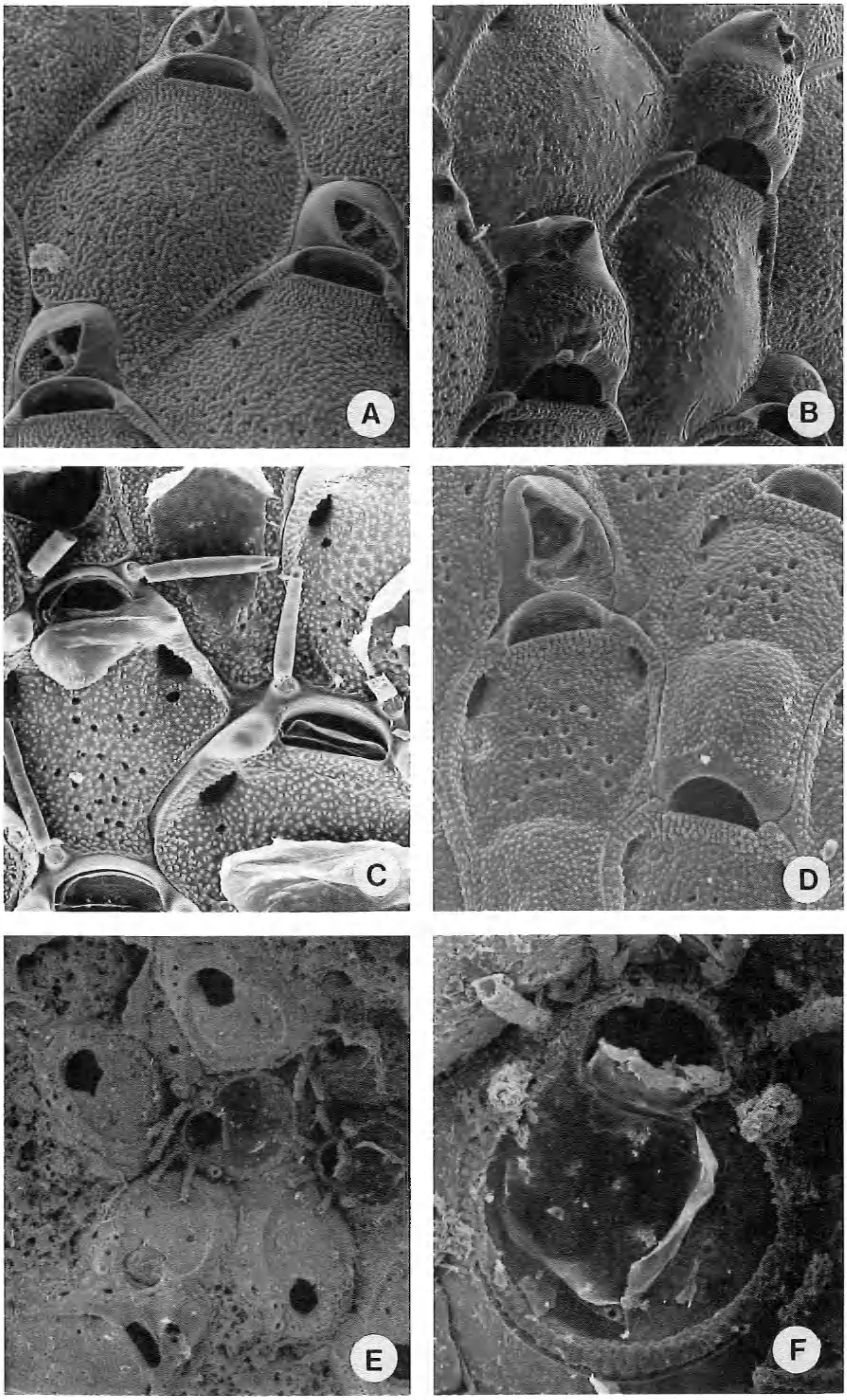
Colony comprising a mat of closely packed, erect autozooids, 0.9–1.0 × 0.25 mm; each autozooid with four short connecting tubes, closely spaced around the proximal end. Six short, curved spines arranged in an arc around the distal end of the autozooid; lateral margins of frontal membrane without spines. Avicularia budded disto-laterally, just distal to the proximalmost pair of spines; paired, small, 0.20 mm long, with a short, hooked rostrum.

This species is still known only from the few autozooids described from Oates Land by Hastings (1943). It is easily recognized by its six distal spines, and four proximal connecting tubes, but is perhaps less conspicuous than the other endemic Antarctic species, *B. erecta.*

MICROPOROIDEA Gray, 1848

MICROPORIDAE Gray, 1848

Colony typically encrusting; less frequently erect, branching, flustrine or articulated. Autozooids with lateral walls forming a rim around the frontal membrane, but lacking a gymnocyst. Cryptocyst extensive, underlying at least two-thirds of the frontal membrane; most usually complete, so that the opesia is actually coextensive with the orifice of the autozooid, and pierced by paired opesiules, through which the parietal muscles pass. Oral spines present in few species. Avicularia present or absent,


A
B
C
D
E
F

interzooidal or adventitious. Ovicells recumbent or immersed, or absent. Interzooidal communication via basal pore chambers or multiporous septula.

Moyano (1994) reviewed the zoogeography of the Microporidae, with special reference to the Southern Hemisphere faunas.

Micropora Gray, 1848

Colony encrusting. Cryptocyst entire, with small perforations, opesia coextensive with operculum; lateral walls of autozooid forming a raised rim around the frontal membrane, variably thickened adjacent to the opesia, and often developed as a pair of thickened knobs. Opesiules small, paired, proximo-lateral to opesia and usually overarched by the lateral wall. Spines present or absent. Avicularia interzooidal or vicarious, sometimes absent. Ovicell partially immersed, closed by autozooidal operculum. Small basal pore chambers present. Type species: *Flustra coriacea* Johnston, 1847.

Species of *Micropora* occur in shallow water environments in all of the world's seas, including both Arctic and Antarctic regions.

Key to Antarctic Species

1. Opesia about twice as wide as long, with a pronounced knob on each side, and two distal spines in newly budded autozooids. Ovicell without an avicularium distal to it. Avicularium longer than opesia width .... *M. notialis*

   Opesia two-and-a-half times wide as long; knobs indistinct, no spines. Ovicell usually capped by an avicularium, which is always shorter than opesia width .... *M. brevissima*

Micropora brevissima Waters — Fig. 120A,B

Micropora brevissima Waters 1904: 40 (in part), pl.2, figs.7a–c

Micropora brevissima: Hayward and Thorpe 1989b: 937 (in part), not figs.6A,B; Hayward and Ryland 1993: 130, Fig. 2d,e

Colony forming broad, flat sheets. Autozooids oval to hexagonal, or diamond shaped, stout, separated by indistinct sutures; 0.55–0.7 × 0.4–0.5 mm. Opesia very short, its width two to two-and-a-half times greater than length; proximal edge straight, lateral borders abruptly rounded to give a quadrangular appearance. Lateral walls of autozooids slightly thickened adjacent to opesia, but not markedly raised, and not forming prominent knobs. Cryptocyst finely granular, almost completely flat, with 30–40 tiny pores; opesiules slender, oval, sometimes indistinct; a single pore, larger than the rest, proximal to each opesiule. Avicularia rather sparse, often infrequent; small, length generally equivalent to the width of the opesia, rostrum short, triangular, acute to frontal plane, disto-laterally directed. Ovicell about as wide as long, gently convex; aperture with a smooth rim, peaked medially and sometimes with a small umbo; usually with an avicularium distal to it, the smooth calcification of the avicularian cystid capping the ovicell.

Micropora brevissima is an endemic Antarctic species, probably widely distributed in Antarctic shelf seas. It has been recorded from the Ross Sea, the Bellingshausen Sea and the Palmer Archipelago, but probably reaches its northern limit at South Georgia. It is distinguished from *M. notialis*, with which it

Fig. 120. A, B. *Micropora brevissima*. A. Autozooids and avicularia; BANZARE Stn. 39, Enderby Land; ×85. B. Ovicelled autozooids; South Shetland Is.; ×60. C, D. *Micropora notialis*. C. Autozooids at the colony edge; Antarctic Peninsula; ×80. D. Later autozooids, with an ovicell and an avicularium; East Falkland; ×90. E, F. *Apiophragma hyalina*. E. An entire, small colony; Discovery Stn. 1948, South Shetland Is.; ×45. F. Detail of the presumed ancestrula; ×160.

was formerly confused, by its slit-like opesia, small avicularia, and by its ovicell, which is almost always capped distally by an avicularium.

Micropora notialis Hayward and Ryland Fig. 120C,D

Micropora brevissima Waters 1904: 40 (in part)
Micropora brevissima: Hayward and Thorpe 1989b: 937 (in part), figs.6A,B
Micropora notialis Hayward and Ryland 1993: 131, Fig. 2a–c

Colony forming broad, spreading sheets on hard substrata, especially biogenic carbonates. Autozooids oval to hexagonal, rounded distally, tapered proximally, separated by indistinct sutures, rather flat; 0.75–0.85 × 0.4–0.45 mm. Opesia semicircular, its width slightly more than twice its length, proximal edge straight, disto-lateral border smoothly rounded. Two short, cylindrical spines on distal edge of opesia, widely spaced; present only in newly budded autozooids, lost and obscured in later ontogeny. Lateral walls of autozooid raised adjacent to opesia on each side, forming a pair of prominent knobs. Cryptocyst finely granular, gently convex medially, concave peripherally, with 20–40 small, simple pores; opesiules large, oval, distinct; each with a single, stellate pore just proximal to it, later obscured by thickening calcification. Avicularia sparsely distributed, often of infrequent occurrence, longer than width of opesia; rostrum stout, acute to frontal plane, disto-laterally directed, elongate triangular, with hooked tip. Ovicell longer than broad, convex and prominent; immersed in the cryptocyst of the distally succeeding autozooid, without an avicularium associated with it; aperture with a broad rim of smooth calcification, frequently peaked medially, and sometimes developed as a small umbo.

This species was formerly confused with *M. brevissima* Waters. It is distinguished by its larger avicularium, and its relatively larger opesia, by the presence of paired distal spines in newly developed autozooids, and by the ovicell, which is immersed in the calcification of the next autozooid and is never surmounted by an avicularium.

Micropora notialis ranges from Cape Horn to the Falklands, South Georgia and the Antarctic Peninsula, where its range overlaps that of the exclusively Antarctic *M. brevissima.*

Apiophragma Hayward and Ryland, 1993

Colony encrusting. Autozooids with short gymnocyst, a thickly calcified, crenellate mural rim, and extensive, flat cryptocyst. Opesia reduced, comprising less than one-third total autozooid length; operculum occupying distal two-thirds of opesia, articulating with stout, prominent, lateral condyles. Paired opesiules present, proximal to opesia. Oral spines present, avicularia absent. Ovicell hyperstomial, imperforate. Basal pore chambers present.

Type species: *Megapora hyalina* Waters, 1904.

Apiophragma hyalina resembles the Arctic species *Megapora ringens* (Busk), but differs fundamentally in its smaller opesia and independent opesiules.

Apiophragma hyalina (Waters) Fig. 120E, F

Megapora hyalina Waters 1904: 39, pl.2, figs.13a, b, text fig.1
Apiophragma hyalina: Hayward and Ryland 1993: 130, Fig. 1

Autozooids oval, 0.5 × 0.4 mm, separated by deep grooves. Gymnocyst and lateral walls distinct, smooth; frontal membrane bounded by a thickly calcified, crenellate mural rim; cryptocyst flat, granular. Opesia more or less bell-shaped, less than one-third autozooid length, with straight proximal edge and pronounced condyles laterally for articulation of the operculum. Opesiules elongate oval, situated halfway along length of cryptocyst.

Six short, cylindrical spines in an arc at distal end of autozooid.

A. hyalina has been reported on only two occasions, from the Bellingshausen Sea (Waters 1904) and the South Shetland Isles (Hayward and Ryland, 1993). It forms small colonies on hard substrata, and is perhaps rather inconspicuous.

Andreella Jullien, 1888

Colony encrusting. Autozooids with complete cryptocyst; opesia with thickened, crenellate rim, scarcely larger than operculum; opesiules in the form of large, simple lacunae, one or more pairs. Distal oral spines present. Avicularia adventitious, at proximal end of each autozooid. Ovicell recumbent on distally succeeding autozooid, hyperstomial, ectooecium partly or wholly uncalcified. Basal pore chambers present.

Type species: *Micropora uncifera* Busk, 1884.

The type species, *Andreella uncifera* (Busk), is known from Tierra del Fuego, Cape Horn and the Magellan Strait, and is widely distributed across the Southern Patagonian Shelf, off the Falklands Isles and on Burdwood Bank. It ranges south at least as far as the South Orkney Isles, and has been reported from Gough Island, Tristan da Cunha and Kerguelen. *A. umbonata* Moyano non Busk is presently known from the Magellan Strait and the Patagonian Shelf, while two other species, *A. polypora* Moyano and *A. megapora* Moyano and Melgarejo, have been described from the southern coasts of Chile. All four species have been described and figured by Moyano (1985a). Only *A. uncifera* seems likely to extend into Antarctic seas, and then probably only in western Antarctica.

Andreella uncifera (Busk) Fig. 121A

Micropora uncifera Busk 1884: 71, pl.15, fig.7
Andreella uncifera: Jullien 1888: 80, pl.4, fig.9, pl.14, figs.1–3
Micropora uncifera: Calvet 1904b: 20; d'Hondt and Redier 1977: 225, pl.1, figs.4–6.
Andreella uncifera: Moyano 1974b: 12; 1985a: 83; Hayward 1980: 702

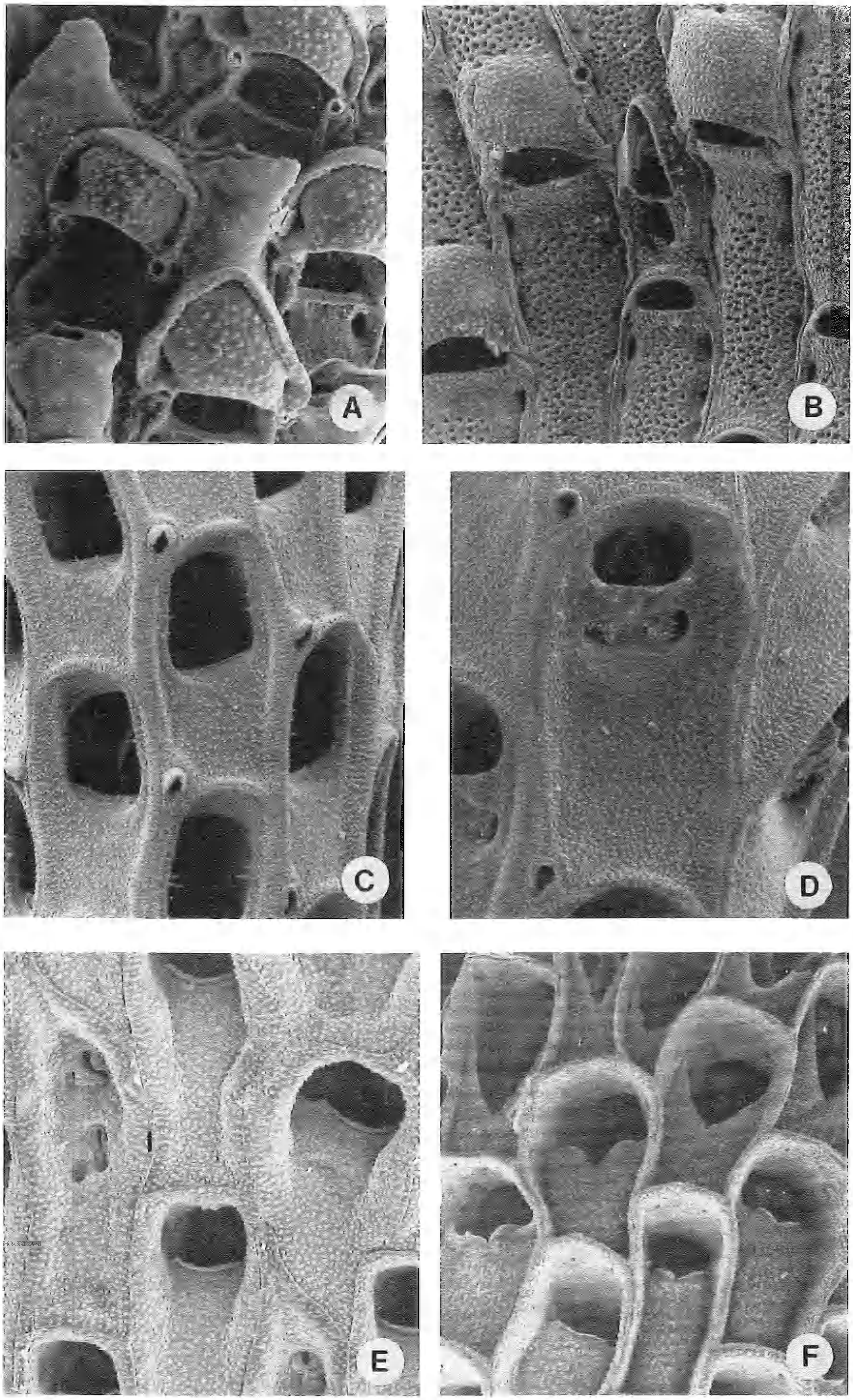
Colony forming broad, spreading sheets. Autozooids oval to hexagonal, 0.5–0.6 × 0.30–0.35 mm; lateral walls raised above the level of the cryptocyst, distinctly crenulate. Cryptocyst occupying four-fifths of autozooid length, flat, finely granular; opesia D-shaped, with crenulate rim; opesiules elongate-oval, or slightly crescentic, as long as opesia and quite conspicuous. Two short thick spines present, situated one on each side of opesia. Each autozooid bearing a large adventitious avicularium at its proximal end; cystid swollen, rostrum acute to frontal plane, laterally directed, with toothed edges and sharply hooked tip. Ovicell prominent, slightly wider than long, the convex frontal surface consisting of granular entooecium, with a thick border of smooth ectooecium.

Andreella uncifera forms extensive, unilaminar colonies on stones, shells and other hard substrata. It is widespread across the southern Patagonian Shelf, and throughout the Magellanic region generally. Described by Busk (1884) from two stations in the Tristan group, it has also been reported from Kerguelen, ranges south to the South Orkneys, and may prove to extend to the Antarctic peninsula.

Flustrapora Moyano, 1970

Colony erect, bilaminate, flustrine, attached by encrusting autozooids. Cryptocyst complete, opesia exactly coincident with operculum, opesiules indistinct. No ovicells. Vicarious avicularia present. Autozooids linked by large multiporous septula.

Type species: *Flustrapora magellanica* Moyano,1970.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Flustrapora magellanica Moyano — Fig. 121B

Flustrapora magellanica Moyano 1970a: 60, pl.1

Colony forming broad, lobed flustrine fronds up to 3 cm high, lightly calcified and flexible; branches edged with slender, uncalcified kenozooids. Autozooids elongate, linguiform: truncate proximally, broadly rounded distally; 0.75–0.90 × 0.25–0.35 mm. Lateral walls forming a thin rim around the frontal membrane. Cryptocyst under- lying whole of frontal membrane, thinly calcified, hyaline, with numerous small pores; opesia short, wider than long, exactly coextensive with operculum, comprising less than one-eighth total autozooid length; opesiules in distal third of autozooid, close to lateral walls, indistinct. Operculum with thickened marginal sclerite. Vicarious avicularia rare, half length of autozooids, proximal half rectangular, its cryptocyst with a slender elongate opesia, distal half comprising a slender lanceolate rostrum, distally directed, raised above frontal plane of colony; mandible strongly chitinized.

Flustrapora magellanica was described by Moyano (1970a) from Tierra del Fuego. The type material evidently lacked avicularia, but specimens collected by *Discovery* Investigations from the southern Patagonian Shelf included colonies with rare vicarious avicularia. In all other respects the specimens were identical to those described by Moyano (1970a). At present, *F. magellanica* has a known range from Cape Horn and Tierra del Fuego, to the southern Patagonian Shelf and the Falkland Isles. It has not been reported from Antarctic waters.

Ogivalia Jullien, 1881

Colony erect, branching, attached by encrusting base, unjointed. Autozooids with extensive, depressed cryptocyst; opesia constituting about one half total autozooid length, its rim bearing medially directed spinules, or larger spinous processes, sometimes partly occluding opesia. No spines. Avicularia interzooidal. Ovicells absent. Interzooidal communication via multiporous septula.

Type species: *Vincularia elegans* d'Orbigny, 1847.

Ogivalia elegans (d'Orbigny) — Fig. 121C, D

Vincularia elegans d'Orbigny 1847: 21, pl.9, figs.25–28
Vincularia steganoporoides Goldstein 1882: 44: pl.2, fig.5
Vincularia gothica: Busk 1884: 72, pl.23, fig.1
Vincularia labiata Busk 1884: 73, text fig.3
Thalamoporella michaelseni Calvet 1904b: 18, pl.2, figs.1a–c
Hemiseptella michaelseni: Androsova 1972b: 334, fig.11
Thalamoporella gothica: d'Hondt 1984: 109
Ogivalia elegans: Moyano 1974b: 13, figs.1, 19,30; López Gappa 1975: 434, pl.1, fig.2; Hayward 1980: 702.

Colony erect, cylindrical, branching dichotomously at irregular intervals, occasionally anastomosing; up to 5 cm high; branches with a constant width of about 2 mm, each comprising eight alternating, longitudinal series of autozooids, opening around the whole periphery of the branch. Autozooids more or less rectangular, with thin, raised lateral walls

Fig. 121. A. *Andreella uncifera*. Discovery Stn. 399, Gough Id.; ×70. B. *Flustrapora magellanica*. Discovery Stn. WS85, East Falkland; ×50. C, D. *Ogivalia elegans*. C. Discovery Stn. WS755, Falkland Is.; ×30. D. 'michaelseni' morphotype, with partly obscured opesia, Tierra del Fuego; ×40. E, F. *Chondriovelum adeliense*. Discovery Stn. 190, Bismarck Strait. E. Autozooids and an avicularium; ×45. F. Autozooids at the growing edge; ×32.

marking their boundaries; cryptocyst depressed, finely granular, comprising just less than half total autozooid length; opesia elongate oval, with inward pointing spinules, or spinous processes on its proximal and lateral borders, variously developed. No spines; no ovicells. Avicularia minute, situated at one or both proximal corners of the autozooid, sometimes missing entirely; mandible triangular, directed distally.

The spinous processes projecting inwards from the proximal and lateral borders of the opesia vary greatly in development, even within single colonies, and may perhaps reflect ontogenetic stages. In their most developed state they form flat, toothed plates which meet and fuse along the midline of the opesia; this was described by Busk (1884) in specimens from Prince Edward Island and from the Patagonian Shelf, and was used by Calvet (1904b) to characterize his new species *Thalamoporella michaelseni*.

Ogivalia elegans is widespread and abundant in shallow Subantarctic waters, including Tierra del Fuego and the Magellan Strait, the southern Patagonian Shelf, the Falkland Isles, the Marion Island group and MacDonald Island. It does not seem to extend into Antarctic coastal waters.

ONYCHOCELLIDAE Jullien, 1882

Colony encrusting, or erect. Autozooids with well developed cryptocysts; opesia comprising less than half autozooid length, with distinct notches in the proximal corners marking the position of the parietal muscles; less frequently, these are enclosed in distinct opesiules. Avicularia vicarious, the mandible with a central, longitudinal, chitinous rachis, and symmetrical or asymmetrical lateral expansions. Embryos brooded internally, typically in specialized dimorphic brooding zooids.

Chondriovelum Hayward and Thorpe, 1988

Colony encrusting, or developing erect, branching bilaminate form attached by an encrusting base. Cryptocyst depressed, occupying two-thirds frontal surface of autozooid, with reflected distal lip and lateral opesiular indentations. Avicularia as large as autozooids, tapered distally, with a slender groove for reception of the tip of the mandible; with complete granular cryptocyst, pierced by small opesiules in separate distal and proximal groups; mandible symmetrical, with thickened longitudinal sclerites, fused to form a central rachis, and membranous lateral expansions. Brooding zooids undescribed. Vertical walls of autozooids pierced by small, multiporous septula.

Type species: *Labioporella adeliensis* Livingstone, 1928.

The type species, which forms stout, irregularly branching, erect colonies, is widely distributed in Antarctic coastal waters. *C. angustiloba* (Moyano), which forms thick, encrusting patches, occurs around Cape Horn and on the southern Patagonian Shelf.

Chondriovelum adeliense (Livingstone) Fig. 121E,F

Labioporella adeliensis Livingstone 1928: 29, pl.6, fig.3, text figs.3,4

Labioporella adeliensis: Androsova 1972b: 333, fig.10

Chondriovelum adeliense: Hayward and Thorpe 1988b: 278, pl.1, figs.A,B.

Colony erect, bilaminate, forming irregularly branching, twisted, antler-like growths; up to 3 cm high, typically slender at the base, and often palmate distally. Autozooids linguiform, broadest distally, 0.85–1.00 × 0.35–0.5 mm; lateral walls prominent, raised, thickening in later ontogeny to form a granular, crenulate rim. Cryptocyst depressed, flat, granular, with an angular, reflected distal lip, with distinct opesiular indentations on each side; opesia comprising about one-third total autozooid length. Avicularium as large as autozooid, distal one-third tapered and directed obliquely distally, with a shallow groove for the reception of the distal portion of the mandible rachis; cryptocyst depressed, granular, with groups of two or three opesiular pores distally and proximally; mandible symmetrical. Brooding zooids have yet to be described.

This endemic Antarctic species is widely distributed in Antarctic coastal waters. It is presently known from Adelie Land, Queen Mary Land, the Ross Sea, and the Palmer Archipelago.

CELLARIOIDEA Lamouroux, 1821

CELLARIIDAE Lamouroux, 1821

Colony erect, branching; branches cylindrical or flat sectioned; unjointed, or with flexible chitinous articulations — nodes. Autozooids rhombic or hexagonal, in longitudinal series alternating around the entire surface of each internode. Lateral walls of autozooid forming a thin, raised rim; frontal membrane distinct and conspicuous; cryptocyst depressed, imperforate, grading imperceptibly into lateral walls, no gymnocyst. Opesia constituting one-quarter or less of autozooid length, usually coextensive with operculum; proximal border straight, or with a variably formed lip, usually bearing paired condyle-like processes (denticles). Spines absent. Avicularia interzooidal; or apparently vicarious, replacing autozooids in a longitudinal series. Ovicell partly or wholly immersed, opening via a small orifice distal to the maternal orifice (endotoichal); when wholly immersed, the ovicell may be recognized only by its orifice, or by swellings along an internode indicating a complete whorl of ovicells.

The classification of the Cellariidae is presently unsatisfactory, especially within the key genus, *Cellaria* Ellis and Solander. Busk (1884) first proposed an informal division of the genus *Salicornaria* into three groups — the *inarticulatae*, with unjointed branches; the *simplices*, with branches produced as lateral offsets; the *articulatae*, with jointed, dichotomous branches. The latter group, which more or less corresponds to the modern concept of *Cellaria*, was subdivided by Busk (1884) into the *tubulatae*, with rhomboidal autozooids and tubular, chitinous joints between branches, and the *nodatae*, in which autozooids were hexagonal in frontal view and branches were linked by bundles of frontally budded rhizoids which formed distinctive knots in the axil of the bifurcation. Hastings (1946) demonstrated that this subdivision was untenable, as these two supposedly correlated characters intergraded independently among southern hemisphere species of *Cellaria*. Rogick (1956d) distinguished her new genus, *Cellariaeforma*, from *Cellaria* principally on the basis of its small interzooidal avicularia, overlooking the fact that *C. sinuosa* (Hassall), the type species of *Cellaria*, has avicularia very similar to those of *C. parvimuralis* Rogick (= *Cellaria aurorae* Livingstone), the type species of *Cellariaeforma*. While *C. sinuosa* has tubular joints, those of *C. parvimuralis* are formed from knotted, frontally budded rhizoids. As with Busk's (1884) original groupings, there is no correlation among species of *Cellaria* between size, or type, of avicularium and type of jointing. D'Hondt (1984) characterized his genus *Neocellariaeforma* simply by its habit of branching by lateral offsets, although both offset branching and dichotomous branching can be found in the southern hemisphere *Cellaria clavata* (Busk), in which the joints are rhizoidal knots, and the European *C. salicornioides* (Lamarck) in which they are simple tubes. At present there seems to be no utility in maintaining taxonomic distinctions between *Cellaria*, *Cellariaeforma* and *Neocellariaeforma*.

This family is abundantly represented in cold southern hemisphere waters. Gordon (1984, 1986) has given well illustrated accounts of New Zealand species, and the Antarctic and Subantarctic species collected by 'Discovery' investigations were reported by Hayward and Thorpe (1989b).

Cellaria Ellis and Solander, 1786

Colony erect, tufted, branching dichotomously; internodes cylindrical, stout or slender, linked by tubular, chitinous nodes, continuous with the basal autozooids of each new internode, or by bundles of twisted and knotted, chitinous rhizooids budded from the frontal surfaces of the autozooids on each side of a simple fracture joint marking the node. Autozooids rhombic or hexagonal; opesia barely larger than the operculum, with a raised proximal lip, often reflected; a pair of prominent denticles present in the proximal corners of the opesia, sometimes with an opposing pair on the distal border. Avicularia interzooidal, interposed between autozooids in a normal longitudinal series; or vicarious, replacing an autozooid. Colony attached to substratum by chitinous rhizoids budded from the frontal surfaces of autozooids in the basal portions of the colony.

Type species: *Farcimia sinuosa* Hassall, 1840.

Cellaria lata Waters, founded on a single small specimen from the Bellingshausen Sea, has not been recognized again. Waters' (1904) description is inadequate but his figure shows broad autozooids, opesiae with straight proximal borders and denticulate distal borders, and small, transversely orientated, interzooidal avicularia. The type material of *C. lata* cannot be traced and it is presently impossible to characterize it further. *Cellaria complanata* Liu and Hu, and *C. coronata* Liu and Hu (*non* Rogick) are recently described species (Liu and Hu, 1991) founded on fragmentary material. Both need to be more fully characterized.

Key to Antarctic species

1. Avicularium as large as an autozooid, with broadly triangular or semicircular rostrum 2
   Avicularium smaller than an autozooid; rostrum slender, triangular or crescentic 4
2. Avicularium with semicircular rostrum. Opesia with single, anvil-shaped articulating process projecting above proximal edge .... *C. incula*
   Avicularium with triangular rostrum. Opesia with an inconspicuous denticle in each proximal corner 3
3. Avicularium with massive, hooked rostrum projecting from plane of branch. Opesia relatively large, equivalent to one-quarter autozooid length .... *C. malvinensis*
   Avicularium with short, broadly triangular rostrum, not markedly hooked. Opesia relatively small, equivalent to less than one-sixth of autozooid length .... *C. diversa*
4. Avicularium with short, crescentic rostrum 5
   Avicularium with slender, triangular rostrum 7
5. Rostrum orientated obliquely to long axis of internode. Opesia rectangular, with an angular proximal lip .... *C. aurorae*
   Rostrum orientated transversely to long axis of internode. Opesia semicircular, with rounded proximal lip 6
6. Internodes slender, curving. Autozooids in whorls of four. Opesia enclosed by a prominent, oval cryptocystal ridge .... *C. coronata*
   Internodes stout, club-shaped. Autozooids in whorls of eight. Cryptocyst ridges present lateral to opesia but not enclosing it proximally .... *C. clavata*
7. Opesia narrowly crescentic; cryptocyst ridges conspicuous laterally but not meeting proximally.

Rostrum length only about 1.5 × width .... *C. moniliorata*
Opesia more or less semicircular; cryptocyst ridges fused proximally to form a complete oval. Rostrum more than twice as long as broad .... *C. sagittula*

Cellaria aurorae Livingstone Fig. 122A,B

Cellaria aurorae Livingstone 1928: 36, pl.4, fig.7, text.fig.8
Cellariaeforma parvimuralis Rogick 1956d: 241, pl.7, figs.C–H
Cellariaeforma aurorae: Moyano 1969: 48, pl.2, figs.7–15, pl.3, figs.16–19
Cellariaeforma extentamuralis Rogick 1956d: 239, pl.7, fig.I, pl.8, figs.A,B

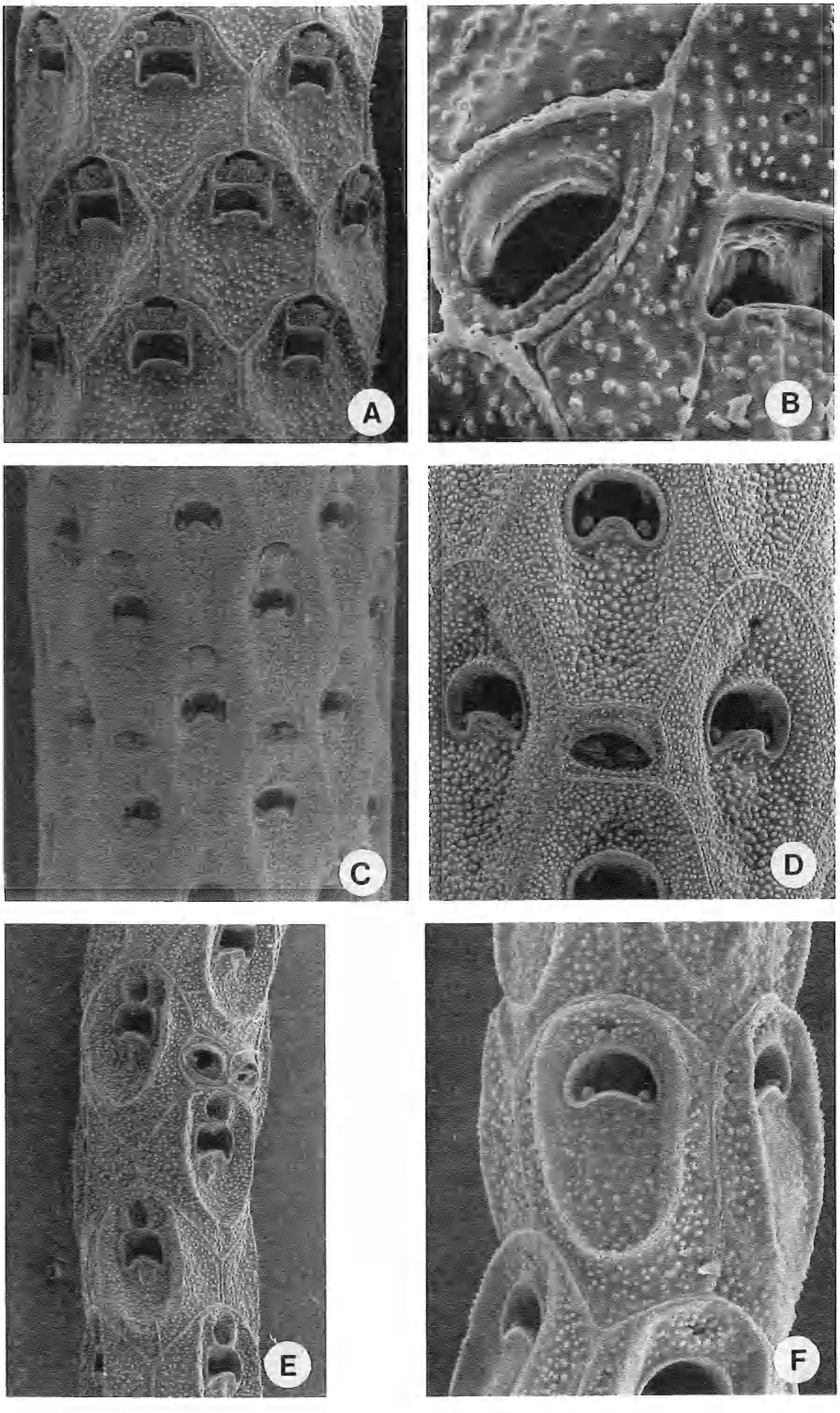
Colony stout, candelabriform; internodes commonly 10 mm, but up to 20 mm long, about 2 mm wide. Autozooids in whorls of six to eight, 0.6–0.7 × 0.4–0.5 mm; broadly hexagonal, with raised, thickened mural rims; cryptocyst coarsely granular, flat or with a slight median concavity. Opesia in distal half of autozooid, close to terminal wall; rectangular, distal border and sides straight, proximal edge forming a squared, slightly projecting lip; a pair of short, triangular denticles proximally, opposed by an equally pronounced distal pair linked by a low ridge. Avicularia infrequent; each wedged in at the boundaries of three autozooids, no larger than the opesia of an autozooid; triangular or irregularly quadrangular; rostrum oblique to long axis of branch, narrowly crescentic, projecting slightly and obscuring the short, paired condyles. Ovicell visible as a distinct swelling on the frontal surface of the autozooids distal to the fertile autozooid; aperture demarcated by two short ridges extending from the distal edge of the opesia of the fertile autozooid, partly occluded by a short, rectangular plate with cusped corners.

This is an endemic, and apparently common, Antarctic species. It is widely distributed in the Antarctic Seas, and ranges along the Scotia Arc as far north as Signy Island; it has not been reported from South Georgia.

Cellaria clavata (Busk) Fig. 122C,D

Salicornaria clavata Busk 1884: 88 (in part), pl.12, fig.8
Cellaria clavata: Hastings 1946: 236; d'Hondt 1984: 101
Cellaria clavata: Hayward and Thorpe 1989b: 938, fig.6C,D
Mesostomaria hastingsae d'Hondt and Redier 1977: 224, fig.3

Colony forming large clumps, composed of stout internodes up to 40 mm long, straight or irregularly curved; up to 1.5 mm wide, narrowed proximally, broadest and often clavate distally, frequently with distinct constrictions, perhaps representing growth checks. Branching occurs through production of lateral offshoots, each arising from a modified autozooid and anchored to the parent internode by chitinous rhizoids, infrequent; dichotomous branching apparently occurs very rarely. Autozooids in about 14 alternating longitudinal series, giving whorls of seven or eight; modified rhombic in outline, becoming clearly hexagonal in fertile areas of internode; separated by thin raised ridges, becoming indistinct in later ontogeny; 0.55–0.65 × about 0.4 mm. Cryptocyst thickly calcified, nodular; concave medially, with paired ridges flanking the opesia, curving proximally for half length of autozooid; calcification thickens in late ontogeny, with cryptocyst less markedly concave and ridges indistinct. Opesia in distal half of autozooid but distant from distal edge; about one-eighth total autozooid length, reniform, with low, rounded proximal lip; a blunt, forwardly projecting denticle in each proximal corner; a pair of smaller, pointed denticles present within distal border, linked by a finely denticulate ridge. Ovicell aperture transversely oval, about half width of opesia, partly occluded by a large, quad-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rangular proximal lip. Avicularium small, about as large as an autozooid opesia; rectangular, with crescentic rostrum acute to frontal plane, distally directed; condyles thick, blunt.

Cellaria clavata has been reported from Kerguelen, Marion Island, Crozet Island, Bouvet Island, and from off the southern Patagonian Shelf. It shows some morphological variation over this broad geographical range (Hayward and Thorpe 1989b), and Hastings (1946) implied that more than one species might be represented in the relatively few specimens at her disposal. *Neocellariaeforma elongata* d'Hondt, from Marion Island, seems very similar to *C. clavata*, and the distinction between the two taxa is not clear.

Cellaria coronata (Rogick) Fig. 122E,F

Cellariaeforma coronata Rogick 1956d: 237, pl.8, fig.C

Cellaria sp. Hayward and Thorpe 1989b: 944, figs.10A,B

not *Cellaria coronata* Liu and Hu 1991: 145

Colony form unknown. Internodes slender, irregularly curved, commonly 0.5 mm wide (up to 1.0 mm, Rogick 1956d). Autozooids in alternating whorls of four, 0.45–0.6 × 0.25–0.4 mm; hexagonal, or with the distal end smoothly rounded, separated by thin, raised mural rims; cryptocyst coarsely granular, with a flat or slightly concave central area bounded by a raised, oval cryptocystal ridge. Opesia in distal half of autozooid; more or less crescent-shaped, with a smoothly curving distal-lateral rim, and the proximal edge gently convex; a stout denticle visible in each proximo-lateral corner. Avicularia infrequent; much smaller than autozooids, each wedged in between successive autozooids in a linear series, rostrum orientated transversely to long axis of branch, with a short, broad, crescentic mandible. Aperture of ovicell simply rounded, indistinct.

Few specimens of this inconspicuous species have been collected, and its morphology and habit are incompletely known. Rogick (1956d) based her description on a single unbranched node, 14 mm long, from the Ross Sea. Additional specimens collected by *Discovery* Investigations and the New Zealand Oceanographic Institute all originate from close to the type locality.

Cellaria diversa Livingstone Fig. 123A–C

Cellaria diversa Livingstone 1928: 34, pl.6, fig.8, text figs.6,7

Cellaria vitrimuralis Rogick 1956d: 232, pl.4, pl.5, figs.A–E; Androsova 1972a: 97; 1972b: 338

Cellaria diversa: Hayward and Thorpe 1989b: 939, fig.7B–C

Colony forming dense, richly branched tufts up to 50 mm high. Internodes straight and slender, up to 10 mm long, with a constant width of 0.75 mm, linked at the node by simple chitinous tubes. Autozooids elongate, hexagonal (or rhombic in fertile parts of internode), rounded distally; 0.85–1.0 × 0.35–0.4 mm; each internode comprising ten alternating longitudinal series. Lateral walls of autozooids raised, prominent, with thin sutures marking boundaries of each autozooid; cryptocyst depressed, flat, finely granular. Opesia almost semicircular, about one-tenth total autozooid length; situated close to distal end of autozooid; with thin raised rim, the proximal edge straight, slightly reflected, with a minute, rather inconspicuous denticle in each corner. Avicularia infrequent, a single one occurring at or close to the basal part of each internode, marking

Fig. 122. A, B. *Cellaria aurorae.* Ross Sea. A. Brooding autozooids; ×40. B. Detail of an avicularium; ×150. C, D. *Cellaria clavata.* Discovery Stn. WS871, off Patagonian Shelf. C. Part of an internode; ×40. D. Detail of autozooids and avicularium; ×80. E, F. *Cellaria coronata.* NZOI Stn. E188. Ross Sea. E. Part of an internode, with ovicells and avicularia; ×45. F. Detail of autozooids; ×100.

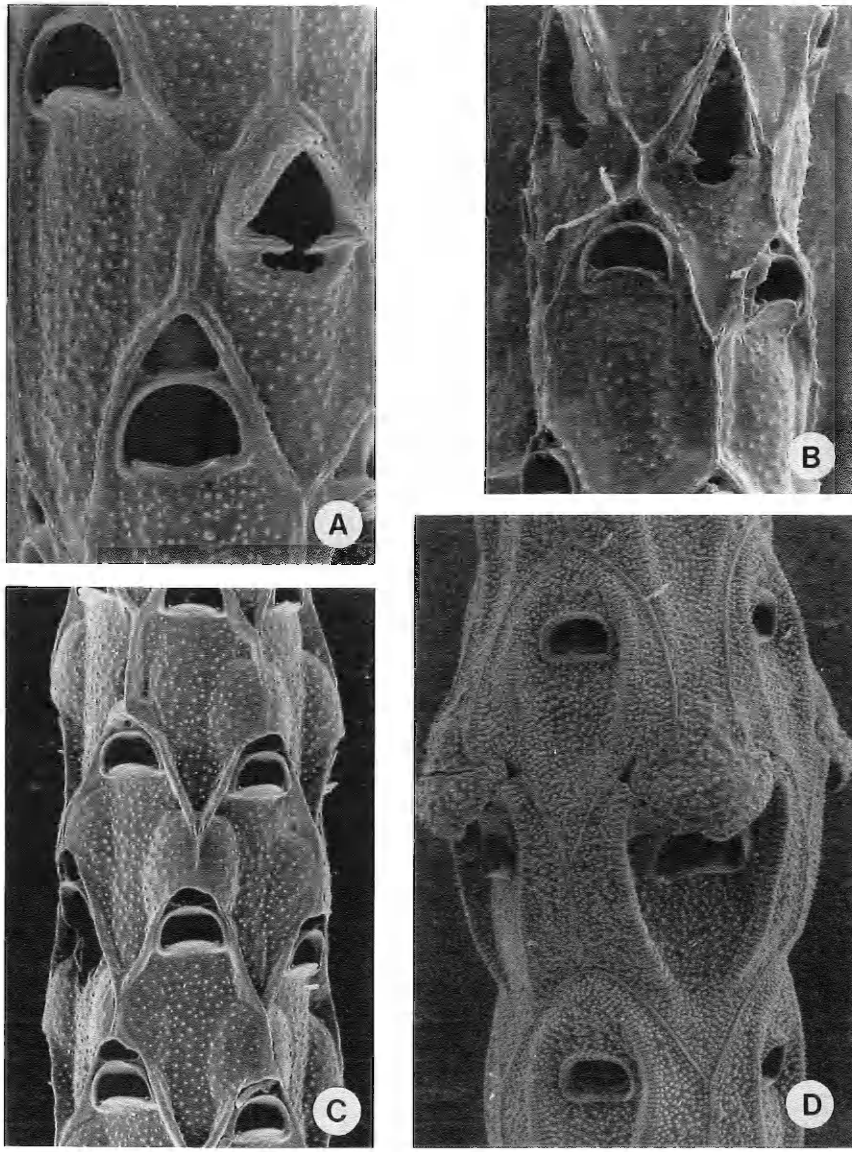


Fig. 123. A–C. *Cellaria diversa*. A. Discovery Stn. 42, South Georgia; autozooids and an avicularium; ×90. B. Part of Livingstone's holotype: note that the avicularium is broken; ×50. C. Discovery Stn. 42; ovicelled autozooids; ×45. D. *Cellaria incula*. EPOS 3, Stn. 271, Weddell Sea; brooding autozooids; ×70.

the division of an autozooid series; cystid hexagonal, about two-thirds the length of an autozooid, rostrum occupying distal half, supporting a broadly triangular mandible; condyles prominent, almost meeting medially. Brooding autozooids occur as whorls, not, however, giving a nodulated appearance to internode; ovicells visible as prominent, independent, oval swellings distal to each maternal autozooid; aperture about half width of opesia, transversely oval.

Cellaria diversa is an endemic Antarctic species. Described originally from Adelie Land (Livingstone 1928) and the Ross Sea (Rogick 1956d), where it is abundant, it has since been recorded in numerous samples from the Palmer Archipelago, the South Shetlands, South Sandwich Islands and South Georgia, and also from Bouvet Island (Hayward and Thorpe 1989d).

Cellaria incula Hayward and Ryland Figs. 123D,124A

Cellaria incula Hayward and Ryland 1993: 133, Fig. 3a,b

Colony developing a diffuse, richly branched, rather spindly form, exceeding 5 cm high. Internodes commonly 10 mm long, 0.8–1.0 mm wide, the nodes consisting of knotted bundles of frontally budded rhizoids. Autozooids in alternating whorls of four, 0.7–0.8 × about 0.4 mm; hexagonal, separated by distinct, thin mural rims. Cryptocyst granular, the central area concave, flanked by curving lateral cryptocystal ridges, which do not meet either proximally or distally. Opesia in distal half of autozooid, but distant from distal edge; semicircular, the proximal edge straight; a conspicuous, anvil-shaped articular plate projecting above proximal lip of opesia. Avicularia infrequent; as large as autozooids, with hood-like, semicircular rostrum, larger than an autozooid opesia, projecting from the frontal plane of the internode. Ovicell with a rounded distal cowl overhanging the aperture.

C. incula is presently known from the Ross Sea and the Weddell Sea, and is perhaps distributed throughout all Antarctic coastal waters.

Cellaria malvinensis (Busk) Fig. 124B,C

Salicornaria malvinensis Busk 1852: 18, pl.63, figs.1,2; 1884: 91, pl.12, figs.1,5,7

Cellaria malvinensis: Waters 1904: 37, pl.2, fig.10, pl.8, fig.5; Calvet 1904b: 9; 1909: 23; d'Hondt and Redier 1977: 224; d'Hondt 1984: 101

Cellaria malvinensis: Hayward and Thorpe 1989b: 940, figs.8A–C

Colony forming dense clumps up to 50 mm high. Internodes up to 8 mm long, 0.75–1.75 mm wide; slightly curved proximally, straight distally, each dichotomy forming a regular, tuning-fork shape; nodes consisting of simple fracture joints, secured by small knot-like bundles of rhizoids. Autozooids in spiral whorls of six to 12, elongate hexagonal, 0.45–0.55 × 0.25–0.3 mm, separated by raised, often crenulate, ridges. Cryptocyst lightly calcified, initially smooth but becoming progressively more granular in late ontogeny; uniformly concave. Opesia in distal half of autozooid; relatively large, equivalent to one-quarter autozooid length, wider than long; proximal border gently convex, slightly projecting; distal border with fine denticulations in later ontogeny; a small, bluntly tapered denticle just visible in each proximal corner. Ovicell visible as a distinct swelling on the cryptocyst of the two autozooids distal to the brooding autozooid; aperture large, transversely oval or semielliptical. Avicularia frequent, almost twice length of an autozooid; rostrum elongate triangular, hooked distally and projecting from the frontal plane of the autozooid; condyles stout, fusing medially, and characteristically fused to a median projection from the proximal edge of the opesia; distal to the condyles, the opesia occupies the whole of the palatal area.

Cellaria malvinensis displays two distinct colony morphotypes. In one, the internodes are slender, composed of 12 to 16 alternating longitudinal autozooid series, while in the other the noticeably stouter internodes comprise 20 to 24 autozooid series. These two morphotypes have coextensive geographical distributions, and in autozooid morphology and dimensions are practically identical. This common and widespread species has

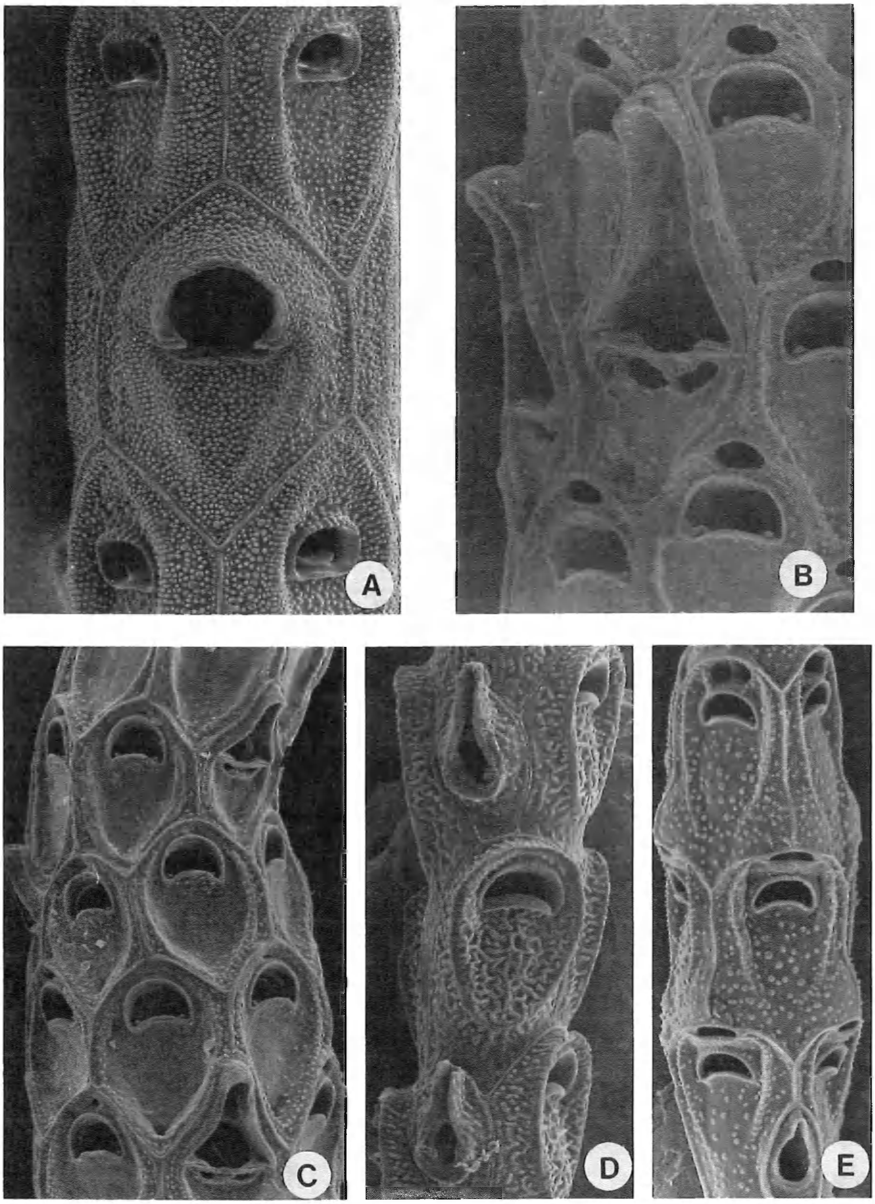


Fig. 124. A. *Cellaria incula*. EPOS 3, Stn. 271, Weddell Sea; autozooids and an avicularium; ×70. B, C. *Cellaria malvinensis*. B. Discovery Stn. WS177, South Georgia; ×80. C. Discovery Stn. 1321, west end of Magellan Strait; ×60. D. *Cellaria sagittula*. NZOI Stn. A534, Ross Sea; ×80. E. *Cellaria moniliorata*. Ross Sea; ×60.

been reported from numerous localities, from the western end of the Magellan Strait eastwards to Kerguelen. It is abundant over the southern Patagonian Shelf, around the Falkland Isles and on Burdwood Bank, and extends southwards as far as South Georgia, which seems to be its extreme southern limit.

Cellaria moniliorata Rogick — Fig. 124E

Cellaria moniliorata Rogick 1956d: 229, pl.5, figs.F–I; pl.6, figs.A–L
Cellaria moniliorata: Moyano 1969: 44, pl.1, fig.3; Androsova 1972b: 338; Hayward and Thorpe 1989b: 941, fig.7A

Colony forming delicate, diffuse tufts up to 40 mm high. Internodes slender, curved, exceeding 10 mm in length, but only 0.25 mm wide, increasing to 0.5 mm in fertile parts of internode. Nodes comprise simple fracture joints secured by bundles of frontally budded rhizoids arising on each side of the joint. Autozooids in eight strictly alternating longitudinal series, giving a quadrangular branch section; elongate hexagonal, 0.55–0.65 × 0.2–0.25 mm. Conjoined lateral walls of autozooids form a thin, scarcely raised rim to each; cryptocyst not markedly depressed, flat or slightly convex proximally, concave medially; with paired ridges extending two-thirds of its length, most prominent adjacent to opesia, gradually fading proximally; surface with prominent, widely spaced granulations. Opesia in distal third of autozooid, about one-tenth total length, crescentic, with thin, finely crenulate rim, and a minute, indistinct denticle in each proximal corner. Ovicell immersed, but visible as a pronounced oval swelling distal to the maternal autozooid; aperture transversely oval, about half size of opesia. Avicularia frequent; interzooidal, with pyriform cystid about one-third length of autozooid; rostrum slender, triangular, with indistinct condyles.

Originally described from Cape Royds and the Knox coast (Rogick 1956d), *C. moniliorata* has subsequently been reported from the Bransfield Strait, the Palmer Archipelago and the South Shetlands, and also from the Ross Sea. It is an endemic Antarctic species.

Cellaria sagittula Hayward and Ryland — Fig. 124D

Cellaria sagittula Hayward and Ryland 1993: 133, Fig. 3c

Colony form unknown. Internodes slender, 0.4 mm wide. Autozooids arranged in triple whorls; 0.4–0.45 × about 0.25 mm, separated by indistinct sutures. Cryptocyst coarsely granular, with a prominent, oval ridge completely encircling the opesia and projecting conspicuously from the frontal plane of the internode; opesia semicircular, equivalent to one-fifth total autozooid length, the proximal lip slightly convex, an indistinct denticle in each proximal corner. Avicularia with slender, triangular rostrum, 0.25 mm long, raised prominently above frontal surface of branch, distally directed.

This tiny species is known from a very few specimens collected from the Ross Sea.

Paracellaria Moyano, 1969

Colony erect, branching, attached by chitinous rhizoids. Branches cylindrical, dividing dichotomously; the two rami at first continuous with the ramus preceding the dichotomy, later forming simple fracture joints at their bases and securing them with bundles of chitinous rhizoids developed from the frontal surfaces of the most proximal autozooids of each branch. Autozooids in alternating whorls, opening around the entire periphery of the branch; thickly calcified, typically with a coarsely granular surface. Opesia in distal half of autozooid, with thickened, raised rim; a pair of stout, forwardly directed denticles projecting above proximal edge. Paired extensions of the lateral cryptocyst often flank opesia, and may project frontally. Avicularia interzooidal, smaller than autozooids, with raised triangular rostrum. Ovicells endotoichal.

Type species: *Cellaria wandeli* Calvet, 1909.

Key to Antarctic species

1. Opesia longer than wide. Avicularia much smaller than autozooids ... 2
   Opesia wider than long. Avicularia almost as large as autozooids .... *P. calveti*
2. Cryptocyst ridges developed as prominent lobes adjacent to opesia. Avicularia directed distally or proximo-laterally 3
   Without projecting lobes adjacent to opesia. Avicularia directed disto-laterally .... *P. wandeli*
3. Avicularia directed distally................. .... *P. cellarioides*
   Avicularia directed proximo-laterally .... *P. elephantina*

Paracellaria wandeli (Calvet) Fig. 125A

Cellaria wandeli Calvet 1909: 23, pl.2, figs.3–6; Rogick 1956d: 236, pl.7, figs.A,B

Paracellaria wandeli: Moyano 1969: 59, pl.1, fig.6, pl.7, figs.33,35,36; Androsova 1972a: 97; 1972b: 337; Hayward and Thorpe 1989b: 946, fig.12C

Colony forming diffuse tufts, up to 40 mm high; internodes cylindrical, straight or curved, up to 15 mm long and 1 mm wide. Autozooids in whorls of six, 0.70 × 0.25 mm; elongate, hexagonal, separated by raised, crenulate ridges; cryptocyst evenly and deeply concave, finely granular. Opesia close to distal end of autozooid, longer than wide, comprising about one-quarter total autozooid length; lateral and distal edges slightly flared, crenulate, proximal edge developed as a prominent, convex lip; a stout rounded denticle projecting from each proximal corner. Ovicell recognized by small, rounded aperture immediately distal to opesia. Avicularia frequent, about one third length of autozooids; cystid roughly lozenge-shaped, with raised, triangular, disto-laterally directed rostrum in distal half; condyles well developed, almost meeting medially.

Paracellaria wandeli is an endemic Antarctic species. It seems to be widely distributed in Antarctic Shelf waters, and has been reported from the coasts of Australian Antarctic Territory, the Ross Sea and the Palmer Archipelago.

Paracellaria calveti (d'Hondt) Fig. 125C

Mawsonia calveti d'Hondt 1984: 103, pl.2, figs.1–3

Paracellaria calveti: Hayward and Thorpe 1989b: 946, fig.12D

Colony form unknown; internodes cylindrical, straight or curved, up to 10 mm long, with maximum width 0.5 mm. Autozooids in whorls of four, hexagonal, with rounded distal ends, 0.5–0.6 × 0.35–0.40 mm. Cryptocyst irregularly granular, concave medially, with a median ridge extending from just proximal to opesia, and a pair of curved lateral ridges, almost meeting proximally, developed on each side of opesia as narrow, triangular-sectioned lobes which meet and fuse medially in later ontogeny. Opesia in distal half of autozooid, about one-fifth total autozooid length, almost semicircular; distal edge crenulate, projecting, proximal edge convex, slightly reflexed; a short, rounded denticle in each proximal corner. D'Hondt (1984) describes, but does not figure, a large avicularium, 0.4 mm long, with a broadly triangular rostrum.

Described originally from a single station between Marion and Crozet Islands, *P. calveti* was subsequently recorded from the South Shetland Islands by Hayward and Thorpe (1989b). Very little material of this species has been collected; the type specimen consisted of a single, unbranched internode, those from the South Shetlands bore lateral branches, attached to the main internode by rhizoids, but colony form remains unknown.

Paracellaria cellarioides Hayward and Thorpe, resembles *P. calveti* in having projecting, trifaceted processes adjacent

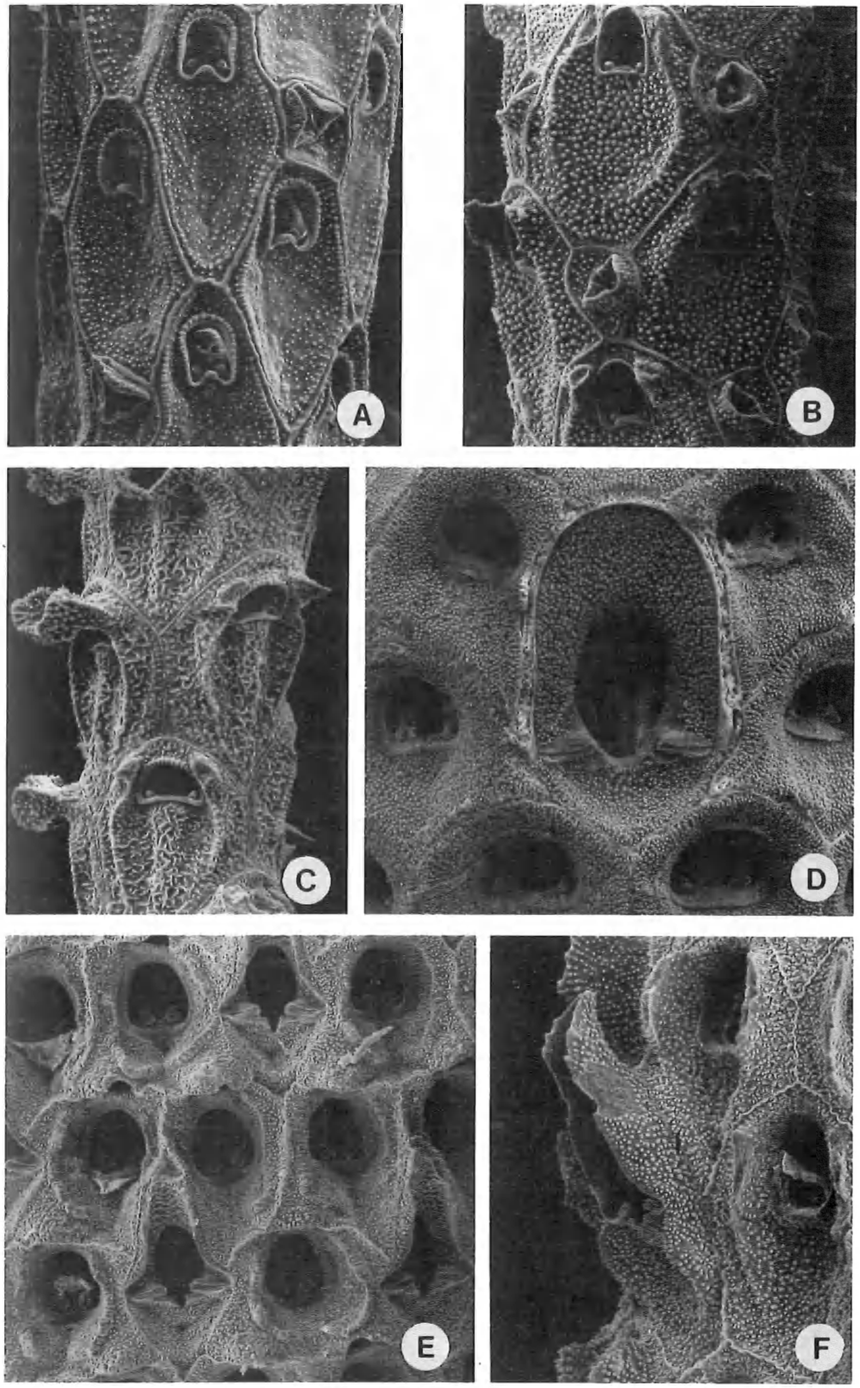


Fig. 125. A. *Paracellaria wandeli*. Ross Sea; ×55. B. *Paracellaria elephantina*. Discovery Stn. 1948, South Shetland Is.; ×70. C. *Paracellaria calveti*. Discovery Stn. 1948; ×60. D. *Swanomia belgica*. Discovery Stn. 187, Palmer Archipelago; ×40. E, F. *Swanomia membranacea*. Discovery Stn. 1660, Ross Sea. E. Autozooids, avicularia and ovicells; ×36. F. Profile of undamaged avicularium; ×45.

to the opesia. Unlike *P. calveti*, these processes do not seem to fuse medially. *P. cellarioides* differs from *P. calveti* in its opesia, which is distinctly longer than wide, and in its avicularia, which have a shield-shaped outline to the cystid, and a projecting, distally directed rostrum. *Paracellaria cellarioides* was described from two stations off the southern Patagonian Shelf (Hayward and Thorpe 1989b), and has not been recorded from the Antarctic Seas.

Paracellaria elephantina Hayward and Thorpe — Fig. 125B

Paracellaria elephantina Hayward and Thorpe 1989b: 948, fig.12E

Colony form unknown; internodes slender, cylindrical, 10 mm long, 0.7 mm wide. Autozooids in whorls of four, hexagonal, with rounded distal ends, 0.45–0.50 × 0.35 mm; cryptocyst coarsely granular, concave medially, with paired, curved lateral ridges, meeting proximally, developed on each side of opesia as short, projecting, triangular-sectioned lobes. Opesia in distal half of autozooid, almost twice as long as wide, about one-fifth total autozooid length; distal edge with smooth, slightly projecting rim; proximal edge convex, forming a projecting lip, a short, bluntly rounded denticle in each proximal corner. Avicularia frequent; cystid roughly hexagonal, about one-third length of autozooid; rostrum broadly triangular, acute to frontal plane, directed proximolaterally, condyles well developed, almost meeting medially.

Paracellaria elephantina is distinguished by its elongate opesia, and its avicularium, which is constantly proximo-laterally directed. At present it is known only from a few specimens collected from the South Shetland Islands.

Swanomia Hayward and Thorpe, 1989

Colony erect, cylindrical, branching dichotomously at irregular and infrequent intervals, unjointed; attached to the substratum by chitinous rhizoids. Autozooids with deeply concave cryptocyst; opesia at least half frontal length of autozooid, almost medially situated, proximal border with massive, paired condyles linked by a thickened ridge. Avicularia vicarious, as large as, or larger than, autozooids.

Type species: *Cellaria membranacea* Thornely, 1924.

Swanomia was introduced by Hayward and Thorpe (1989b) as a *nomen novum* for *Mawsonia* Livingstone, 1928, which is preoccupied by *Mawsonia* Woodward, 1907. The rigid, unjointed and usually heavily calcified colonies of *Swanomia* species distinguish them immediately from the more delicate, articulated colonies of *Cellaria* species. *Swanomia* appears to be endemic to Antarctic waters; three species are presently known.

Key to Antarctic species

1. Avicularium with broadly rounded, semielliptical mandible. Autozooid opesia wider than long ... *S. belgica*
   Avicularium mandible triangular. Opesia longer than wide. 2
2. Rostrum elongate-triangular, constituting at least two-thirds length of avicularium .... *S. membranacea*
   Rostrum short, broadly triangular, constituting no more than half avicularium length .... *S. brevimandibulata*

Swanomia membranacea (Thornely) — Fig. 125E,F

Cellaria membranacea Thornely 1924: 9, fig.2

Mawsonia membranacea Livingstone 1928: 39; Rogick 1956d: 247, pl.9, figs.F–M, pl.10, fig.A; Moyano 1969: 55, pl.1, figs.2,4, pl.6, figs.31,32

Mawsonia extensalata Rogick 1956d: 244, pl.8, figs.D–F; pl.9, figs.A–E; Moyano 1969: 56, pl.6, fig.30; Androsova 1972a: 97, fig.13; 1972b: 338

Swanomia membranacea: Hayward and Thorpe 1989b: 949, figs.13C–D

Colony slender, cylindrical, straight or irregularly curved, with periodic growth checks giving a nodulated outline; branching dichotomously at infrequent intervals; maximum size unknown, but exceeding 50 mm, with a maximum branch width of 3 mm. Autozooids in alternating whorls of up to 13 (i.e., 26 alternating longitudinal series), irregularly hexagonal, 0.6–0.7 × 0.4–0.5 mm, boundaries marked by low, crenulate ridges. Cryptocyst deeply concave, thickly calcified, with a densely nodular surface; developing a thickened longitudinal ridge on each side of the opesia, which extends proximally for about two-thirds autozooid length; especially prominent lateral to the opesia where they may be produced as flattened, wing-like projections. Opesia slightly less than half autozooid length, longer than wide, distinctly semielliptical; rim slightly reflected; proximal denticles closely spaced, thickened, with prominent ridge between, curving frontally. Avicularia frequent, as large as autozooids; rostrum elongate triangular, its rim raised and projecting markedly from the frontal plane, often crenulate; condyles stout, not meeting medially. Ovicell completely immersed, marked by a narrow, transversely oval aperture distal to the maternal autozooid, overhung by a short, projecting hood.

The paired cryptocystal projections on each side of the opesia may be particularly conspicuous, developed as prominent lobes with crenulate and scalloped edges. Specimens displaying this condition were described by Rogick (1956d) as a distinct species, *Mawsonia extensalata.* However, examination of a longer series of specimens, representing a more complete ontogenetic sequence, shows that the cryptocystal 'wings' may be variably developed among autozooids in a single colony, and that in later ontogeny they tend to break off, so that the proximal autozooids of a colony only bear low thickened ridges (Hayward and Thorpe 1989b).

Swanomia membranacea is an endemic Antarctic species, widely distributed in Antarctic shelf seas, and extending northwards as far as the South Sandwich Islands.

Swanomia belgica Hayward and Ryland — Fig. 125D

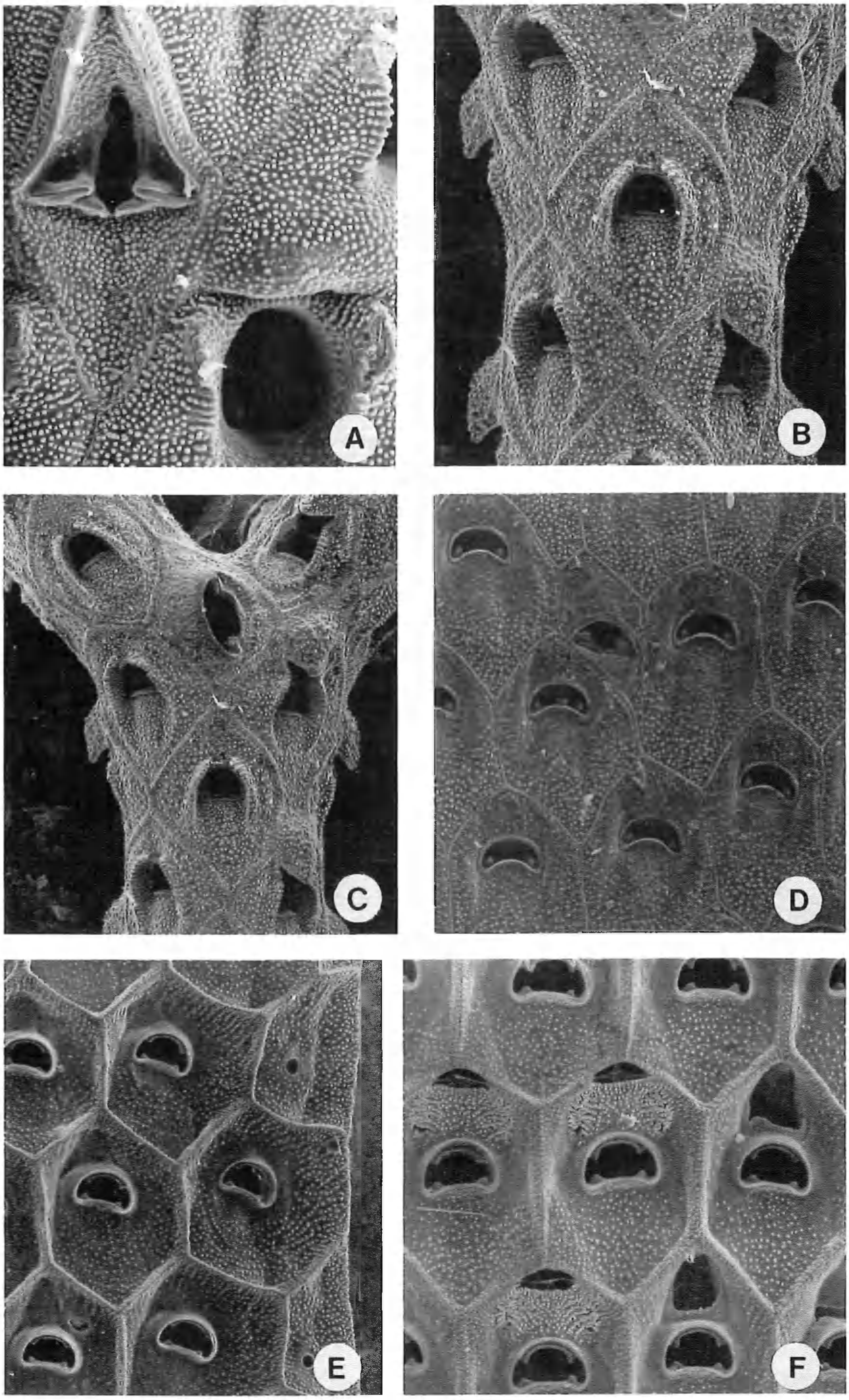
Cellaria dennanti: Waters 1904: 36, pl.2, figs.9a–f, pl.7, fig.4a

Paramawsonia dennanti: Androsova 1972b: 340, fig.14

Swanomia belgica Hayward and Ryland 1993: 135, Fig. 3f

Colony stout, with cylindrical or nodulated stems 3 mm wide; maximum height unknown, but exceeding 40 mm (Waters 1904); branching dichotomously at infrequent intervals. Autozooids in alternating whorls of up to 12 (i.e., 24 alternating longitudinal series), broadly hexagonal, 0.8–1.0 × 0.6–0.8 mm, boundaries marked by narrow, indistinct sutures. Cryptocyst depressed, thickly calcified, finely granular. Opesia constituting one-third total frontal length of autozooid, slightly wider than long, with finely crenellate rim; proximal edge thickened, bearing a pair of conspicuous, knob-like condyles, linked by a prominent ridge. Avicularia frequent, larger than autozooids, with an evenly concave cryptocyst and an elongate oval, central opesia; distal two-thirds of rim forming a broad, semielliptical rostrum, with proximally a pair of short, thick condyles, mandible 0.75–0.8 mm long. Ovicells presently undescribed.

This species was first described by Waters (1904), who ascribed it to the Australian Miocene fossil, *Cellaria dennanti* MacGillivray. Androsova (1972b) introduced *Paramawsonia* gen.nov.for the Antarctic species described by Waters, but denoted *C. dennanti* MacGillivray as type species. However, the Antarctic species is quite distinct from the fossil, *Paramawsonia dennanti,* and was thus in need of a new name. It was shown (Hayward and Ryland 1993) to be cor-


A
B
C
D
E
F

rectly placed in *Swanomia* Hayward and Thorpe. *S. belgica* appears to be an endemic Antarctic species. It was reported by Waters (1904) from the Bellingshausen Sea, from off Queen Maud Land by Androsova (1972b), and from Halley Bay and the Palmer Archipelago (Hayward and Ryland 1993).

Swanomia brevimandibulata (Moyano) Fig. 126A

Mawsonia brevimandibulata Moyano 1969: 51, pl.1, fig.5, pl.4, figs.20,21, pl.5, figs.22–29

Mawsonia brevimandibulata: Androsova 1972a: 97

Swanomia brevimandibulata: Hayward and Thorpe 1989b: 949, fig.13E

Colony slender, cylindrical, straight or slightly curved, with a nodulated outline imparted by growth checks; branching dichotomously at irregular intervals; maximum height exceeding 50 mm, with a branch width of 2 mm. Autozooids in alternating whorls of up to 13 (i.e., 26 alternating longitudinal series), irregularly hexagonal, separated by low, crenulate ridges; 0.5–0.6 × 0.4–0.5 mm. Cryptocyst deeply concave, thickly calcified, nodular, with a longitudinal, thickened ridge on each side of the opesia, often developed as a rounded lobe with crenulate edge, grading into the cryptocyst proximally. Opesia occupying about half total autozooid length, almost twice as long as wide, semielliptical, with rounded proximal corners; proximal denticles closely spaced, large and conspicuous, linked by a thickened ridge. Avicularia frequent, as large as autozooids, the rostrum broadly triangular, constituting half length of avicularium, projecting slightly from branch surface; condyles stout, not meeting medially. Ovicell completely immersed, with a narrow, transversely oval aperture immediately distal to maternal autozooid, overhung by a short, projecting hood.

Described originally from the Antarctic peninsula region, *S. brevimandibulata* has since been reported from the coast of Adelie Land (Androsova 1972a), and from the Ross Sea (Hayward and Thorpe 1989b). It may be regarded as an endemic Antarctic species.

Stomhypselosaria Canu and Bassler, 1927

Colony erect, dichotomously branching, unjointed; branches slender, cylindrical; attached to substratum by chitinous rhizoids. Opesia with straight, slightly reflected proximal lip, often notched or indented in each proximal corner; proximal denticles inconspicuous. Prominent cryptocystal ridges developed on each side of opesia. Avicularia vicarious, typically with a broadly semielliptical mandible, situated singly in the axil of each dichotomy. Ovicell endotoichal, with a widely open orifice, shielded frontally by a conspicuous convex hood.

Type species: *Stomhypselosaria condylata* Canu and Bassler, 1927.

The distinction between this genus and *Cryptostomaria* Canu and Bassler, 1927 is unclear (see Gordon 1986), and re-examination of type materials may show them to be synonymous. *S. condylata* was described from the Philippine Islands; what is certainly the same genus is represented in Antarctic and Subantarctic seas by *S. watersi* Hayward and Thorpe. D'Hondt's (1984) record of *S. condylata* from Kerguelen might perhaps refer to *S. watersi.*

Fig. 126. A. *Swanomia brevimandibulata.* Palmer Archipelago; ×85. B, C. *Stomhypselosaria watersi.* Discovery Stn. 366, South Sandwich Is. B. Part of internode, with autozooids and ovicells; ×40. C. Dichotomy with avicularium; ×29. D. *Melicerita latilaminata.* Ross Sea; ×45. E, F. *Melicerita blancoae,* off Patagonian Shelf. E. Margin of colony; ×40. F. Fertile autozooids; ×50.

Stomhypselosaria watersi Hayward and Thorpe Fig. 126B,C

Cellaria dubia: Waters 1904: 37, pl.2, fig.2
Stomhypselosaria watersi Hayward and Thorpe 1989b: 945, fig.11

Colony forming diffuse tufts up to 20 mm high, branching dichotomously at intervals of about 5 mm; branches cylindrical, curved basally, up to 0.7 mm wide. Autozooids in six alternating longitudinal series, thus disposed in alternating whorls of three; lozenge-shaped, separated by thin, raised sutures; 0.75–0.85 × 0.5–0.6 mm. Cryptocyst coarsely granular, deeply concave immediately proximal to opesia, elsewhere convex; a thick, raised ridge developed on each side of opesia, extending proximally for about two-thirds total autozooid length. Opesia comprising about one-fifth total autozooid length, situated in middle of frontal surface, with straight, slightly reflected proximal lip; a pair of widely spaced, small and inconspicuous denticles just visible above lip. Ovicell with a large, quadrangular aperture opening immediately distal to opesia, hidden by a convex, granular hood, with overhanging, medially peaked lip. Avicularia present at dichotomies only, close to axil, typically one on each side, in the same plane as the two branches; as large as autozooid, with transversely orientated, elliptical rostrum, extensive opesia and short, knob-like condyles; mandible semielliptical.

S. watersi is inconspicuous among benthic samples of other erect bryozoans, which is perhaps why it has been so seldom recorded. It is presently known from the Ross Sea, the Bellingshausen Sea, the South Sandwich Isles and Signy Island, and also from the southern Patagonian Shelf. It is probably widely distributed in Antarctic and Subantarctic waters.

Melicerita Milne-Edwards, 1836

Colony erect, bilaminar; forming single, flattened blades, or branching dichotomously at infrequent intervals; margins of colony typically acute. Autozooids broadly hexagonal, arranged in alternating transverse rows, curved with respect to the long axis of the colony. Cryptocyst depressed; opesia short, typically crescent-shaped, more or less coincident with operculum; prominent, paired, proximal denticles present, frequently opposed by paired distal denticles. Ovicell completely immersed, visible as a low bulge distal to the brooding autozooid; with a narrow, curved aperture opening at extreme distal end of maternal autozooid, within its distal terminal wall, adjacent cryptocystal calcification typically perforate or cribrate. Avicularia vicarious or interzooidal, lacking in some species. Small kenozooids often present along branch margins.

Type species: *Melicerita charlesworthii* Morris, 1843.

Species of *Melicerita* occur throughout Tertiary deposits of Europe and Australasia, and Recent species are found in the south-west Pacific, the south-west Atlantic, and in Antarctica. New Zealand species have been described and illustrated by Gordon (1986). D'Hondt (1984) described a new species, *M. subantarctica*, from Bouvet Island, while *M. atlantica* Busk (1884), described from the northern Patagonian Shelf, has yet to be rediscovered. A key to all Recent species of *Melicerita* was presented by Rosso (1992). *Melicerita robusta* Liu and Hu (1991) does not seem to differ significantly from *M. obliqua; M. lingulata* Liu and Hu (1991) is perhaps *M. blancoae.*

Key to Antarctic species

1. Avicularia absent 2
   Avicularia present 3
2. Colony unbranched, curved, sabre-like. Opesia and ovicell aperture both distinctly reniform .... *M. obliqua*
   Colony irregularly branched. Opesia semicircular, with pronounced distal and proximal denticles; ovicell aperture broadly triangular or slit-like .... *M. blancoae*

3. Colony forming narrow, branched blades. Avicularia interzooidal, much smaller than autozooids 4
   Colony forming a broad fan-shape. Avicularia vicarious, as large as autozooids .... *M. flabellifera*
4. Avicularia distributed along branch margins only, opesiae much smaller than those of autozooids. Proximal edge of autozooid opesia straight, with angular corners .... *M. digeronimoi*
   Avicularia distributed over whole of branch, opesiae as large as those of autozooids. Proximal edge of autozooid opesia smoothly curved, convex .... *M. latilaminata*

Melicerita blancoae López Gappa Fig. 126E,F

Melicerita blancoae López Gappa 1981b: 127, figs.1–7
Melicerita blancoae: Hayward and Thorpe 1989b: 951, fig.14B

Colony forming thin, flat blades, dividing dichotomously at irregular intervals; exceeding 25 mm height, with a maximum width of 8 mm. Autozooids regularly hexagonal, 0.55–0.65 × about 0.45 mm, broader and less regular at colony margins, where the autozooid rows terminate with variably sized kenozooids, each with a tiny, round central foramen; vertical walls forming a narrow crenulate rim around each autozooid, cryptocyst deeply depressed, finely granular. Opesia in distal half of autozooid, its proximal border more or less on the midline; semicircular, half width of autozooid and about one-fifth as long, rim raised and prominent in early ontogeny; proximal denticles widely spaced, triangular, exactly opposed on the distal border by an identical pair of denticles, linked by a thin ridge. Ovicell aperture narrow, lozenge-shaped, at extreme distal end of autozooid; proximal to it, on each side, a cribrate area of porous calcification. No avicularia.

Originally described from a single station on the southern Patagonian Shelf, *M. blancoae* has since been reported more widely in the same region, including the Falkland Isles and Burdwood Bank. It perhaps does not extend into Antarctic waters.

Melicerita digeronimoi Rosso Fig. 127

Melicerita digeronimoi Rosso 1992: 186, pl.1, figs.1–6

Colony form unknown, branches flat and slender, perhaps sabre-like. Autozooids regularly hexagonal, separated by thin raised ridges, 0.62–0.77 × 0.60–0.70 mm. Cryptocyst flat, with pronounced, paired, longitudinal ridges developing in later ontogeny. Opesia in distal third of autozooid, semicircular, with a prominent, straight-edged, proximal lip, with thickened, cusped corners. Aperture of ovicell semicircular, flanked on each side by a large, irregular pore. Avicularia distributed along margins of branch, irregularly polygonal, about half size of autozooids; rostrum semielliptical, acute to frontal plane, with a narrow, semielliptical mandible.

This distinctive species is known only by the single type specimen, a rooted fragment 12 × 1.5 mm, described by Rosso (1992) from the Ross Sea.

Melicerita flabellifera Hayward and Winston Fig. 128A,B

Melicerita flabellifera Hayward and Winston 1994: 242, figs.3C–E

Colony a flat, brittle fan up to 5 cm high; 2–3 mm wide proximally, to more than

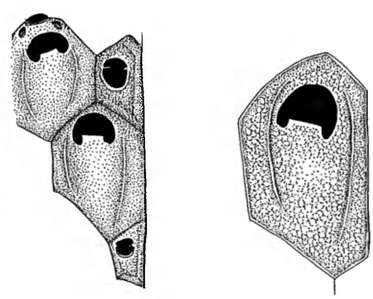


Fig. 127. *Melicerita digeronimoi.* After Rosso (1992).

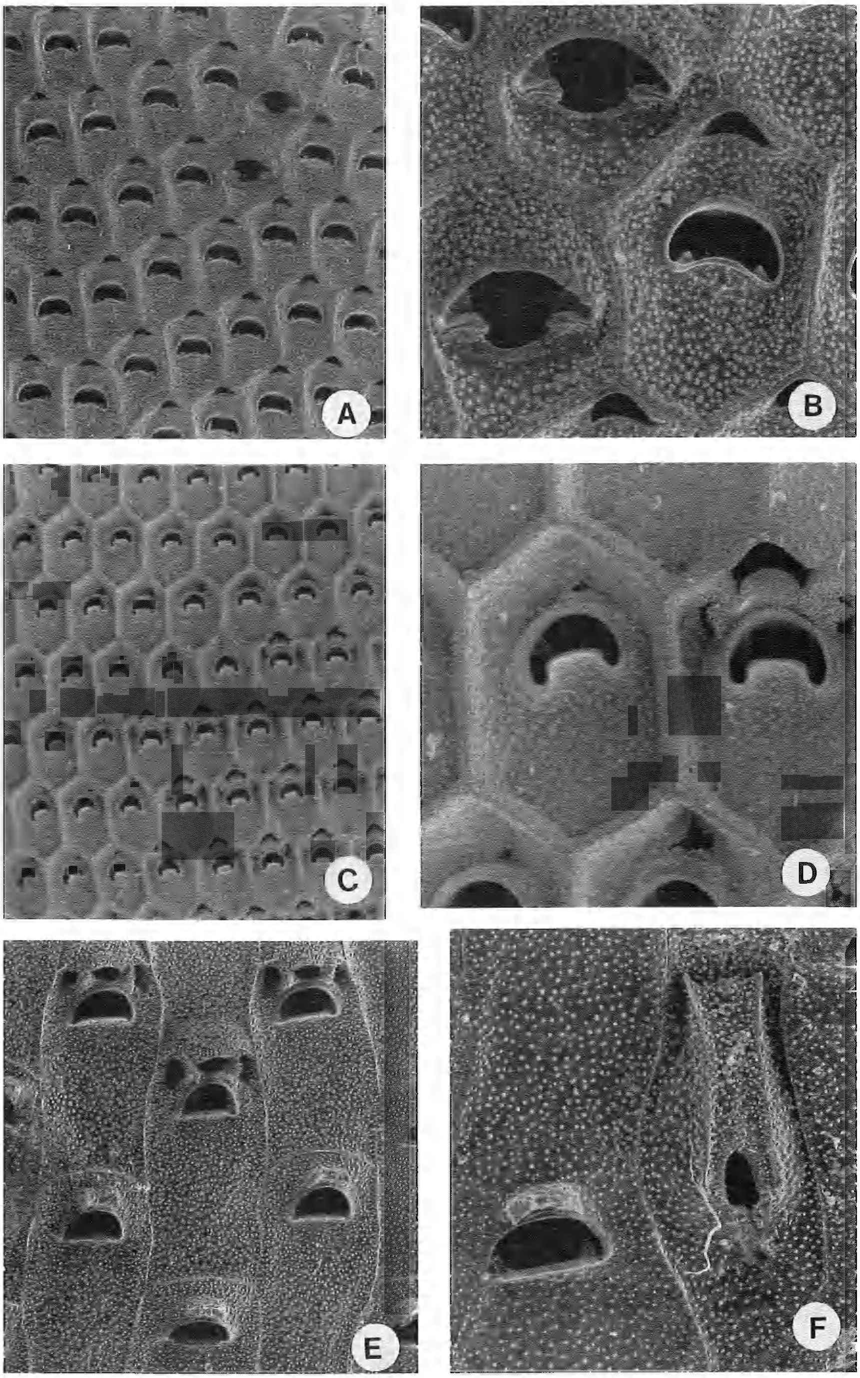


Fig. 128. A, B. *Melicerita flabellifera.* Low Id., Antarctic Peninsula. A. Portion of colony; ×26. B. Detail showing avicularia; ×80. C, D. *Melicerita obliqua.* Discovery Stn. 175, South Shetland Is. C. Part of colony; ×12. D. Detail showing an ovicell; ×50. E, F. *Larvapora mawsoni.* Discovery Stn. 170, South Shetland Is. E. Group of autozooids, three with ovicells; ×22. F. Autozooid and avicularium; ×40.

30 mm across the growing edge. Autozooids hexagonal, flat, separated by raised ridges, 0.5–0.55 × 0.3–0.35 mm. Opesia relatively large, two-thirds width of autozooid, reniform, with a rounded proximal lip; a conspicuous triangular denticle in each proximal corner. Ovicell aperture relatively large, equivalent to half width of opesia; crescentic, with its distal edge projecting slightly. Avicularia frequent, conspicuous; vicarious, each as large as an autozooid, rostrum projecting from frontal plane, 0.3 mm wide, with a broad, crescentic mandible. Each edge of the fan-shaped colony consists of a single linear series of zooids, either normal autozooids or simple kenozooids with tiny central foramina; both autozooids and kenozooids give rise to tubular rhizoids which pass basally, closely applied to the edges of the fan, to form a stalk-like bundle proximally attaching it to the substratum.

This distinctive species is presently known from a single locality off Low Island, in the Palmer Archipelago.

Melicerita latilaminata Rogick — Fig. 126D

Melicerita latilaminata Rogick 1956d: 248, pl.10, figs.B–J; pl.11, figs.A–F

Melicerita latilaminata: Moyano 1969: 57, pl.7, fig.34; Androsova 1972a: 98; Hayward and Thorpe 1989b: 951, fig.14A.

Colony forming thin, flat, dichotomously branching blades; exceeding 22 mm height, with a maximum width of 7 mm. Autozooids hexagonal, flat, separated by thin raised ridges; in transverse rows which curve slightly towards colony margins. Cryptocyst not markedly depressed, slightly concave medially, becoming convex towards opesia, and towards proximal end. Opesia in distal half of autozooid, narrowly crescentic, half width of autozooid, but only about one-tenth as long; proximal rim convex, slightly raised, forming a distinct lip; a stout, blunt denticle in each proximal corner, but no distal denticles. Ovicell aperture crescentic, about one-third width of opesia, at extreme distal end of autozooid. Interzooidal avicularia infrequent, cystid occupying about half area of an autozooid, irregularly quadrilateral or polygonal; rostrum semicircular, acute to frontal plane, supporting a narrow, semielliptical mandible.

Melicerita latilaminata is an endemic Antarctic species, presently known from the Ross Sea, the Palmer Archipelago and the South Shetland Isles.

Melicerita obliqua (Thornely) — Fig. 128C,D

Aspidostoma obliquum Thornely 1924: 16, fig.4

Pseudocellaria obliqua: Livingstone 1928: 42

Melicerita obliqua: Rogick 1956d: 250, pl.11, figs.G–I; Androsova 1972a: 98, figs.3–5; Winston 1983: figs.2,5,9; Hayward and Thorpe 1989b: 952.

Colony forming a thin, flattened, sabre-like rod, curved to a variable extent; unbranched, although Androsova (1972a) reported short, lateral offsets in some specimens; reaching a length of at least 100 mm, with a width of up to 14 mm; typically ridged transversely with presumed growth checks, at intervals of 5–6 mm. Autozooids regularly hexagonal in middle regions of branch, less so laterally as autozooid rows curve towards colony margins, terminating with larger or smaller autozooids, or small kenozooids. Cryptocyst coarsely granular; deeply concave between raised and prominent lateral walls in early ontogeny, thicker and less concave in later ontogeny; frontal membrane brown, distinct. Opesia situated in distal half of autozooid; narrowly crescentic; half width of autozooid, one-fifth as long, proximal lip angular and reflected. Towards colony margins the opesia is increasingly orientated acute to the long axis of the autozooid. Ovicell aperture about two thirds width of opesia, in the form of a narrow, medially peaked slit. No avicularia.

M. obliqua is an endemic species widely distributed in Antarctic waters, and extending north as far as Signy Island. It seems to be particularly abundant in the Ross Sea; Winston (1983) studied the ecology and reproductive biology of *M. obliqua* from this region of Antarctica.

ASPIDOSTOMATIDAE Jullien, 1888

Colony encrusting; or erect, attached to the substratum by an encrusting base. Typically heavily calcified: lacking gymnocystal calcification; cryptocyst underlying whole of frontal membrane, the opesia scarcely larger than the operculum. Interzooidal avicularia present. Spines absent. Ovicell recumbent or immersed, its aperture distant from the autozooid orifice.

Aspidostoma Hincks, 1881

Colony encrusting; or erect, cylindrical or bilaminate, branching or plate-like, always attached by a thick base of encrusting autozooids. Thickly calcified; autozooids with extensive, granular cryptocyst, extending distal to the opesia, where it is typically produced as stout, cervicorn or knob-like processes; with few, scattered frontal pores. Opesia small, typically comprising less than one-quarter total autozooid length, distal lip thickened, reflected in some species, often with a pronounced median ridge proximal to it. Avicularia sparsely developed, interzooidal, with characteristic shape for each species. No oral spines. Ovicell globular, recumbent on distally succeeding autozooid and sometimes partially immersed; aperture well distal to autozooid opesia, framed proximally by a stout bar. Vertical walls of autozooids with small, simple, recessed septula. Kenozooids present in some species, contributing to colony architecture.

Type species: *Aspidostoma crassum* Hincks, 1881 = *Eschara gigantea* Busk, 1854.

Aspidostoma is an ancient genus with few living representatives; fossil species are known from Tertiary deposits of Patagonia, Australia and New Zealand (Brown 1952), but its reported occurrence in Cretaceous sediments seems to be based on Canu's (1900) revision of some of d'Orbigny's specimens, which perhaps should be re-examined. The type species, *A. giganteum* is widely distributed in the south-west Atlantic, from Magellan Strait to the Falkland Isles, and across much of the southern Patagonian Shelf; it has also been reported from Gough Island, and ranges south to the South Shetland Isles, which is perhaps the limit of its distribution in Antarctic waters. *A. coronatum* appears to be endemic to the Antarctic. Elsewhere, *Aspidostoma livida* Hayward and Cook is presently known only from western South Africa, and *A. cylindricum* Harmer from Indonesia, while Gordon (1984) described some fragments possibly referable to *Aspidostoma* from western New Zealand.

Key to Antarctic species

1. Colony encrusting. Proximal lip of opesia arched and thickened, but not reflected; developing a pronounced subopesial ridge in later ontogeny .... *A. coronatum*

   Colony erect, but often with a broad, spreading base of encrusting autozooids. Proximal lip of opesia reflected and thickened, with anvil-like shape .... *A. giganteum*

Aspidostoma giganteum (Busk) Fig. 129A,B

Eschara gigantea Busk 1854: 91, pl.99, fig.3
Aspidostoma crassum Hincks 1881: 160, pl. 10, fig.6
Aspidostoma gigantea: Jullien 1888: 77, pl. 6, figs.5,6; Calvet 1904b: 19
Aspidostoma giganteum: Waters 1905: 243, pl.29, figs.1–3; López Gappa 1977: 179, pl.1, figs.1–3

Colony rising from a broad, spreading base of encrusting autozooids; forming erect, bilaminate, irregularly branching

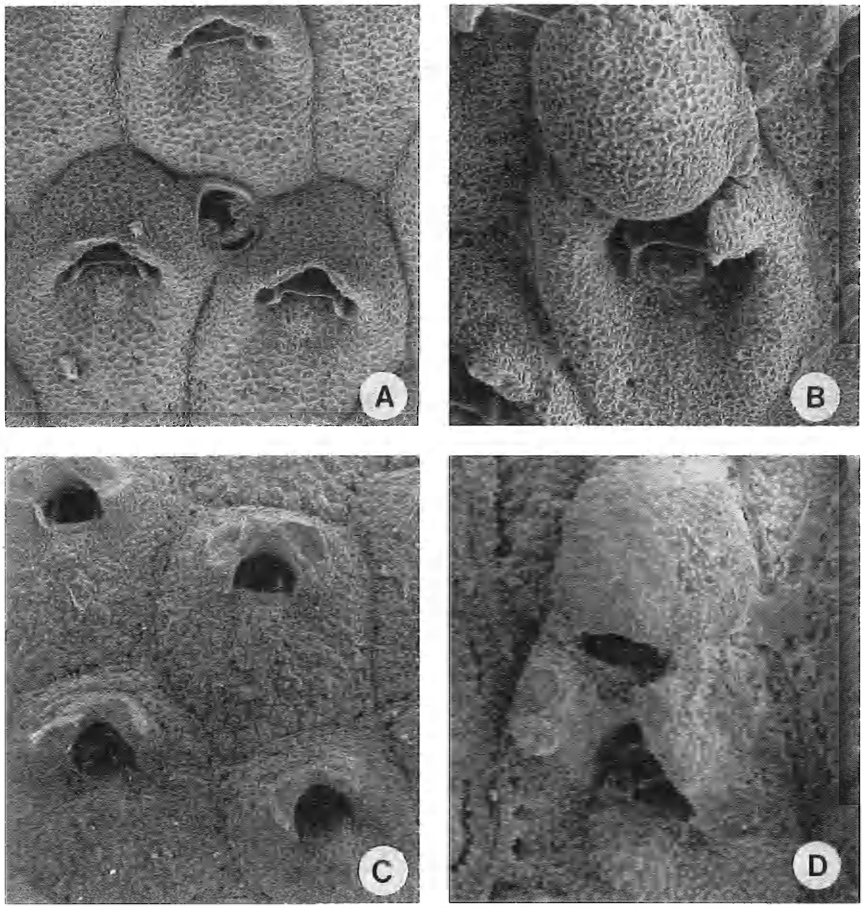


Fig. 129. A, B. *Aspidostoma giganteum.* Discovery Stn. WS867, Patagonian Shelf. A. Autozooids and an avicularium; ×40. B. Ovicelled autozooid; ×50. C, D. *Aspidostoma coranatum.* Discovery Stn. 170, South Shetland Is. C. Group of autozooids; ×27. D. Ovicelled autozooid; ×55.

and anastomosing growths up to 10 cm high. Branches flat, very variable: slender, dichotomously branching in one plane, or irregularly curved and twisted, forming numerous anastomoses, or developed as stout, folded plates. Autozooids hexagonal, convex, separated by distinct grooves, 1.0–1.7 × 0.7–0.8 mm; calcification thick and granular, with a regular, shagreened appearance, a few scattered frontal pores visible in early ontogeny. Opesia 0.2 mm long; proximal lip raised and thickened, notched on each side where the depressor muscles of the frontal membrane pass, with the central region reflected, straight-edged, and thus appearing anvil-shaped; distal corners of lip continuous with inconspicuous ridges of calcification which descend steeply to the basal wall, thus delimiting paired opesiular channels. Cryptocyst concave immediately proximal to the opesia, though with a slight ridge developing in later ontogeny. Cryptocyst raised distal to the opesia, forming a projecting hood, typically with paired disto-lateral process, often bifurcate or cervicorn, curving frontally and medially above the opesia. Small interzooidal avicularia sparsely distributed throughout colony, each developed at the confluence of the autozooids; 0.3 mm long, the rostrum broadly triangular, with stout condyles, mandible broad, bluntly triangular. Ovicell longer than wide, globular, prominent; imperforate, with narrow, transversely oval aperture.

Colony form is very variable in this species, perhaps responding to local hydrodynamic factors. In branched or anastomosing forms, the edges of the branches tend to be formed from irregularly shaped kenozooids, or normal sized autozooids with obliterated orifices. *Aspidostoma giganteum* occurs on coarse grounds in shelf waters. It is widespread and common over much of the southern Patagonian Shelf; it ranges from the western end of the Magellan Strait to the Falkland Isles, and as far south as the South Shetland Isles. Busk (1884) recorded it from Tristan da Cunha, and it has also been collected from Gough Island.

Aspidostoma coronatum (Thornely) Fig. 129C,D

Mucronella coronata Thornely 1924: 15, text fig. 3
Chaperia coronata: Livingstone 1928: 16, pl.2, figs.1–3, text fig. 2

Colony encrusting, developing broad, thick sheets. Autozooids broadly hexagonal or rectangular, flat or slightly convex, bounded by well-marked sutures, 0.85–1.1 × 0.7–1.0 mm; calcification thick, irregularly nodular, with a few scattered frontal pores, and more distinct marginal pores. Opesia 0.2 mm long; proximal lip slightly concave, arched frontally but not reflected; on each side, a slender, conspicuous ridge descending obliquely towards the distal autozooid wall, delimiting paired opesiular channels. Cryptocyst distinctly convex proximal to opesia, thickening in later ontogeny to form a pronounced longitudinal ridge. Cryptocyst distal to opesia raised into a projecting hood, with paired disto-lateral processes, typically branched and cervicorn. Avicularia very sparsely developed, at the intersection of three autozooids; rostrum elongate triangular with stout condyles, supporting a slender triangular mandible. Ovicell longer than wide, prominent, imperforate, with narrow, transversely oval aperture. Irregularly shaped kenozooids occur sporadically, as do both autozooids and avicularia with apertures sealed by thickened calcification.

The projecting, cervicorn processes distal to the opesia are very characteristic, but are often broken short. *A. coronatum* forms extensive nodular sheets on a variety of hard substrata. It is known from the Ross Sea, from Commonwealth Bay, and from the South Shetland Isles, but has been collected on very few occasions.

Larvapora Moyano, 1970

Colony erect, bilaminar, brittle, forming irregularly folded sheets, or narrow, dichotomizing branches; attached by an encrusting base. No gymnocystal calcification; cryptocyst entire, imperforate; opesia reduced, coincident with operculum, with paired, proximal condyles. Avicularia vicarious. No spines. Ovicell immersed, with aperture independent of autozooidal aperture. Multiporous and uniporous septula present.

Type species: *Cellaria mawsoni* Livingstone, 1928.

Larvapora mawsoni (Livingstone) Fig. 128E,F

Aspidostoma giganteum: Thornely 1924: 16
Cellaria mawsoni Livingstone 1928: 32, pl.4, figs. 3,5, pl.6, fig.4, text fig. 5
Larvapora mawsoni: Moyano 1970c: 157, fig.3 (7–11), fig.4 (12–14); Hayward and Taylor 1984: 72; Hayward and Thorpe 1989b: 950, fig.13A,B.

Colony forming folded, bilaminar sheets, or slender, dichotomously branching growths, attached by encrusting sheets of autozooids; up to 5 cm high, with plate-like forms often exceeding 10 cm^2. Autozooids elongate, rectangular, separated by thin raised ridges, 1.1–1.5 ×

0.65–0.8 mm. Cryptocyst flat, finely granular; opesia semicircular, half width of autozooid, but only one-tenth as long; distal border raised, forming a projecting hood, typically with a pair of short, lobed or branched processes; proximal border straight, with a prominent lip and a short, blunt condyle in each corner. Avicularia sporadic, developed at bifurcation of autozooid rows, almost as large as autozooid but tapered proximally; rostrum slender, almost parallel-sided, raised, with a small oval opesia; supporting a narrow, distally rounded mandible. Ovicell immersed, but convex frontally and quite prominent; aperture narrow, transversely oval, divided by two longitudinal, calcified struts.

This endemic Antarctic species has been recorded from Queen Mary Land, Adelie Land and the Ross Sea, and from stations in the Bellingshausen Sea and through the Palmer Archipelago. It ranges northwards to South Georgia.

CRIBRILINOIDEA HINCKS, 1879

CRIBRILINIDAE HINCKS, 1879

Colony encrusting or erect. Frontal surface of autozooid with a shield formed from flattened spines (costae) arched above the frontal membrane and fused along the midline. Costae fused laterally to a greater or lesser extent, with small pores or larger lacunae between, allowing the passage of water into the epistege — the space between the shield and the underlying frontal membrane. Some genera with uncalcified spots (pseudopores or pelmata) on the surfaces of the costae. Gymnocyst variably developed proximally and laterally to the costate frontal shield. Avicularia present or absent, adventitious, vicarious and/or interzooidal. Oral spines present or absent. Ovicell hyperstomial. Pore chambers and/or mural septula present.

Dendroperistomata Moyano, 1985

Colony encrusting. Frontal shield of autozooid formed from numerous fine costae, each with many intercostal fusions, separated by small, round lacunae, and thus appearing as a regularly perforated shield; inconspicuous pelmata present, varying in frequency and distribution. Aperture transversely oval, enveloped by a raised peristome formed from the fusion of flattened, spinous processes, united by grossly thickened, distalmost pair of costae. Small adventitious avicularia present infrequently, budded from the proximal end of the autozooid. Ovicells unknown. Conspicuous basal pore chambers present.

Type species: *Cribrilina projecta* Waters, 1904.

Dendroperistomata projecta (Waters) Fig. 130A

Cribrilina projecta Waters 1904: 41, pl.2, fig.14a–d

Cribrilina projecta: Androsova 1972b: 336, fig.12; Moyano 1984b: 54, figs.11–13, 27–29, 32

Dendroperistomata projecta: Moyano 1985a: 85, pl.8, figs.4,6.

Autozooids broadly hexagonal to oval, rather flat, with indistinct boundaries; 0.85–1.1 × 0.6–0.9 mm. Frontal shield formed from 22–30 slender costae, with about 11–13 small, round, intercostal pores in each complete transverse series; pelmata small and inconspicuous, rather infrequent, mostly present on the central area of the shield. Peristome formed by the fusion of the distalmost pair of costae, together with six flattened, distal oral spines, closely fused, and subdivided apically to give a denticulate appearance to rim. Avicularia 0.2 mm long, sporadic, developed at the proximal ends of the autozooid, single or paired, sometimes intimately associated with peristome of preceding autozooid; rostrum slender, acuminate, with variable orientation, lacking both crossbar and palate.

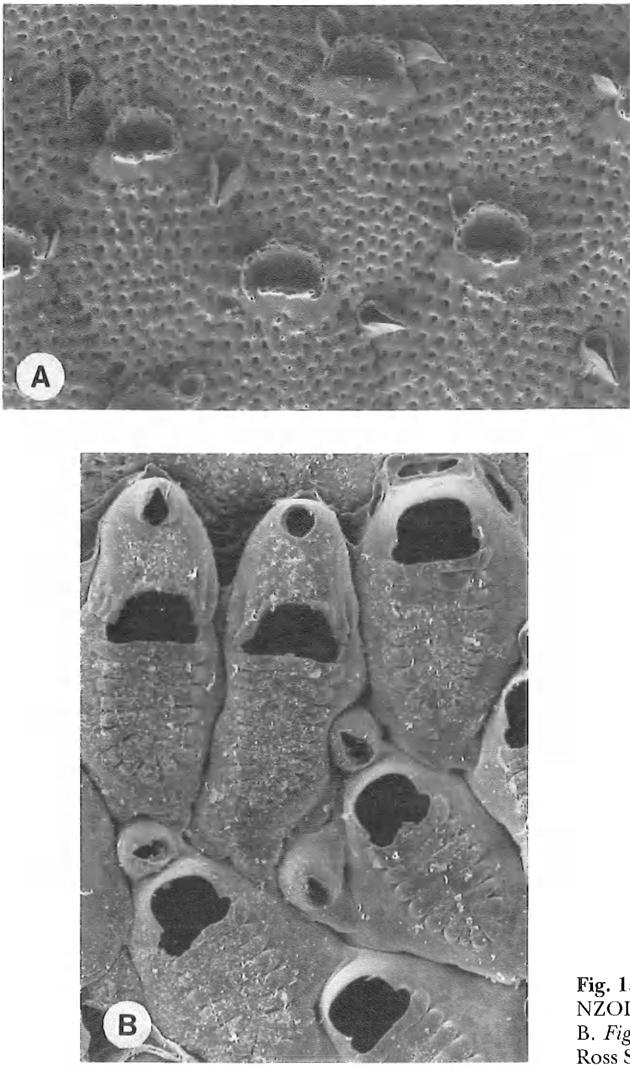


Fig. 130. A. *Dendroperistomata projecta.* NZOI Stn. E176, Ross Sea; ×35. B. *Figularia discors.* NZOI Stn. E177, Ross Sea; ×50.

Dendroperistomata projecta forms flat, unilaminar sheets on hard substrata, particularly hydrocorallines and erect Bryozoa. It is known from South Georgia, the South Sandwich and South Shetland Islands, the Weddell Sea, the Bellingshausen Sea, the Ross Sea, and the coasts of Adelie Land. It is an endemic Antarctic species.

Figularia Jullien, 1886

Colony encrusting, unilaminar. Autozooids with well-developed gymnocyst, and extensive costate frontal shield; costae fused medially, and at intervals along their length, with a few irregular pores between points of fusion, and with one or more pseudopores on each. Aperture rounded-quadrangular; operculum pivoting on lateral condyles, not hinged against distal edge of frontal shield, frequently compound, with a transverse line of flexure at the level of the condyles. Oral spines present or absent. Avicularia vicarious, usually of similar size to autozooids; or interzooidal. Ovicell hyperstomial, prominent, closed by autozooidal operculum; usually with a disto-proximal, median suture and few, large pores, or larger fenestrae. Vertical walls with uniporous or multiporous septula. Ancestrula tatiform.

Type species: *Lepralia figularis* Johnston, 1847.

Figularia discors Hayward and Taylor Fig. 130B

Figularia discors Hayward and Taylor 1984: 74, fig.1A

Colony a small, rounded patch. Autozooids oval to hexagonal, steeply convex, separated by deep grooves, with a broad border of gymnocystal calcification; 0.7–0.8 × 0.4–0.5 mm. Costate frontal shield occupying about two-thirds total length, consisting of eight to ten pairs of flat costae, closely fused along all edges. Aperture about as wide as long, distinctly bell-shaped; no oral spines. Avicularia interzooidal, cystid 0.15 mm diameter, budded from the distal pore-chamber of the autozooid; rostrum acute to frontal plane, disto-laterally directed, with short triangular mandible. Brooding autozooids with dimorphic operculum, almost twice as wide as long; ovicell elongate oval, with an indistinct, longitudinal, frontal carina, and a large frontal fenestra on each side.

Figularia discors has been collected only from the Ross Sea, encrusting rock or other, erect, bryozoans.

Filaguria Moyano, 1991

Colony encrusting. Autozooids with extensive costate frontal shield, the costae fused laterally at just one or two points, with large intercostal lacunae between; small pelmata present. Oral spines present. Avicularia vicarious, large; proximal half of frontal surface occupied by a costate shield, distal half with a projecting rostrum. Ovicell hyperstomial, with a longitudinal median ridge, and a pair of small frontal fenestrae; closed by autozooid operculum. Vertical walls of autozooid with mural septula.

Type species: *Cribrilina spatulata* Calvet, 1909.

Filaguria spatulata (Calvet) Fig. 131A–C

Cribrilina spatulata Calvet 1909: 9, pl.2, figs.1–3

Figularia spatulata: Livingstone 1928: 47, pl.2, fig.6; Moyano 1966a: 117; Androsova 1972a: 96; 1972b: 337; Moyano 1984b: 55, figs.10,36,37.

Filaguria spatulata: Moyano 1991: 383, pls.8,9

Colony developing small, irregular patches. Autozooids oval to hexagonal, elongate, separated by deep grooves; 0.6–0.9 × 0.3–0.4 mm. Gymnocyst smooth, imperforate, comprising about one-quarter total autozooid length; frontal shield consisting of about 20 flattened costae, not touching around the edges of the shield, but fused medially, and at one or two points along their length, leaving slit-like pores between. Four or five short, stout oral spines present, cylindrical or spatulate, the proximal pair, usually conspicuously spatulate, persisting in ovicelled autozooids. Avicularia rare, frequently lacking altogether; as large as an autozooid, but with a reduced frontal shield, comprising less than half autozooid length; rostrum slightly acute to frontal plane, supporting a semielliptical mandible 0.3 mm long. Ovicell elongate oval, with a conspicuous, ridged, longitudinal median suture, and on each side a single, small fenestra.

Filaguria spatulata forms small, opaque white encrustations, most especially on algae and other erect substrata, such as bryozoans, hydroids and hydrocorallines. It is known to occur from the South Shetlands to Graham Land, the Palmer Archipelago and the Bellingshausen Sea, and has been reported also from the Ross Sea and the coasts of Adelie Land.

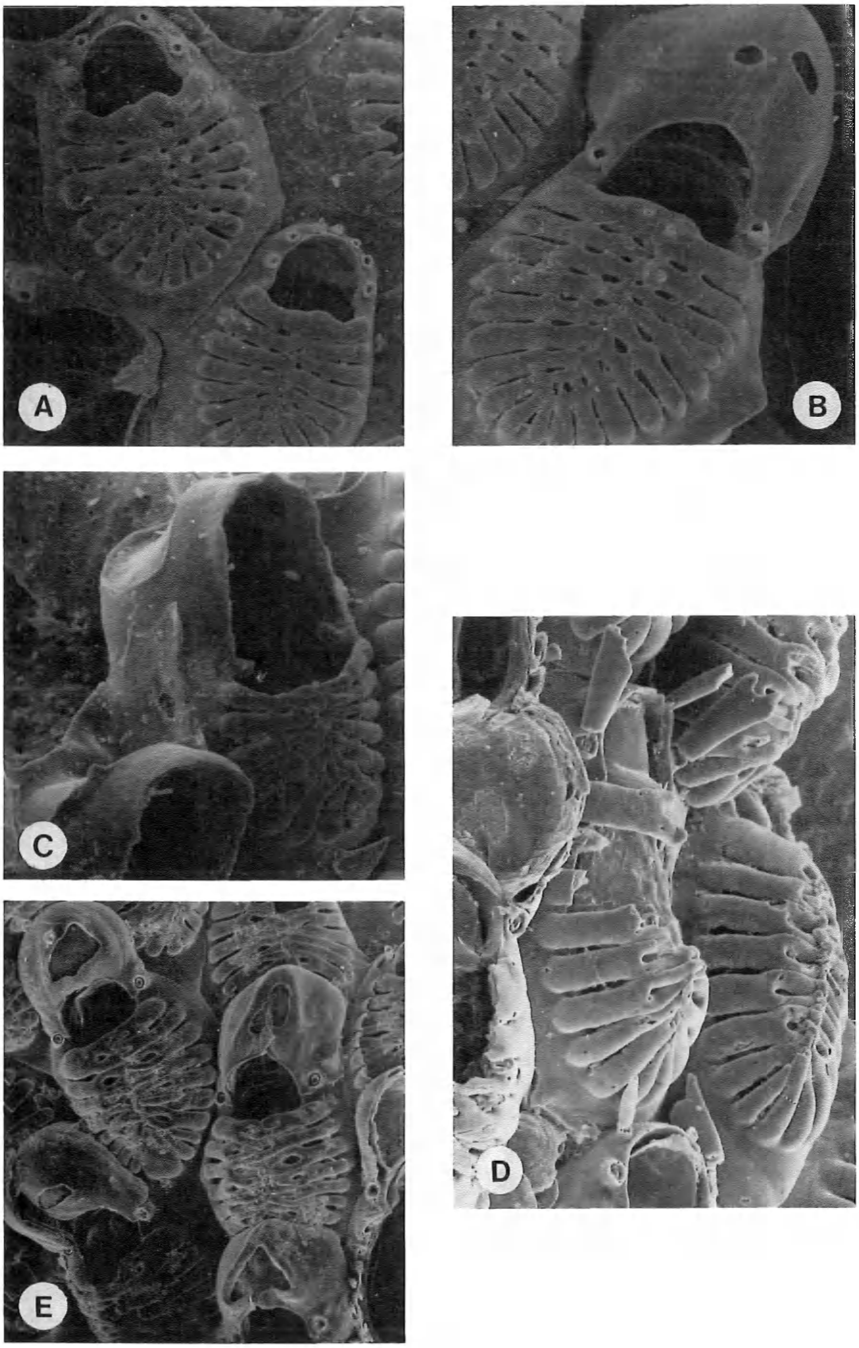


Fig. 131. A–C. *Filaguria spatulata.* NZOI Stn. E185, Ross Sea. A. Autozooids; ×80. B. Ovicelled autozooid; ×100. C. An avicularium; ×100. D, E. *Klugerella antarctica.* NZOI Stn. E185, Ross Sea. D. In profile, showing spatulate spines; ×80. E. Ovicelled autozooids; ×40.

Klugerella Moyano, 1991

Colony encrusting. Autozooids with frontal shield formed from bifurcate costae, overlapping and fused along the midline, but with few lateral fusions. No pelmata. Gymnocyst reduced. Oral spines present. Avicularia vicarious, sporadic, sometimes absent; with costate shield occupying proximal half of frontal surface, linguiform rostrum occupying distal half. Ovicell hyperstomial, closed by autozooid operculum; ectooecium with large frontal foramen. Vertical walls with mural septula. Ancestrula tatiform.

Type species: *Membraniporella antarctica* Kluge, 1914.

Klugerella antarctica (Kluge) Fig. 131D,E

Membraniporella antarctica Kluge 1914: 677, pl.33, fig.7
Membraniporella antarctica: Moyano 1966a: 117; 1984b: 57, figs.14,15,30,31,35
Klugerella antarctica: Moyano 1991: 376, pl.7

Colony encrusting, unilaminar. Autozooids oval, steeply convex, separated by deep grooves; 0.6–0.7 × about 0.35 mm. Frontal shield comprising eight to ten pairs of flattened, hollow costae, each bifurcate distally and fused only along the midline of the autozooid; a narrow marginal band of smooth gymnocystal calcification present. Aperture as wide as long, with four widely spaced oral spines, the proximal pair often spatulate or bifurcate, and persisting in ovicelled autozooids. Avicularia rare, often absent; as large as autozooids, half frontal length occupied by costate shield, with a raised, linguiform, rostrum occupying distal half. Ovicell hyperstomial, elongate, the ectooecium with a large uncalcified frontal area, typically bordered by a raised rim.

This rather inconspicuous species is known from just a few localities, on the Kaiser Wilhelm Coast, off the South Shetlands, and in the Ross Sea.

ARACHNOPUSIOIDEA Jullien, 1888

ARACHNOPUSIIDAE Jullien, 1888

Colony encrusting; or erect, developing foliaceous, unilaminar or bilaminar sheets. Frontal wall of autozooid a spinocystal umbonuloid shield, with varying numbers of foramina, often with additional layers of secondary calcification. Oral spines present. Avicularia adventitious, vicarious or interzooidal; frequently more than one type in a single species. Ovicells present. Interzooidal communication via basal pore chambers or mural septula.

Arachnopusia Jullien, 1888

Colony encrusting; or erect, forming folded, plate-like or foliaceous sheets, unilaminar or bilaminar. Frontal shield variably developed: entire, with few or many foramina; or minimal, consisting of one or two spinous processes overarching frontal membrane. Characteristically with a thickened, projecting, proximal apertural bar bearing one to many avicularia. Distal and lateral oral spines present, one or more typically grossly enlarged; a thickened, flat or concave, apertural plate underlies distal portion of operculum. Adventitious avicularia present lateral to aperture, on the proximal apertural bar, and often elsewhere on the frontal shield; larger, adventitious or interzooidal, avicularia variably developed, usually sporadic. Ovicell hyperstomial, recumbent, with frontal area of uncalcified ectooecium; budding from a frontal septulum on the distally succeeding autozooid, indicating its individual polymorphic identity, closed by an operculate ooecial vesicle; developing an aviculiferous ooecial cover. Large mural septula present in lateral vertical walls; frontal septula also present.

Type species: *Lepralia monoceros* Busk, 1854.

Arachnopusia is a richly speciose genus widely distributed in the temperate and polar waters of the southern hemisphere. Most species occur in shallow, shelf seas, encrusting hard substrata, most especially biogenic carbonates. Antarctic and Subantarctic species have been described by Moyano (1970b) and Hayward and Thorpe (1988c), while Gordon (1984, 1989a) has given good accounts of New Zealand species. Brown (1952) describes Tertiary fossil species from New Zealand. Among Antarctic and Subantarctic faunas, some distinctive species are readily recognizable but identification of others can be difficult and depends on the morphology of the subopercular apertural plate, the number of oral spines and the disposition of lateral oral and subapertural avicularia. All of these features are best seen in cleaned autozooids close to the colony growing edge.

Key to Antarctic species

1. Autozooids with membranous frontal surface, the frontal shield reduced to two or three short, flat processes, each issuing from the base of an avicularium. Oral spines paired, one grossly enlarged, sabre-like, exceeding 1 mm length .... *A. gigantea*

   Autozooids with perforated frontal shield 2
2. Apertural plate – visible at distal end of autozooids close to growing edge — broad, flat or only slightly concave 3

   Apertural plate deeply concave, narrow, often thickly calcified ... 4
3. Frontal shield of autozooids with 10–15 round foramina, some with a short, digitate ligula. Three spines present, one remaining conspicuous in late ontogeny. Aperture symmetrical. Ovicell with a narrow frontal band of entooecium exposed frontally .... *A. monoceros*

   Frontal shield of autozooids with 15–25 round foramina, each occluded by a round ligula and appearing reniform. Two spines present, neither visible in late ontogeny. Aperture transversely oval in later ontogeny, and frequently asymmetrical. Ovicell with triangular area of entooecium exposed frontally .... *A. tubula*
4. Frontal shield with slit-like foramina. No spines. Lateral-oral avicularia large, with short, broadly triangular mandibles; one usually grossly enlarged, its cystid almost as long as autozooid.. *A. latiavicularis*

   Frontal shield with rounded foramina. One or more spines at distal end of young autozooids (may be lost later). Lateral-oral avicularia small or large, but with narrow, acuminate mandibles; never as long as autozooid 5
5. Each autozooid with three large avicularia developed in association with the aperture: one median, subapertural, perpendicular to frontal plane; paired lateral oral, acute to frontal plane. All three with elongate triangular rostrum, sharply hooked at tip 6

   One to many apertural avicularia; all small, triangular, without hooked tips 7
6. Frontal shield with 20–30 small foramina. Three spines present in young autozooids, the most proximal grossly enlarged—up to 2 mm long—and persisting in late ontogeny. Ovicell with broad, transverse band of entooecium exposed frontally .... *A. ferox*

   Frontal shield with 10–14 large foramina. A single short spine present, persisting in late ontogeny but not projecting far above aperture rim. Ovicell with a triangular area of entooecium exposed frontally .... *A. aquilina*

7. Proximal rim of aperture with a projecting fan of up to eight small, columnar avicularia. Ooecial cover with up to five (or more) similar avicularia. Much larger avicularia, up to 0.45 mm long, with triangular, hooked rostrum, sometimes frequent. Only one distal spine per autozooid .... *A. aviculifera*
   Proximal rim of aperture with one small avicularium medially; sometimes one or two adjacent to this, but never with a projecting fan. Two or more spines per autozooid 8
8. Avicularia dimorphic: small, up to 0.15 mm long, on frontal shield or associated with aperture; large, 0.3 mm long, often surmounting an ovicell. Two or three slender spines in young autozooids, the single proximal spine just visible in late ontogeny .... *A. inchoata*
   Avicularia monomorphic, small. Three or four stout spines in young autozooids 9
9. Frontal shield with seven to 12 foramina. Three or four stout spines, often longer than autozooid; all persisting in later ontogeny, with the most proximal particularly conspicuous. Aperture with one median subapertural avicularium, and one or two additional avicularia on the adjacent apertural rim. Short columnar avicularia present on frontal shield .... *A. columnaris*
   Frontal shield with five to eight foramina. Four spines present in young autozooids, one or both of the proximal pair persisting but scarcely projecting above the aperture rim. A single median subapertural avicularium; others present on ovicell or frontal shield, but only rarely on aperture rim .... *A. decipiens*

Arachnopusia monoceros (Busk) Fig. 132,A,B

Lepralia monoceros Busk 1854: 72, pl.93, figs.5,6

Arachnopusia monoceros: Moyano 1970b: 265, pl.4, figs.16–18; Hayward and Thorpe 1988c: 776, Fig.1A–D

Colony encrusting, frequently developing loosely attached, folded or enrolled, unilaminar sheets. Autozooids oval to hexagonal, strongly convex, with distinct boundaries; 0.7–0.85 × 0.35–0.45 mm. Frontal shield with 10–15 rounded foramina, many with a small ligula, which may subdivide the foramen in later ontogeny. Aperture as wide as long, appearing distinctly quadrangular. Apertural plate well developed, slightly wider than long, flat, with a rounded proximal edge. Three oral spines present in early ontogeny, only the single proximal spine persisting, and appearing to rise from the aperture rim rather than projecting from within it. Lateral oral avicularia paired (rarely, single), one tilted towards aperture and directed proximally, the other clearly situated outside the aperture rim and directed proximo-laterally. Proximal edge of aperture gently arched, with a single, median avicularium, distally directed, acute to frontal plane. Similar small avicularia sporadically present on the frontal shield or the ooecial cover. Larger avicularia frequent, developed on proximo-lateral margins of autozooid, proximally directed; rostrum 0.3 mm long, broadly scaphoid, supporting a bluntly triangular mandible. Even larger, interzooidal, avicularia occur infrequently, with broadly triangular mandible exceeding 0.3 mm length. Ovicell wider than long, with a broad, medially peaked, band of entooecium exposed frontally; developing a thick ooecial cover in later ontogeny, with one or two small avicularia (or surmounted by the rostrum of a larger avicularium), but remaining distinct.

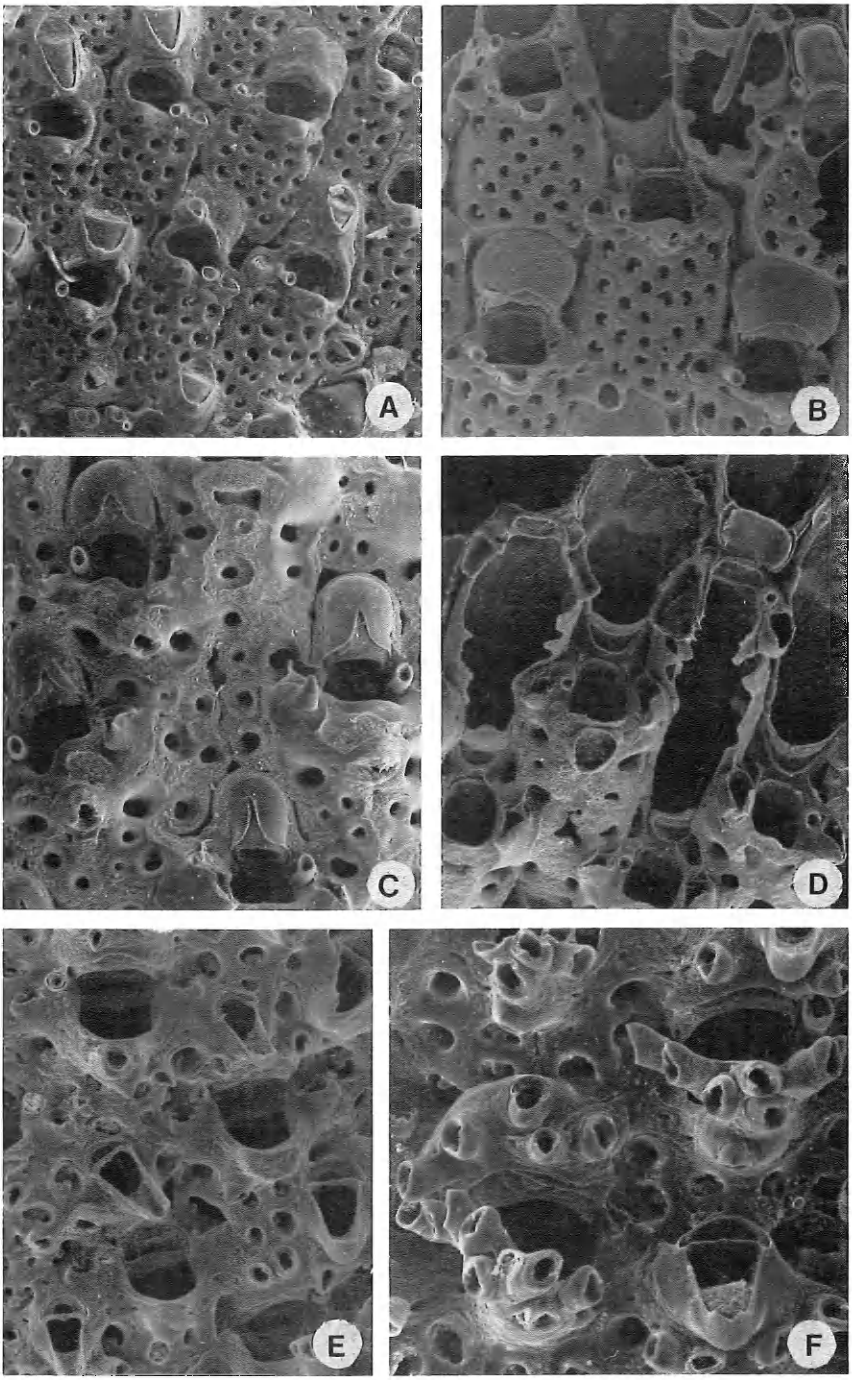


Fig. 132. A, B. *Arachnopusia monoceros*. Discovery Stn. 1563, Marion Id. A. Autozooids, with ovicells and avicularia; ×30. B. Autozooids at growing edge; ×40. C, D. *Arachnopusia aquilina*. Terra Nova Stn. 194, off Oates Land. C. Ovicelled autozooids; ×30. D. Autozooids at growing edge; ×26. E, F. *Arachnopusia aviculifera*. Discovery Stn. 140, South Georgia. E. Group of autozooids; ×32. F. Two ovicelled autozooids, with well developed avicularia; ×45.

Arachnopusia monoceros was considered by Hayward and Thorpe (1988c) to be a strictly magellanic species (*sensu* Moyano 1982), with a geographical range encompassing southern Chile, Tierra del Fuego and the Magellan Strait, the Falkland Isles and the southern Patagonian Shelf, and extending eastwards to the Marion Island group. Antarctic records of this species should be regarded with doubt.

Arachnopusia aquilina Moyano Fig. 132C,D

Arachnopusia aquilina Moyano 1970b: 261, pl.1, figs.1–4; pl.2, figs.5–8
Arachnopusia aquilina: Hayward and Thorpe 1988c: 780, Fig.1E,F

Colony initially encrusting, unilaminar; developing erect, bilaminar sheets, folded or convoluted. Autozooids elongate, convex, with boundaries distinct only at the growing edge; 1.35–1.65 × 0.6–0.7 mm. Frontal shield thickly calcified, finely granular, with 10–14 variably and unequally sized foramina, each with a smoothly calcified rim. Aperture more or less quadrangular, proximal edge thickened and arched, with a triangular or quadrangular median lobe. Apertural plate wider than long, shallowly concave, with a straight or sinuous proximal edge. A single disto-lateral spine present, short, antenniform, oval in section; persisting in late ontogeny but not projecting far beyond rim of aperture. Lateral oral avicularia paired, equal-sized, or one much larger than the other; rostrum parallel to apertural plane, elongate-triangular, sharply hooked at tip, directed proximally or proximo-laterally. A single median, subapertural avicularium present; rostrum almost perpendicular to frontal plane, directed distally. Ovicell elongate oval, with a broad band of granular entooecium frontally, continued medio-distally below a narrow fissure in the ectooecium; later partly obscured by ooecial cover.

Arachnopusia aquilina probably develops substantial colonies, but only fragments have ever been collected. It is an endemic Antarctic species, reported from several localities around the South Shetland Isles, and from off Oates Land.

Arachnopusia aviculifera Hayward and Thorpe Fig. 132E,F

Arachnopusia aviculifera Hayward and Thorpe 1988c: 780, Fig.2A,B

Colony forming loosely attached, folded, unilaminar sheets, developing into erect, bilaminar plates. Autozooids rectangular, convex, with boundaries distinct only at growing edge; 0.9–1.1 × 0.45–0.6 mm. Frontal shield with seven to nine large foramina, each with a well-defined ligula; as the shield thickens in later ontogeny, the rims of two or more foramina may fuse to give as few as five, deep, smoothly rimmed pits. Aperture longer than wide, quadrangular. Apertural plate narrow, concave, coarsely granular, its proximal lip deep, smoothly calcified and slightly concave. A single disto-lateral spine, lacking in some autozooids, persisting in late ontogeny but not projecting far beyond aperture rim. Lateral oral avicularia single or paired, situated outside aperture rim, rostrum elongate triangular, strongly hooked at tip, directed proximally or proximo-laterally. Proximal edge of aperture strongly arched, median subapertural avicularium perpendicular to frontal plane, distally directed, surmounted by a fan of up to eight short, columnar avicularia, largely obscuring aperture in frontal view. Similar small avicularia present on frontal shield in older autozooids, often numerous. Larger avicularia developed sporadically along proximo-lateral borders of autozooids, each with strongly hooked, triangular rostrum, 0.45 mm long, acute to frontal plane and proximally directed. Ovicell spherical, with a narrow frontal rim of granular entooecium; ooecial cover developing in early ontogeny, bearing five or more small avicularia, each directed proximally towards the autozooidal aperture.

Loosely attached, unilaminar colonies of *A. aviculifera* tend to develop stout, basal processes, especially when overgrowing sponges and other uneven substrata. The prominent subapertural process, bearing a cluster of small avicularia, distinguishes this species from other Antarctic species of *Arachnopusia*. *A. triarmata* Hayward and Thorpe, which is known only from Marion Island, develops a similar process in later ontogeny, but has up to 30 small foramina piercing the autozooid frontal shield. *A. aviculifera* was described from abundant material collected around South Georgia, and is perhaps an endemic Antarctic species.

Arachnopusia columnaris Hayward and Thorpe Fig. 133A,B

Arachnopusia columnaris Hayward and Thorpe 1988c: 781, Fig.2D,E

Colony forming loosely encrusting, unilaminar sheets. Autozooids oval, convex, with boundaries distinct only at growing edges; 0.8–1.1 × 0.45–0.55. Frontal shield with seven to 12 large, irregular, foramina, rarely with small ligulae. Aperture as wide as long. Apertural plate narrow, thickened, deeply concave, the proximal edge deep, and longitudinally ridged. Three or four thick spines present, all as long as, or longer than the autozooid in early ontogeny; shorter in late ontogeny, with the most proximal spine protruding well above the aperture rim and particularly conspicuous. A single, small, lateral oral avicularium situated on aperture rim, tilted inwards towards operculum; mandible triangular. Proximal border of aperture strongly arched, its median portion straight; with a small, median, subapertural avicularium, the rostrum perpendicular to frontal plane, distally directed. An additional avicularium developed on one or both sides of the median, on a short columnar cystid, the rostrum variably orientated, but usually projecting over the aperture. Similar avicularia occur sporadically on the frontal shield, each on a short columnar cystid; typically, these develop in early ontogeny, budding from the tips of the struts which eventually fuse to form the frontal shield. Ovicell elongate oval, prominent, with a narrow frontal border of granular entooecium; ooecial cover initially with a single, median avicularium, proximally directed, but with one or two others developing later.

This species is known only from Port Lackroy, Wiencke Island, in the Palmer Archipelago, where it was collected from the low intertidal zone, encrusting stones. The frontal shield and apertural plate of *A. columnaris* recall those of *A. aviculifera*. However, *A. columnaris* lacks the large avicularia, and cluster of subapertural avicularia, seen in *A. aviculifera*, and is further distinguished by its three or four stout spines.

Arachnopusia decipiens Hayward and Thorpe Fig. 133C,D

Arachnopusia decipiens Hayward and Thorpe 1988c: 782, Fig.3A,B

Colony developing erect, folded, bilaminar sheets, attached by an encrusting base. Autozooids broad, rectangular, rather flat, with indistinct boundaries; 0.6–0.7 × 0.4–0.5 mm. Frontal shield with five to eight large, round foramina, some developing a tiny ligula. Aperture slightly wider than long. Apertural plate narrow, deeply concave, the proximal edge convex. Four short, thick spines visible in newly budded autozooids, one or both of the proximal pair persisting in later ontogeny, but scarcely projecting above aperture rim. Lateral oral avicularia single or paired, sometimes completely lacking; small, enclosed within distal angles of aperture and rather inconspicuous. Additional small avicularia, on short, columnar cystids, sporadically present on frontal shield, with variable orientation. Proximal edge of aperture arched, the median portion distinctly produced; with a single, small, median avicularium, and one or more additional avicularia developed on the adjacent aperture rim in later ontogeny. Ovicell elongate oval; with a broadly triangular area of granular ectooecium exposed frontally, later obscured by the ooecial

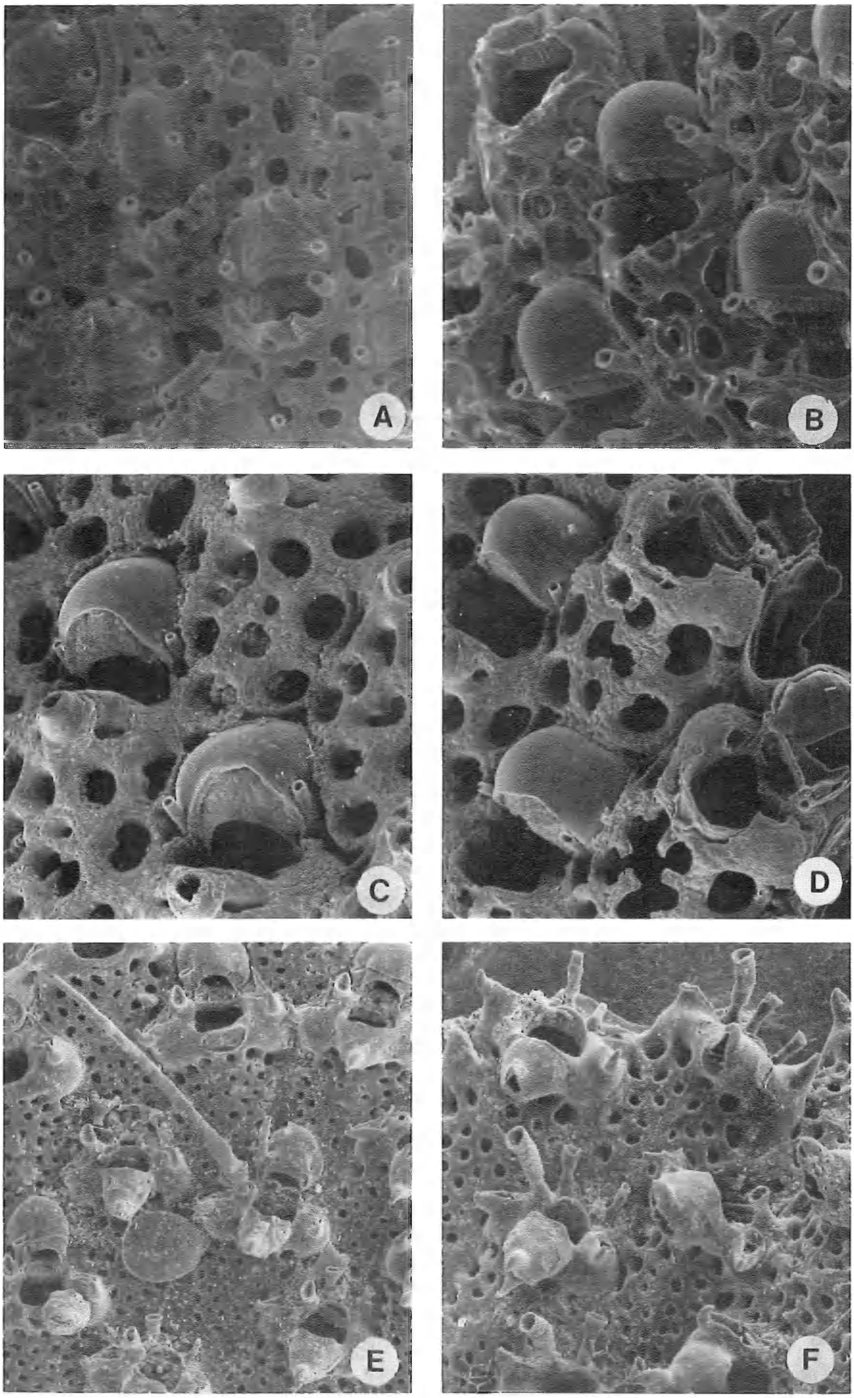


Fig. 133. A, B. *Arachnopusia columnaris.* Port Lackroy, Palmer Archipelago. A. Ovicelled autozooids; ×26. B. Autozooids at the growing edge; ×37. C, D. *Arachnopusia decipiens.* NZOI Stn. A534, Ross Sea. C. Ovicelled autozooids; ×55. D. Autozooids at the growing edge; ×50. E, F. *Arachnopusia ferox.* Discovery Stn. 1948, South Shetland Is. E. Ovicelled autozooids, with one long spine remaining; x21. F. Autozooids at the growing edge; ×31.

cover, which bears three or four short, columnar avicularia.

This species was described from the South Shetlands, the Palmer Archipelago, Oates Land and the Ross Sea, and possibly represents the species recorded from Antarctica by previous authors as *A. monoceros.*

Arachnopusia ferox Hayward and Thorpe — Fig. 133E,F

Arachnopusia ferox Hayward and Thorpe 1988c: 784, Fig.3F

Colony encrusting, forming loosely attached, unilaminar sheets. Autozooids oval to hexagonal, convex, separated by narrow borders of smooth calcification, less distinct in later ontogeny; 1.05–1.40 × 0.6–0.75 mm. Frontal shield perforated by 20–30 small, closely spaced, round foramina. Aperture slightly longer than wide; apertural plate narrow, deeply concave, the proximal edge thickened and slightly convex. Three distal oral spines present: tapered, antenniform, with slightly flattened section; proximal spine grossly enlarged, frequently exceeding length of autozooid; all spines persist in later ontogeny. Proximal edge of aperture thickened, arched, smoothly calcified; forming a prominent and conspicuous structure incorporating large, paired, lateral oral avicularia. Subapertural avicularium perpendicular to frontal plane, its elongate, hooked rostrum projecting from the apertural rim; lateral oral avicularia with similar, elongate triangular, sharply hooked rostrum, acute to frontal plane and directed proximo-laterally. Ovicell elongate oval, smooth surfaced, with a broad band of entooecium frontally, bordered by a ridge of ectooecium; remaining prominent, not immersed by an ooecial cover.

This species is distinguished from all other Antarctic species of *Arachnopusia* by its finely perforate frontal shield, its grossly enlarged proximal spine, and by its thickened apertural border, incorporating three large avicularia. At present it is known only from a single locality in the South Shetland Islands.

Arachnopusia gigantea (Kluge) — Fig. 134A,B

Membranipora gigantea Kluge 1914: 662, pl. 34, fig.5

Callopora gigantea: Androsova 1972b: 332; Hayward and Taylor 1984: 72

Arachnopusia gigantea: Hayward and Thorpe 1988c: 786, Fig.5C,D.

Colony forming broad, unilaminar encrusting sheets, growing freely to produce erect, lobed, bilaminar plates. Autozooids large, elongate oval to hexagonal, flat, separated by narrow grooves; 1.15–1.55 × 0.65–0.85 mm. Frontal surface entirely membranous; frontal shield represented by a few short, rounded processes projecting over the frontal membrane, each usually arising from the base of an avicularium. Apertural plate distinct, appearing as a narrow, curved, concave structure at the distal end of the autozooid. One pair of distal oral spines present: one of the pair short, thin and not persisting in later ontogeny, the other grossly enlarged, curved, tapered, sabre-like, exceeding 1 mm in length. Lateral oral avicularia typically paired, rarely single, of unequal size; rostrum acute to frontal plane, proximally directed, elongate triangular with a pronounced distal hook. Similar avicularia may occur elsewhere on the lateral walls of the autozooids, particularly where autozooid rows divide. Ovicell prominent, spherical, with a broad, frontal area of granular entooecium; not developing an ooecial cover.

Arachnopusia gigantea is an endemic Antarctic species, reported from the coasts of Australian Antarctic Territory, and from the Ross Sea. Its distinctive brownish colonies are often conspicuous encrusting the basal surfaces of other large, erect cheilostomates.

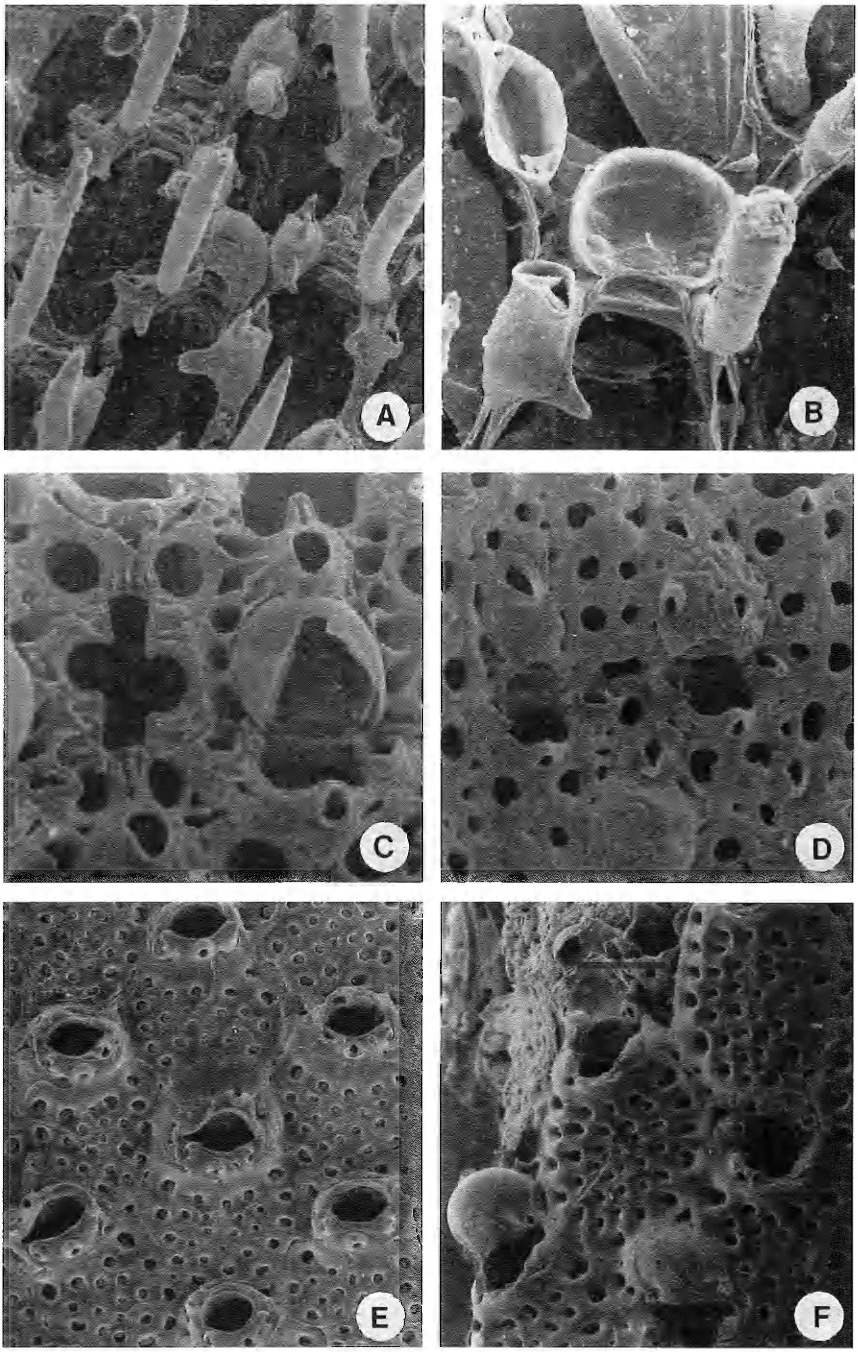


Fig. 134. A, B. *Arachnopusia gigantea.* Discovery Stn. 1652, Ross Sea. A. Group of autozooids with spines; ×24. B. Distal end of a single autozooid; ×45. C, D. *Arachnopusia inchoata.* Discovery Stn. 177, South Shetland Is. C. At the colony edge, showing developing frontal shield; ×50. D. Autozooids with ovicells and avicularia; ×40. E, F. *Arachnopusia tubula.* E. Discovery Stn. 1948, South Shetlands; ×27. F. NZOI Stn. E205, Ross Sea; ×35.

Arachnopusia inchoata Hayward and Thorpe Fig. 134C,D

Arachnopusia inchoata Hayward and Thorpe 1988c: 789, Fig.4D,E, 5A,B

Colony attached by an encrusting base, spreading as loosely attached, unilaminar sheets, and developing erect, folded, bilaminar foliaceous growths, with plates anastomosing to form rigid, three-dimensional structures; height may exceed 70 mm, with horizontal spread in excess of 100 mm. Autozooids elongate, rectangular, convex, with boundaries distinct only at growing edge; 0.9–1.2 × 0.4–0.5 mm. Frontal shield with six to nine large, round foramina, sometimes slightly reniform, but generally lacking ligulae; genesis of shield from the fusion of medially growing processes typically clear at growing edge, an intermediate stage, showing a large, cruciform foramen, usually seen in actively growing colonies. Aperture about as wide as long, proximal rim gently arched, with a single median avicularium, perpendicular to frontal plane. Apertural plate narrow, deeply concave, the proximal edge thickened and finely beaded. Two or three slender spines present in early ontogeny, the distal pair later obliterated, only the single proximal spine persisting, just projecting above aperture rim. Paired lateral oral avicularia present, located on rim of aperture; rostrum acute to frontal plane, elongate, triangular, sharply hooked distally; similar avicularia occur elsewhere on the frontal wall, and up to three on the ooecial cover. Larger, interzooidal avicularia occur sporadically, sometimes frequently, often succeeding an ovicell; with broadly triangular, sharply hooked rostrum. Ovicell as wide as long, convex, prominent, with a narrow, transverse band of entooecium exposed frontally; ooecial cover rugose, not completely obscuring ovicell, with one to three small avicularia.

Arachnopusia inchoata develops large, coralliform colonies, similar to those of the north-east Atlantic *Pentapora fascialis*. It is abundant on hard substrata around Signy Island; its distribution as presently known encompasses the South Shetlands, South Orkneys and South Sandwich Islands, and also South Georgia and Bouvet Island. It was also recorded by Hayward and Thorpe (1988c) from Gough Island.

Arachnopusia latiavicularis Moyano Fig. 135A

Arachnopusia latiavicularis Moyano 1970b: 263, pl.3, figs.9–14, pl.4, fig.15

Arachnopusia latiavicularis: Moyano 1984a: 80; Hayward and Taylor 1984: 72; Hayward and Thorpe 1988c: 789, Fig.3E

Colony initially encrusting, developing erect, folded, unilaminar or bilaminar sheets. Autozooids elongate, quadrangular, with indistinct boundaries; 0.9–1.1 × 0.45–0.55 mm. Frontal shield thick and flat, finely granular, with 9–13 small, oval foramina, distributed mostly around edges of shield; foramina narrower in later ontogeny, apparent as elongate slits bordered by thick, smooth calcification. Aperture broader than long, proximal edge only gently arched. Apertural plate narrow, deeply concave; no oral spines. A small, median, subapertural avicularium present or absent; lateral oral avicularia paired, located on edge of aperture, rostrum acute to frontal plane, broadly triangular, hooked distally. One or both of the lateral oral avicularia may be grossly enlarged, with a voluminous cystid extending proximally for almost the whole length of the autozooid. One to three, rarely more, small avicularia present elsewhere on frontal shield; occasionally, large vicarious avicularia occur. Ovicell elongate oval, prominent, with a large oval area of entooecium exposed frontally; developing a peripheral ooecial cover in later ontogeny, often bearing two or three small avicularia.

This distinctive, endemic, Antarctic species is presently known from the South

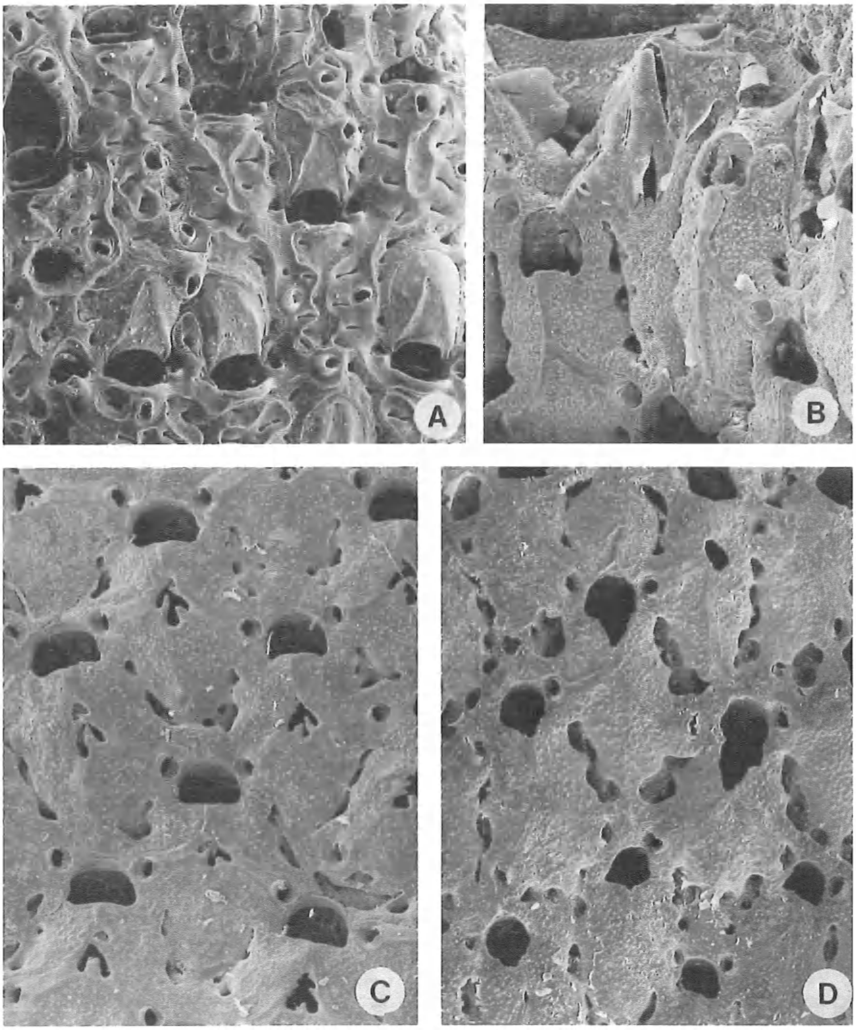


Fig. 135. A. *Arachnopusia latiavicularis.* McMurdo Sound, Ross Sea; ×33. B–D. *Trilaminopora trinervis.* B. Discovery Stn. 152, South Georgia; an avicularium at the growing edge; ×45. C. Discovery Stn. 190, Bismarck Strait; autozooids with fully formed frontal shields; ×45. D. Discovery Stn. 1660, Ross Sea; ovicelled autozooid; ×40.

Shetland Islands, Graham Land and the Ross Sea.

Arachnopusia tubula Hayward and Thorpe — Fig. 134E,F

Arachnopusia tubula Hayward and Thorpe 1988c: 793, Fig.5E,F.

Colony encrusting, forming broad, thick, unilaminar sheets. Autozooids broadly oval to hexagonal, rather flat, separated by indistinct grooves; 0.9–1.1 × 0.55–0.70 mm. Frontal shield smoothly calcified, with 15–25 small, round foramina, each almost occluded by a well developed oval ligula and appearing reniform. Aperture quadrangular, as wide as long, obscured by raised proximal rim and thickened distal rim, and appearing transversely oval. Aperture plate large, almost square, with curved proximal edge; smoothly calcified, flat or shallowly concave. A single pair of spines on distal edge of aperture, obscured by development of thickened distal rim, not persisting in late ontogeny. Proximal apertural rim raised, bearing one small, median avicularium, perpendicular to frontal plane and distally directed, and a pair of lateral avicularia, also perpendicular and distally directed but with the rostrum facing laterally; single or paired avicularia occasionally present on the lateral rim of the aperture, and sporadically on the frontal wall. Ovicell broadly oval, rather flat frontally, with triangular area of entooecium exposed frontally; obscured by ooecial cover in early ontogeny, becoming immersed and inconspicuous. Apertural rim continues across frontal surface of ovicell, typically bearing a single median avicularium.

Arachnopusia tubula is especially characterized by its flat, finely perforated, frontal shield and transversely oval secondary aperture. The broad, almost flat, apertural plate is also characteristic. It is presently known only from the South Shetland Islands. *A. valligera* Hayward and Thorpe, a magellanic species, has some resemblance to *A. tubula*, but is distinguished by its frontal shield, which has fewer (<11), larger foramina, each with short, digitate ligula, and by the presence of a single, short, stout spine projecting above the apertural rim.

Trilaminopora Moyano, 1970

Colony encrusting. Autozooids with umbonuloid frontal shield formed through the fusion of separately developed proximal and lateral lobes, the lines of fusion marked by a distinct tripartite suture; often incomplete medially, leaving a small, variously shaped foramen. Irregular grooves, slits or larger foramina between frontal shields of adjacent autozooids mark the presence of frontal septula. Aperture simple, lacking spines and mucrones. Adventitious avicularia present; larger, vicarious avicularia infrequent. Ovicell immersed, imperforate. Vertical walls with small basal pore chambers and few uniporous mural septula.

Type species: *Microporella trinervis* Waters, 1904.

Trilaminopora trinervis (Waters) Fig. 135B–D

Microporella trinervis Waters 1904: 45, pl.2, fig.17
(?*Microporella*) *trinervis*: Livingstone 1928: 55, pl.7 fig.3
Trilaminopora trinervis: Moyano 1970c: 162, fig.5 (15–18); Hayward and Taylor 1984: 72

Colony developing extensive, unilaminar sheets, with a thick, brown, outer cuticle rendering it strikingly visible to the unaided eye. Autozooids oval to irregular, rather flat, bordered by irregular grooves or pits; 0.65–0.9 × 0.3–0.5 mm. Frontal shield finely nodular, with a characteristic trilobed suture; most usually this is incomplete medially, and the shield has a distinctive, variably shaped, central foramen, but in some colonies the foramen is sealed over in later ontogeny. Aperture slightly wider than long, more or less D-shaped, the proximal edge occasionally sinuous, or indented. Each autozooid aperture flanked disto-laterally by a pair of small adventitious avicularia, budded from the frontal septula of neighbouring autozooids; rostrum oval, <0.1 mm long, acute to frontal plane, disto-laterally directed; mandible semicircular. Vicarious avicularia rare, frequently not developed at all; as long as autozooids, with a unitary frontal shield; rostrum slender, occupying distal half of avicularium, supporting an elongate, triangular mandible with rounded tip. Ovicell immersed, longer than wide, with finely nodular calcification, imperforate.

Trilaminopora trinervis is an endemic species widely distributed throughout Antarctica, from South Georgia, the Weddell Sea, the Palmer Archipelago and the Bellingshausen Sea, to the Ross Sea and the coasts of Australian Antarctic Territory. It occurs most frequently encrusting other bryozoans, and its deep brown colonies are conspicuous on the basal surfaces of large colonies of *Bostrychopora dentata,* and others of similar form.

UMBONULOIDEA Canu, 1904

UMBONULIDAE Canu, 1904

Astochoporella Hayward and Thorpe, 1988

Colony loosely encrusting; or erect, unilaminar, forming folded sheets. Autozooids with umbonuloid frontal wall development; with well marked marginal, frontal septula. Aperture thin-rimmed, lacking denticles; no oral spines. Operculum supported distally by a narrow, calcified rim, continuous proximally, on each side, with a basally deflected, dentate, occlusor lamina. Ovicell developed as a submersed expansion of the distal wall of the maternal autozooid, with ooecial cover developed from the frontal wall of the distally succeeding autozooid; closed by autozooidal operculum. Avicularia adventitious, proximal to aperture.

Type species: *Astochoporella cassidula* Hayward and Thorpe, 1988.

Astochoporella cassidula Hayward and Thorpe Fig. 136A,B

Pemmatoporella marginata: Hayward and Taylor 1984: 76, Fig.2A,B

Astochoporella cassidula Hayward and Thorpe 1988b: 292, Fig.4E,F

Colony forming lobed, folded or convoluted, unilaminar sheets, attached by an encrusting base; maximum dimensions, and colony form unknown, but surface area exceeding 10 cm^2. Autozooids elongate, hexagonal or rectangular, flat, separated by thin, raised sutures; 1.6–1.85 × 0.6–0.95 mm. Aperture slightly wider than long; proximal border straight, or convex and angular; the basally curving, paired occlusor laminae clearly visible in cleaned specimens. Avicularium situated immediately proximal to aperture, proximally directed; rostrum elongate oval, normal to frontal plane, with its distal tip slightly upcurved; crossbar slender, frequently incomplete medially. Ovicell hemispherical, about as long as aperture, slightly submerged, with a single, large, frontal foramen; a granular ooecial cover developing in early ontogeny.

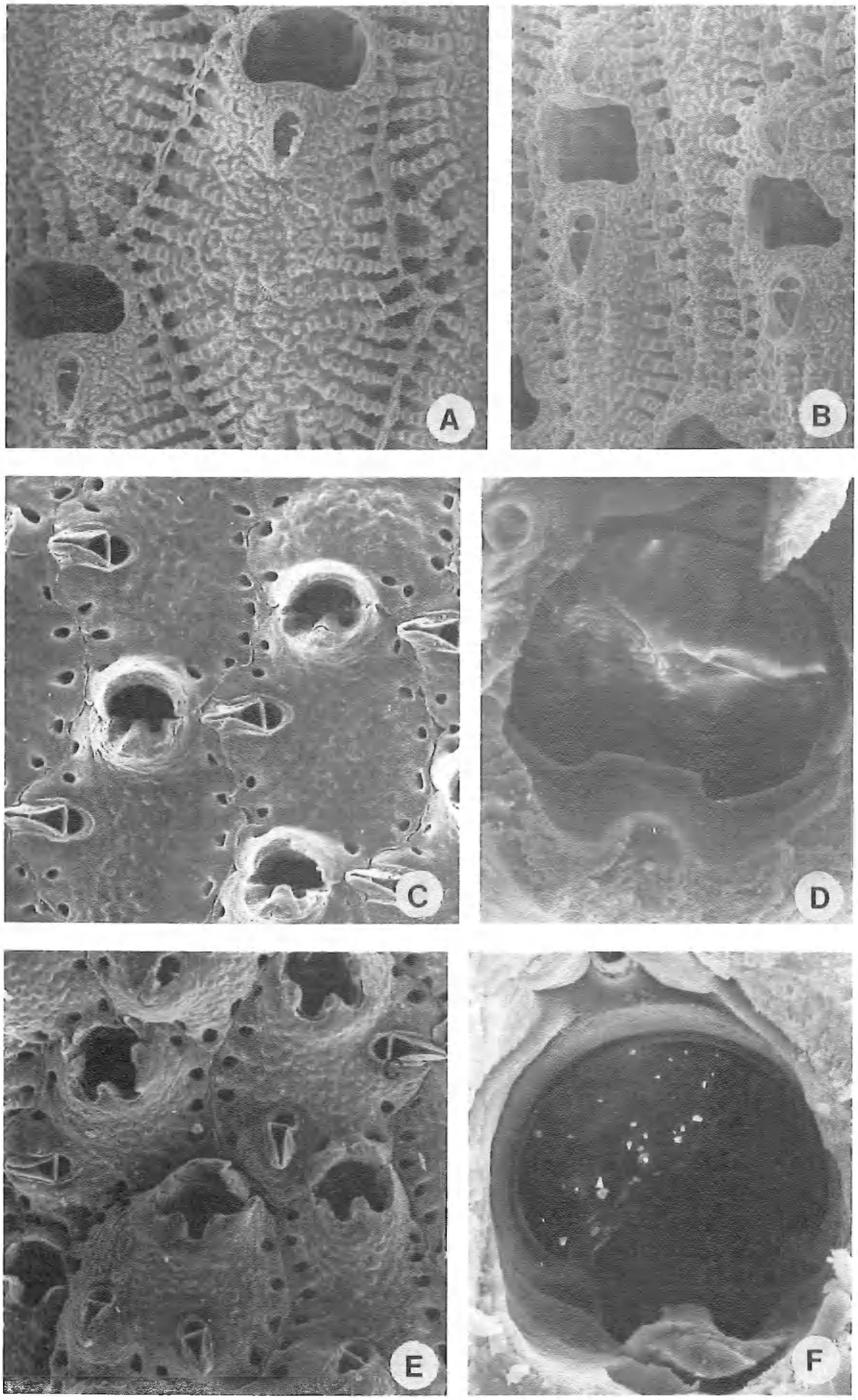
A. cassidula is common in bottom samples from the Ross Sea. It has been collected also from one station in the Palmer Archipelago, and possibly occurs elsewhere in the Antarctic shelf seas.

EXOCHELLIDAE Bassler, 1935

Autozooids with umbonuloid frontal wall development; frontal wall with conspicuous marginal pores. Proximal border of aperture with one or more denticles, its rim often with prominent mucrones; distal oral spines typically present. Avicularia adventitious, usually lateral, paired. Ovicells hyperstomial, often partially immersed in secondary calcification; imperforate or with marginal pores. Large basal pore chambers present.

Exochella Jullien, 1888

Colony encrusting. Umbonuloid frontal wall with reduced compensation space ('epistege') occupying about distal third of its length; marginal pores large and conspicuous. Aperture typically with a stout medio-proximal denticle and paired lateral denticles, together defining paired channels on the inner surface of the peristome which may form complete tubes; median denticle frequently produced frontally as a thickened mucronate process. Distal oral spines present in early ontogeny. Lateral adventitious avicularia present, single or paired (or multiple), usually laterally directed. Ovicell recumbent on succeeding autozooid, spherical,


A
B
C
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E
F

often immersed and obscured in later ontogeny.

Type species: *Mucronella tricuspis* Hincks, 1881.

The genus *Exochella* is almost entirely limited to the southern hemisphere. The magellanic species *E. longirostris* was formerly confused with the New Zealand type species *E. tricuspis*, adequately redescribed by Gordon (1984, 1989a), together with several other cold temperate New Zealand species. A second magellanic species, *E. discors* Hayward, is also known, and Marion Island, in the southern Indian Ocean, has its own endemic species, *E. marioni* Hayward. Only a single species, *E. conjuncta* Brown, is known to occur in tropical waters. The Antarctic fauna includes five endemic species of *Exochella.*

Key to Antarctic species

1. Autozooid orifice distinctly longer than wide; no oral spines. Peristome tubular, the median mucro and ridge slender. Autozooids mostly >1 mm long .... *A. rogickae*

   Autozooid orifice wider than long, or as wide as long; spines present or absent 2
2. Three distal oral spines present in newly budded autozooids.Proximal part of peristome strongly trilobed 3

   No distal oral spines. Proximal part of peristome trilobed, but not markedly so 4
3. Autozooids flat, with slit-like marginal pores. Three lobes of peristome partly fused, defining two rounded spiramina. Avicularium with very slender rostrum .... *E. elegans*

   Autozooids convex, with rounded marginal pores. Three lobes of peristome closely juxtaposed but not fused. Avicularium with elongate triangular rostrum .... *E. longirostris*
4. Autozooids each with stout, conical umbo on frontal wall. Avicularia sparse. Peristome trilobed, with stout, angular median ridge.. *E. umbonata*

   Autozooids lacking umbo. Avicularia numerous. Peristome slightly trilobed, but median ridge not prominent 5
5. Avicularia typically numerous in later ontogeny, each with triangular rostrum .... *E. avicularis*

   Avicularia with scaphoid rostrum, bluntly rounded at tip; usually one or two per autozooid .. *E. hymanae*

Exochella longirostris Jullien — Fig. 136C,D

Exochella longirostris Jullien 1888: 55, pl.3, figs.1–4; pl.9, fig.2

Exochella longirostris: Calvet 1904b: 29; Hayward 1980: 705; 1991: 306, Fig. 2A–C

Colony developing extensive, unilaminar sheets. Autozooids hexagonal, convex, separated by distinct sutures which become less apparent in later ontogeny; 0.48–0.50 × 0.30–0.43. Frontal wall coarsely nodular, with numerous, large, round marginal pores, which remain clearly defined in later ontogeny. Orifice semicircular when newly formed, with straight proximal edge; developing a low, medio-proximal lyrula, and indistinct proximo-lateral condyles; three closely spaced distal oral spines present. Peristome originating in early ontogeny as a thickened proximo-lateral fold, with an

Fig. 136. A, B. *Astochoporella cassidula.* Discovery Stn. 1652, Ross Sea. A. Autozooids with small avicularia; ×35. B. Ovicelled autozooids with enlarged avicularia; ×30. C, D. *Exochella longirostris.* C. Discovery Stn. WS225, Patagonian Shelf; ×75. D. Discovery Stn. 1902, Patagonian Shelf; primary orifice; ×400. E, F. *Exochella avicularis.* NZOI Stn. A526, Ross Sea. E. Group of autozooids; ×64. F. Primary orifice; ×400.

angular medio-proximal denticle; thickening and deepening, with the median denticle becoming more pronounced, continued frontally as a ridge which projects from the rim of the peristome as a stout mucro. Bluntly triangular processes projecting inwards from the edges of the peristome give its rim a trilobed outline. Distal portion of peristome developed from frontal calcification of next autozooid, obliterating oral spines. Avicularium single or paired, midlateral in position, laterally directed; rostrum slender, acuminate. Ovicell globular, coarsely nodular, with distal part of peristome forming a distinct lip above its aperture.

Exochella longirostris is strictly a magellanic species, distributed from Southern Chile to the Falkland Isles. Records of Antarctic specimens (e.g. Rogick 1956c) refer to one or more similar species present in Antarctic Seas.

Exochella avicularis Hayward Figs. 136E,F, 137A

?*Exochella longirostris*: Rogick 1956c: 123, Fig.1A–J
Exochella avicularis Hayward 1991: 301, Fig.1A–C

Colony forming thick, extensive, unilaminar sheets. Autozooids oval to hexagonal, convex, separated by distinct grooves; 0.7–0.85 × 0.45–0.65. Frontal wall thickly calcified, nodular, with small, closely spaced marginal pores separated by short, low ridges. Primary orifice about as wide as long, proximal edge broadly concave, condyles rounded; no oral spines. Peristome low and conical; with a prominent, angular, medio-proximal mucro, slightly thickened on its inner distal face, the peristome rim shallowly scalloped on each side; inner surfaces of lateral peristome lobes also thickened, delimiting a shallow channel on each side of the medio-proximal ridge. Avicularia paired, midlateral in position, the elongate triangular rostrum laterally directed. In later ontogeny, numerous additional avicularia develop along proximal and lateral borders of the autozooid, directed laterally, or obliquely proximally or distally. Ovicell about as wide as long; initially prominent, but inconspicuous in later ontogeny; calcification uniform with frontal wall, distal portion of peristome forming a low frontal ridge above the aperture.

This species is presently known from specimens collected off the South Shetland Isles, off Oates Land, and in the Ross Sea, all of which were encrusting large stones. It is possibly the species described by Rogick (1956c) as *E. longirostris*, and is almost certainly restricted to Antarctic waters.

Exochella elegans Hayward Fig. 137B,C

Exochella elegans Hayward 1991: 304, Fig.2D,E.

Colony forming broad, flat, unilaminar sheets. Autozooids broadly hexagonal, rather flat, separated by indistinct sutures; 0.55–0.65 × 0.45–0.6 mm. Frontal wall finely nodular, with few, widely spaced, marginal pores which become elongate and slit-like in later ontogeny. Primary orifice transversely oval, with shallowly concave proximal edge and low, rounded condyles; three closely spaced, distal oral spines present in newly budded autozooids. Proximal part of peristome strongly trilobed; with a thick medio-proximal ridge on its inner face; inner surfaces of lateral lobes produced as stout, spiked processes, fusing with the median ridge to define two closed channels, especially pronounced in later ontogeny; distal portion of peristome developed from frontal calcification of succeeding autozooid. Avicularia paired, midlateral in position; the rostrum very slender, acutely pointed, laterally directed. Ovicell about as wide as long, with finely nodular surface.

This species is most similar to *E. longirostris*, but is distinguished by its larger, flatter autozooids, with slit-like marginal pores; by its very slender avicularia; and

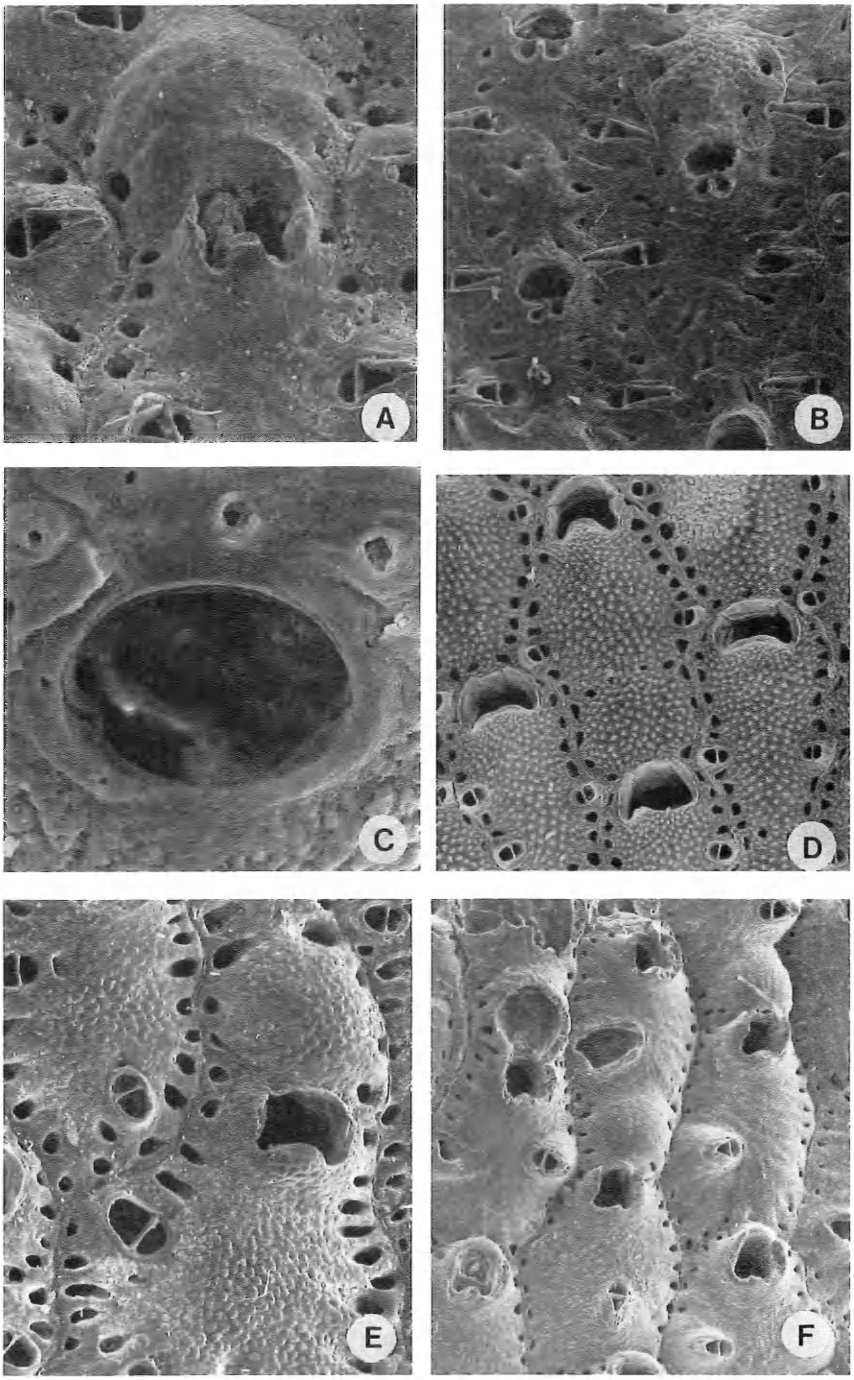


Fig. 137. A. *Exochella avicularis.* Terra Nova Stn. 194, Ross Sea; ×60. B, C. *Exochella elegans.* Discovery Stn. 1948, South Shetland Is. B. Group of autozooids, one ovicelled, with characteristic peristome; ×60. C. Primary orifice; ×270. D, E. *Exochella hymanae.* Discovery Stn. 1660, Ross Sea. D. Group of autozooids; ×40. E. Ovicelled autozooid; x55. F. *Exochella rogickae.* Discovery Stn. 2605, Queen Maud Land; ×25.

by its oval orifice, and strongly trilobed peristome. *E. elegans* is known only from specimens collected off the South Shetland Islands.

Exochella hymanae (Rogick) Fig. 137D,E

Parasmittina hymanae Rogick 1956d: 280, pl. 21

Parasmittina hymanae: Moyano 1966a: 119; Redier 1965: 25

Exochella rossi Hayward 1991: 309, Fig.4A,B

Colony forming flat, unilaminar sheets. Autozooids large, more or less hexagonal, convex, separated by distinct sutures; 0.84–1.00 × 0.45–0.6 mm. Frontal wall finely nodular, with large, closely spaced marginal pores. Primary orifice wider than long, proximal edge straight, or with a variously developed denticle; condyles prominent, rounded; no oral spines. Peristome low and flared; proximal edge with a rounded median lobe, thickening on its inner face in later ontogeny to form a low ridge; lateral lobes less prominent, but defining a shallow channel on each side of the median ridge. Avicularia single or paired, midlateral in position, laterally directed; rostrum broadly scaphoid, with bluntly rounded distal tip. Ovicell wider than long, finely nodular, with peristome forming a pronounced lip over the aperture.

E. hymanae is distinguished from all other species of *Exochella* by its rounded avicularian rostrum. The proximal edge of the primary orifice may be straight, or convex to a varying degree. In some specimens it bears a distinct denticle, which appears to represent the basal part of the median peristomial ridge, resembling a smittinid lyrula. It is presently known from several localities in the Ross Sea, from the South Orkneys and South Georgia, and from Marguerite Bay.

Exochella rogickae Hayward Figs. 137F, 138A,B

Exochella rogickae Hayward 1991: 309, Fig.3E,F

Colony developing extensive, thick, unilaminar sheets. Autozooids large — visible to unaided eye, oval to hexagonal, convex, separated by deep grooves; 0.9–1.8 × 0.6–0.75 mm. Frontal wall finely granular, with small, closely spaced marginal pores, separated by faint, radiating ridges. Primary orifice longer than wide, proximal edge shallowly concave; condyles prominent, knob-like; no oral spines. Peristome forming a complete tube, with its rim variously lobed or produced; highest distally; proximal edge with a slender, tapered, median mucro, its inner face slightly thickened to form a ridge; lateral lobes projecting on inner face, each bounding a shallow groove on either side of the median ridge, but not markedly thickened. Avicularia single or paired, midlateral in position, laterally directed. Ovicell more or less spherical, finely granular, with the peristome forming a pronounced lip above the aperture.

Exochella rogickae develops thick sheets, often exceeding 25 cm^2 in area, on large stones. It has been collected from two Antarctic localities, one from the eastern edge of the Weddell Sea, and the other off Oates Land.

Exochella umbonata Hayward Fig. 138C–E

Exochella umbonata Hayward 1991: 312, Fig.4E,F

Colony forming thick, unilaminar sheets. Autozooids oval to hexagonal, convex, separated by distinct sutures; 0.6–0.7 × 0.4–0.55 mm. Frontal wall finely nodular, with small, closely spaced marginal pores; developing a prominent median umbo. Primary orifice as wide as long, proximal edge shallowly concave between low,

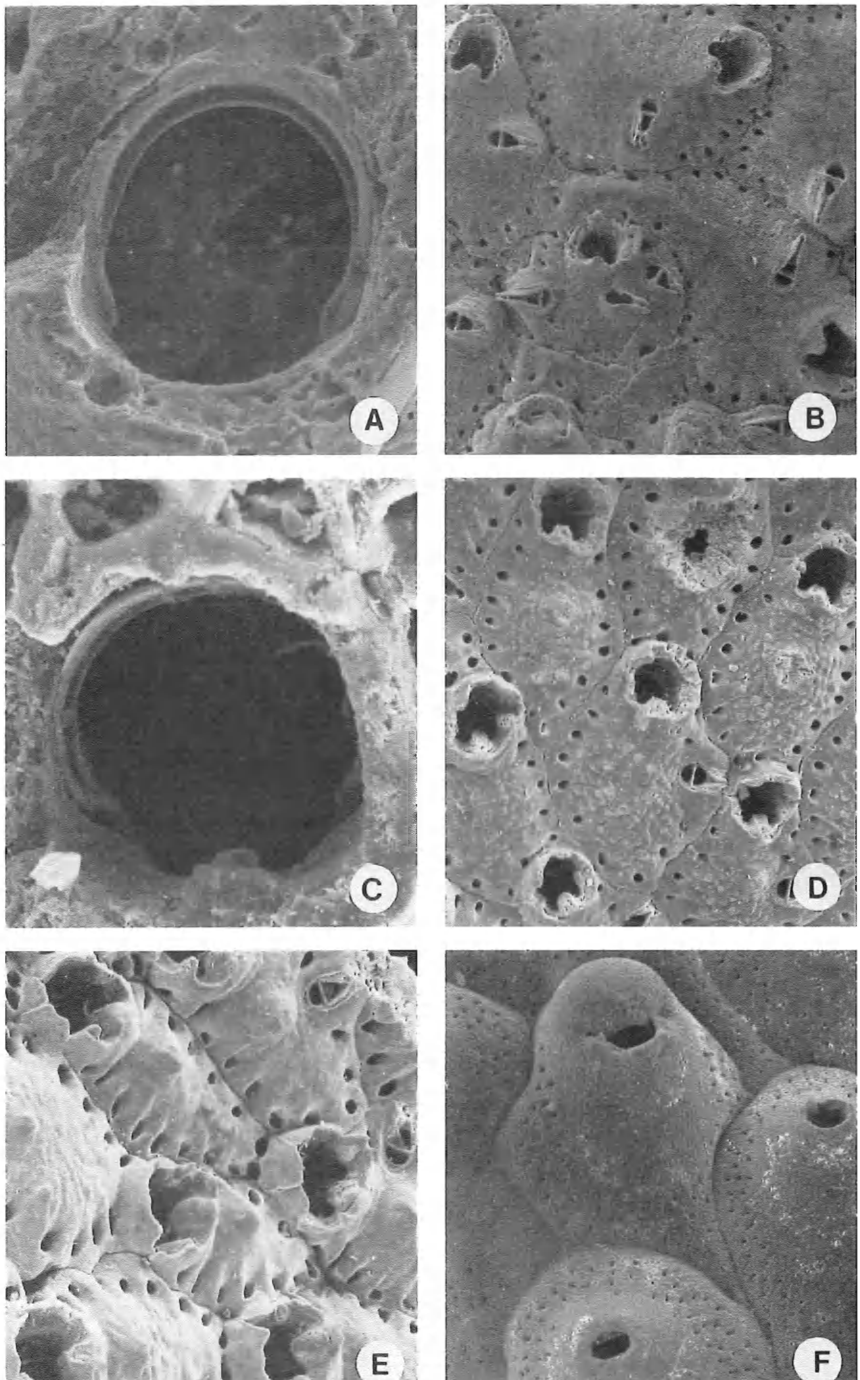


Fig. 138. A, B. *Exochella rogickae.* Discovery Stn. 2605, Queen Maud Land. A Primary orifice; ×170. B. Group of autozooids; ×26. C–E. *Exochella umbonata.* C. Discovery Stn. 1873, South Shetland Is.; primary orifice; ×230. D. Discovery Stn. 1873; ×37.5. E. Discovery Stn. 1652, Ross Sea; ×45. F. *Escharella mamillata.* South Shetland Is.; ×24.

rounded, proximo-lateral cusps; thickened condyles visible just distal to the cusps; no oral spines. Peristome low and thickened, proximal edge with a stout median mucro, grossly thickened on its inner face to form an angular ridge; inner surfaces of lateral peristome lobes thickening in later ontogeny, projecting inwards to delimit a shallow channel on each side of the median ridge. Avicularia sparse, usually unpaired, midlateral in position, the triangular rostrum laterally directed. Ovicell undescribed.

This species is presently known only from the South Shetland Islands. It is distinguished from other Antarctic species of *Exochella* by its prominent frontal umbones, and its sparsely distributed, often rare, avicularia.

Escharella Gray, 1848

Colony encrusting, unilaminar. Autozooids with umbonuloid frontal shield, bordered by marginal pores. Primary orifice with well developed lyrula; condyles small, or absent; oral spines usually present. No avicularia. Ovicell prominent, imperforate, not closed by autozooid operculum. Small basal pore chambers present. Ancestrula tatiform, with variably developed cryptocyst, frontal membrane surrounded by spines; budding a distal triplet of autozooids.

Type species: *Lepralia immersa* Fleming, 1828.

Gordon (1989a) showed that the autozooidal frontal wall in the type species is an umbonuloid shield, and assigned *Escharella* to the Exochellidae. Scanning electron microscopy of several New Zealand species revealed essentially the same frontal wall structure. It is probable that all species of *Escharella*, an apparently remarkably homogeneous genus, will be found to display umbonuloid frontal wall ontogeny but the majority of described species have still to be examined by SEM. *Escharella* occurs in temperate and polar waters of both hemispheres.

Key to Antarctic species

1. Autozooids with two oral spines in early ontogeny only, obscured by development of a tall, tapered, complete peristome .... *E. mamillata*

   Autozooids with six to eight spines, persisting in later ontogeny. Peristome developed as an angular, proximal lip to the orifice .... *E. watersi*

Escharella mamillata Hayward and Thorpe — Figs. 138F, 139A

Escharella mamillata Hayward and Thorpe 1989a: 371, Fig.3G

Colony a spreading, ill-defined sheet; continuous or dividing into narrow lobes comprising one or two series of autozooids, which may fuse again to give a loosely reticulate form. Autozooids large, visible to the unaided eye; broadly rounded distally, tapered proximally; steeply convex, with a narrow, spout-like peristome imparting a conical volcano-shape; 1.25–1.8 × 0.9–1.2 mm. Primary orifice wider than long, proximal border almost entirely occupied by a low, broad lyrula; two distal oral spines present in autozooids at the growing edge, obliterated by development of the peristome. Frontal calcification coarsely granular, with a double or triple series of small marginal pores. Ovicell spherical, dependent from distal border of orifice, its aperture partly hidden by the projecting proximal lip of the peristome.

Escharella mamillata forms thick, extensive crusts on hard substrates, especially stones. It is presently known from Shag Rocks, the South Shetlands, the South Sandwich Islands, and from the Ross Sea.

Escharella watersi Hayward and Thorpe — Fig. 139B–D

Smittia crozetensis: Waters 1904: 64 (part), pl.8, fig.15

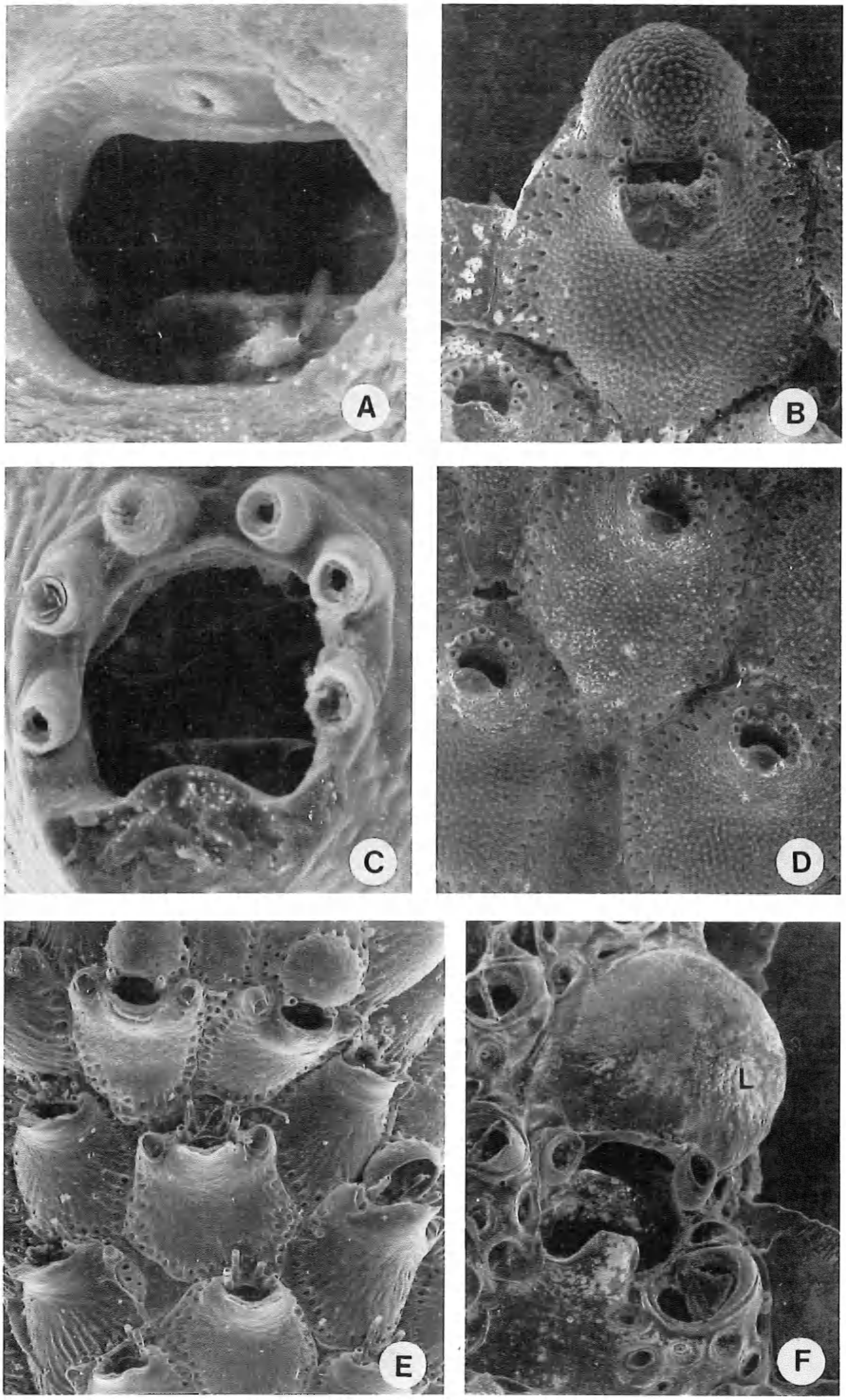


Fig. 139. A. *Escharella mamillata.* South Shetland Is.; primary office; ×280. B–D. *Escharella watersi.* Discovery Stn. 160, Shag Rocks. B. Ovicelled autozooid; ×45. C. Primary orifice; ×220. D. Group of autozooids; ×40. E. *Escharoides praestita.* McMurdo Sound, Ross Sea; ×22. F. *Escharoides torquata.* Discovery Stn. 152, South Georgia; ×80.

Mucronella crozetensis: Livingstone 1928: 66; Rogick 1956d: 278, pl.20
Escharella watersi Hayward and Thorpe 1989a: 369, Fig.3A–C

Colony developing as a broad, coherent sheet. Autozooids oval to hexagonal, often tapered proximally, strongly convex, separated by deep grooves; 1.0–1.3 × 0.8–1.0 mm. Primary orifice about as wide as long; lyrula occupying about half proximal width of orifice, anvil-shaped, with slightly convex edge and sharply pointed corners, occasionally notched or bifid, and often with additional, sharply pointed processes on its frontal surface. Six to eight stout oral spines, six persisting in ovicelled autozooids; proximal lip of aperture produced as a thickened, angular mucro, as long as the oral spines, with a thick, longitudinal ridge on its distal face. Frontal calcification thick, nodular, vitreous, with a single or double series of small, but distinct, marginal pores. Ovicell as broad as long, narrowed towards its aperture, calcification uniform with that of autozooid.

Escharella watersi occurs on a wide range of hard substrata, including hydrocorallines and other bryozoans. It is distributed from South Georgia, through the Palmer Archipelago, to the Ross Sea, and probably occurs throughout Antarctica.

Escharoides Milne-Edwards, 1836

Colony encrusting, unilaminar. Frontal wall of autozooids an umbonuloid shield, bordered by conspicuous marginal areolae, imperforate centrally. A broad, distal oral shelf underlies operculum. Peristome produced laterally and proximally, characteristically umbonate, and often with pronounced denticles or ridges on inner face. Distal oral spines present. Avicularia adventitious, usually lateral to aperture. Ovicell prominent, hyperstomial, imperforate; not closed by autozooidal operculum. Basal pore chambers present.

Type species: *Cellepora coccinea* Abildgaard, 1806:

Key to Antarctic species

1. Proximal lip of aperture with a narrow, angular, median mucro; three prominent denticles present on its inner, distal face. Avicularia developed around whole periphery of autozooid, typically numerous .... *E. torquata*
   Proximal lip of aperture developed as a broad, projecting spout, extending between the oral spine bases; no denticles on inner edge. One or two avicularia per autozooid only (sometimes lacking altogether) 2
2. Four distal oral spines. Avicularia single or paired, lateral to aperture .... *E. praestita*
   Two distal oral spines. Avicularia single or paired, or lacking, on lateral edges of autozooids .... *E. tridens*

Escharoides praestita (Waters) Fig. 139E

Smittia praestita Waters 1904: 67, pl.8, figs.10a,b
Escharoides praestita: Rogick 1955b: 444, Figs.28–38; Moyano 1966a: 118; Hayward and Taylor 1984: 72

Colony developing broad, unilaminar sheets on hard substrata, especially rock. Autozooids hexagonal to oval, strongly convex, separated by deep grooves; 1.0–1.4 × 0.7–0.8 mm. Frontal wall thickly calcified, finely granular, with radiating striations or corrugations; produced proximal to the aperture as a projecting, angular peristomial lip, its inner face lacking denticles. Marginal pores small and round, but quite conspicuous. Four short, distal oral spines present, the oral shelf readily visible between the proximal pair in cleaned specimens. Avicularia sporadically developed lateral to the aperture, single or paired; rostrum acute to frontal plane, disto-laterally directed, supporting a semielliptical mandible. Ovicell relatively small, slightly wider than long, smooth surfaced.

Escharoides praestita is a common, endemic Antarctic species. Its geographical range encompasses the Weddell Sea, South Georgia, the Antarctic Peninsula and the Palmer Archipelago, and the Ross Sea.

Escharoides torquata Hayward and Ryland Figs. 139F, 140A

Escharoides torquata Hayward and Ryland 1991: 242, pl.1, figs.A–C

Colony forming a thick, spreading crust. Autozooids broadly oval to hexagonal, convex, separated by deep grooves; 1.0–1.25 × 0.7–0.9 mm. Frontal wall thickly calcified, finely granular, sometimes with a few fine longitudinal corrugations; marginal pores distinct. Proximal lip of aperture produced as a narrow, angular, median mucro; inner rim with an anvil-shaped median denticle, flanked on each side by a short, pointed triangular denticle. Four short, club-shaped, distal oral spines present, two persisting in ovicelled autozooids. Avicularia numerous; rostrum oval, slightly raised distally, 0.1–0.2 mm long, with complete crossbar; typically one on each side of the mucro, acute to frontal plane and distolaterally directed; others develop later, closely juxtaposed, around the whole periphery of the autozooid, forming a closed ring of avicularia with varying orientation. Ovicell about as wide as long, smooth surfaced, with a slight apertural lip.

This species is presently known from just a single station off South Georgia.

Escharoides tridens (Calvet) Fig. 140B

Smittia praestans var. *tridens* Calvet 1909: 30, pl.3, fig.6

Peristomella excavata var. *tridens*: Livingstone 1928: 61

Escharoides tridens: Rogick 1955b: 447, Figs.39–45

Colony forming a thick, irregular crust on hard substrata. Autozooids oval to hexagonal, convex distally, almost flat proximally, separated by indistinct sutures; 0.8–1.0 × 0.5–0.6 mm. Frontal wall finely granular, bordered by a single series of large, conspicuous marginal pores; distally, raised to form a prominent, spout-like peristomial lip. Aperture transversely oval, lacking denticles, with a single, stout, cylindrical spine on each side. Avicularia small, oval, 0.15 mm long, with semielliptical mandible; sparsely developed on lateral margins of autozooids, laterally directed. Ovicell elongate-oval, with finely granular surface; partially immersed, but remaining conspicuous.

Escharoides tridens is an endemic Antarctic species. It has been reported infrequently, from isolated localities off the Antarctic Peninsula, from Signy Island and from Adelie Land, and is probably widely distributed in Antarctic coastal waters.

Romancheina Jullien, 1888

Colony encrusting, unilaminar. Autozooids with umbonuloid frontal shield, steeply convex distally and forming a projecting, subapertural lip, continuous with a well developed peristome; with well marked marginal pores. Distal edge of aperture smoothly rounded, without an oral shelf; no spines, condyles or denticles. Avicularia adventitious, single or paired, lateral to aperture and enclosed within peristome; plane of rostrum perpendicular to plane of aperture; directed fronto-proximally. Large basal pore chambers present. Ovicell hyperstomial, imperforate, not closed by autozooid operculum. Ancestrula tatiform, with stout marginal spines arching over the frontal membrane to form a cribrate shield.

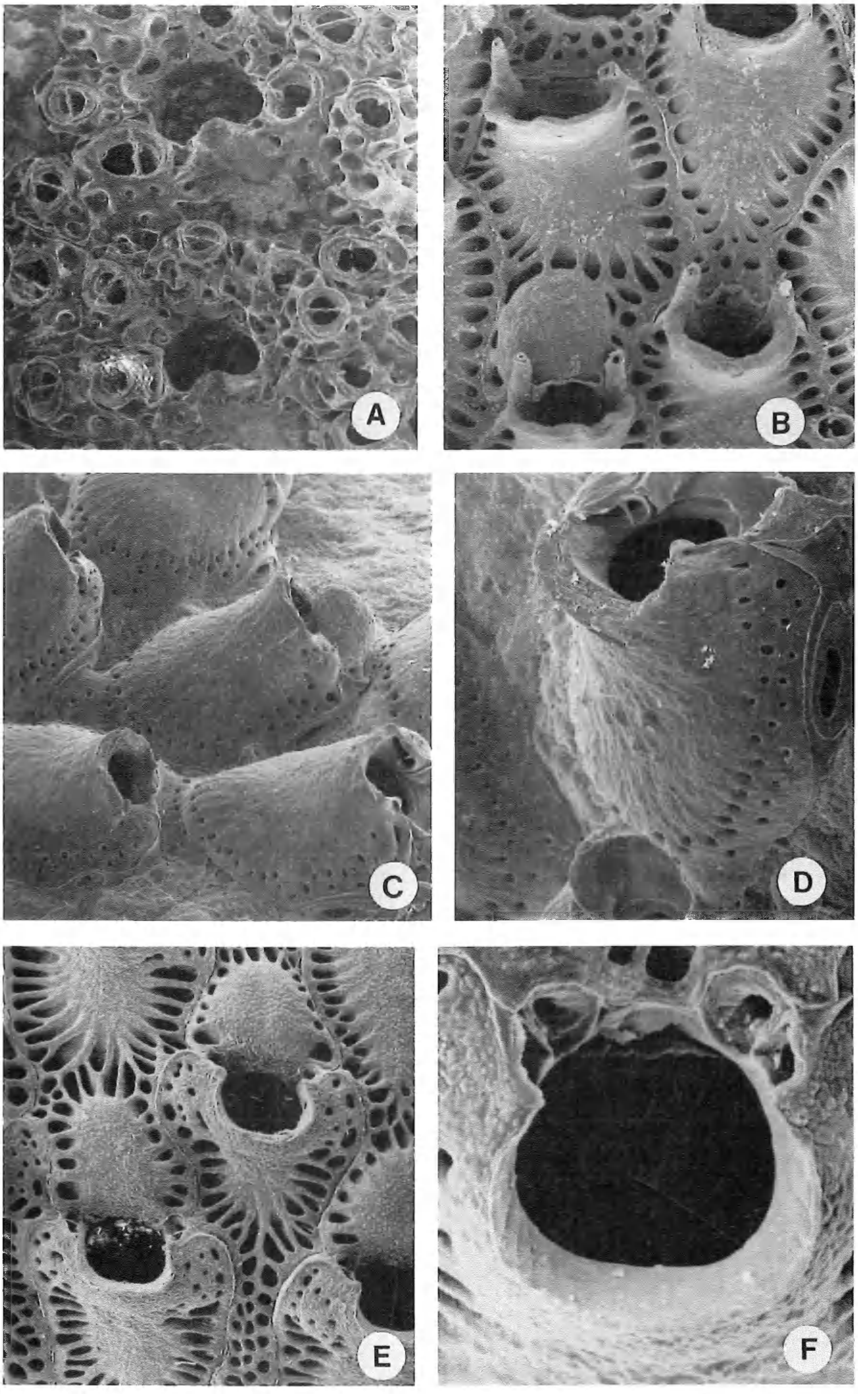


Fig. 140. A. *Escharoides torquata.* Discovery Stn. 152, South Georgia; ×35. B. *Escharoides tridens.* Discovery Stn. 1352; 60° 4.5′S, 8° 6.5′W; ×49. C, D. *Romancheina asymmetrica.* NZOI Stn. A526, Ross Sea. C. Group of autozooids; ×23. D. Detail of orifice and avicularium; ×40. E, F. *Romancheina barica.* NZOI Stn. A529, Ross Sea. E. Ovicelled autozooids; ×25. F. Primary orifice; ×80.

Type species: *Romancheina martiali* Jullien, 1888 = *R. labiosa* (Busk, 1854).

The type species is presently known from a few localities around Tierra del Fuego. Livingstone's (1928) record of *R. labiosa* from two stations off the Shackleton iceshelf, Australian Antarctic Territory, clearly refers to a species of *Cellarinella*.

Key to Antarctic species

1. Avicularia enclosed within lateral borders of peristome, not extending onto distal edge of aperture. Marginal pores small and round, without prominent ridges between .... *R. asymmetrica*

   Avicularia enclosed within disto-lateral borders of peristome, their proximal portions clearly visible on the distal rim of the aperture. Marginal pores in deep areolae, with stout ridges between .... *R. barica*

Romancheina asymmetrica Moyano Fig. 140C,D

Romancheina asymmetrica Moyano 1975b: 63, Figs.1–8

Colony forming small patches on hard substrata; coherent or partly disjunct, with adjacent autozooids linked by their pore chambers. Autozooids oval, steeply convex, highest distally where the frontal shield develops a conspicuous, projecting, spout-like subapertural lip; 0.75–1.4 × 0.5–1.0 mm. Frontal shield finely granular, smooth or with fine corrugations; bordered by a single or double series of small, round marginal pores. Avicularia single or paired, enclosed within peristome and extending along lateral edges of aperture, not readily visible; 0.4 mm long, rostrum elongate triangular, sharply hooked distally. Ovicell more or less spherical, smooth surfaced. Basal pore- chambers large and distinct. Ancestrula (described by Moyano (1975b)) oval, 0.5 mm long, the opesia overarched by six or seven stout marginal spines.

R. asymmetrica was described from Deception Island, South Shetlands, by Moyano (1975b), and an additional specimen has been collected from the Ross Sea by the New Zealand Oceanographic Institute. It is almost certainly endemic, and limited, to Antarctic shelf seas.

Romancheina barica (Rogick) Fig. 140E,F

Escharoides barica Rogick 1955b: 437, Figs.1–7

Escharoides barica: Moyano 1966a: 118

Colony forming a thick, loosely attached sheet. Autozooids large, irregularly polygonal, broadest distally, flat or gently convex, separated by thin, raised sutures; 1.6–1.8 × 1.1–1.3 mm. Frontal shield finely granular, bordered by a single series of large areolae, with prominent ribs between extending medially. Aperture longer than wide, enclosed proximally by a low peristome, continuous on each side with a conspicuous, swollen, avicularian chamber; rostrum of avicularium acute to apertural plane (not perpendicular), proximally directed, 0.2 mm long, with sharply hooked tip. Ovicell wider than long, smooth surfaced.

This species is known from fragmentary specimens collected off Wilkes Land, in Marguerite Bay, and from the Ross Sea.

Antarcticaetos Hayward and Thorpe, 1988

Colony erect, slender; branches cylindrical or flattened, dividing dichotomously, with or without tubular, chitinous nodes at the base of each ramus; autozooids opening around whole circumference of branch. Autozooids with umbonuloid frontal shield; imperforate centrally, but with well marked frontal, marginal septula. Proximal edge of aperture produced as a pronounced lip, but lacking denticles; no distal oral spines. Avicularia adventitious, dimorphic, typically adjacent to aperture of autozooid. Ovicell developed from distal wall of autozooid, recumbent on succeeding autozooid, imperforate. Vertical walls with small, multiporous septula. Ancestrula tatiform.

Type species: *Escharoides bubeccata* Rogick, 1956.

Antarcticaetos bubeccata (Rogick) Fig. 141A,B

Escharoides bubeccata Rogick 1955b: 442, Figs.8–27

Escharoides bubeccata: Moyano 1966a: 118; 1984a: 80; Hayward and Taylor 1984: 72

Antarcticaetos bubeccata: Hayward and Thorpe 1988b: 281, Fig.1D–F

Colony up to 30 mm high, branching dichotomously at infrequent intervals, or developed simply as slender, flat-sectioned rods; autozooid rows continuous at dichotomies, or with a node formed from a bundle of chitinous tubes at the base of each ramus. Autozooids in whorls of three to eight, elongate, tapered proximally; 1.5–3.0 × about 0.5 mm. Frontal shield smooth, strongly convex, its distal edge projecting as a prominent, spout-like lip; aperture rim simple, without denticles, condyles or mucrones; frontal septula large and distinct, in a single marginal series, interspersed with slender ribs. Avicularia typically paired, one situated in each proximo-lateral corner of the aperture, the rostrum oval, acuminate and laterally directed, less than 0.2 mm long; in many autozooids replaced on one side by grossly enlarged avicularium, with strongly hooked rostrum perpendicular to frontal plane, laterally directed. In some cases the enlarged avicularium may be situated on the frontal wall of the autozooid, proximal to the aperture. Ovicell elongate oval, convex, smooth-surfaced, the strongly arched orifice bordered by a distinct lip.

Antarcticaetos bubeccata is widely distributed in the Ross Sea, where it is perhaps quite common. It has also been collected from the Bismarck Strait, the South Sandwich Islands, and from Signy Island, and probably has a circumpolar distribution in Antarctic waters.

Lageneschara Hayward and Thorpe, 1988

Colony erect, forming irregular, folded, unilaminar sheets, sometimes enrolled or overlapped to give secondarily bilaminar plates; attached by an encrusting sheet of autozooids. Frontal wall of autozooid comprising a proximal, cryptocystidean portion, perforated by small, stellate pores, and a more extensive, distal umbonuloid shield, devoid of pores. Aperture formed into a thickened peristomial shield, with a broad lyrula at its base. No spines or avicularia. Ovicell prominent, imperforate, not closed by autozooid operculum. Vertical walls with small mural septula. Ancestrula tatiform.

Type species: *Phylactella lyrulata* Calvet, 1909.

Lageneschara lyrulata (Calvet) Fig. 141C,D

?*Phylactella (sic) lyrulata* Calvet 1909: 32, pl.3, fig.7

Phylactella lyrulata: Livingstone 1928: 73, pl.6, figs.1,2,6, pl.7, fig.1,text figs.16,17

Phylactellipora lyrulata: Rogick 1957a: 2, Figs.1–21; Moyano 1966a: 118; 1984a: 81; Hayward and Taylor 1984: 72

Lageneschara lyrulata: Hayward and Thorpe 1988b: 282, Fig.2A,B

Colony developed from a broad, unilaminar, encrusting base; forming erect, folded, enrolled or convoluted sheets, basically unilaminar, but anastomosing and overlapping basally to give irregular bilaminar growth; in largest colonies forming a rigid, domed, three-dimensional, meandriform structure, 100 mm or more high, with a diameter exceeding 200 mm. Autozooids hexagonal, strongly convex, separated by distinct sutures; 1.3–2.00 × 0.8–1.00 mm. Frontal shield finely nodular, distal portion imperforate, proximal portion rather flat, with regularly spaced, stellate, pores, which continue distally along the margins of

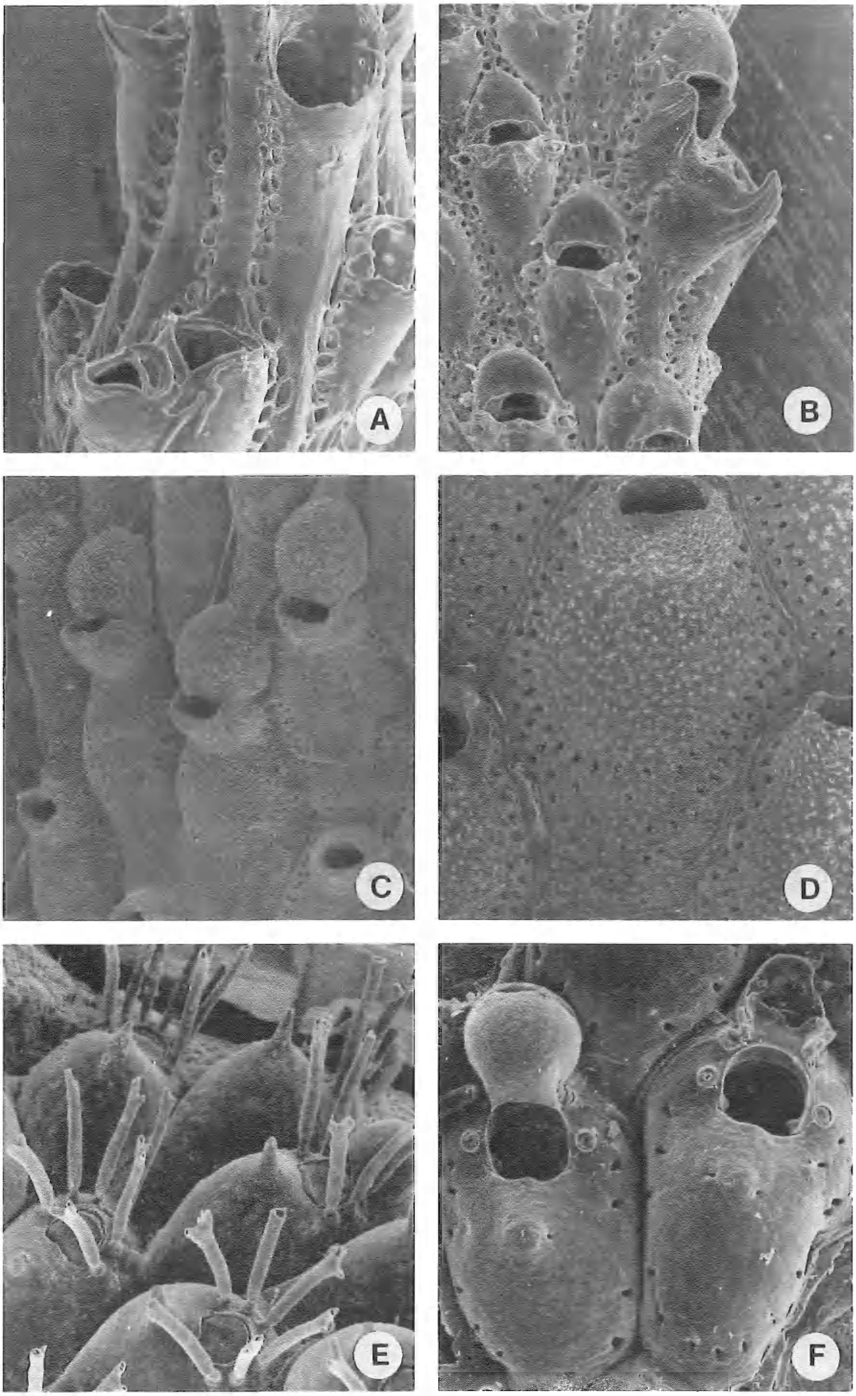


Fig. 141. A, B. *Antarcticaetos bubeccata.* Ross Sea. A. Autozooids at the growing tip of a branch; ×40. B. Ovicelled autozooids; ×25. C, D. *Lageneschara lyrulata.* Ross Sea. C. Ovicelled autozooids; ×20. D. Detail; ×40. E, F. *Acanthophragma polaris.* NZOI, Ross Sea. E. Stn. E205; autozooids with spines intact; ×21. F. Stn. A527; detail of cleaned autozooids; ×40.

the autozooid. Aperture transversely oval, surmounting a thickened, projecting peristomial tube. Ovicell spherical, prominent, with densely nodular surface; orifice strongly arched; peristome of brooding autozooid developed proximally as a broad, protruding lip, not extending onto frontal surface of ovicell. Basal wall of each autozooid with a single, oval foramen disto-medially.

L. lyrulata forms compact, coral-like colonies reminiscent of those of the British species *Pentapora fascialis*, but also occurs as single, unilaminar sheets that may be loosely encrusting or entirely erect. It is brittle and easily damaged, and maximum colony size is unknown. This endemic species has been reported from most quarters of Antarctica, and seems to be widespread, and common, in all Antarctic coastal waters.

LEPRALIELLIDAE Vigneaux, 1949

Acanthophragma Hayward, 1993

Colony encrusting, unilaminar. Autozooids with umbonuloid frontal shield, bordered by areolae. Primary office with straight proximal edge; condyles prominent. Large, basally jointed oral spines present. Ovicell prominent, imperforate, ectooecium membranous frontally; not closed by zooidal operculum. Large basal pore chambers present.

Type species: *Acanthophragma polaris* Hayward, 1993.

Acanthophragma polaris Hayward Fig. 141E,F

Acanthophragma polaris Hayward 1993: 288, Fig.2C,D

Colony encrusting, forming small, unilaminar patches on hard substrata. Autozooids oval to hexagonal, steeply convex, separated by deep grooves; 0.9–1.15 × 0.6–0.75 mm. Primary orifice large, commonly 0.2 × 0.2 mm; distolateral rim smooth, thickened, terminating proximo-laterally in a pair of thick, rounded condyles; proximal edge slightly arched frontally. Six long, thick oral spines disposed in an arc around distal and lateral borders of orifice (four in ovicelled autozooids); jointed basally, cylindrical, or broadened and bifurcated apically. Frontal wall smoothly calcified, with a single series of small, widely spaced marginal pores; a spike-like umbo developed just proximal to orifice. No avicularia. Ovicell short, globular; ectooecium present as a peripheral band only, entooecium exposed over whole of frontal and lateral surfaces, finely granular; not closed by zooidal operculum.

This species is known from the Ross Sea only.

METRARABDOTOSIDAE Vigneaux, 1949

Colony encrusting; or erect, branching, attached by an encrusting base. Autozooids with umbonuloid frontal shield, with conspicuous marginal areolar pores. Aperture with a distal oral shelf; typically with proximal denticles, and a complex proximal peristome. No oral spines. Avicularia adventitious, monomorphic or dimorphic. Embryos brooded in modified gonozooids, in which the cavity of the ovicell is continuous with that of the brooding autozooid. Vertical walls of autozooids with mural septula.

Polirhabdotos Hayward and Thorpe, 1987

Colony erect, cylindrical, branching; autozooids disposed in whorls around the branch axis. Autozooids with umbonuloid frontal shield, imperforate centrally but with conspicuous marginal areolae communicating with main coelomic cavity via multiporous septula. Aperture of autozooid with complex peristome, incorporating a medio-proximal pseudosinus and a single, proximo-laterally situated, adventitious avicularium. Embryos brooded in modified gonozooids.

Type species: *Smittia inclusa* Waters, 1904.

Polirhabdotos inclusum (Waters) Fig. 142A–C

Smittia inclusa Waters 1904: 68, pl.4, figs.5a–f
Clithriellum inclusum: Rogick 1956a: 70, figs.A–L; Moyano 1966a: 118
Polirhabdotos inclusum: Hayward and Thorpe 1987: 1473, Figs.1,2

Colony slender, cylindrical or moniliform, branching dichotomously at irregular intervals; perhaps exceeding 45 mm high, with maximum width of 2 mm. Autozooids in alternating longitudinal series, forming whorls of four (rarely, three or five) around the colony axis; elongate, narrowed proximally, broadest distally, separated by well-marked sutures; 1.5–2.0 × 0.5–0.6 mm. Frontal shield thick, tuberculate, developing irregular longitudinal ridges in later ontogeny; marginal areolae large, conspicuous, closely spaced and separated by thickened ridges. Aperture initially D-shaped, with straight proximal edge; elaboration of the peristome begins with the formation of a broad, reflected proximal lip bearing a longitudinal groove, terminating at a short, rounded, median sinus; subsequently, a projecting distal hood develops, and the proximal and lateral borders of the peristome deepen, enveloping a small avicularium, situated to one side of the peristomial groove, budded from a marginal septulum. The sides of the groove thicken, almost meeting medially and delimiting a frontal pseudosinus. In some autozooids the avicularium is lacking. Gonozooids abruptly broadened distally, the incubatory chamber domed, conspicuous, with a projecting, transversely oval peristome; avicularia lacking, but proximal lip of peristome with a well defined, median pseudosinus. Frontal calcification thickens in later ontogeny, obliterating the orifices of the autozooids; thick calluses of irregular calcification also occur, enclosing epizootic organisms, or fusing adjacent portions of different colonies.

Polirhabdotos inclusum has been collected from the South Shetland Isles, the Palmer Archipelago, the Bellingshausen Sea, from off Oates Land, and widely in the Ross Sea. It is an endemic Antarctic species.

SCLERODOMIDAE Levinsen, 1909

Colony erect, branching, rod-like or lamellar; attached to the substratum by chitinous rhizoids, or encrusting sheets of autozooids. Frontal wall of autozooids with marginal perforations only; developing a reticulate secondary calcification which thickens progressively and appears regularly porous. Orifice hidden by a deep peristome. No oral spines. Avicularia adventitious, most usually associated with the peristome, and often situated deep within it; many species with both peristomial and frontal avicularia. Ovicell opening into peristome; imperforate, but submerged in reticulate calcification and appearing uniform with frontal wall. Vertical walls of autozooids with uniporous and multiporous septula.

Gordon (1988) reviewed the Sclerodomidae, demonstrating that Moyano's (1970c) family Cellarinellidae was originally encompassed by Levinsen's (1909) concept of this family, and accordingly referring Cellarinellidae to the synonymy of Sclerodomidae Levinsen. The family is entirely southern hemisphere in distribution, and is largely limited to Antarctic, Subantarctic, or deep cold temperate habitats.

Cellarinella Waters, 1904

Colony erect, attached by chitinous rhizoids, or by encrusting sheets of autozooids; branches slender, with autozooids in whorls of two to five, or strap-like and bilaminar, or bilaminar-frondose; typically branching freely, many species with transverse growth-check

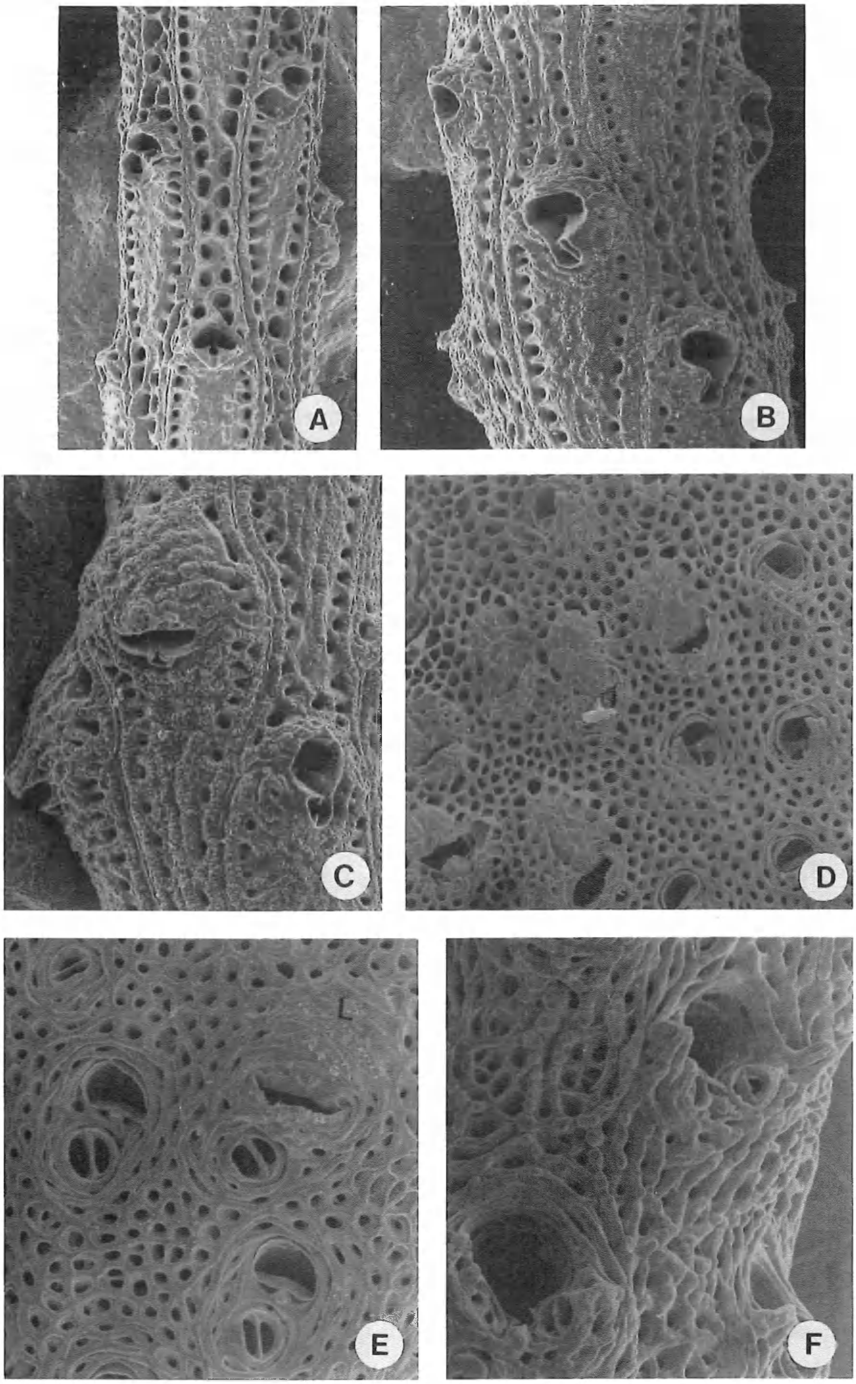


Fig. 142. A–C. *Polirhabdotos inclusum.* Ross Sea. A. Autozooids at branch tip, with secondary orifices beginning to form; ×29. B. Later autozooids, with peristome and avicularium complete; ×40. C. Ovicelled autozooid; ×40. D, E. *Cellarinella anomala.* Discovery Stn. WS42, South Georgia. D. Part of colony, with ovicells and large avicularia; ×28. E. Detail, showing ovicell and frontal avicularia; ×40. F. *Cellarinella dubia.* Off Patagonian Shelf; ×50.

banding. Autozooid boundaries obscured by colony wide, reticulate calcification; primary frontal shield imperforate, with marginal septula, but secondary surface appearing regularly porous. Primary orifice lacking an operculum, not visible in frontal view, situated at base of deep peristomial tube. Secondary orifice (aperture) semicircular to subtriangular, with a proximal oral ledge; often with associated umbones. Avicularia adventitious, associated with aperture, typically one within peristomial tube, or lodged within proximal edge of aperture, and one or more subapertural in position. Ovicell globular, opening into peristome, immersed in secondary calcification; in some species brooding autozooids bear thickened, proximal, apertural lips, sometimes enclosing additional avicularia. Uniporous and multiporous septula present; inner surfaces of autozooid walls with calcareous processes.

Type species: *Cellarinella foveolata* Waters, 1904.

Cellarinella is almost exclusively Antarctic in distribution. One species, *C. dubia,* has its centre of distribution in magellanic South America, ranges as far south and east as South Georgia, but has not been reliably reported from any other Antarctic locality. All other species of *Cellarinella* are endemic, and limited, to Antarctic Seas. Some range as far north as South Georgia, but none ranges into Subantarctic regions. '*Cellarinella*' *planulata* Hayward, from the Burdwood Bank, was incorrectly referred to this genus and is now referred to the Smittinidae, as type species of the genus *Platychelyna* Hayward and Thorpe, 1990. In some parts of Antarctica, such as the deep, level bottom of the Ross Sea, *Cellarinella* species appear to be abundant, forming dense and extensive thickets, perhaps representing long-lived, clonal populations. In these populations the remarkable regenerative ability of the *Cellarinella* colony is perhaps more important than sexual reproduction in sustaining population levels (Winston 1983).

In three species, including the type, *C. foveolata,* the colony is attached to the substratum by an encrusting base, and the aperture of brooding autozooids develops a pronounced proximal lip, often with one or more avicularia on its inner, lateral face. These characters may suggest that the genus is diphyletic, but at present there is insufficient comparative morphological data to draw any firm conclusions. Liu and Hu (1991) described a new species, *C. angustilaminata,* from the peninsular region of Antarctica. They had just one fragment of a colony, and it is not possible to make useful comparisons with species described here.

Key to species

1. Colony with slender, cylindrical branches, perhaps slightly flattened at tips, smooth or with a distinctly serrated appearance. Autozooids in back-to-back pairs, or in whorls of three to five 2

   Colony with bilaminate branches, narrow and strap-like, or broad and frondose, or with irregularly varying width, but not cylindrical 5
2. Autozooid aperture with a symmetrical, median notch on the proximal border, flanked on one or both sides by small, disto-laterally directed avicularia; without projecting subapertural umbones. Frontal surface of ovicell with two tiny avicularia .... *C. dubia*

   Autozooid aperture without a median notch, with or without projecting umbones. Ovicell without frontal avicularia 3
3. Aperture transversely oval, with a smooth, horizontal oral shelf proximally. A single subapertural avicularium present, its rostrum laterally or disto-laterally directed; no apertural avicularia. Ovicell aperture with distal hood and thickened proximal lip. Attached by encrusting base ...... *C. foveolata*

   Aperture asymmetrical, with a single, transversely orientated avicularium on its inner proximal lip, and one or two avicularia mounted on conspicuous proximal apertural umbones. Ovicell not conspicuous. Colony attached by basal rhizoids 4

4. Autozooids arranged in alternating, back-to-back pairs. Apertural avicularia with semicircular mandibles .... *C. virgula*

   Autozooids arranged in whorls of three to five. Apertural avicularia with slender, triangular mandibles; mounted on strongly projecting apertural umbones which give the colony a serrated outline .... *C. laytoni*

5. Colony with narrow, strap-like branches, with regular transverse growth checks. Aperture twice as wide as long, with smooth, straight edged proximal oral shelf and overhanging distal border. A small disto-laterally directed avicularium present in each proximal corner of the aperture .... *C. njegovanae*

   Not as described 6

6. Avicularia subapertural only, on frontal wall of autozooid; rarely, some autozooids in colony with a very large avicularium transversely lodged in aperture, almost occluding it 7

   Avicularia present proximal to aperture, and also associated with proximal aperture lip (sometimes on a pronounced umbo), and deep within aperture with just the tip of the rostrum showing 9

7. Colony consisting of broad, folded, bilaminar sheets. Aperture developing a stout, conical, proximal umbo .... *C. latilaminata*

   Colony branching. Aperture without a proximal umbo 8

8. Colony slender, regularly branching. Each autozooid with a single avicularium proximo-lateral to aperture, directed proximolaterally .... *C. edita*

   Colony irregularly branched, developing broad lobes as well as narrow branches. Some autozooids with a single proximo-lateral avicularium, others with a massive hooked avicularium lodged within aperture .... *C. anomala*

9. Colony with slender, flat branches, the whorls of autozooids, with prominent, projecting umbones, giving a moniliform or nodulated appearance to branch profile. Aperture subtriangular, widely open, with a large internal avicularium along one side, its frontal plane perpendicular to plane of aperture .... *C. nodulata*

   Not as described 10

10. Aperture with a transversely orientated avicularium within its proximal edge, orientated so that it is only seen in profile, giving an asymmetrically notched appearance to inner proximal edge of aperture. Frequently a second avicularium present proximo-lateral to aperture, proximo-laterally directed .... *C. nutti*

    If aperture has a transversely orientated avicularium, it is orientated so that the rostrum and mandible are visible in frontal view 11

11. Edge of oral plate arched but not markedly oblique. Internal avicularium, when present, not visible in frontal view 12

    Edge of oral plate markedly oblique, distal tip of internal avicularium clearly visible in frontal view 13

12. Distal rim of aperture not projecting from frontal plane. Distal tip of internal avicularium visible in oblique view, just projecting above edge of oral plate. A single, laterally directed, lateral suboral avicularium present. Colony slender, 2–3 mm broad, sparsely branched, nodulated .... *C. margueritae*

    Distal rim of aperture projecting from frontal plane, cowl-like. No internal avicularium. A large, laterally directed, lateral suboral avicularium present, occasionally replaced by a very much smaller one. Colony broad and flat, up to 15 mm wide .... *C. terminata*

13. Proximo-lateral edge of oral plate curving back into peristome adjacent to tip of internal avicularium. One or two small, disto-laterally directed avicularia on proximal edge of aperture, typically with a conspicuous umbo between .... *C. watersi*

    Proximo-lateral edge of oral plate folded to form a deep groove, extending frontally along the edge of a stout umbo. A single avicularium proximo-lateral to aperture, proximo-laterally directed 14

14. Colony slender, nodulated, branches rarely more than 3 mm wide. Proximo-lateral avicularium narrow, twice as long as wide .... *C. rossi*

    Colony with broad, flat branches, usually about 8 mm wide. Proximo-lateral avicularium very broad, width typically two-thirds length .... *C. rogickae*

Cellarinella anomala Hayward and Ryland — Fig. 142D,E

Cellarinella anomala Hayward and Ryland 1991: 243, pl.1, fig.D, pl.2, figs.A,B

Colony with flat, curved or irregularly twisted branches, exceeding 40 mm high; narrow basally, rarely wider than 6 mm, but typically broadening abruptly to 20 mm or more and then dividing into a number of unequal rami. Basal attachment unknown. Autozooids in up to 20 alternating longitudinal series on each face of branch, usually far fewer; about 1.5 × 0.7 mm; boundaries obliterated in early ontogeny by coarsely reticulate, colony-wide calcification, basal parts of colony with all apertures obscured. Aperture wider than long, more or less semicircular, with a smooth, transverse, proximal oral shelf; broad distal oral shelf visible in early ontogeny, before completion of aperture rim. No internal avicularium. Most autozooids with a single frontal avicularium, proximal to aperture, rostrum oval, 0.15 mm long, acute to frontal plane, directed proximo-laterally. Some autozooids with a second, larger avicularium, 0.24 mm long, lodged within the proximal edge of the aperture, transversely orientated, with a curved, slightly hooked rostrum. Ovicell longer than wide, initially prominent, but soon submerged in reticulate calcification; brooding autozooids with a thick, projecting, proximal lip, sometimes with a small avicularium in one or both proximo-lateral corners.

Cellarinella anomala is presently known only from South Georgia. It has some resemblance to *C. latilaminata*, which is distinguished, however, by its larger aperture, with stout proximal mucro, and its larger frontal avicularia. *C. latilaminata* does not develop the enlarged apertural avicularia seen in *C. anomala,* and its colony is characteristically formed of broad, folded sheets.

Cellarinella dubia Waters — Figs. 142F, 143A

Cellarinella dubia Waters 1904: 58, pl.8, figs.12a, b, text fig.2

Cellarinella dubia: Livingstone 1928: 48; Moyano 1974b: 14; Hayward 1980: 73

Colony attached by a bundle of chitinous rhizoids; developing a slender, spreading, dichotomously branching form, exceeding 40 mm high; branches 2– 3 mm wide, cylindrical or slightly flattened, sometimes curved or twisted, but most usually all orientated in the same plane. Autozooids in alternating whorls of four or five, or eight to ten in flat branched colonies; elongate, fusiform, divided by distinct sutures in early ontogeny; 1.0–1.3 × 0.4–0.5 mm. Autozooid boundaries indistinct in later ontogeny; frontal wall thickening leads to a uniform reticulate or longitudinally ridged colony surface, with all apertures deeply immersed.

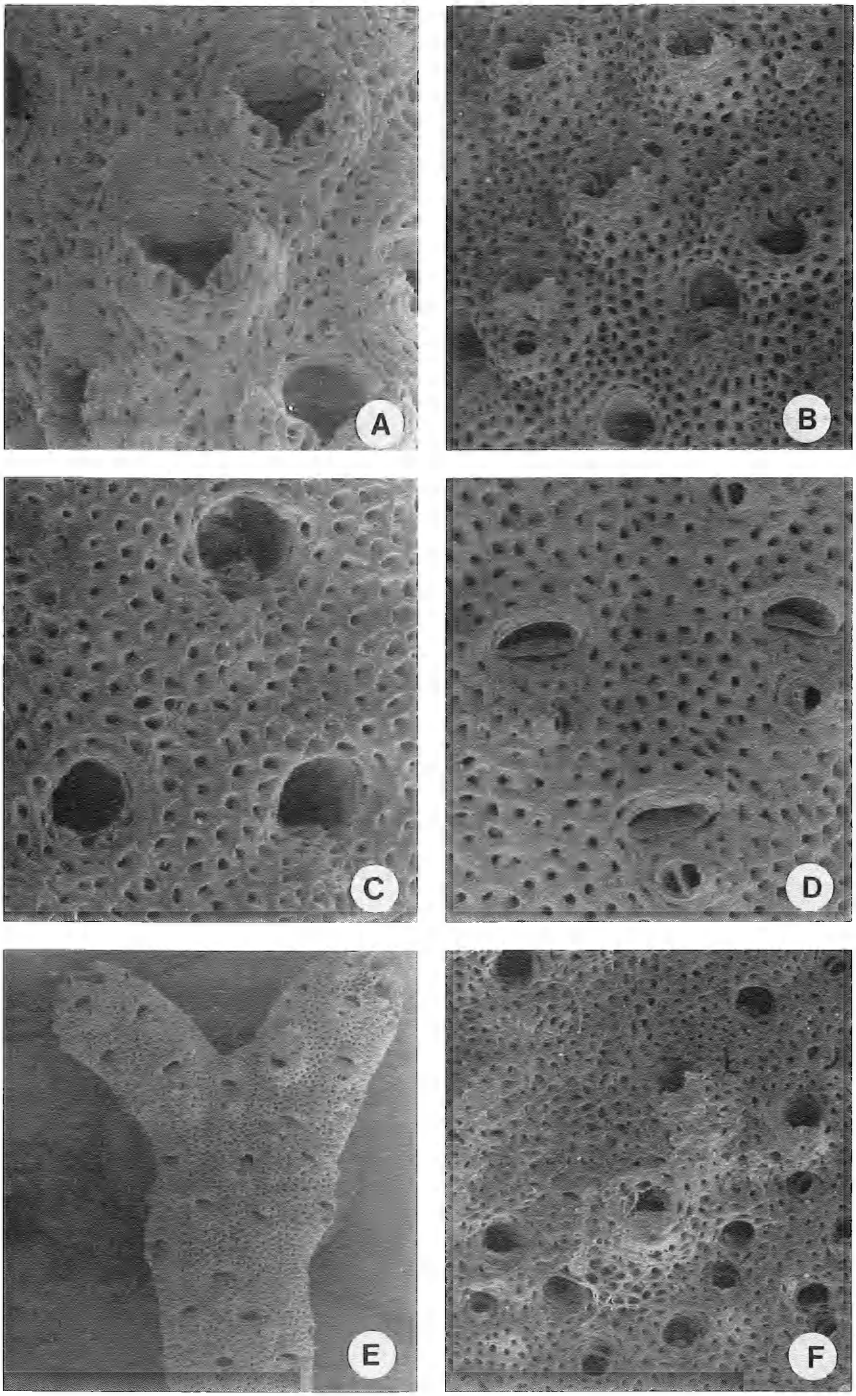


Fig. 143. A. *Cellarinella dubia.* Off Patagonian Shelf; ovicelled autozooids; ×40. B, C. *Cellarinella edita.* Ross Sea. B. Ovicelled autozooids; ×24. C. Three autozooids; ×40. D, E. *Cellarinella foveolata.* Ross Sea. D. Group of autozooids from close to branch tip; ×32. E. A complete dichotomy; ×11. F. *Cellarinella latilaminata.* Signy Id.; ×21.

Aperture rim raised, slightly flared, with two short, umbonal processes flanking a medio-proximal notch; typically with a small, disto-laterally directed avicularium on one or both sides of the peristomial notch. Ovicell elongate oval, with straight edge above aperture, becoming submerged in secondary calcification and developing a pair of tiny adventitious avicularia frontally.

Cellarinella dubia ranges from South Chile to Cape Horn and the Magellan Strait, across the Southern Patagonian Shelf to the Falkland Isles and Burdwood Bank. It has occurred at South Georgia, but it is perhaps doubtful whether it ranges further into Antarctica. Waters (1904) stated that the material he recorded from the Bellingshausen Sea was possibly wrongly labelled, and, while Livingstone (1928) reported specimens from an unknown, and presumed, Antarctic locality, no other author has recorded *C. dubia* from Antarctic Seas.

Cellarinella edita Hayward and Ryland — Fig. 143B,C

Cellarinella edita Hayward and Ryland 1991: 244, pl.2, figs.C,D.

Colony attached by an encrusting base, developing a slender, irregularly branching, three-dimensional form, exceeding 80 mm high, often with an equivalent horizontal spread; typically with a slender, cylindrical basal portion, the branches broadening, flattening and twisting distally, with a maximum width of 5–6 mm. Autozooids about 1.5 × 0.5 mm, strongly convex, boundaries apparent only at the growing edge; frontal surface of entire colony consisting of coarsely reticulate calcification which thickens continuously, eventually obliterating autozooid apertures, so that the basal portion of the colony consists of a smooth, evenly reticulate surface. Aperture large, initially more or less D-shaped, but becoming more nearly round as frontal thickening continues; proximal border with a smooth, convex, oral shelf projecting into the aperture, eventually hidden by ontogenetic thickening; frequently with a stout, conical umbo projecting distally from just proximal to the aperture. A single avicularium situated proximo-lateral to the aperture, with rounded, proximo-laterally directed rostrum, supporting a semicircular mandible. No internal avicularium. Ovicell wider than long, at first very prominent, with a wide orifice opening above the aperture of the brooding autozooid, which is further distinguished by a prominent, spout-like proximal apertural lip; eventually becoming immersed in reticulate calcification, and less obvious.

This species is presently known only from the Ross Sea, where, however, it seems to be quite widely distributed.

Cellarinella foveolata Waters — Fig. 143D,E

Cellarinella foveolata Waters 1904: 57, pl.5, figs.2a–h

Cellarinella foveolata: Livingstone 1928: 49, pl.1, fig.2; Moyano 1965: 13, pl.3, fig.17; pl.6, figs.1,2; Winston 1983: 692; Gordon 1988: 284, figs.16–20.

Colony attached by an encrusting base, developing an open, three-dimensional form; slender, cylindrical branches dividing dichotomously at irregular intervals, with frequent anastomoses, giving an erect, rigid structure exceeding 80 mm in height, with an equivalent horizontal spread. Growing tips of branches about 2.5 mm diameter, large colonies up to 3 mm diameter at base. Autozooids budded in alternating whorls of four, elongate oval, commonly 1.4 × 0.5 mm, but boundaries discernible only at the growing tip of the branch. Frontal shield of newly budded autozooids rapidly thickened by reticulate ridges of calcification, advancing centripetally from their margins; within two or three autozooid generations from the growing tip, the colony surface has a uniformly porous appearance, with closely spaced, large, round pores, each in an angularly rimmed pit. Secondary orifice transversely oval with a broad, smooth, curved oral shelf; distal border produced as a projecting, cowl-like structure, obscured in later ontogeny. A single avicularium proximo-lateral to orifice, with broadly triangular mandible, acute to frontal plane, directed disto-laterally. Ovicell spherical; imperforate, with a distinct lip over the aperture; at first bulging prominently from the frontal plane, but rapidly covered by encroaching, reticulate calcification, and eventually immersed. Towards the basal portions of the colony, frontal calcification may be up to 0.8 mm thick. The secondary orifice becomes deeply immersed, rounded, and encloses the avicularium, which can be seen within the upwardly slanting peristomial tube. Ovicells are completely immersed and no longer visible. In the oldest colonies, autozooid orifices are occluded and the colony surface has a smooth, regularly reticulate appearance.

Cellarinella foveolata is widely distributed in Antarctic shelf seas, and in some areas, such as the Ross Shelf (Winston 1983), it may be one of the most abundant cellarinellid species present.

Cellarinella latilaminata Moyano — Figs. 143F, 144A

Cellarinella latilaminata Moyano 1974a: 182, figs.1–3

Colony attached by an encrusting base, developing a narrow, erect stalk, forming broad, folded, bilaminate sheets; lobed, occasionally dividing and anastomosing, developing a complex three-dimensional form 30–40 mm high, with an equivalent horizontal spread. Autozooids arranged in regular, alternating, longitudinal series; oval to hexagonal, strongly convex, but with boundaries visible only at the growing edge, elsewhere obscured by colony-wide, secondary reticulate calcification; 1.4–1.8 × about 0.5 mm. Aperture about as wide as long, more or less round, its rim distinct, but immersed and not protruding frontally; distal oral shelf clearly visible in developing autozooids; proximal edge of aperture reflected, developing a stout medio-proximal umbo, but without a proximal oral shelf. Most autozooids with a single avicularium proximo-lateral to aperture, not incorporated in the umbo; rostrum oval, with a semicircular mandible, directed proximally or proximo-laterally. Rarely, an autozooid may bear two such avicularia. Internal avicularia absent. Ovicell spherical, imperforate, immersed in reticulate calcification which bulges prominently; in brooding autozooids the aperture develops a broad, tapered, conspicuously projecting, proximal lip. In some cases, the apertural lip of the brooding autozooid incorporates on one or both sides an avicularium, with a sharply hooked, vertically orientated rostrum; this avicularium cannot be seen in frontal view, but its presence is indicated by a strong lateral swelling on the side of the aperture.

Cellarinella latilaminata was described from the South Shetland Isles by Moyano (1974a), and listed from the Ross Sea by Hayward and Taylor (1984). Subsequent specimens were collected from the South Shetlands (illustrated here) by *Discovery* Investigations.

Cellarinella laytoni Rogick — Fig. 144B,C

Cellarinella laytoni Rogick 1956d: 267, pl.18, figs.A–I

Colony attached by tubular, chitinous rhizoids, developing a delicate, irregularly branching form, rarely more than 30 mm high; branches have a maximum width of about 2 mm, with a boldly serrated outline, visible to the unaided eye. Autozooids arranged in irregular whorls of three to five, each whorl narrowed proximally and greatly broadened distally; about 1.5 × 0.5 mm, without clear boundaries between. Aperture terminal, its plane perpendicular to the long axis of the autozooid, broadest distally, tapered proximally, with on one side a narrow border of smooth calcification extending obliquely towards a stout, pro-

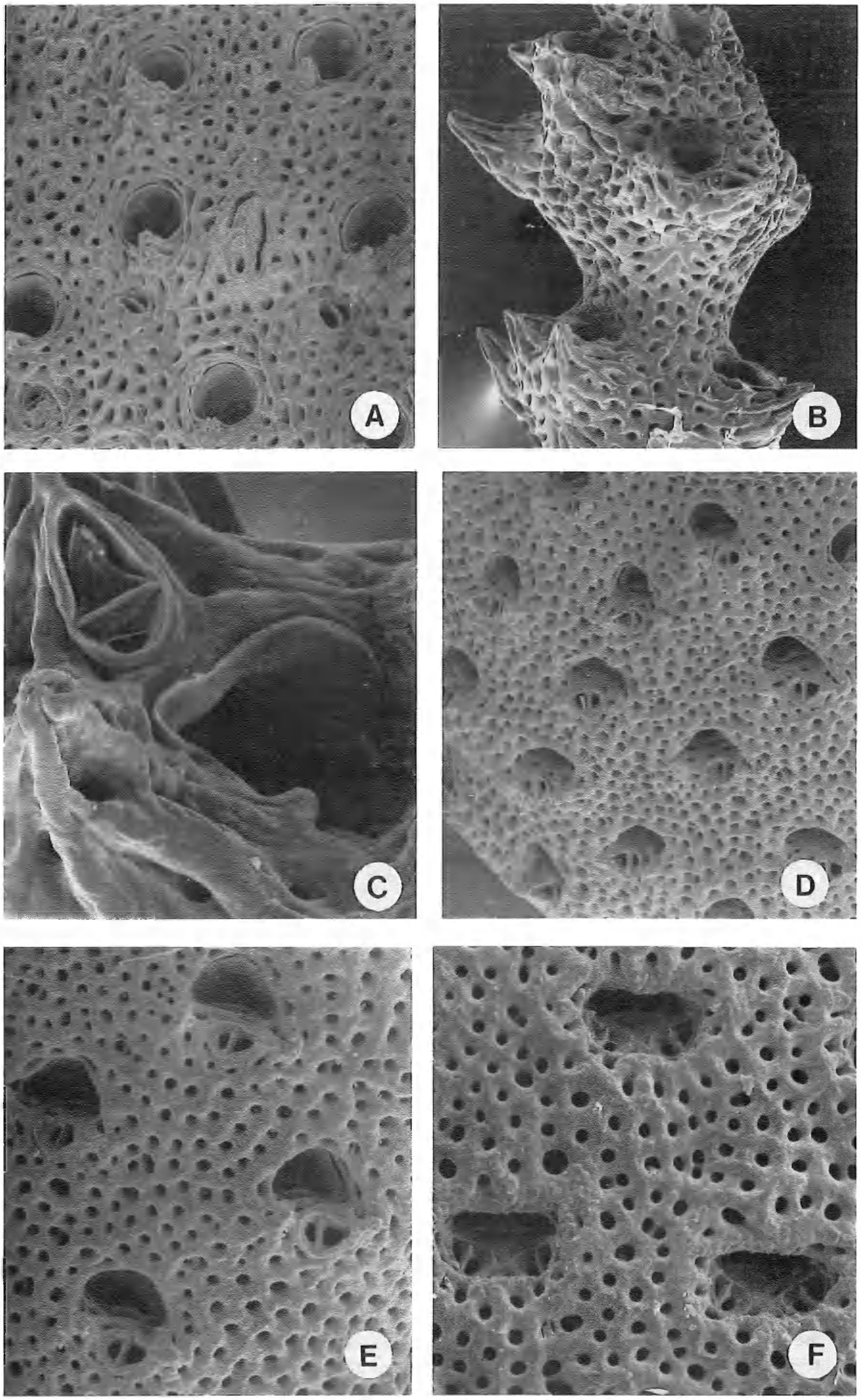


Fig. 144. A. *Cellarinella latilaminata.* Ross Sea; ×27. B, C *Cellarinella laytoni.* Ross Sea.B. Branch tip; ×26. C. Detail of orifice; ×130. D, E. *Cellarinella margueritae.* Ross Sea. D. Part of a colony; ×20. E. Detail of orifice; ×30. F. *Cellarinella njegovanae.* Ross Sea; ×45.

jecting conical umbo; a second, equally prominent umbo diverging from the first, situated in the opposite proximal corner of the aperture, supporting on its inner, distal, face a single avicularium, 0.2 mm long, with elongate triangular mandible. A second avicularium situated within the aperture, its plane perpendicular to that of the aperture, directed disto-laterally. Ovicell immersed, its presence indicated by frontal bulging, and with its orifice arching above the aperture of the autozooid.

This distinctive species has been collected from numerous localities in the Ross Sea, and from a single station off the South Shetland Isles. Its colonies are readily recognized by their boldly serrated profile, and, together with *C. virgula*, it is among the smallest and most delicate of the species of *Cellarinella*.

Cellarinella margueritae Rogick — Fig. 144D,E

Cellarinella margueritae Rogick 1956d: 255, pl.12, figs.A–K

not *Cellarinella margueritae*: Gordon 1988: 257, figs.21–24 (= *C. rossi*)

Colony attached by tubular, chitinous rhizoids, developing a slender, sparsely branched, nodulated form; straight or irregularly curved or twisted, at least 70 mm high, with a width of 2–3 mm (exceptionally to 4 or 5 mm). Many colonies do not branch at all, most have simply a distal bifurcation, but occasionally two or three levels of dichotomous branching occur, giving a fan-shaped, two-dimensional form with irregular anastomoses. Strongly pronounced growth discontinuities at intervals of 4 or 5 mm give slender, unbranched colonies a distinctly moniliform appearance. Autozooids about 1.4 × 0.6 mm, boundaries indistinct from earliest ontogeny, uniform, reticulate calcification continuous over the whole colony surface; arranged in alternating whorls of four to six in slender, moniliform colonies, in up to 12 alternating longitudinal series per side in broader, flatter branches. Aperture wider than long, distal border immersed and never projecting from frontal plane; proximal edge typically with a stout, conical umbo on one side, and a single avicularium on the other, with acuminate, hooked rostrum, 0.25 mm long, laterally directed; a second, smaller, umbo may develop close to the distal tip of the avicularium. Proximal oral plate distinct: smooth, with curving, arched edge, slightly oblique to plane of aperture, but not reaching frontal proximal corner (cf. *C. watersi*), almost symmetrical in frontal view; distal tip of internal avicularium just visible above oral plate, on opposite side of aperture to that occupied by external avicularium. Ovicell immersed in earliest ontogeny, not apparent in frontal view.

The typical, narrow, sparsely branched colonies of *C. margueritae* are easily distinguished from the broader colonies of *C. watersi*, although broad-branched specimens might easily be confused with the latter. The proximal oral plate of *C. watersi* is strongly asymmetrical, curving obliquely towards one proximal corner of the aperture, and this feature is sufficient to distinguish the two species.

C. margueritae was described from specimens collected in Marguerite Bay, Graham Land, but it seems to be particularly common on the Ross Sea shelf.

Cellarinella njegovanae Rogick — Fig. 144F

Cellarinella njegovanae Rogick 1956d: 262, pl.15, figs.A–H, pl.16, figs.A–I

Colony attached by chitinous rhizoids, developing a slender, sparsely branched form, often exceeding 60 mm high, mostly two-dimensional, but with branches sometimes twisting or curving distally. Branches flat, strap-like, up to 8 mm wide but often less, frequently abruptly narrowed, or broadened; banded at intervals of 5 or 6 mm by transverse growth discontinuities, which in especially narrow parts of the colony give the branch a distinctly moniliform appearance. Autozooids 1.0–

1.4 × about 0.5 mm, boundaries indistinct even at growing edges; arranged in up to 15 alternating longitudinal series. Aperture twice as wide as long, the distal border overhanging, the proximal border extended disto-basally as a smooth, flat oral shelf. Avicularia paired, each one lodged in a proximal corner of the aperture; rostrum acute to frontal plane, directed disto-laterally, with a short, triangular mandible. Rogick (1956d) described a third avicularium in her specimens, located deep within the aperture, hidden by the proximal oral shelf. Ovicell completely immersed and not discernible in frontal view.

C. njegovanae is widely distributed in Antarctic Seas, and has been reported from the Bransfield Strait, Marguerite Bay, the Ross Sea, and from the Knox coast.

Cellarinella nodulata Waters — Fig. 145A

Cellarinella nodulata Waters 1904: 58, pl.8, figs.6a–c

Cellarinella nodulata: Livingstone 1928: 49, pl.1, figs.1,4,7; Winston 1983: 692

Colony attached by bundles of chitinous, tubular rhizoids; branches flat-sectioned, dividing dichotomously at infrequent intervals, developing an open, two-dimensional form. Maximum size unknown, but fragments 30–40 mm high are frequent; branches 2–6 mm wide, or sometimes flatter, to 10 mm width; slender branches appearing 'nodulated' or moniliform through the occurrence of transverse discontinuities between successive generations of autozooids, at intervals of three to seven generations. The resulting saw-toothed outline of the branch edge is enhanced by stout, conical processes developed close to each autozooid orifice. Autozooids in alternating whorls of four to eight; about 1.6 × 0.5 mm, strongly convex, the branches of each marked by distinct concavities in early ontogeny, but without clear sutural boundaries. Imperforate frontal shield rapidly covered by reticulate calcification; in old colony fragments this is continuous across the whole colony surface, but the proximal border of the secondary orifice of each autozooid remains prominent, and strongly projecting. Secondary orifice more or less pear-shaped in plane view; broadest distally, the lateral borders converging medio-proximally, with one projecting as a narrow plate; deep within the aperture a well-developed plate is seen projecting from the disto-basal wall of the autozooid. Medio-proximal edge of aperture produced as a stout, conical umbo, ridged or reticulate like the frontal calcification. Two avicularia present: one located within aperture, on the opposite side to the oral plate, rostrum 0.3 mm long, hooked, perpendicular to aperture plane and directed towards disto-basal wall of autozooid; second situated on proximo-lateral edge of aperture, right or left, rostrum 0.2–0.3 mm long, acute to frontal plane, directed disto-laterally; occasionally a third avicularium present on opposite proximal corner of aperture. Ovicell submerged in early ontogeny, never prominent, and usually not readily visible; its presence recognized by its orifice, opening within the aperture, just above the disto-basal plate.

Cellarinella nodulata has been widely reported in Antarctic Shelf waters, including the Weddell Sea, the Bellingshausen Sea, the Ross Sea, and the coasts of Australian Antarctic Territory.

Cellarinella nutti Rogick — Fig. 145B–D

Cellarinella nutti Rogick 1956d: 260, pl.14, figs.A–K

Cellarinella nutti: Moyano 1965: 10, pl.3, figs.11–13, pl.5, figs.1,2; Winston 1983: 692, figs.6,8

Colony attached by tubular chitinous rhizoids; developing a tall, slender, freely branching growth, mostly two-dimensional, although with some branches twisting or curving apically; branches flat,

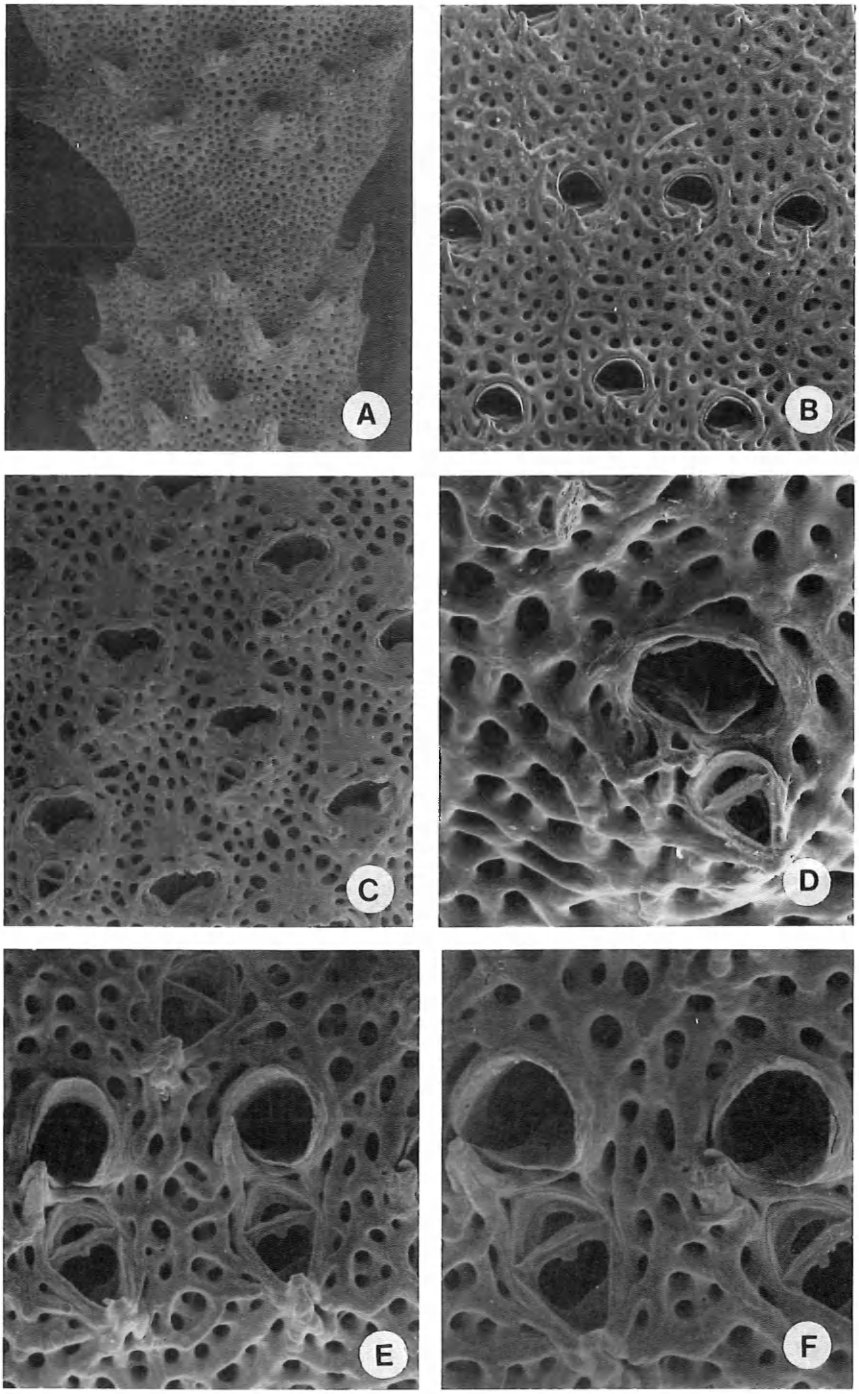


Fig. 145. A. *Cellarinella nodulata.* Ross Sea; ×11. B–D. *Cellarinella nutti.* Ross Sea. B. Group of autozooids; ×30. C. Ovicelled autozooids; ×30. D. Oblique view of orifice; ×85. E, F. *Cellarinella rogickae.* Ross Sea. E. Two typical orifices, with avicularia; ×50. F. Oblique view showing inner edge of peristome; ×70.

strap-like, 4–8 mm wide, in young growing colonies banded at intervals of 4–5 mm by transverse discontinuities; maximum size probably exceeding 100 mm high, but with lateral spread of perhaps 20–30 mm. Autozooids in up to 30 alternating longitudinal series on each face of branch, about 1.0 × 0.5 mm; strongly convex proximal to aperture in early ontogeny, with thick nodular calcification forming an ill-defined umbo, and with fine reticulate calcification between adjacent autozooids; in later ontogeny, the entire frontal surface of the colony is uniformly reticulate. Aperture broader than long; distal border produced as a smooth, projecting cowl; proximal border occupied by a transversely orientated avicularium, 0.25 mm long, its plane perpendicular to that of the aperture so that it is seen in profile from frontal view; a narrow fold of calcification encircling proximal end of avicularium gives the proximal edge of aperture a distinctive notched appearance. In many autozooids a second avicularium present proximo-lateral to aperture, 0.25 mm long, with broadly triangular mandible, proximo-laterally directed. At its apex, the avicularium encroaches on a short, thick umbonate process; frequently a second umbo develops proximal to aperture, close to proximal part of the avicularium. Ovicell spherical, smooth, bordered by encroaching struts of calcification; remaining distinct into later ontogeny, but eventually quite immersed.

Cellarinella nutti is common across the whole of the Ross Sea shelf, and has been reported also from the Knox coast, and from Marguerite Bay.

Cellarinella rogickae Moyano — Fig. 145E,F

Cellarinella rogickae Moyano 1965: 6, pl.1, figs.A–K, pl.2, figs.A–D, pl.3,fig.1, pl.4, figs.1,2

Colony attached by chitinous rhizoids, developing a dichotomously branching, two-dimensional form, exceeding 70 mm high; branches flat, up to 8 mm broad, with bold growth discontinuities at intervals of 5 to 7 mm. Autozooids in up to 30 alternating longitudinal series; about 1.0 × 0.5 mm, with boundaries distinct only at the growing edge, colony-wide frontal calcification coarsely reticulate. Aperture slightly broader than long; distal and lateral borders with a smooth hood-like rim which projects slightly from the frontal plane; proximally, this rim is continuous with a smooth, broad, oral plate, the free edge of which is abruptly folded in one corner, the fold then delimiting a deep groove which passes frontally to the proximal corner of the aperture; at this point, the aperture rim is produced as a short, conical umbo. External avicularium proximo-laterally directed, its proximal portion situated close to the umbo; very large and broad, commonly 0.35 × 0.25 mm, with strongly hooked rostrum, and a broadly triangular mandible, as wide as long. Internal avicularium smaller, its distal tip just visible beyond the groove formed by the folded oral plate. Ovicell longer than wide, deeply immersed, with its orifice opening below the smooth distal rim of the aperture.

This species was distinguished from *C. rossi* by Moyano (1965). *C. rossi* has very similar aperture morphology to *C. rogickae*, but differs in its smaller, more slender external avicularium, its more pronounced apertural rim, and its very slender, nodulated colonies. *C. rogickae* was described originally from a single locality in western Antarctica, but seems to be common in the Ross Sea, and probably has a wide Antarctic distribution.

Cellarinella rossi Rogick — Fig. 146A,B

Cellarinella rossi Rogick 1956d: 257, pl.13, figs.A–K

Cellarinella rossi: Moyano 1965: 9, pl.3, figs.14–16, pl.4, fig.3

Colony attached by chitinous rhizoids, slender, sparsely branched, up to 30 mm high, perhaps larger; branches oval or

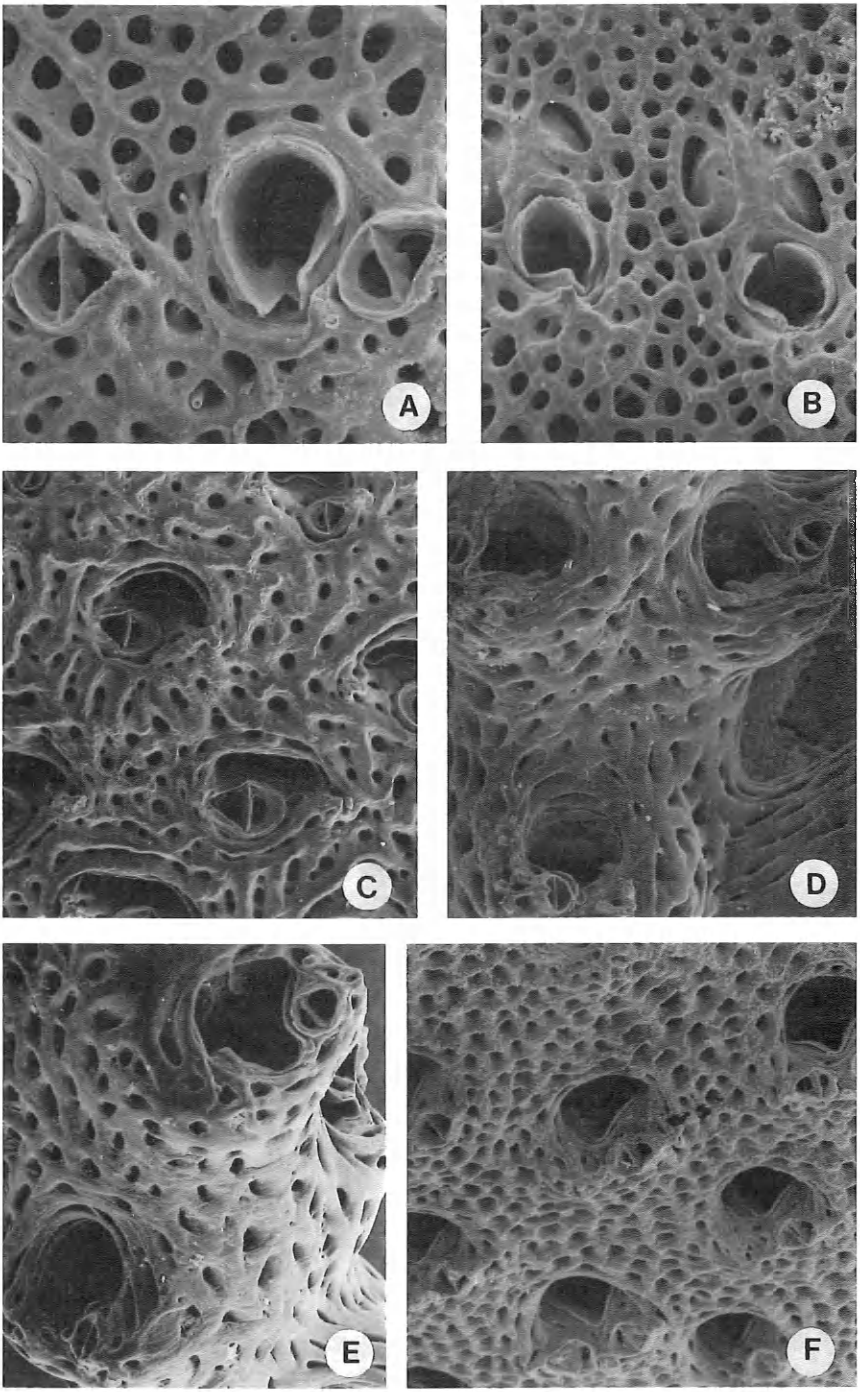


Fig. 146. A, B. *Cellarinella rossi.* Ross Sea. A. Typical orifice; ×90. B. Ovicelled autozooids; ×55. C. *Cellarinella terminata.* Eltanin 6, Stn. 415, South Shetland Is.; ×38. D, E. *Cellarinella virgula.* Discovery Stn. 1948, South Shetland Is. D. Group of autozooids; ×70. E. Oblique view of orifices; ×70. F. *Cellarinella watersi.* Discovery Stn. 160, Shag Rocks; ×40.

flat-sectioned distally, more nearly cylindrical in later ontogeny, up to 3 mm wide (4 mm prior to dichotomy), with bold growth discontinuities at 3 or 4 mm intervals giving the branch a moniliform appearance. Autozooids in seven to ten alternating longitudinal series, 0.8–1.00 × about 0.5 mm, convex, boundaries distinct only at growing edge, reticulate calcification tending to round off the branch section in later ontogeny. Aperture wider than long, lateral and distal rim produced as a smooth, hood-like structure which projects markedly from frontal plane, even late in ontogeny; proximally the rim forms a smooth oral plate, interrupted halfway along its free edge by a strong fold, flanking a deep groove which passes obliquely to the proximal corner of the aperture, continuing along the inner face of a stout subapertural umbo. External avicularium directed laterally or proximo-laterally, its proximal part located close to the base of the apertural umbo, its distal end frequently raised on a second, smaller umbo; commonly 0.25 × 0.12 mm, with an elongate triangular mandible. Distal tip of internal avicularium visible just beyond the groove in the oral plate. Ovicell becoming immersed in earliest ontogeny, and generally not evident in frontal view.

This species is distinguished from the similar *C. rogickae* by its smaller, more slender colonies, by its proportionately smaller external avicularium, and by the more pronounced groove in the oral plate, which when fully developed gives the apertural rim a distinctly asymmetrical appearance. It has been widely recorded in Antarctic shelf waters, from the Weddell Sea, the Palmer Archipelago, Graham Land, and the Ross Sea.

Cellarinella terminata Fig. 146C
Hayward and Winston

Cellarinella terminata Hayward and Winston 1994: 244, fig.4

Colony attached by chitinous rootlets, sparsely branched, with flat branches up to 15 mm wide; periodic growth checks impart irregular outline to branch edges. Autozooids in up to 20 alternating longitudinal series; individual boundaries unclear, except at growing edge, obscured by thick, continuous, reticulate calcification. Aperture wider than long, more or less crescentic, the distal rim projecting as a distinct, cowl-like, hood. A single, lateral-suboral, avicularium, transversely orientated, situated just within proximal edge of orifice, clearly visible in frontal view; rostrum broadly triangular, usually 0.2–0.3 mm long, but in some autozooids less than half this. No internal avicularium. A short umbo developed on the proximal edge of the peristome in some autozooids. Ovicell presently undescribed.

A few species of *Cellarinella* lack the internal peristomial avicularium otherwise typical of the genus. *C. anomala* is most similar to this species, but is distinguished by its broadly oval avicularium, which is situated proximal to the orifice; some autozooids may bear a transversely orientated avicularium within the orifice, but this is massive compared to that of *C. terminata*, and strongly hooked distally.

This species is known from a few specimens collected around the South Shetland Islands.

Cellarinella virgula Fig. 146D,E
Hayward and Ryland

Bifaxaria denticulata: Waters 1904: 59, pl.8, figs.14a,b

Bifaxaria rustica: Waters 1904: 60, pl.8, figs.19a,b

Cellarinella virgula Hayward and Ryland 1991: 245, pl.3, figs.A–C

Colony attached by chitinous rootlets, forming a slender, rod-like growth, 10 mm high (perhaps more), branching dichotomously at irregular intervals; branches with a maximum width of 1 mm. Autozooids arranged in alternating, back-to-back pairs, with slender vase-like profile. Aperture terminal, irregularly pear-shaped, the proximal border formed on one side by a curved, obliquely orientated internal avicularium. Paired, lateral suboral umbones present, either or both with a small avicularium on the inner, median face, the rostrum oval, disto-laterally directed. In later ontogeny frontal thickening obscures the umbones, the avicularia become indistinct, and the aperture deeply immersed and quite rounded. Ovicell unknown.

This smallest species of *Cellarinella* has a superficial resemblance to *C. laytoni*, which develops similar narrow, sparsely branched colonies. However, the larger autozooids of *C. laytoni* are disposed in whorls of three to five, from earliest ontogeny, in contrast to the constant paired arrangement of *C. virgula*, and its more pronounced umbones give a decidedly serrated profile to the branch. *C. virgula* is presently known only from the South Shetland Islands, attached to other small, erect Bryozoa, such as *Paracellaria elephantina*. However,it is very inconspicuous and may prove to be more widely distributed in Antarctica.

Cellarinella watersi Calvet Figs. 146F, 147A

Cellarinella watersi Calvet 1909: 33, pl.3, figs.8–10

?not *Cellarinella watersi*: Livingstone 1928: 51, pl.1, figs.8,10

Cellarinella roydsi Rogick 1956d: 265, pl.16, figs.J,K, pl.17, figs.A–I

Cellarinella roydsi: Moyano 1965: 12, pl.3, figs.2-6; pl.4, fig.4

Cellarinella watersi: Hayward and Ryland 1991: 246, Fig.1, pl.4, figs.A,B

Colony attached by a thickened bundle of chitinous rhizoids, developing a robust, two-dimensional, dichotomously branching form; branches commonly 5–10 mm wide, often broadening to as much as 40 mm, to give a flat, flabellate outline with indistinctly lobed growing edge; banded with conspicuous growth discontinuities at intervals of from 5 mm (in narrow branched colonies) to 15 mm (flabellate colonies). Autozooids in alternating longitudinal series, up to 70 in the broadest colonies, about 1.4 × 0.6 mm, but individual boundaries not apparent; thick, flat, reticulate calcification uniform over the whole branch from early ontogeny. Aperture longer than broad, its distal rim deeply immersed and never projecting above the frontal plane; proximal border with an avicularium on the right or left, 0.15 mm long, rostrum acuminate, hooked, directed laterally or disto-laterally; a short, distally directed umbo develops on the midline of the aperture's proximal border, close to the proximal end of the avicularium, and a second umbo may arise adjacent to the distal tip of the rostrum. In some autozooids, a second avicularium is present in the opposite proximal corner of the aperture. Proximal oral plate strongly arched on one side (on the same side as the avicularium, if unpaired), curving obliquely to opposite proximal corner; distal tip of internal avicularium visible at this point. Ovicell completely immersed, not visible in frontal view.

This species is rather similar to *C. margueritae*, especially with regard to the structure of the aperture and its associated avicularia. However, in *C. margueritae* the proximal oral plate is of more or less constant depth across its width, while in *C. watersi* its free edge curves obliquely towards one proximal corner, beyond which the hooked rostrum of the internal avicularium is visible; in frontal view the profile of the avicularium and the edge of the oral plate create an impression of a deep notch within the aperture.

Cellarinella watersi is widely distributed in Antarctic coastal waters, having been recorded from South Georgia, the Weddell Sea, Signy Island, the Palmer Archipelago and the coast of Graham Land, as well as from the Ross Sea.

Cellarinelloides Moyano, 1970

Colony erect, branching, bilaminar. Autozooids covered by reticulate secondary calcification, obscuring individual boundaries; primary frontal shield with

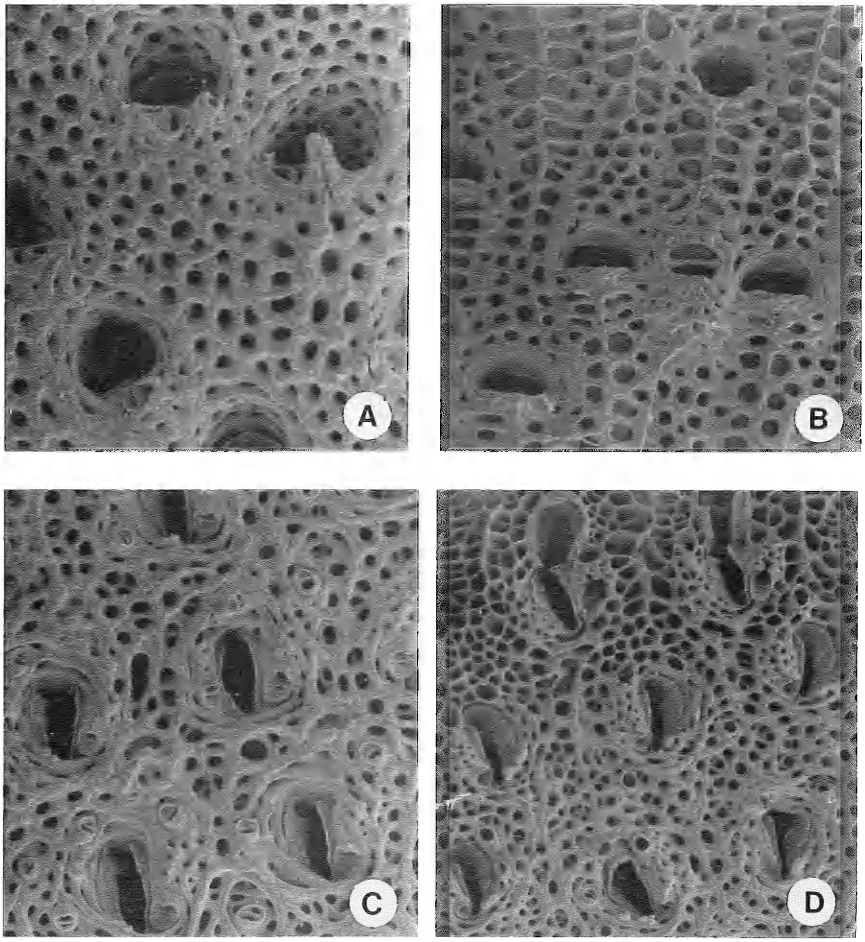


Fig. 147. A. *Cellarinella watersi.* Discovery Stn. 160, Shag Rocks; ×50. B. *Cellarinelloides crassus.* Ross Sea; ×23. C, D. *Stystenopora contracta.* Ross Sea. C. Autozooids in later ontogeny; ×30. D. Autozooids from close to branch tip; ×21.

marginal pores only. Primary orifice lacking an operculum, enclosed and hidden by a deep peristome; no oral ledge, oral avicularia or peristomial avicularia; frontal adventitious avicularia only. Ovicell imperforate, immersed in reticulate secondary calcification. Autozooids without internal calcareous processes.

Type species: *Cellarinelloides crassus* Moyano, 1970.

Cellarinelloides crassus Moyano — Fig. 147B

Cellarinelloides crassus Moyano 1970c: 155, fig.1 (1,2); Fig.2 (3–6)

Cellarinelloides crassus: Winston 1983: 692; Hayward and Taylor 1984: 72.

Colony with brittle, lamellate or frondose branches, typically curved or twisted, irregularly bifurcating, 10–40 mm wide; attaining at least 100 mm high, and perhaps larger. Autozooids elongate, rectangular, flat, with indistinct boundaries; 1.8–3.00 × 0.5–0.6 mm. Frontal wall with marginal pores, interspersed by slender ribs that spread across entire frontal surface, fusing to form a reticulate secondary layer; in later ontogeny this reticulate calcification thickens considerably, so that the frontal wall of older autozooids appears regularly and densely porous. Secondary orifice transversely oval, the distal border immersed, the proximal raised as a prominent lip, peaked medially. Avicularia sparsely developed; rostrum perpendicular to frontal plane, supporting a stout, semicircular mandible. Ovicell spherical, smooth, imperforate; rapidly immersed in reticulate calcification and becoming obscured.

Cellarinelloides crassus is an endemic Antarctic species. It was first described from Marguerite Bay, Graham Land, but is widely distributed in the Ross Sea, and perhaps elsewhere in Antarctica.

Systenopora Waters, 1904

Colony erect, branching, bilaminate, attached by chitinous rhizoids. Primary frontal wall of autozooids with marginal pores only; covered by reticulate secondary calcification and appearing regularly porous. Primary orifice enclosed and hidden by a deep peristome; secondary orifice an elongate slit, bordered on one side by a reflected plate, and on the other by a tubular avicularian cystid, the rostrum of which is lodged in the proximo-lateral corner of the orifice. Frontal adventitious avicularia typically numerous. Ovicell hyperstomial, imperforate, immersed in reticulate calcification. Vertical walls with mural septula, and internal calcareous processes.

Type species: *Systenopora contracta* Waters, 1904.

Systenopora contracta Waters — Fig. 147C,D

Systenopora contracta Waters 1904: 56, pl.5, figs.1a–k

Systenopora contracta: Thornely 1924: 48; Livingstone 1928: 48, pl.6, fig.5; Moyano 1965: 14, pl.3, figs.18,19, pl.6, figs.3,4; 1966a: 119; Winston 1983: 692; Gordon 1988: 259, figs.25–27

Colony exceeding 70 mm in height; branches up to 10 mm wide, flat or twisted, with oval section, dividing dichotomously, in a single plane, at irregular intervals. Autozooids in 10–20 alternating longitudinal series on each face of branch, with one or two additional series along the branch edges; 1.2–2.0 × 0.5–0.8 mm, boundaries obliterated by coarsely reticulate, colony-wide secondary calcification. Aperture an elongate slit, 0.4 mm long, visible to the unaided eye; the lip on one side deflected downwards into the peristome, on the other flared frontally beneath a cylindrical avicularian cystid, with the oval, hooked rostrum at the proximal end of the aperture, acute to frontal plane and facing proximally. Similar, smaller avicularia develop around the outer edges of the aperture and elsewhere on the frontal wall. Ovicell elongate oval, smooth and imperforate, completely submerged by reticulate calcification and only apparent close to growing tip of colony.

This distinctive, endemic species is widespread and common in all Antarctic coastal waters.

HIPPOTHOOIDEA Fischer, 1866

HIPPOTHOIDAE Fischer, 1866

Colony encrusting, more rarely, erect, attached by an encrusting base. Frontal wall calcification gymnocystal, smooth, ridged or tuberculate, sometimes with punctae, but imperforate. Primary orifice sinuate; oral spines absent. Polymorphism generally marked, including autozooids, brooding female zooids, male zooids, and minute zooids (zooeciules) of unknown function; avicularia present in some species, interzooidal or vicarious only. Ovicell hyperstomial, closed by zooidal operculum. Basal pore chambers present, often tubular, linking disjunct zooids.

The two major genera of this family, *Hippothoa* Lamouroux and *Celleporella* Gray, achieve remarkable levels of diversity in southern hemisphere cold temperate waters. Three important taxonomic sources are Ryland and Gordon (1977), Moyano and Gordon (1980) and Moyano (1986b), while Gordon (1984, 1986) has given further accounts of the New Zealand species. Both genera have suffered considerable taxonomic confusion, over a long period of time, which is only now being resolved, and it is probable that additional species remain to be recognized. Hippothoid colonies are typically lightly calcified; a few are opaque and chalky, and easily seen, but most are hyaline and thus inconspicuous. They may be common on small algae, on hydroids, erect bryozoans, shell and other biogenic carbonates.

Hippothoa Lamouroux, 1821

Colony encrusting, consisting of branching, uniserial chains of polymorphic zooids. Autozooids typically clavate, with filiform proximal portion, and oval distal portion; ovicellate female zooids frequently shorter than autozooids with dimorphic orifice; zooeciules often present, of variable length, usually slender, cylindrical, with simple orifice. Primary orifice with proximal sinus and well marked condyles. No oral spines. Frontal calcification smooth, or ridged, and sometimes with suborificial umbo. Ovicell steeply convex, smoothly calcified, often with a frontal umbo; imperforate, or with one or two minute, apical pores. Tubular pore chambers present in lateral and distal walls, the number and disposition characteristic for each species. Ancestrula kenozooidal or tatiform.

Type species: *Hippothoa divaricata* Lamouroux, 1821.

Hippothoa flagellum Manzoni — Fig. 148D–F

Hippothoa flagellum Manzoni 1870: 328, pl.1, fig.5

Hippothoa flagellum: Ryland and Gordon 1977: 22, figs.2A,3; Gordon 1984:111, text fig.10D, plate 43, figs.C,D; 1986: 25, pl.11, figs.E,G.; Hayward and Taylor 1984: 72; Moyano 1986b: 102, pl.2

Hippothoa distans: Waters 1904: 54, pl.3, figs.8a–g; Rogick 1956b: 189, figs.10, 12,13,19–21,23,24

Hippothoa belgica Hayward and Thorpe 1989a: 373, figs.4C–E

Colony diffuse, ramifying widely over the substratum; branching cruciform, with each autozooid producing one distal and paired lateral buds. Oval distal portion of autozooid 0.2–0.35 × 0.15–0.2 mm, proximal caudal portion thread-like, two to three times length of distal portion, 0.04 mm wide; primary orifice longer than wide, broadest distally and appearing distinctly pear-shaped, sinus a deep U-shape, comprising one-quarter total orifice length, condyles small, knob-like. Female zooid with much shorter caudal portion, distal portion of similar size to that of autozooid; primary orifice wider than long, the proximal border straight, or with an indistinct median sinus notch. Ovicell more or less hemispherical, with a small apical umbo. Female zooids typically laterally budded from autozooids. Short, clavate zooeciules with minute terminal orifice occur in some populations (Gordon 1986). A single pore chamber present in each lateral wall of the autozooid, and a third in the distal, terminal wall. Ancestrula oval, kenozooidal, sometimes with a membranous frontal surface.

This species appears to be genuinely cosmopolitan in continental shelf seas. It can be found on almost any substratum, but is especially common on shells, and other biogenic carbonates, including bryozoans. Hayward and Thorpe (1989a) introduced *Hippothoa belgica* for Antarctic specimens which they considered to be distinct from *H. flagellum*. Subsequently, comparison of these with a wider range of material from Subantarctic localities, and from northern hemisphere localities, including the materials published by Moyano (1986b) and Gordon (1984,

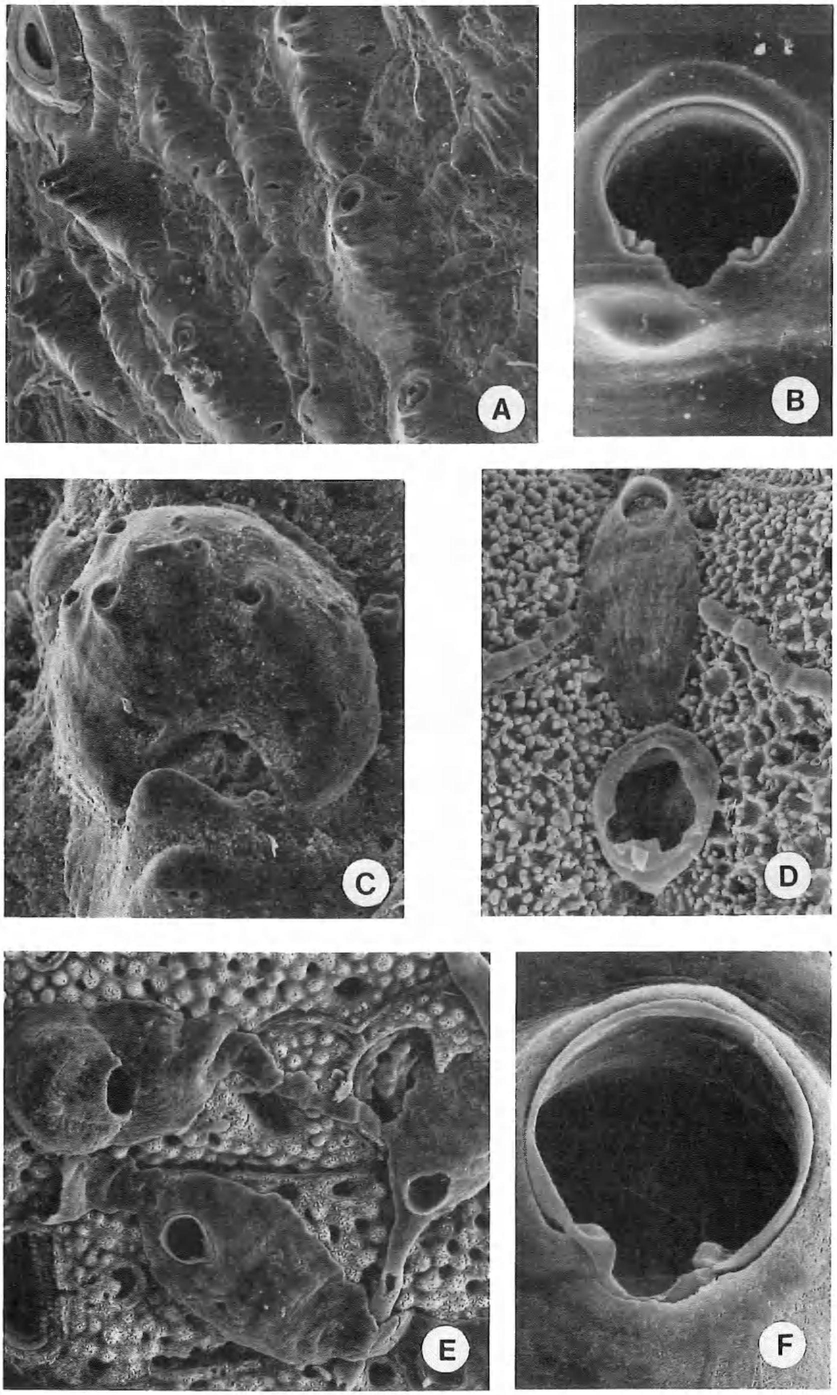


Fig. 148. A–C. *Plesiothoa calculosa*. Discovery Stn. 170, South Shetland Is. A. Part of colony with autozooids and dimorphic zooids; ×40. B. Autozooid orifice; ×290. C. Ovicelled female orifice; ×130. D–F. *Hippothoa flagellum*. D. Discovery Stn. WS84, East Falkland; ancestrula and first autozooid; ×110. E. Discovery Stn. WS85, East Falkland; autozooids and ovicelled female zooid; ×150. F. Discovery Stn. WS84; autozooid orifice; ×650.

1986), confirms that only one species may be recognized. *H. flagellum* is thus known with certainty from the Ross Sea and from numerous localities in western Antarctica, and will probably be found to occur throughout the Antarctic shelf seas.

Celleporella Gray, 1848

Colony encrusting, forming a coherent sheet; occasionally disjunct, but rarely uniserial. Autozooids, brooding female zooids and presumed male zooids occur; no other polymorphs present. Frontal calcification smooth or ridged, often umbonate; imperforate. Primary orifice sinuate, with small condyles. Ovicell perforate. Tubular basal pore chambers present. Ancestrula with sinuate orifice; rarely, tatiform.

Type species: *Cellepora hyalina* Linnaeus, 1767.

Key to Antarctic species

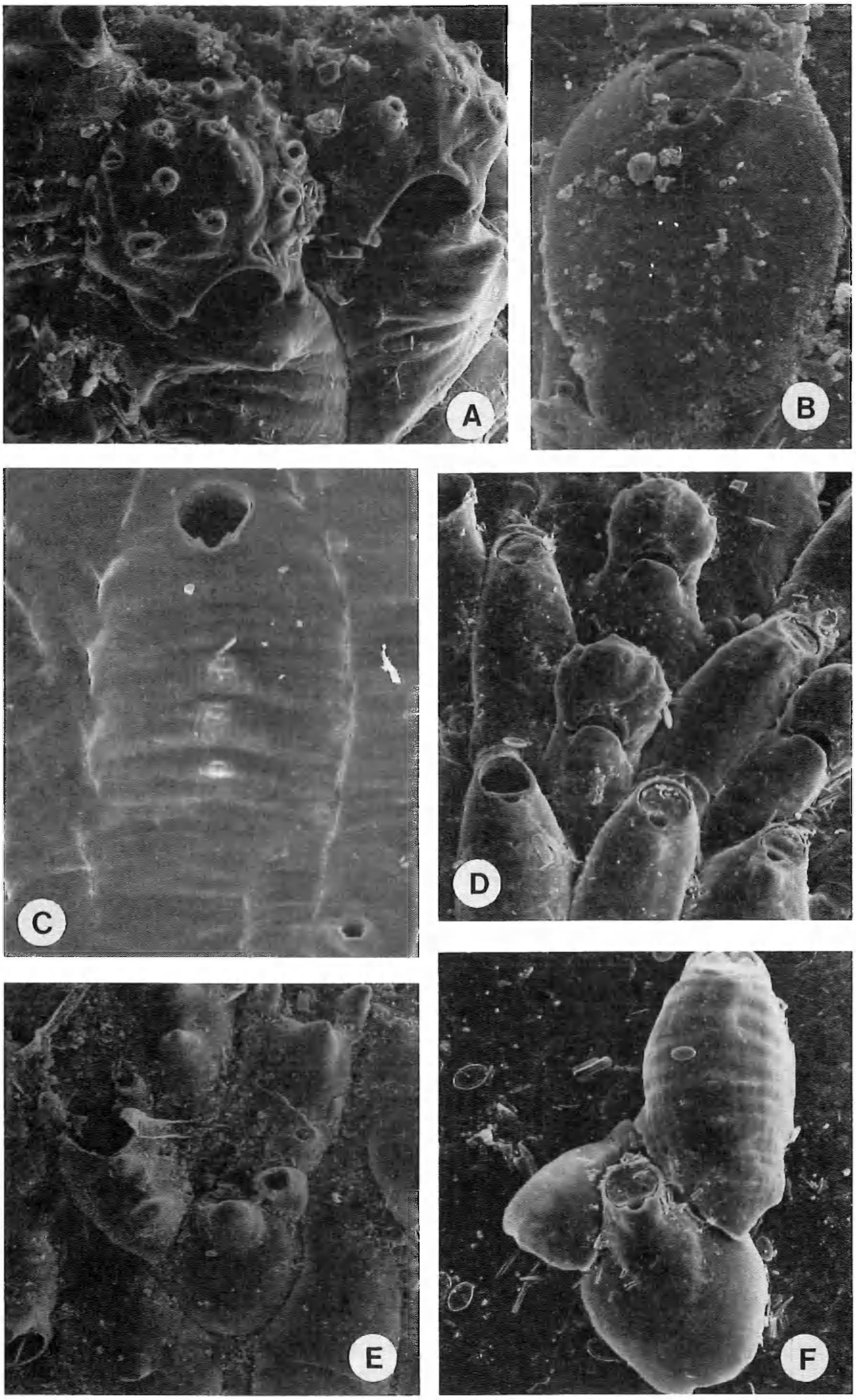
1. Colony partly or wholly disjunct, the zooids linked to each other by slender tubular processes 4
   Colony forming coherent sheets, with all zooids closely juxtaposed 2
2. Colony forming a thin, flat sheet. Frontal surfaces of zooids with transverse wrinkles and fine longitudinal striations, giving a chequered effect; frontal umbones small, conical. Ancestrula producing a single distal bud .... *C. alia*
   Colony developing thick sheets of strongly convex zooids. Frontal surface of zooids with coarse corrugations, often developed as stout umbones medially. Ancestrula with twinned disto-lateral buds 3
3. Autozooid orifice with deep U-shaped sinus. Frontal umbones with straight edge, appearing angular. Ancestrula flask-shaped, with tubular distal portion .... *C. antarctica*
   Autozooid orifice with short U-shaped sinus, appearing oval. Frontal umbones stout, conical; similar processes often present lateral to orifice. Ancestrula without tubular distal portion .... *C. bougainvillei*
4. Autozooid orifice with short, deep U-shaped sinus. Frontal wall with small, conical umbones and numerous papillate excrescences .... *C. dictyota*
   Autozooid orifice with broad, shallow sinus. Frontal wall with broad, straight-edged umbones .... *C. discreta*

Celleporella alia Hayward — Fig. 149A–C

Celleporella alia Hayward 1993: 294, Fig.3E–G

Colony developing a thin, coherent sheet. Autozooids, ovicelled female zooids and dimorphic (? male) zooids present. Autozooids rectangular to polygonal, flat, their boundaries marked by narrow, sinuous sutures; 0.5–0.7 × about 0.3 mm. Frontal wall finely granular, with numerous transverse wrinkles and fine longitudinal striations giving a decussate, or chequered, appearance; frequently with a series of small umbones along the midline. Primary orifice about as wide as long, with a broadly U-shaped proximal sinus, comprising about one-fifth total autozooid length; condyles bifid, indistinct. Female zooids as broad as autozooids but slightly shorter; orifice broader than long, with a pronounced V-shaped sinus; frontal wall wrinkled and decussate, often with an especially prominent umbo proximal to the orifice. Ovicell about as wide as long, with about 20 tubaeform pores. Dimorphic zooids scattered throughout colony, infilling between autozooids, with varying orientation and size; orifice minute, 0.025 mm long, pear-shaped, with a V-shaped sinus flanked by short, prominent condyles. Ancestrula oval, convex, 0.3 mm long, with sinuate orifice; producing a single distal bud.

This species is presently known from a few localities around the South Orkney


A
B
C
D
E
F

Islands, South Georgia and the southern Patagonian shelf.

Celleporella antarctica Moyano and Gordon Fig. 149D,F

Hippothoa bougainvillei: Rogick 1956b: 183 (in part), Figs.2–4, 6–9, 11,14,16,18,22; Moyano 1972a: 7, pl.1, figs.7–8

Celleporella antarctica Moyano and Gordon, 1980: 91, Fig.8A–K; Hayward and Taylor 1984: 72; Moyano 1984a: 80; 1986b: 108, pl. 11; Moyano and Wendt 1981: 7

Colony forming small, unilaminar patches, particularly on algae, erect bryozoans and hydroids. Autozooids, ovicelled female zooids and male zooids occur. Autozooids slender, elongate, fusiform, convex; commonly 0.5–0.6 × about 0.2 mm. Primary orifice slightly longer than wide, with deep, symmetrical, U-shaped sinus; condyles short, bifurcate, rather indistinct. Frontal wall smooth, with a few fine, transverse wrinkles or striations; a low, rounded umbo sometimes developed proximal to orifice, but without a marked longitudinal series of umbones. Female zooid slightly shorter than autozooid, primary orifice semicircular, with a short V-shaped sinus, partly hidden by a prominent suboral umbo with rounded, projecting edge. Ovicell globular, with about ten, thick-rimmed marginal pores; frontal region imperforate. Male zooids sporadic, sometimes lacking in small colonies; variably sized but generally smaller than autozooids, with minute orifice about one-third size of autozooid. Ancestrula characteristic: oval, convex; the orifice sinuate, surmounting a tubular distal portion, giving the ancestrula a flask-like shape; producing paired disto-lateral buds.

This endemic Antarctic species, formerly confused with *C. bougainvillei*, has a wide geographical distribution in shallow coastal waters. It is common at South Georgia, and occurs along the Scotia Arc, abundantly around the Antarctic Peninsula, and in the Ross Sea. It will probably prove to range around the whole of the continent.

Celleporella bougainvillei (d'Orbigny) Figs. 149E, 150A,B

Escharina bougainvillei d'Orbigny 1842: pl.4, figs.9–12; 1847: 12

Chorizopora hyalina var. *bougainvillei*: Busk 1884: 148, pl.22, fig.4

Diazeuxia reticulans Jullien 1888: 33, pl.4, fig.5 (as *D. reticulata*)

Hippothoa bougainvillei: Rogick 1956b: 184 (in part), fig.5

Celleporella bougainvillei: Moyano and Gordon 1980: 89, Figs.6D–E, 7A–I; Moyano 1986b: 109, pls.12,13

Colony developing extensive, unilaminar sheets. Autozooids, ovicelled female zooids and dimorphic male zooids present. Autozooids elongate, oval to fusiform, strongly convex; commonly 0.7 × 0.3 mm. Frontal wall with transverse striations, or coarser corrugations, typically with a longitudinal series of two to four stout, conical umbones along the midline. Primary orifice orbicular, about as wide as long, with a broad, U-shaped proximal sinus; condyles broad, blunt, sometimes notched. A pair of stout, cylindrical processes often developed lateral to the orifice. Female zooids as broad as, but slightly shorter than autozooids; primary orifice wider than long, more or less semicircular, with a short V-shaped sinus; frontal wall with one to three median umbones, the most distal being the largest, conical or bluntly pointed,

Fig. 149. A–C. *Celleporella alia*. A. Discovery Stn. WS25, South Georgia; ovicelled female zooids; ×150. B. Discovery Stn. 27, South Georgia; ancestrula; ×200. C. Discovery Stn. 228, Southern Patagonian Shelf; autozooid, and orifice of dimorphic zooid; ×120. D. *Celleporella antarctica*. Signy Id.; autozooids and female zooids; ×80. E. *Celleporella bougainvillei*. Signy Id.; ancestrula and first autozooids; ×60. F. *Celleporella antarctica*. Signy Id.; ancestrula and first autozooids; ×110.

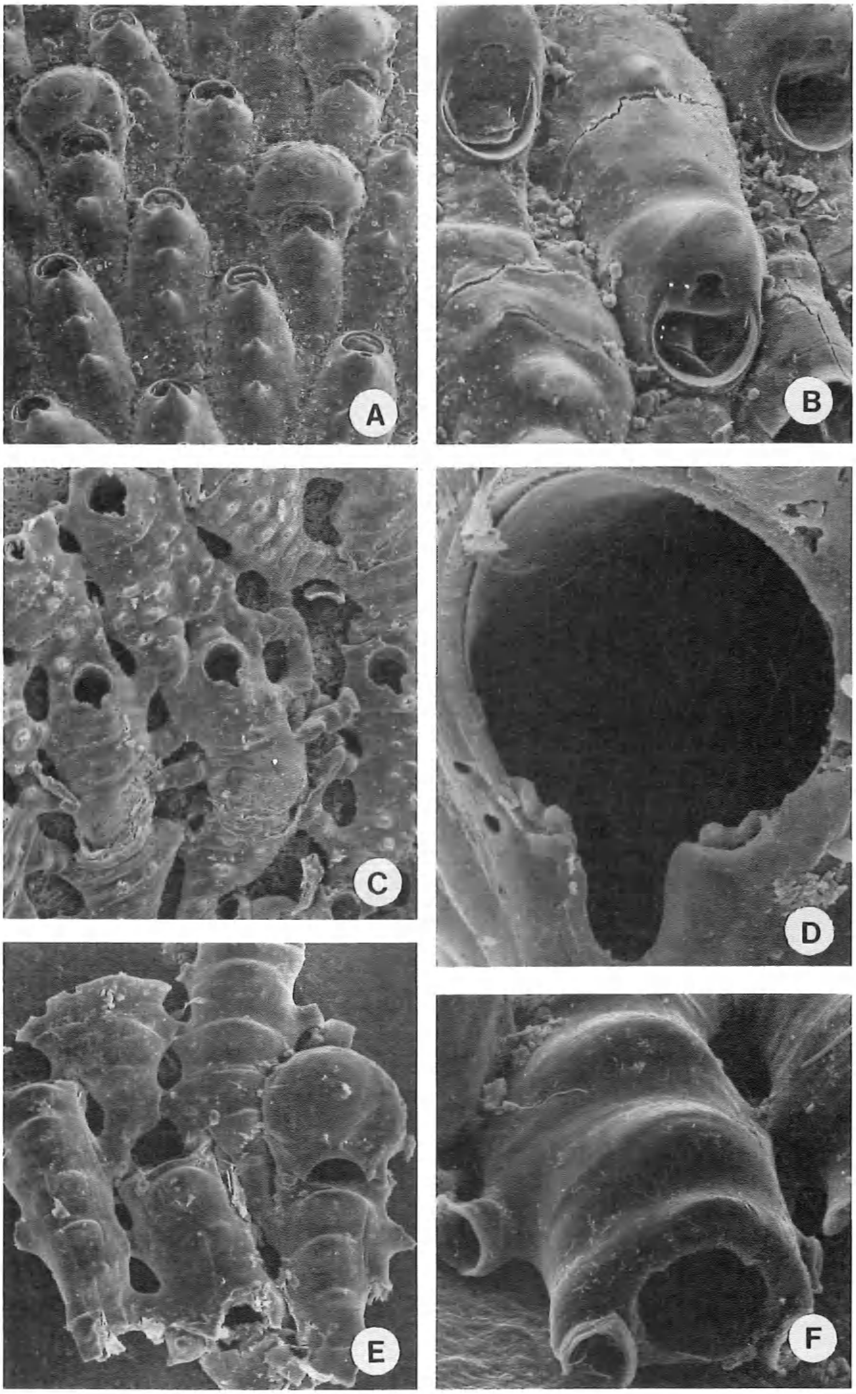


Fig. 150. A, B. *Celleporella bougainvillei*. Signy Id. A. Autozooids and female zooids; ×40. B. Autozooid orifices; ×100. C, D. *Celleporella dictyota*. Signy Id. C. Portion of colony; ×60. D. Autozooid orifice; ×600. E, F. *Celleporella discreta*. Discovery Stn. 56, East Falkland. E. Autozooids and a female zooid; ×90. F. Autozooid orifice; ×220.

partly hiding the orifice. Ovicell globular, slightly wider than long, with about a dozen relatively large marginal pores; frontal area sometimes developing a low umbo. Male zooids slightly smaller than autozooids; the orifice about half size that of autozooid, but with a proportionately deeper sinus. Ancestrula oval, convex, with sinuate orifice; producing paired disto-lateral buds, between and distal to which the third bud appears.

This species is widely distributed in the Magellanic region, including Southern Chile, Tierra del Fuego, the Southern Patagonian Shelf and the Falkland Isles. It occurs at South Georgia and has been reported reliably from several localities on the Antarctic Peninsula. It probably does not extend further into the Antarctic realm.

Celleporella dictyota Hayward — Fig. 150C,D

Celleporella dictyota Hayward 1993: 293, Fig.3C,D

Colony a thin, irregularly and loosely coherent sheet; autozooids closely packed, or disjunct to a varying extent, linked by short tubular processes. Autozooids, ovicelled female zooids and dimorphic (?male) zooids present. Autozooids fusiform, broadest distally, tapered proximally, each linked to its neighbours by four to six, sometimes more, narrow tubes, presumably originating from basal pore chambers; 0.5–0.7 × about 0.2 mm. Frontal wall thinly calcified, transversely ridged and wrinkled, often with one or more umbones along the midline, and typically developing numerous papillate excrescences, often so densely distributed as to give the colony surface a flecked appearance. Primary orifice longer than wide, with a slender, U-shaped proximal sinus comprising just less than one-third total length; condyles notched, indistinct. Female zooids 0.4–0.5 × about 0.12 mm, shorter than autozooids and much more slender. Primary orifice semicircular, with an inconspicuous notch-like sinus, partly hidden by a pronounced, angular, suborificial umbo. Frontal wall ridged, developing additional small umbones. Ovicell globular, prominent, wider than long, typically with a longitudinal median ridge, a few large round pores, and a number of small papillae. Dimorphic zooids shorter and more slender than autozooids; orifice about one-third length of autozooid orifice but similarly proportioned. Ancestrula oval, 0.3 mm long, with sinuate orifice; with twin disto-lateral buds.

This species is presently known from Signy Island and East Falkland Island only. It is perhaps more strictly Subantarctic than Antarctic, but only the collection of further specimens, from additional localities, will resolve this point.

Celleporella discreta (Busk) — Fig. 150E,F

Lepralia discreta Busk 1854: 85, pl.101, figs.3,4

Celleporella discreta: López Gappa 1985: 54, figs.7–9; Moyano 1986b: 110.

Colony forming rounded, unilaminar patches; disjunct, with zooids linked by short tubular processes, appearing reticulate. Autozooids, ovicelled female zooids and dimorphic male zooids present. Autozooids elongate, slender, fusiform, steeply convex; 0.4–0.6 × 0.15–0.2 mm. Frontal wall with a few coarse transverse corrugations, raised into broad, angular, straight-edged umbones along the midline. Primary orifice terminal in position, almost perpendicular to frontal plane, slightly wider than long, with a shallow, U-shaped proximal sinus; condyles rounded, indistinct. Female zooids only slightly smaller than autozooids; orifice wider than long, with a broad, shallow sinus; ovicell wider than long, with a few inconspicuous pores marginally, sometimes developing a low frontal umbo. Male zooids similar to autozooids, but slightly smaller, and with the orifice half the size of that of the autozooid. Ancestrula oval, convex, with sinuate orifice; giving rise to paired disto-lateral buds, which produce the third bud distally.

This essentially magellanic species extends southwards to South Georgia, but has not been reported from elsewhere in Antarctica.

Plesiothoa Gordon and Hastings, 1979

Colony encrusting, uniserial to pluriserial. Autozooids clavate, the caudal portion tapered but not thread-like; frontal wall with marginal perforations; orifice with sinus and condyles. Female zooids resemble autozooids; zooeciules and/or dimorphic male zooids present, usually with reduced or modified orifice. Polypide with gizzard. Pore chambers rounded to tubular. Ancestrula schizoporelloid.

Type species: *Hippothoa gigerium* Ryland and Gordon, 1977.

Plesiothoa calculosa Hayward — Fig. 148A–C

Plesiothoa calculosa Hayward 1993: 291, Figs.2E,F; 3A,B

Colony comprising densely intergrown, branching chains of zooids, frequently intersecting but never developing coherent sheets. Branching cruciform, with each zooid developing a single distal bud, and paired disto-lateral and disto-proximal buds; buds abort on encountering adjacent zooids, forming short, kenozooidal structures. Autozooids, ovicelled female zooids and dimorphic (? male) zooids present. Autozooids elongate, slender, broadest distally, tapered proximally, strongly convex; 0.33–0.55 × 0.16–0.25 mm. Frontal wall thickly calcified, smooth, crossed by conspicuous transverse folds, often developing one to four short umbones along the midline; uncalcified windows sporadically present. Primary orifice orbicular, about as wide as long, with a short, U-shaped proximal sinus; condyles short, bifid. A second orifice rim often developed within the primary orifice, very much smaller and resembling that of the dimorphic zooids. Female zooids similar in size to autozooids, with a slightly broader orifice, partly hidden by a projecting suboral umbo; ovicell broader than long, thickly calcified with about ten, thick-rimmed, round pores. Dimorphic zooids variable in size, as large as autozooids or very much smaller; primary orifice much smaller than that of autozooid, with proportionately larger sinus and indistinct condyles.

This species is known only from the South Shetland Isles, encrusting pebbles, and from the Ross Sea, on an erect bryozoan. It is rather inconspicuous and will probably prove to be generally widespread in Antarctic shelf seas.

CATENICELLOIDEA Busk, 1852

CATENICELLIDAE Busk, 1852

Colony erect, flexible, attached to substratum by chitinous rhizoids; jointed, with internodes comprising one to few zooids. Polymorphic; autozooids, dimorphic female zooids and adventitious avicularia occur. Frontal wall structure complex, including gymnocystal and cryptocystal elements, and generally with a variably developed costate frontal shield. Pore chambers and uniporous septula present.

Talivittaticella Gordon and d'Hondt, 1985

Colony erect, branching, jointed. Internodes comprising a single autozooid, or a brooding female zooid with an associated autozooid; bifurcations originate at bizooidal internodes. Zooidal frontal wall with small costate shield, and infracostal windows. Avicularia small, at disto-lateral corners of autozooid, single or paired; often lacking. Brooding zooid shorter than autozooid, ovicell globular, with extensive ectooecial fenestra, surmounted by a modified autozooid. Large proximo-lateral pore-chambers.

Type species: *Orthoscuticella (?) problematica* d'Hondt.

Talivittaticella is primarily a deep-sea genus. The three species originally assigned to it by Gordon and d'Hondt (1985) occur from 770 m to beyond 5000 m depth. *T. frigida* (Waters) was described from a few fragments collected in the Bellingshausen Sea, at no more than 500 m, but occurs also on the shallow Southern Patagonian shelf.

Talivittaticella frigida (Waters) Fig. 151A–C

Catenicella frigida Waters 1904: 20, pl.1, figs.1a–d

Talivittaticella frigida: López Gappa and Lichtschein 1990: 23, pl.7, figs.4–5, pl.11

Colony a short, curled tuft, up to 10 mm high. Single-zooid internodes 0.7–0.85 × about 0.25 mm; autozooid fusiform, lightly calcified, orifice D-shaped, as wide as long; costate frontal shield comprising five fused costae, two-thirds as long as orifice; each costa with a conspicuous infracostal pore. Proximo-lateral pore chambers (or vittae) extending along proximal half of autozooid, broad and shallow, with a median longitudinal series of small round pores; disto-lateral pore chambers almost as long, in absence of avicularium, with similar series of pores. Avicularia single, paired or lacking; 0.07 mm long, rostrum semi-elliptical, acute to long axis of autozooid. Branch dichotomy achieved by bizooidal internodes; axial zooid no longer than an ordinary autozooid, its disto-lateral bud slightly shorter, but otherwise little modified. Fertile internodes 1.1 × 0.4 mm, consisting of a squat female zooid, with a reduced frontal shield, and a globular ovicell, surmounted by a modified autozooid, with a shield of just two costae.

Waters (1904) founded this species on a few fragments collected from the Bellingshausen Sea. López Gappa and Lichtschein (1990) described and figured a specimen from the Southern Patagonian shelf, north of the Falkland Isles. It has not been discovered from any other Antarctic locality and there is thus no clue as to what its geographical affinity may be.

SCHIZOPORELLOIDEA Jullien, 1883

EMINOOECIIDAE Hayward and Thorpe, 1988

Autozooids with cryptocystidean frontal wall development, vertical walls with multiporous septula; frontal wall with few marginal pores, defined as frontal septula. Primary orifice with well developed condyles, proximal border concave to deeply sinuate. Adventitious avicularia present. Ovicell budded from frontal septula of autozooid distal to maternal autozooid, closely associated with avicularian polymorphs, or inferred homologues; imperforate. In later ontogeny, primary orifices of autozooids tend to be sealed by calcification.

Eminooecia Hayward and Thorpe, 1988

Colony erect, branching, attached by encrusting base. Autozooids in whorls around the central axis of the branch. Primary orifice with prominent condyles. Suboral avicularia sporadically developed. Oral spines absent. Ovicell incorporating a chamber distally; ectooecium calcified, imperforate.

Type species: *Hippadenella carsonae* Rogick, 1957.

Eminooecia carsonae (Rogick) Fig. 151D,E

Hippadenella carsonae Rogick 1957b: 120, figs.1–32

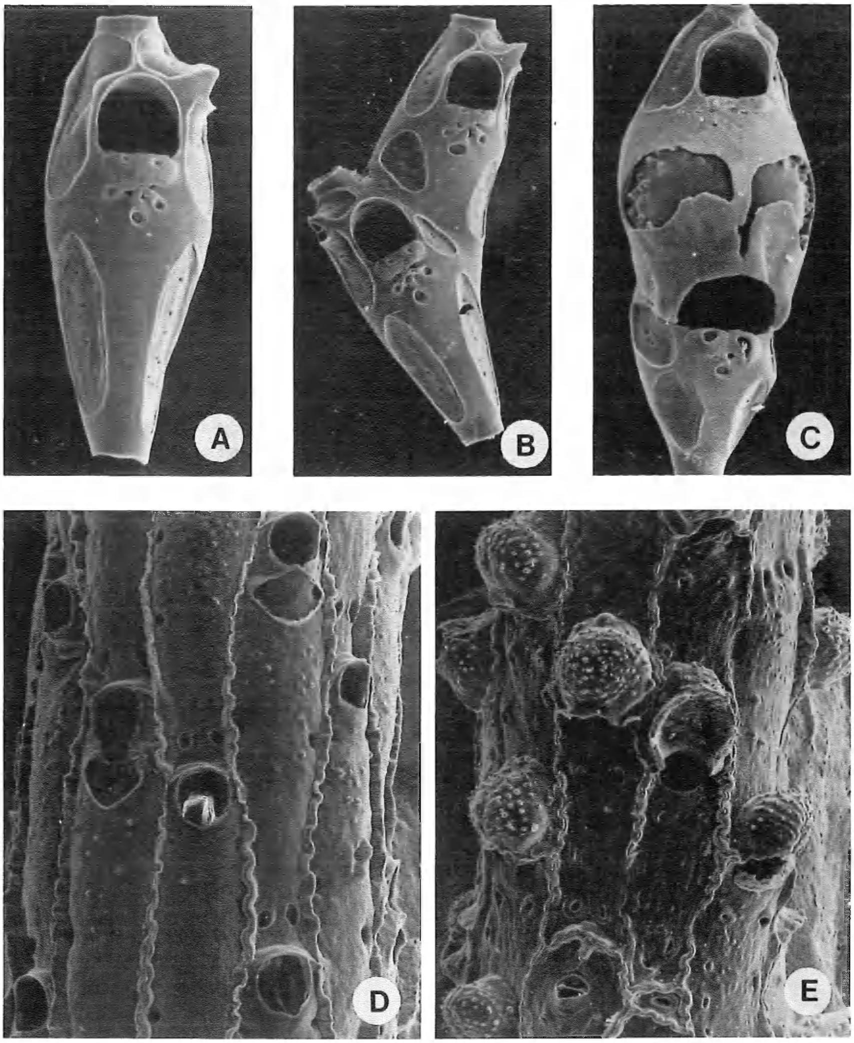


Fig. 151. A–C. *Talivittaticella frigida*. Off Patagonian Shelf. A. A single autozooid; ×80. B. Bizooidal internode; ×60. C. Fertile internode; ×70. D, E. *Eminooecia carsonae*. Ross Sea. D. Autozooids in early ontogeny; ×40. E. Later autozooids, with ovicells; ×29.

Hippadenella carsonae: Hayward and Taylor 1984: 72; Moyano 1984a: 80
Eminooecia carsonae: Hayward and Thorpe 1988a: 5, Figs.1–2

Colony erect, slender, branching dichotomously at irregular intervals; the branches occasionally anastomosing, oval or round sectioned, typically irregularly curved or kinked. Perhaps exceeding 55 mm in height, with maximum branch width 2 mm. Autozooids arranged in quincunx, the orifices appearing to spiral around the branch axis, each spiral comprising about 12 autozooids; elongate, quadrangular, separated by distinct, raised, crenulated ridges; 1.1–1.3 × 0.38–0.45 mm. Primary orifice slightly wider than long, proximal border shallowly concave between small, rounded condyles. Frontal wall flat, at first thin, smooth and hyaline, but thickening in later ontogeny, becoming coarsely tuberculate, opaque and vitreous; imperforate except for four or five large, distinct, marginal pores, typically a pair at the distal end of the autozooid, a pair at the proximal end, and one (rarely two) elsewhere along its length. Suboral avicularia sporadically present, budded from the distal pair of frontal wall pores; cystid inflated, occupying whole width of autozooid; rostrum oval, acute to frontal plane, proximally directed, with semielliptical mandible. Ovicell budded from proximal frontal pore pair of autozooid succeeding the maternal autozooid; wider than long, strongly convex, with highly arched orifice; imperforate, with a distinctly papillate surface; distally, the two layers of the ovicell are widely separated, incorporating a small chamber. In later ontogeny the primary orifice of the autozooid becomes sealed by calcification and avicularia are obliterated; frontal walls thicken considerably, but the ridges separating the autozooids, and the marginal pores, remain distinct.

Eminooecia carsonae is an endemic Antarctic species. It has been reported from off Signy Island, from the Palmer Archipelago and widely from the Ross Sea.

Isoschizoporella Rogick, 1960

Colony erect, slender and branching, with autozooids disposed in whorls, or developing folded, anastomosing, bilaminar sheets. Primary orifice with concave or sinuate proximal edge, condyles well developed. Suboral avicularia present; additional adventitious avicularia present in strict relationship to ovicells. Ectooecium uncalcified frontally; entooecium entirely calcified, imperforate.

Type species: *Schizoporella tumida* var. *tricuspis* Calvet, 1909.

Key to Antarctic species

1. Colony a slender, branching rod, with autozooids in whorls of four. Distal edge of ovicell aperture produced as a narrow, tapered spout .... *I. virgula*
   Colony consisting of broad, folded plates. Ovicell aperture rounded, peaked disto-medially, or developing a flaring spout 2
2. Primary orifice shallowly concave proximally. Ovicell with a simply curved distal aperture rim; associated with a squat distal chamber bearing an avicularium .... *I. secunda*
   Primary orifice with distinct proximal sinus. Distal rim of ovicell aperture peaked or spout-like ... 3
3. Primary orifice with short condyles and broad, U-shaped sinus. Ovicell with peaked distal rim; flanked on each side by a low, conical avicularian chamber, scarcely overtopping the ovicell .... *I. similis*
   Primary orifice with deep condyles and a narrow U-shaped sinus. Ovicell with distal rim produced as a flaring spout; flanked on each side by a spike-like avicularian chamber, projecting far above the ovicell .... *I. tricuspis*

Isoschizoporella tricuspis (Calvet) Fig. 152A,B

Schizoporella tumida var. *tricuspis* Calvet 1909: 28, pl.3, figs.1–3
Schizoporella tumida var. *tricuspis*: Livingstone 1928: 52
Isoschizoporella tricuspis: Rogick 1960: 488, pl.2, figs.11–19, pl.3, figs.20–32; Moyano 1966a: 118; Hayward and Thorpe 1988a: 8, Fig.3

Colony consisting of lobed, convolute, anastomosing sheets; maximum size unknown, but exceeding 20 mm high, with an equivalent horizontal spread. Autozooids elongate, rectangular, slightly convex, separated by distinct sutures; 1.2–1.35 × 0.4–0.45 mm. Primary orifice wider than long, distal border coincident with terminal wall of autozooid; proximal border with shallow, median concavity,

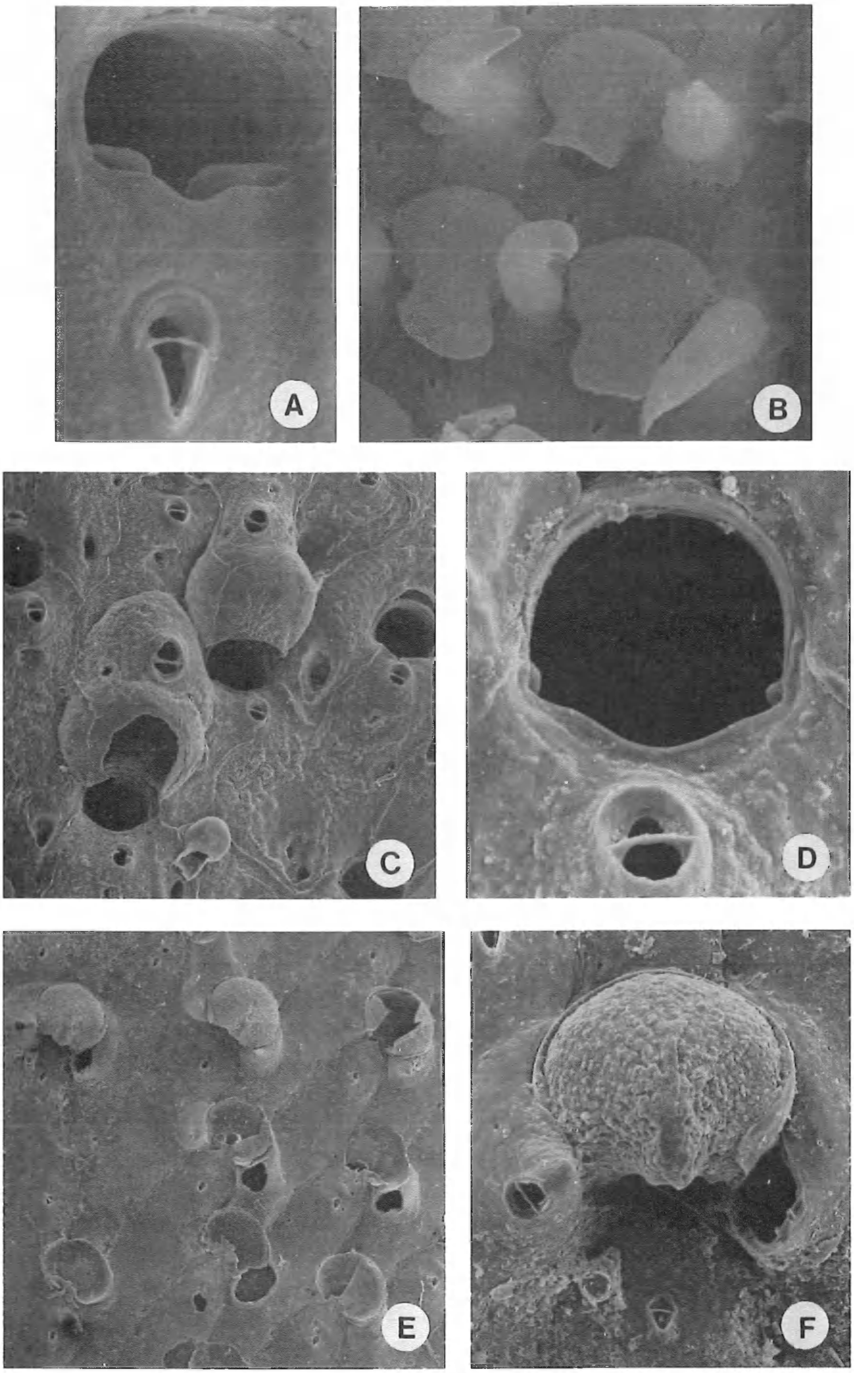


Fig. 152. A, B. *Isoschizoporella tricuspis.* Discovery Stn. 190, Bismarck Strait. A. Primary orifice and avicularium; ×180. B. Ovicelled autozooids, with columnar avicularia; ×40. C, D. *Isoschizoporella secunda.* Ross Sea. C. Ovicelled autozooids, with avicularia; ×35. D. Primary orifice and avicularium; ×140. E, F. *Isoschizoporella similis.* Terra Nova Stn. 294, Ross Sea. E. Part of colony with ovicells and sealed orifices; ×19. F. Detail of ovicelled autozooid; ×60.

the deep, broad condyles on each side delimiting a pronounced, U-shaped sinus. Frontal wall finely granular, vitreous, with few (<10) small, round pores widely spaced around its margins. A single avicularium proximal to orifice; cystid low but occupying entire width of autozooid; rostrum small, 0.1 mm long, acute to frontal plane, proximally directed, with slender, triangular mandible. Ovicell distinctive: prominent, transversely oval distally, abruptly narrowed proximally, with the aperture flared and projecting above the maternal orifice as a hood; entooecium with finely nodulated surface, ectooecium present merely as a smooth band around distal and lateral margins. Ovicells interspersed with tall, spike-like polymorphs in strict quincuncial arrangement, each ovicell centred within a group of four polymorphs; these are perpendicular to frontal plane, up to 1.5 mm high, tapered, hollow, each with an elongate oval, hooked rostrum, perpendicularly orientated, close to its base.

This species is presently known from several localities off the Antarctic Peninsula, and from the Ross Sea, but is probably more widely distributed in Antarctic seas.

Isoschizoporella secunda Hayward and Taylor — Fig. 152C,D

Isoschizoporella secunda Hayward and Taylor 1984: 85, Fig.8A

Isoschizoporella secunda: Hayward and Thorpe 1988a: 12, Figs.5B–D

Schizoporella bilamellata Liu and Hu 1991: 154, figs.18C, 22G, 28A

Colony developing folded, strap-like, loosely anastomosing lobes; maximum size unknown, but exceeding 60 mm high, 30 mm wide. Autozooids elongate, oval to oblong, convex, separated by distinct ridges; 1.4–1.75 × 0.5–0.55 mm. Primary orifice slightly wider than long, distal border coincident with distal wall of autozooid; proximal border broadly and shallowly concave; condyles small, indistinct. Frontal calcification coarsely nodular, with five or six widely spaced marginal pores. Suboral avicularium with low, tumid, cystid, occupying entire width of autozooid; rostrum oval, acute to frontal plane, proximally directed, 0.1 mm long. Ovicell broader than long, rather flattened frontally, the aperture smoothly rounded, not projecting; entooecium with nodular or ribbed surface, ectooecium developed as a broad, distal and lateral band, smooth at first but becoming nodular in later ontogeny. Frequently, a squat avicularian cystid present distal to ovicell, with oval, distally directed rostrum.

This endemic Antarctic species is presently known from Signy Island, the Bismarck Strait, Palmer Archipelago, and from several localities in the Ross Sea.

Isoschizoporella similis Hayward and Thorpe — Figs. 152E,F, 153A

Isoschizoporella similis Hayward and Thorpe 1988a: 12, Figs.4,5A

Colony consisting of broad, folded, bilaminar sheets; maximum size unknown, but exceeding 50 mm high, with equivalent spread. Autozooids elongate, rectangular, slightly convex, separated by fine ridges, 1.75–2.00 × 0.5–0.6 mm. Primary orifice broader than long, distal border coincident with distal wall of autozooid; proximal border with broad, shallow sinus occupying three-quarters of its total width; condyles low and indistinct. Frontal calcification smooth, usually with fewer than ten, widely spaced, marginal pores. Suboral avicularium with low, indistinct cystid occupying whole width of autozooid; rostrum acute to frontal plane, proximally directed, 0.1 mm long, with slender, triangular mandible. Ovicell characteristic: broader than long, aperture wide, with medially peaked distal rim, and median longitudinal frontal ridge; surface finely nodular, ectooecium present as a narrow, distal and lateral, marginal band of smooth calcification. A low, conical avicularium on each side of ovicell aperture,

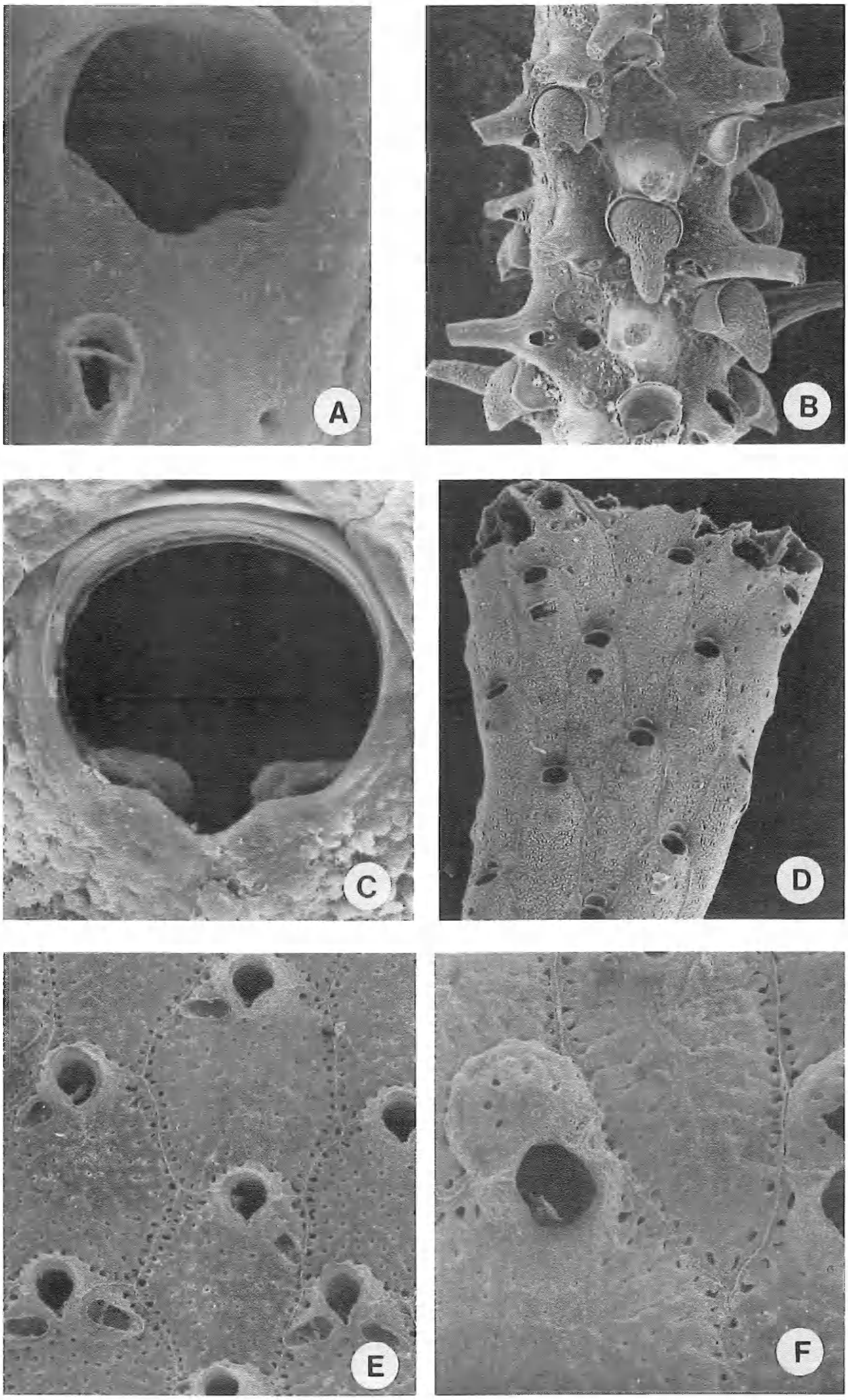


Fig. 153. A. *Isoschizoporella similis.* Terra Nova Stn. 294, Ross Sea; primary orifice and avicularium; ×180. B–D. *Isoschizoporella virgula.* Terra Nova Stn. 340, Ross Sea. B. Ovicelled autozooids; ×21. C. Primary orifice; ×250. D. Autozooids at branch tip; ×20. E, F. *Dakariella dabrowni.* Terra Nova Stn. 316, Ross Sea. E. Group of autozooids; ×19. F. Ovicelled autozooid; ×30.

budded from frontal walls of neighbouring autozooids; cystids extending distally around base of ovicell; rostrum perpendicular to frontal plane, elongate-triangular, hooked, situated close to tip of cystid.

This species is distinguished from *I. tricuspis* by the shape and proportions of the primary orifice, by its generally larger autozooids, and by the ovicell, which lacks the projecting frontal hood of *I. tricuspis*, and is flanked by a pair of low, conical, avicularian polymorphs. *I. similis* is an endemic Antarctic species, presently known only from a few localities in the Ross Sea, and from a single station off Signy Island.

Isoschizoporella virgula Hayward and Thorpe — Fig. 153B–D

Isoschizoporella virgula Hayward and Thorpe 1988a: 14, Fig.6

Colony consisting of a slender, branching rod, exceeding 20 mm high, but with maximum width of only 1.5 mm. Autozooids in alternating whorls of four, elongate-oval, convex, separated by distinct ridges. Primary orifice only slightly wider than long, more or less round; distal border close to distal wall of autozooid, proximal border with a shallow, median sinus, accentuated by broad, deep condyles. Frontal wall coarsely nodular, with a few (<10) distinct, widely spaced, marginal pores. Suboral avicularium present on many autozooids, with low, indistinct cystid extending across whole width of autozooid, rostrum acute to frontal plane, proximally directed, with short triangular mandible. Ovicell broadest distally; aperture arched, rim produced medially as a tapered spout projecting above orifice of maternal autozooid; entooecium coarsely granular, ectooecium forming a narrow, distal and lateral, marginal band of smooth calcification. A tall, tapered, spike-like avicularian polymorph, up to 1.0 mm high, on each side of ovicell and a third closely associated with the distal edge of the ovicell, budded from proximal frontal walls of neighbouring autozooids; rostrum perpendicular to frontal plane, close to base of cystid, much larger than suboral type, with strongly hooked tip.

This distinctive species is presently known only from the Ross Sea.

HIPPOPODINIDAE Levinsen, 1909

Colony encrusting; or developing partly erect, folded, unilaminar or bilaminar plates. Autozooids with cryptocystidean frontal wall, typically with evenly distributed pores. Primary orifice lepralioid: with arched distal border, concave proximal border and lateral condyles. No oral spines. Avicularia, when present, adventitious, usually adjacent to orifice, single or paired. Ovicell hyperstomial or partly immersed.

***Dakariella* Moyano, 1966**

Colony encrusting, or developing erect, unilaminar or bilaminar plates. Autozooids with evenly perforated frontal wall. Primary orifice with concave proximal edge between indistinct condyles; enveloped by a deep peristome, with a short, medio-proximal denticle; no oral spines. Avicularia adventitious. Ovicell hyperstomial, perforated, not closed by autozooid operculum. Vertical walls with small, recessed septula.

Type species: *Dakaria dabrowni* Rogick, 1962.

Sinuhippoporella antarctica Liu and Hu (1991) appears to be a species of *Dakariella*.

Key to Antarctic species

1. Autozooids large, exceeding 1.4 mm long. Frontal wall densely perforated. Avicularia large, their length greater than diameter of peristome .... *D. dabrowni*

   Autozooids smaller than 1.4 mm long. Frontal wall sparsely perforated. Avicularia much shorter than diameter of peristome .... *D. concinna*

Dakariella dabrowni (Rogick) Figs. 153E,F, 154A

Dakaria dabrowni Rogick 1962: 85, pl.1, figs.1–7

Dakariella dabrowni: Moyano 1966b: 83

Colony forming an extensive, irregular, unilaminar sheet, loosely encrusting, occasionally developing erect, unilaminar or bilaminar plates; thickly calcified. Autozooids oval to irregularly hexagonal, flat or slightly convex, separated by distinct sutures; 1.4–2.6 × 0.8–1.1. mm. Primary orifice wider than long, its proximal edge arched frontally, and shallowly concave between indistinct proximolateral condyles. Peristome completely encircling primary orifice in early ontogeny, low and thick, deeply notched proximally; within the peristome a short denticle develops medio-proximally, above the plane of the primary orifice. Frontal wall thick, finely granular, becoming indistinctly ridged in later ontogeny; regularly perforated by small round pores, those along the margins somewhat enlarged. Avicularia sporadic, single or paired, situated proximo-lateral to peristome, directed proximo-laterally; rostrum elongate oval, with slender crossbar. Ovicell prominent, more or less spherical, thickly calcified, with a few frontal pores.

Rogick (1962) described *D. dabrowni* from an unknown Antarctic locality. *Discovery* Investigations collected it from Shag Rocks, west of South Georgia, and *Terra Nova* specimens were collected in the Ross Sea. It may be regarded as an endemic Antarctic species.

Dakariella concinna Hayward Fig. 154B–D

Dakariella concinna Hayward 1993: 286, Fig.1C–E

Colony erect, unilaminar or bilaminar, forming flat or folded plates. Autozooids hexagonal to irregularly polygonal, convex, separated by distinct sutures; 0.9–1.6 × 0.6–1.0 mm. Frontal wall finely granular, with a single series of large marginal pores, and a few smaller frontal pores, both becoming more pronounced as the frontal calcification thickens in later ontogeny. Primary orifice wider than long; proximal border slightly concave, condyles rounded, indistinct; an inconspicuous ridge runs from within peristomial lip to the proximal edge of the orifice where it may be produced as a short, peg-like lyrula. Peristome low and thickened, with a short medio-proximal notch. Avicularia lateral to orifice, single or paired, or absent; rostrum oval, 0.1–0.14 mm long, normal to frontal plane, directed obliquely distally or proximally. Ovicell recumbent, slightly flattened frontally; with a few small, scattered pores, bordered by a thickened ooecial cover.

This species is presently known only from a single fragment collected from the Ross Sea.

Trilochites Hayward, 1991

Colony encrusting, unilaminar. Autozooids with cryptocystidean frontal wall development; with conspicuous marginal pores, and scattered frontal pores. Vertical walls with multiporous septula. Primary orifice lepralioid, with prominent lateral condyles. No oral spines. Avicularia adventitious, suboral and lateral oral. Ovicell recumbent on distally succeeding autozooid, with scattered frontal pores.

Type species: *Escharoides biformata* Waters, 1904.

Trilochites biformatus (Waters) Fig. 154E,F

Escharoides biformata Waters 1904: 72, pl.7, fig.5

Trilochites biformatus: Hayward 1991:321, Fig.8

Colony developing a thick, unilaminar crust on hard substrata. Autozooids oval to hexagonal, strongly convex, separated by distinct sutures; 0.64–0.82 × 0.45–0.6 mm. Primary orifice longer than

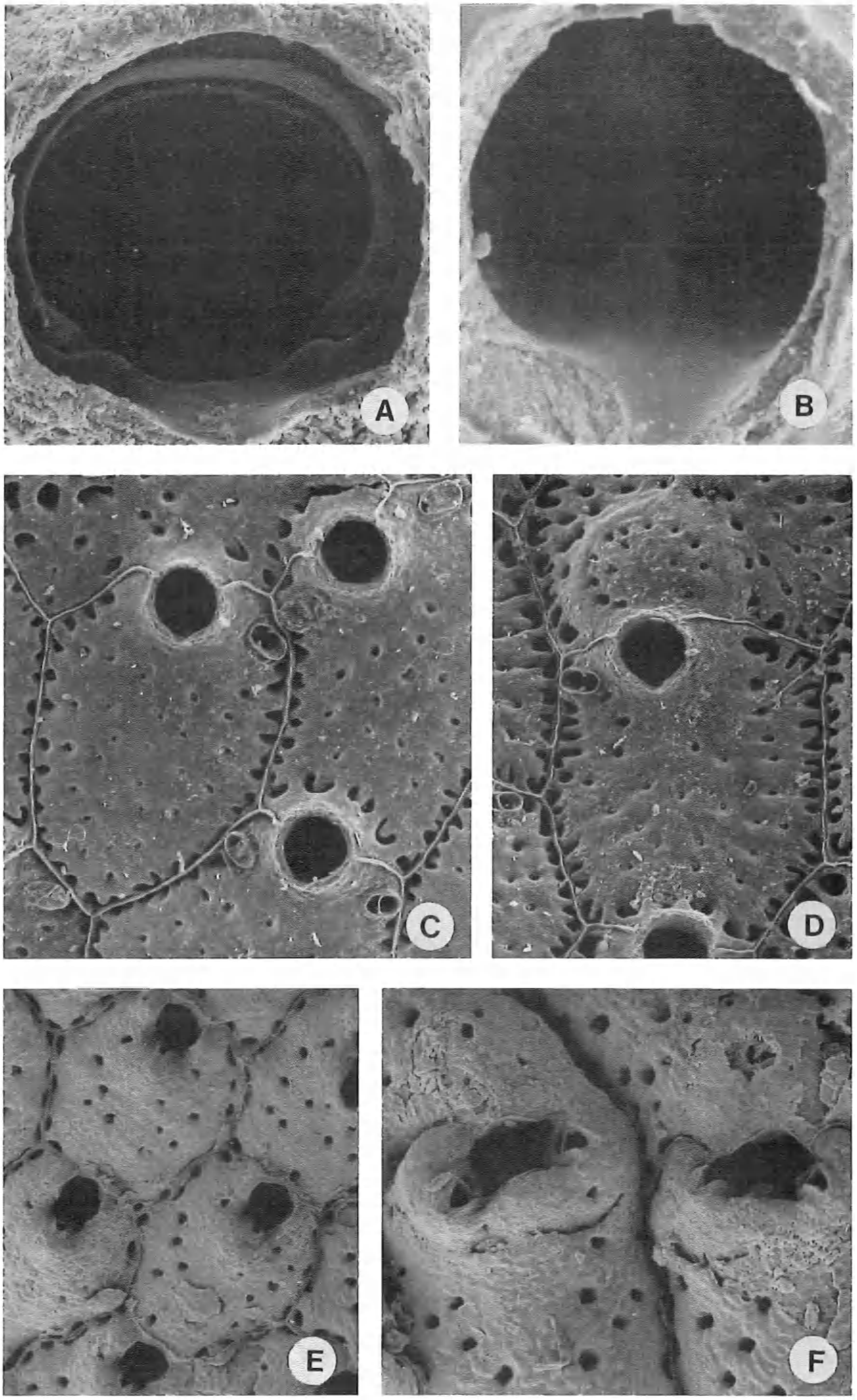
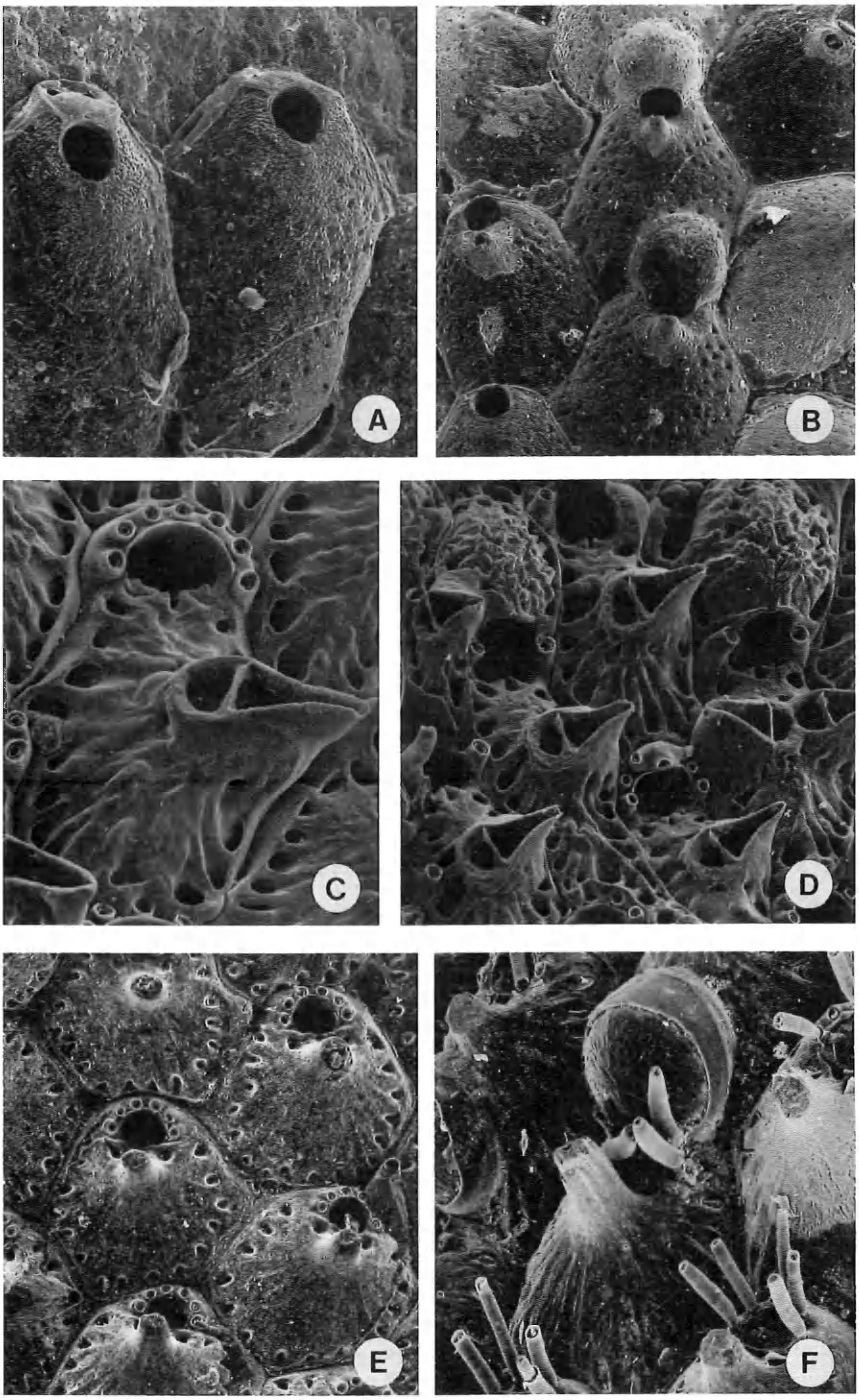


Fig. 154. A. *Dakariella dabrowni.* Terra Nova Stn. 316, Ross Sea; primary orifice; ×290. B–D. *Dakariella concinna.* NZOI, Stn. A525, Ross Sea. B. Primary orifice; ×260. C. Group of autozooids; ×50. D. Ovicelled autozooid; ×45. E, F. *Trilochites biformatus.* Discovery Stn. 482, South Georgia. E. Group of autozooids; ×40. F. Ovicelled autozooids; ×60.


A
B
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E
F

wide, proximal edge gently convex, condyles thick, blunt, basally deflected; surrounded by a low, granular, peristomial thickening. No oral spines. Frontal wall coarsely granular, with a single series of well-marked marginal pores, and about 20, rather large, scattered, frontal pores. Each autozooid with a prominent suboral avicularium; rostrum perpendicular to frontal plane, elongate triangular, hooked distally; crossbar complete, columella and palate lacking. Two identical lateral-oral avicularia (rarely one) present on ovicellate autozooids, with rostrum acute to frontal plane, proximolaterally directed. Ovicell as wide as long, rather flattened frontally, coarse-surfaced, with a few, small frontal pores.

T. biformatus is presently known from a limited area of western Antarctica, including South Georgia, the South Sandwich and South Shetland Islands, and the Bellingshausen Sea. All specimens known are encrusting small pebbles.

Ralepria Hayward 1991

Colony encrusting, unilaminar. Autozooids with cryptocystidean frontal wall development; frontal wall with evenly distributed pores. Primary orifice with concave poster, thickened rim to anter, and small, blunt condyles. No oral spines. Avicularium adventitious, suboral. Ovicell hyperstomial, recumbent on distally succeeding autozooid, imperforate, closed by autozooidal operculum. Large basal pore-chambers present.

Type species: *Ralepria conforma* Hayward, 1991.

Ralepria conforma Hayward — Fig. 155A,B

Ralepria conforma Hayward 1991: 319, Fig.7A,B

Colony forming small, irregular patches on hard substrata, particularly pebbles. Autozooids oval to hexagonal, convex, separated by well-marked grooves; 0.85–1.1 × 0.65–0.8 mm. Primary orifice about as wide as long; anter with a smooth, thickened rim, terminating proximo-laterally, on each side, with small, blunt condyles; poster shallowly concave, slightly arched frontally. Frontal wall finely nodular, evenly perforated by small, round pores. A single suboral avicularium present on some autozooids; cystid conical, with narrowly oval rostrum on distal face, perpendicular to frontal plane. Ovicell spherical, with finely nodular, imperforate surface.

This rather inconspicuous species is known only from a single locality off South Georgia.

Toretocheilum Rogick, 1960

Colony encrusting, unilaminar. Autozooids with thickly calcified frontal wall, with marginal pores only. Primary orifice with median proximal sinus, bounded each side by thickened cusps; condyles well developed; oral spines present. Avicularia, when present, adventitious. Ovicell hyperstomial, not closed by autozooid operculum; imperforate, entooecium entirely calcified, ectooecium with large membranous area frontally. Basal pore chambers present. Ancestrula tatiform.

Type species: *Toretocheilum absidatum* Rogick, 1960.

Key to Antarctic species

1. Calcification coarsely rugose; orifice bordered by seven spines but not shielded by a suboral umbo. Large latero-frontal avicularia present .... *T. absidatum*

Fig. 155. A, B. *Ralepria conforma.* Discovery Stn. 152, South Georgia. A. Autozooids at the colony margin; ×40. B. Ovicelled autozooids; ×28. C, D. *Toretocheilum absidatum.* NZOI, Stn. A520, Ross Sea. C. Detail of an autozooid, with avicularium; ×50. D. Ovicelled autozooids; ×40. E, F. *Toretocheilum turbinatum.* E. Discovery Stn. 1948, South Shetland Is.; group of autozooids; ×35. F. NZOI, Stn. A528, Ross Sea; autozooids with spines intact, including an ovicell; ×45.

Calcification smooth, with faint radiating ridges; orifice with six spines, partly hidden by a massive suboral umbo. No avicularia ....*T. turbinatum*

Toretocheilum absidatum Rogick Fig. 155C,D

Toretocheilum absidatum Rogick 1960: 479, pl.1, figs.1–10

Colony forming a thick crust on pebbles, large bryozoans and other hard substrata. Autozooids broad, oval to hexagonal, strongly convex and separated by deep grooves; 0.7–1.0 × 0.5–0.7 mm. Primary orifice wider than long, the proximal edge with a short, rounded median sinus, flanked on each side by a stout, thickened process; condyles broad and short, extending along most of proximal edge of orifice; seven thick, cylindrical spines evenly spaced around the lateral and distal borders of the orifice. Frontal wall coarsely rugose, with thickened ridges between large, distinct marginal pores. Avicularia sporadic, on proximo-lateral borders of orifice, laterally directed, rostrum about 0.3 mm long, supporting a broadly triangular mandible. Ovicell recumbent on distally succeeding autozooid, globular, conspicuous, slightly wider than long; calcification thick and rugose, the whole of the frontal surface covered by membranous ectooecium, with a few irregular marginal pores. Ancestrula oval, tatiform, 0.6 mm long, the opesia surrounded by 11 or 12 spines.

This species has not been reported again since Rogick's (1960) original account, based on four small specimens from Marguerite Bay. The New Zealand Oceanographic Institute collections yielded further material, encrusting small pebbles or the basal surfaces of large bryozoans, from the Ross Sea.

Toretocheilum turbinatum Hayward Fig. 155E,F

Toretocheilum turbinatum Hayward 1995: 217, Fig. 2

Colony an irregular, thickened crust. Autozooids broadly oval to hexagonal, steeply convex, separated by deep grooves; 0.75–0.9 × 0.6–0.7 mm. Primary orifice as wide as long, almost orbicular, with a small, rounded, median sinus on the proximal edge, accentuated by thickened lateral cusps; condyles broad and thick, extending almost to the cusps of the sinus. Six thick, cylindrical oral spines present. A thick, spike-like, suboral umbo, up to 0.5 mm long, partly obscures the sinus. Frontal wall thick and smooth, with faint, radiating ridges originating between the distinct, almost circular, marginal pores. Ovicell recumbent on distally succeeding autozooid; globular, calcification thick and smooth; with a peripheral band of calcified ectooecium, but no pores.

This species is presently known from the South Orkney Islands and the Ross Sea, encrusting small pebbles and hydrocorallines.

HIPPOPORINIDAE Brown, 1952

Colony encrusting, or erect and attached by an encrusting base. Autozooids with cryptocystidean frontal wall, typically with regular perforation over its entire surface. Primary orifice with broadly concave proximal edge, between prominent condyles. Ovicell hyperstomial, prominent, with frontal perforations. Ancestrula typically tatiform.

Kymella Canu and Bassler, 1917

Colony erect, flustrine, bilaminar, flexible; attached by an encrusting sheet of autozooids, reinforced by modified kenozooids. Frontal wall of autozooids imperforate centrally, with large and distinct marginal pores; lightly calcified. Primary orifice shallowly concave proximally, between indistinct proximolateral condyles. Avicularia adventitious, proximo-lateral to orifice. Ovicell hyperstomial, prominent, the ectooecium uncalcified frontally; closed by autozooidal operculum. Vertical walls with multiporous septula.

Type species: *Cyclicopora polaris* Waters, 1904.

Moyano (1986a) referred *Kymella* to the Hippoporinidae, demonstrating that it was then inappropriately placed in the Euthyrididae, which is characterized by a compound gymnocystal/spinocystal frontal shield (Gordon 1989a).

Kymella polaris (Waters) Fig. 156C,D

Cyclicopora polaris Waters 1904: 53, pl.3, figs.5a–f

Cyclicopora polaris: Calvet 1909: 25; Thornely 1924: 112

Euthyris carthagensis Calvet 1909: 18, pl.1, figs.7–8

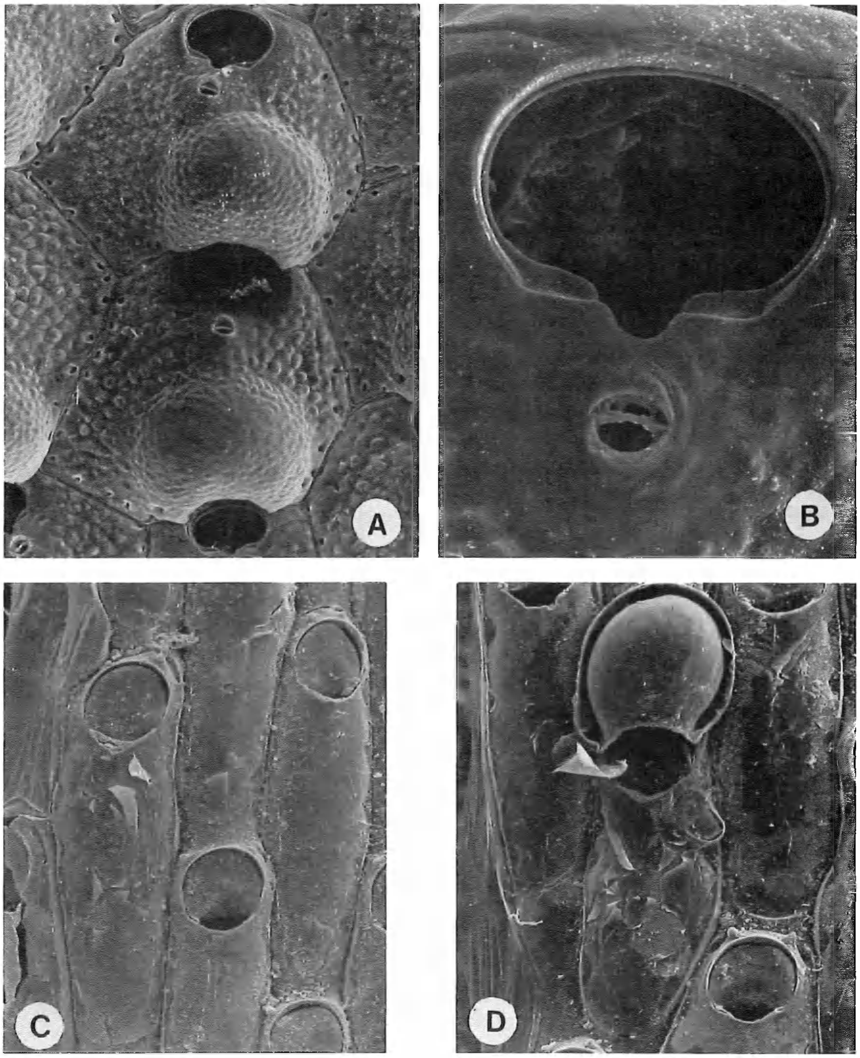


Fig. 156. A, B. *Buffonellodes antarctica.* Ross Sea. A. Group of autozooids, with ovicells; ×60. B. Primary orifice and avicularium; ×230. C, D. *Kymella polaris.* Discovery Stn. 1652, Ross Sea. C. Group of autozooids; ×40. D. An ovicelled autozooid, with an avicularium; ×45.

Kymella polaris: Livingstone 1928: 62, pl.1, fig.3, text fig.14; Moyano 1986a: 23, pls.1–3

Colony flabellate, flexible, the narrow, stem-like proximal portion broadening abruptly and dividing irregularly to form flat lobes or fronds of variable width; maximum size unknown, but exceeding 100 mm high. Autozooids elongate, rectangular to hexagonal, rounded distally, gently convex, separated by distinct sutures; 1.0–1.6 × 0.4–0.6 mm. Primary orifice about as wide as long, the proximal edge deeply concave and arched frontally; condyles small and indistinct; no oral spines (reported in encrusting autozooids by Moyano (1986a)). Frontal wall thin, brittle and most usually damaged in preserved specimens; lightly calcified, smooth, with distinct marginal pores in a single, linear series. Avicularium situated proximo-lateral to orifice, to right or left, budded from a distal marginal pore; rostrum oval, 0.25 mm long, with incomplete crossbar and no palate, laterally directed. Avicularia are sporadically distributed throughout the colony and may be missing from many autozooids, though in some cases they may be paired. Ovicell prominent, elongate oval, its two layers with a conspicuous space between, the ectooecium entirely membranous frontally.

Kymella polaris is an endemic Antarctic species. It has been widely reported, from the Bellingshausen Sea, the Palmer Archipelago, the Ross Sea, Adelie Land and off Drygalski Island, and probably occurs throughout the Antarctic area.

SCHIZOPORELLIDAE Jullien, 1883

Frontal wall of autozooids evenly perforated, or with marginal pores only. Primary orifice with large anter, and small, often slit-like poster (the sinus). Ovicell hyperstomial or partly immersed, perforate or imperforate. Avicularia present or absent, adventitious and/or vicarious. Multiporous septula or basal pore chambers present.

Buffonellodes Strand, 1928

Colony encrusting, unilaminar. Autozooids with cryptocystidean frontal wall development; frontal wall with small marginal pores. Primary orifice with small medio-proximal sinus; condyles well developed; oral spines present or absent. Avicularium adventitious, suboral, typically small and often inconspicuous. Ovicell hyperstomial, recumbent on distally succeeding autozooid, imperforate, not closed by autozooid operculum. Small basal pore chambers present.

Type species: *Buffonella rimosa* Jullien, 1888.

Buffonellodes is widely distributed throughout the cold temperate southern hemisphere, with species described from magellanic South America, the islands of the Southern Ocean and New Zealand (Gordon 1984, 1989a; Hayward 1991). The type species was originally described from Tierra del Fuego, and subsequently reported from the Falkland Islands, the South Sandwich Islands (Hayward 1991), and New Zealand (Uttley and Bullivant 1972; Gordon 1984), but probably does not range further into Antarctic waters. *Schizoporella simplex* (D'Orbigny), recorded from the Bellingshausen Sea (Waters 1904) and from Drygalski Island as *Buffonella simplex* (Livingstone 1928) and the Ross Sea as *Buffonellodes simplex* (Hayward and Taylor 1984), was first described from the Falkland Islands and has never been adequately redescribed or figured. Antarctic records of *Buffonellodes simplex* probably refer to *B. antarctica* Hayward, which is the only species of the genus currently known to be limited to Antarctic waters.

Buffonellodes antarctica Hayward — Fig. 156A,B

Buffonellodes antarctica Hayward 1991: 322, Fig.7C,D

Colony forming flat, unilaminar sheets. Autozooids oval to hexagonal, gently convex, separated by shallow grooves; 0.65–0.8 × 0.45–0.6 mm. Primary orifice wider than long; proximal edge straight, with short, broad condyles, and a small, U-shaped sinus occupying one-quarter its total width. No spines or peristome. Suboral avicularium tiny, very inconspicuous; rostrum oval, 0.03–0.04 mm long, with complete crossbar, supporting a semicircular mandible. Frontal wall finely nodular, imperforate except for a single series of inconspicuous marginal pores. Ovicell broader than long, thickly calcified, with finely nodular surface.

Buffonellodes antarctica is known from the Ross Sea and from off the South Orkney Islands, and will probably prove to be widely distributed in Antarctic Shelf seas.

LACERNIDAE Jullien, 1888

Frontal wall of autozooid imperforate centrally, with large lateral pores, often with complex, cribrate closures; bordered proximally and laterally by smooth gymnocyst. Primary orifice sinuate; condyles and oral spines present. Avicularia present or absent. Ovicell with entirely membranous ectooecium, and calcified, frontally imperforate entooecium. Basal pore chambers or mural septula present.

Lacerna Jullien, 1888

Colony encrusting, unilaminar. Autozooids with cryptocystidean frontal wall; pores simple or stellate, in single marginal series, additional pores often present proximo-lateral to orifice, but central area of frontal wall imperforate. Primary orifice with narrow, median sinus; proximal edge straight, with characteristic transverse, notched condyles. Oral spines present. No avicularia. Ovicell recumbent on distally succeeding autozooid, hyperstomial, closed by autozooid operculum; entooecium calcified, imperforate, except for a single series of pores around basal margin, often developing ridges or umbones; ectooecium uncalcified, except for a basal ridge, continuous with short flutings extending between the pores. Large basal pore chambers present.

Type species: *Lacerna hosteensis* Jullien, 1888.

Lacerna appears to be limited to cold southern hemisphere seas. Of the three species described here, *L. watersi* may be regarded as an endemic Antarctic species, while *L. hosteensis* and *L. eatoni* are essentially Subantarctic species which reach the southern limits of their geographical distributions at the southern end of the Scotia Arc.

Key to Antarctic species

1. Autozooids lightly calcified, with large marginal pores. Orifice with indistinct condyles .... *Lacerna eatoni*
   Autozooids with thicker, vitreous or nodular calcification and proportionately smaller marginal pores. Condyles conspicuous, ridged, resembling toothbrushes 2
2. Orifice width about 1.5 × orifice length (excluding sinus). Frontal wall finely granular .... *Lacerna hosteensis*
   Orifice width about 2 × orifice length (excluding sinus). Frontal wall distinctly nodular .... *Lacerna watersi*

Lacerna eatoni (Busk) Fig. 157A

Lepralia eatoni Busk 1876: 117; 1879: 191, pl.10, figs.7,8

Schizoporella eatoni: Waters 1904: 52, pl.3, fig.10

Schizoporella eatoni var. *areolata* Calvet 1909: 26, pl.2, figs.15,16; Moyano 1975a: 42

Schizoporella ornata Calvet 1904b: 26, pl.2, figs.4a–c

Lacerna eatoni: Hayward 1991: 328, Fig.11D

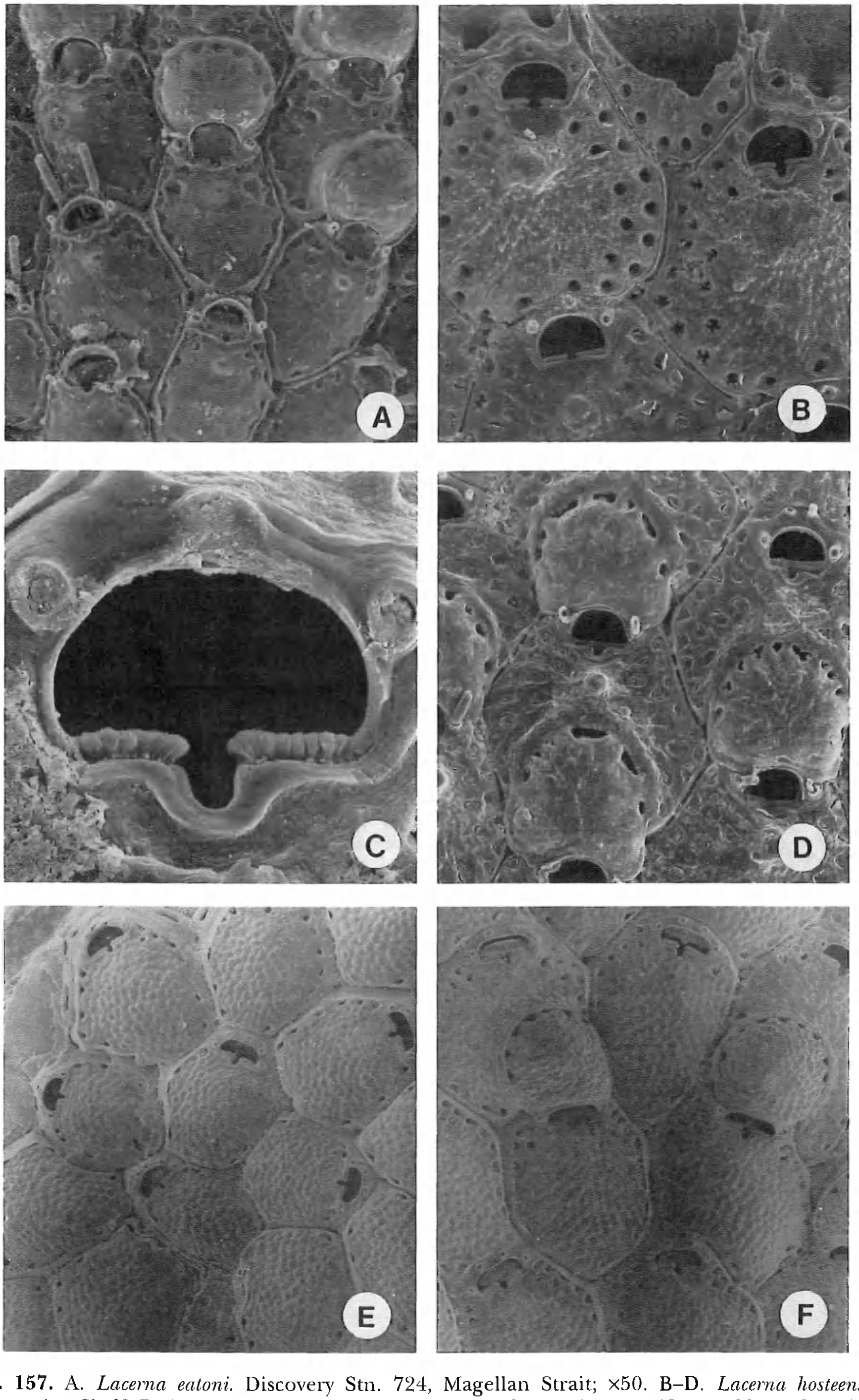


Fig. 157. A. *Lacerna eatoni.* Discovery Stn. 724, Magellan Strait; ×50. B–D. *Lacerna hosteensis.* Patagonian Shelf. B. Autozooids at the colony margin; ×60. C. Primary orifice; ×290. D. Ovicelled autozooids; ×50. E, F. *Lacerna watersi.* Ross Sea. E. Part of a young colony; ×40. F. Ovicelled autozooids; ×40.

Colony forming small, rounded patches. Autozooids oval to hexagonal, convex, separated by distinct sutures; 0.5–0.6 × 0.3–0.35 mm. Primary orifice wider than long; sinus narrow, parallel-sided, condyles indistinct. Three to five oral spines, the proximal pair persisting in ovicelled autozooids. Frontal wall thinly calcified, hyaline, smooth, often with a small umbo proximal to the sinus in later ontogeny; marginal pores large, stellate, in single or double series, often with a few additional pores proximo-lateral to orifice. Ovicell as wide as long, prominent; basal ring of ectooecium thickly calcified, with fine ridges extending between basal pores; entooecium smooth, or with fine radiating striations, often with a small frontal umbo. Ancestrula tatiform, oval, 0.35 mm long, with nine peripheral spines.

This species is distinguished from *L. hosteensis* by its more delicate calcification and proportionately larger marginal pores; further, the proximal edge of the orifice has very indistinct condyles, unlike the conspicuous ridged structures seen in *L. hosteensis* and *L. watersi.* Described originally from Kerguelen, *L. eatoni* has been recorded from Tierra del Fuego, and from Signy Island, the South Shetland Isles and the northern tip of the Palmer Archipelago.

Lacerna hosteensis Jullien — Fig. 157B–D

Lacerna hosteensis Jullien 1888: 48, pl.1, fig.2 (labelled *Lacerna de Carforti*)
Schizoporella hosteensis: Calvet 1904b: 27
Lacerna hosteensis: López Gappa 1977: 181, pl.1, figs.6–7; Hayward 1991: 327, Fig.11A–C

Colony forming irregularly spreading patches. Autozooids broadly oval to hexagonal, flat or slightly convex, separated by shallow grooves; 0.5–0.6 × 0.35–0.42 mm. Primary orifice wider than long, disto-lateral rim slightly acute to frontal plane; sinus narrow, U-shaped; condyles distinct, extending on each side from the edge of the sinus to the proximal corner of the orifice, with ridged, toothbrush-like structure. Three to five oral spines, the proximal pair persisting in ovicelled autozooids. Frontal wall vitreous, becoming distinctly nodular in later ontogeny, sometimes developing a low umbo proximal to the sinus; with a single or double series of round or stellate, marginal pores. Ovicell longer than wide, rather flattened frontally, calcified basal portion of ectooecium especially distinct in later ontogeny; entooecium finely granular, with radial striations, becoming nodular in later ontogeny and often developing coarse corrugations and a small frontal umbo. Ancestrula tatiform, oval, 0.28 mm long, with nine peripheral spines.

L. hosteensis was described from the Magellan Strait. It ranges from Cape Horn, across the Southern Patagonian Shelf to Burdwood Bank, and along the Scotia Arc from South Georgia to the South Shetland Isles, which perhaps mark the limit of its penetration into Antarctic waters.

Lacerna watersi Hayward and Thorpe — Fig. 157E,F

Schizoporella hosteensis: Waters 1904: 51, pl.3, fig.11
Lacerna hosteensis: Livingstone 1928: 52
Lacerna watersi Hayward and Thorpe 1989a: 371, Figs.4A,B

Colony a broad, flat sheet. Autozooids broadly hexagonal, rather flat, separated by distinct grooves; 0.65–0.8 × 0.5–0.65 mm. Primary orifice, excluding sinus, twice as wide as long; sinus a short, rounded U-shape; condyles prominent, projecting well above proximal edge of orifice, distinctly ridged. Four short oral spines present, two persisting in ovicelled autozooids. Frontal wall thick, nodular, becoming coarser in later ontogeny; with a single series of stellate marginal pores, and a few additional pores proximo-lateral to orifice. Ovicell longer than wide, prominent; entooecium coarsely nodular, calcified ectooecium reduced to a narrow, smooth basal band.

This endemic Antarctic species is presently known from the Ross Sea, the Bellingshausen Sea and the South Shetland Isles.

SMITTINIDAE Levinsen, 1909

Frontal wall of autozooids with cryptocystidean development; evenly perforated, or with marginal pores only. Primary orifice characteristically with a medio-proximal lyrula, and/or condyles. Peristome usually developed. Oral spines present or absent. Avicularia usually present; adventitious, rarely vicarious or interzooidal, often polymorphic. Ovicell perforate or imperforate. Basal pore chambers and mural septula present.

Smittina Norman, 1903

Frontal wall of autozooid uniformly porous. Primary orifice with lyrula and condyles. Peristome variously developed. Oral spines present or absent. Avicularia characteristically median suboral, occasionally polymorphic. Ovicell with frontal pores. Mural septula present.

Type species: *Lepralia landsborovii* Johnston, 1847.

Smittina is an unusually diverse genus with a worldwide distribution. There are numerous Antarctic species, and it is probable that others have yet to be described.

Key to Antarctic species

1. Suboral avicularium entirely enclosed within peristome 2
   Suboral avicularium situated proximal to peristome, or partly lodged within its pseudosinus, but not completely enclosed by it 7
2. Suboral avicularium vertically orientated, situated to left or right of the lyrula and not visible in frontal view. Lyrula slender, peg-like. Colony developing erect plates .... *S. abditavicularis*
   Suboral avicularium disto-proximally orientated, situated immediately proximal to lyrula 3
3. Peristome widely open, consisting of thick lateral lobes and a stout medio-proximal umbo. Avicularia rare, broadly oval. Colony encrusting, thickly calcified, with large autozooids up to 1 mm long .... *S. pileata*
   Peristome generally well developed proximally, forming a continuous latero-proximal rim 4
4. Avicularium small, narrowly oval, not wider than lyrula. Condyles rounded, with finely scalloped edges. Ovicell with few, inconspicuous pores, usually just a single median pore clearly visible .... *S. rogickae*
   Avicularium with pear-shaped or distinctly spatulate rostrum, its greatest width exceeding that of the lyrula 5
5. Avicularium with slender crossbar, lacking a columella. Thick, knobbed umbones developing on ovicell and frontal wall in later ontogeny .... *S. glebula*
   Avicularium with a conspicuous columella on the crossbar. Without umbones on frontal wall and ovicell 6
6. Frontal wall of autozooid uniformly and coarsely perforate. Peristome with prominent lateral lobes; deeply cupped proximally, developing a medio-proximal umbo. Lyrula distinctly anvil-shaped .... *S. pocilla*
   Frontal wall of autozooid finely perforate, with a marginal series of larger pores. Peristome of more or less constant height. Lyrula short, with straight edge and angular corners .... *S. incernicula*
7. Suboral avicularium, when present, frontal in position, distant from peristome 8
   Suboral avicularium lodged within proximal pseudosinus and projecting from it 10
8. Colony erect, branching, developing a slender, twig-like form, with autozooids in whorls of four or

five. Avicularia rare. Peristome deep, projecting from the frontal plane in early ontogeny .. *S. directa*
Colony encrusting or plate-like, not developing twiggy growths 9

9. Avicularium elongate, linguiform. Lyrula broad, occupying almost entire proximal edge of orifice .... *S. antarctica*
Avicularium short, oval. Lyrula narrow, occupying about half proximal edge of orifice .... *S. obicullata*

10. Avicularium surmounting a ridge which extends into the peristome from its medio-proximal edge, and thus projecting above the rim of the peristome . *S. excertaviculata*
Avicularium lodged within the medio-proximal pseudosinus of the peristome 11

11. Lyrula with projecting corners, appearing distinctly anvil-shaped. Condyles thickened, projecting frontally over the rim of the orifice .... *S. alticollarita*
Lyrula without projecting corners. Condyles flat 12

12. Proximal part of avicularium well within peristome, the distal part projecting through the peristomial notch. Frontal wall finely granular, evenly perforated .... *S. anecdota*
Proximal part of avicularium lodged within peristome, the edges of which curve above it; distal portion well outside peristome. Frontal wall coarsely granular, with irregular perforation .... *S. diffidentia*

Smittina abditavicularis Rogick — Fig. 158A–C

Smittina abditavicularis Rogick 1956d: 285, pl.23, figs.A–H
Porella malouinensis: Livingstone 1928: 66, pl.6, fig.7, pl.7, fig.2
Smittina abditavicularis: Hayward and Taylor 1984: 77, Figs.3A–D

Colony with encrusting base, developing erect folded sheets, to form irregular funnel-like or tubular growths, lobed and dividing, and frequently anastomosing; initially unilaminar, but developing bilaminar (back-to-back) or superposed multilaminar growths. Large colonies may form robust, complex structures exceeding 100 mm in height, with equivalent spread. Autozooids elongate oval to rectangular, rather flat, separated by thin sutures which become indistinct in later ontogeny; 1.5–2.00 × about 0.6 mm. Primary orifice slightly wider than long; lyrula short, peg-like; condyles broad, rounded. No oral spines. Peristome entire, distal portion continuous with frontal calcification of next autozooid; with deep pseudosinus proximally, accentuated by ontogenetic thickening, when the primary orifice becomes deeply immersed and the peristome assumes a pear shape, flush with the frontal surface of the autozooid. Avicularium tiny (0.1 mm), enclosed within peristome, proximo-lateral to lyrula and completely hidden; rostrum oval, transversely orientated, crossbar slender, without columella. Frontal wall coarsely granular, densely perforated by large round pores, thickening steadily throughout ontogeny, and achieving a thickness of 0.5 mm or more. Ovicell spherical, with about six large pores frontally, becoming immersed in early ontogeny and completely obscured.

The very large colonies of this species are especially robust, and much less brittle than those of many other erect ascophorans. *S. abditavicularis* is an endemic Antarctic species; it seems to be widely distributed in the Ross Sea, and has been recorded from the Knox coast, eastern Antarctica, and from South Georgia.

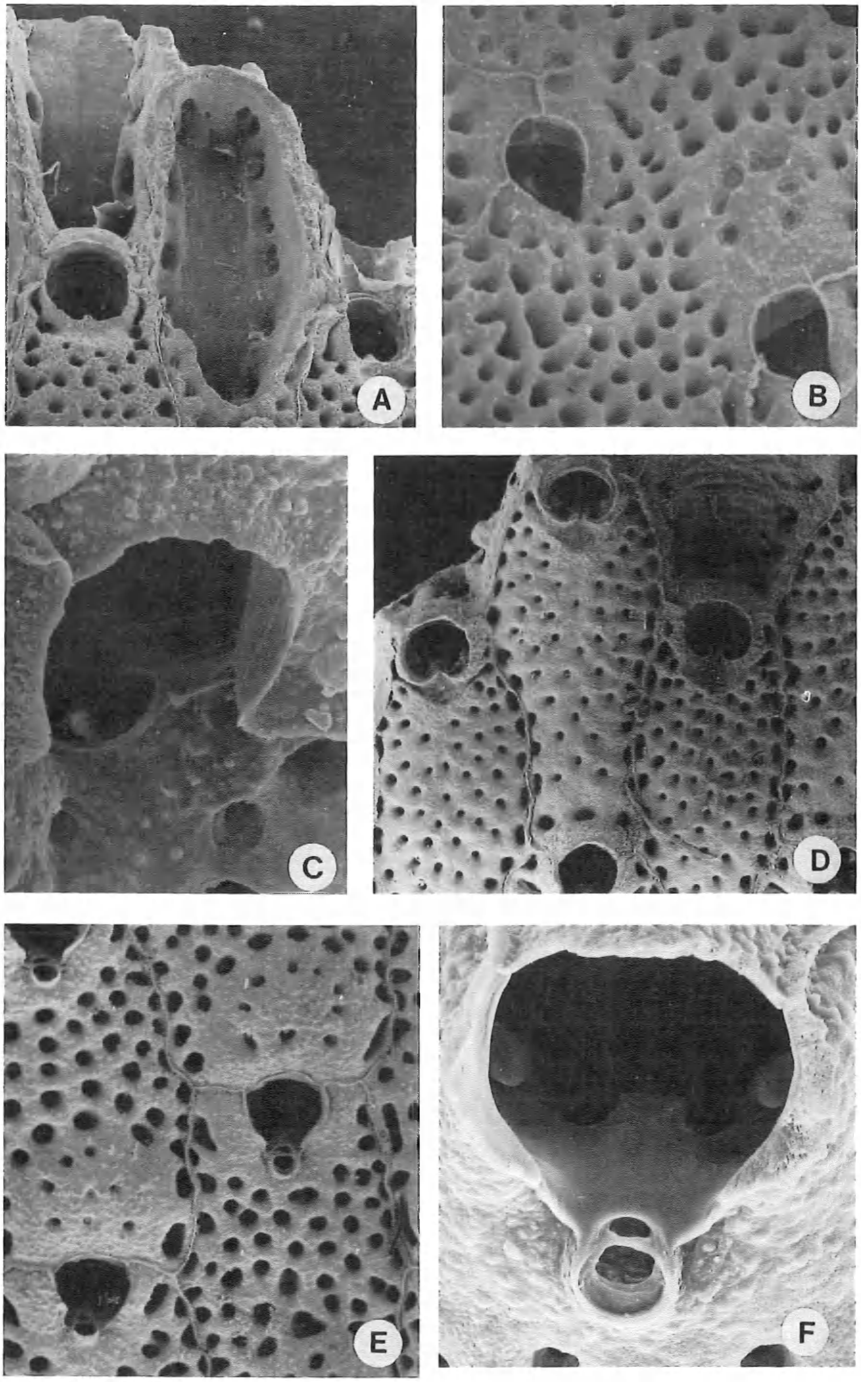


Fig. 158. A–C. *Smittina abditavicularis.* Terra Nova Stn. 294, Ross Sea. A. Autozooids at the growing edge; ×40. B. Ovicelled autozooids; ×45. C. Avicularium within the peristome; ×180. D–F. *Smittina alticollarita.* Ross Sea. D. Autozooids at the colony margin; ×40. E. Ovicelled autozooids; ×50. F. Primary orifice, showing frontally directed condyles; ×240.

Smittina alticollarita Rogick — Fig. 158D–F

Smittina alticollarita Rogick 1956d: 287, pl.24, figs.A–F
Smittina canui Rogick 1956d: 289, pl.25, figs.A–K
Smittina canui: Hayward and Taylor 1984: 72, fig.6A
Smittina alticollarita: Hayward and Thorpe 1990: 138, pl.1, figs.a–c

Colony developing extensive encrusting sheets; or erect, attached by an encrusting base, forming irregularly folded, unilaminar sheets; frequently enveloping erect substrata, and producing hollow cylinders, or cornet shapes, 30–40 mm high. Autozooids oval, hexagonal or rectangular, flat, separated by distinct raised ridges; 1.1–1.4 × 0.60–0.75 mm. Primary orifice as wide as long; lyrula anvil-shaped, with straight edge and sharply cusped corners, occupying about half width of orifice. Condyles distinctive: rounded and knob-like, projecting frontally over the primary orifice rim. No oral spines. Peristome complete, distal portion continuous with frontal calcification of next autozooid; deeply embayed medio-proximally to form a broad pseudosinus; at first erect and thin, thickening and deepening in later ontogeny, to obscure primary orifice. Avicularium oval, situated exactly in pseudosinus and projecting onto frontal surface of autozooid; crossbar slender, without a columella, palate with a large, rounded foramen. Frontal wall thickly calcified, granular, densely perforated by large round pores; marginal pores at first larger than others, less obviously so as the calcification thickens in later ontogeny. Ovicell slightly wider than long, convex, and initially prominent, but becoming immersed in later ontogeny; frontal surface finely granular, with up to a dozen small, round pores.

Smittina alticollarita Rogick and *S. canui* Rogick were shown by Hayward and Thorpe (1990) to be a single species. It is most similar to *S. incernicula* Hayward and Thorpe, but is distinguished by its large autozooids, its narrow lyrula and small avicularium, and especially by its knob-like, forwardly-projecting condyles. *S. alticollarita* is an endemic Antarctic species; it has been reported from the Knox Coast, from numerous stations in the Ross Sea, and from the Palmer Archipelago, the South Shetland Isles and South Georgia.

Smittina anecdota Hayward and Thorpe — Fig. 159A–C

Smittina anecdota Hayward and Thorpe 1990: 140. pl.1, figs.d,e

Colony encrusting, developing erect, folded, unilaminar sheets. Autozooids broadly oval to hexagonal, convex, separated by distinct ridges; 0.8–1.1 × 0.55–0.75 mm. Primary orifice wider than long; lyrula short, rectangular, with straight edge, occupying half proximal width of orifice; condyles large, rounded quadrangular, conspicuous. No oral spines. Peristome entire, distal portion continuous with frontal calcification of next autozooid; low and thickened, with a shallow proximal pseudosinus. Avicularium enclosed within peristome, tiny (<0.1 mm), with narrowly oval rostrum, crossbar lacking columella, palatal foramen extensive. Frontal wall finely granular, evenly perforated by large round pores. Ovicell slightly broader than long, with ten to twenty small, irregular, frontal pores.

This species is similar to both *S. alticollarita* Rogick and *S. rogickae* Hayward and Taylor. The former is distinguished by its narrower, anvil-shaped lyrula, and knob-like condyles, while *S. rogickae* is recognized by its much smaller autozooids, slender lyrula and (at high magnification) by its rounded, denticulate condyles. Specimens of *S. anecdota* have been collected from Halley Bay, Coatsland, and from several stations in the Ross Sea.

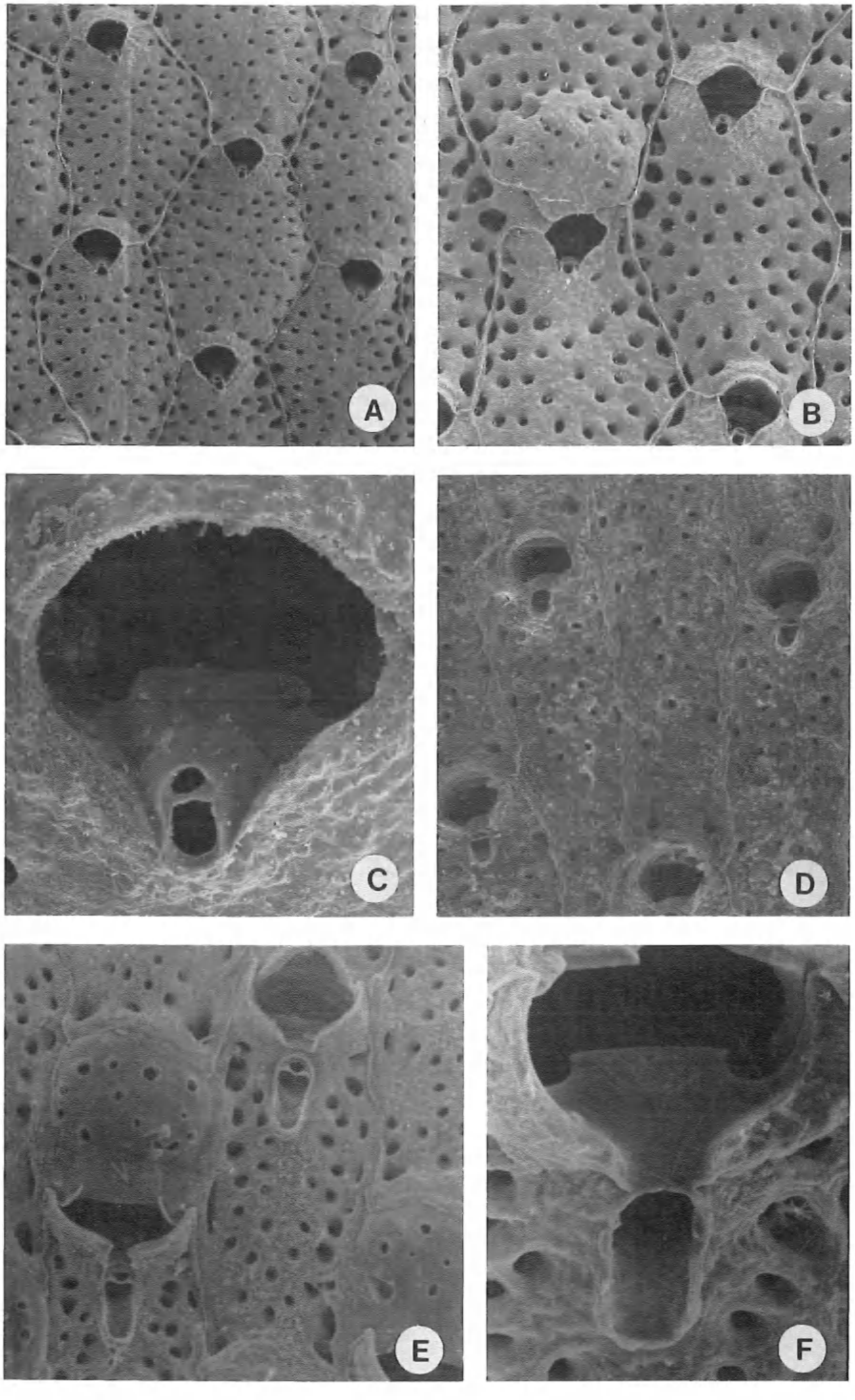


Fig. 159. A–C. *Smittina anecdota.* Terra Nova Stn. 194, Ross Sea. A. Group of autozooids; ×30. B. Ovicelled autozooid; ×50. C. Primary orifice and avicularium; ×210. D. *Smittina diffidentia.* Terra Nova Stn. 194; group of autozooids; ×45. E, F. *Smittina antarctica.* Discovery Stn. 1660, Ross Sea. E. Autozooids and ovicells; ×60. F. Primary orifice; ×110.

Smittina antarctica (Waters) Fig. 159E,F

Smittia antarctica Waters 1904: 65, pl.4, figs.1a–h
Smittina antarctica: Livingstone 1928: 65
Smittina lebruni: Hayward and Taylor 1984: 72, Fig.12C

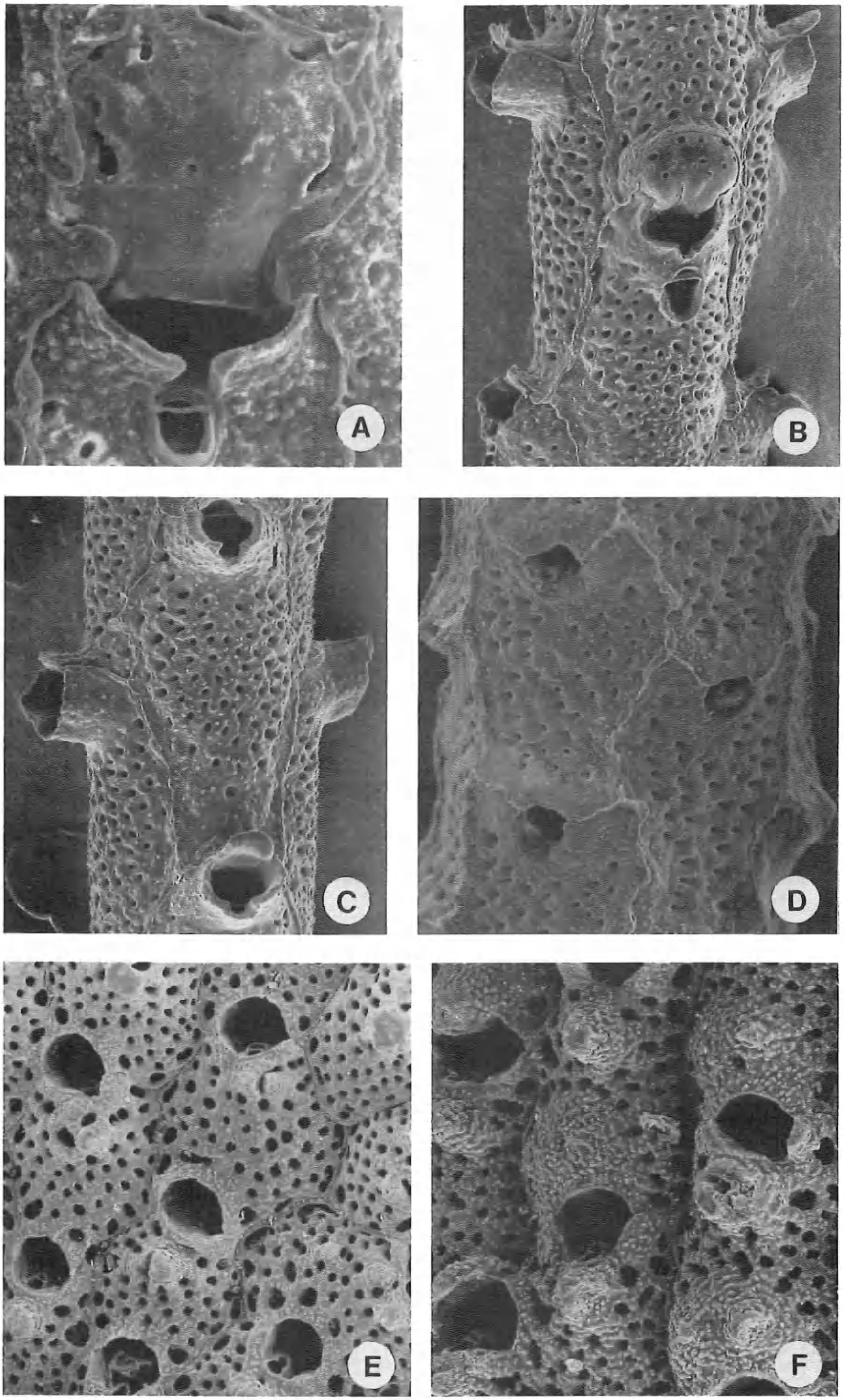
Colony arising from an encrusting base, developing erect, bilaminate branches, 10-20 mm wide, exceeding 50 mm in height; dividing dichotomously at irregular, frequent intervals, the growing edges lobed and curved, forming an irregular three-dimensional structure. Autozooids elongate, flat, more or less rectangular, the lateral walls clearly visible as low, thickened ridges; 1.0–1.3 × 0.3–0.5 mm. Primary orifice wider than long; lyrula short and broad, with slightly curved edge, occupying most of proximal border of orifice; condyles short, rounded and inconspicuous. No oral spines. Peristome low but distinct, formed from paired lateral flaps, with a rounded pseudosinus between, and with distal portion developed from frontal calcification of next autozooid; proximolateral part prominent in later ontogeny, but not extending onto ovicell in brooding autozooids. Suboral avicularium characteristic: elongate oval, 0.2 mm long, its rostral rim normal to frontal plane; crossbar slender, complete, below a small rounded opesia; palate almost entire, with just a small, crescentic foramen below the crossbar. Frontal wall closely punctured by small round pores, smooth in early ontogeny, but later distinctly nodular as calcification thickens around the pores. Ovicell about as wide as long, gently convex, smooth surfaced, with about a dozen variably sized pores; becoming enveloped by a thick ooecial cover, but not completely obscured. Vertical walls with small, recessed septula, in a single linear series close to the basal wall.

Smittina antarctica develops brittle, three-dimensional growths, with its branches twisting and curving, closely intergrown and occasionally anastomosing. Although it has not been fully described again since Waters' (1904) original account, it seems to be common and widespread in Antarctic waters, ranging from the coasts of Australian Antarctic Territory, the Ross Sea, the Bellingshausen Sea and the Palmer Archipelago, and the South Orkney Islands. This endemic Antarctic species bears some resemblance to the magellanic *S. lebruni* (Waters), with which it was confused by Hayward and Taylor (1984). The colonies of *S. lebruni* are broadly foliaceous and anastomosed, resembling those of the north-east Atlantic species *Pentapora fascialis* (Pallas); the distal border of the primary orifice is finely denticulate, and the suboral avicularia are polymorphic. *Smittina oblongata* Rogick (1956d) is probably conspecific with *S. antarctica*, but Rogick's type material is unfortunately limited and it is not possible to be certain of the identity of her species.

Smittina diffidentia Hayward and Thorpe Figs. 159D, 160A

Smittina diffidentia Hayward and Thorpe 1989a: 366, Figs.2A,B

Colony erect, developing bilaminar, dichotomously branching lobes, commonly about 5 mm wide, but up to 15 mm at the rounded branch tips. Branches brittle, flat or irregularly twisted, their edges formed of large kenozooids; may exceed 50 mm height, but overall colony architecture unknown. Autozooids elongate, narrow, rectangular, flat, separated by distinct sutures; 1.1–1.4 × 0.3–0.4 mm. Primary orifice broader than long, distal edge almost straight; lyrula short, broad, quadrangular with rounded corners, occupying two-thirds total orifice width; condyles poorly developed, inconspicuous. No oral spines. Peristome developed simply as paired proximo-lateral lobes on each side of a broadly open pseudosinus. Avicularium very small, 0.1 mm long, oval, its proximal portion within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the pseudosinus, rostrum projecting onto frontal wall; with slender crossbar and extensive palatal foramen. Frontal wall thickly calcified, coarsely granular, with large, round pores, irregularly distributed. Ovicell slightly longer than wide, convex, smooth frontally, with large, irregular pores around its edge and one or more small pores centrally; gradually enveloped laterally and distally by a coarsely granular ooecial cover.

Smittina diffidentia is presently known from a single locality off Oates Land, but is probably more widely distributed in Antarctic seas.

Smittina directa (Waters) Fig. 160B–D

Smittia directa Waters 1904: 69, pl.4, figs.10a–d
Smittia gelida Waters 1904: 71, pl.4, figs.6a–c

Colony erect, slender, cylindrical, attached by an encrusting base; forming twig-like growths, 30–40 mm high, 1–2 mm thick, branching dichotomously at irregular intervals. Autozooids in alternating whorls of four or five, with orifices opening around whole of branch circumference; elongate, rectangular, separated by distinct raised sutures; 1.3–1.5 × 0.4–0.5 mm. Primary orifice wider than long; lyrula anvil-shaped, with straight edge and markedly projecting corners, occupying about half width of orifice; condyles short, blunt, inconspicuous. No oral spines. Peristome complete, distal third continuous with calcification of next autozooid; erect and flared proximo-laterally, with a narrow, U-shaped, proximal pseudosinus; inner borders of peristome thickened on each side to delimit a narrow channel trending towards lyrula. Avicularia rare, most usually absent; situated immediately proximal to pseudosinus, 0.3 mm long, rostrum normal to frontal plane, elongate oval. Frontal wall thickly calcified, finely nodular, evenly perforated by small round pores. Ovicell broader than long, globular, smooth surfaced, with about 10 small, irregular pores frontally; at first prominent, but developing a coarsely granular ooecial cover and becoming partially immersed.

Frontal calcification thickens markedly in later ontogeny, in some instances exceeding 0.5 mm thick, the primary orifice and ovicells become deeply immersed and the autozooids appear irregularly rectangular in outline, with the raised sutures between remaining conspicuous. Waters (1904) founded two separate species on the basis of these ontogenetic differences, but a large sample will show all stages between them, and the morphology and proportions of the primary orifice are of course constant features. *Smittina directa* is an endemic Antarctic species, presently known from the Bellingshausen Sea, and from the Ross Sea, where it seems to be quite common.

Smittina glebula Hayward and Thorpe Fig. 160E,F

Smittina glebula Hayward and Thorpe 1990: 143, pl.2, figs.d,e

Colony encrusting, forming small, rounded, thickened patches. Autozooids hexagonal to rectangular, steeply convex, separated by deep grooves; 0.55–0.7 × 0.3–0.4 mm. Primary orifice as wide as long; lyrula short, rectangular, occupying about half width of proximal border of orifice; condyles prominent, bluntly rounded. No oral spines. Peristome thickened, entire, its distal portion continuous with calcification of next autozooid; with a broad, shallow pseudosinus proximally, less evident as peristome

Fig. 160. A. *Smittina diffidentia.* Terra Nova Stn. 194, Ross Sea; detail of ovicell and peristome; ×110. B–D. *Smittina directa.* B. NZOI Stn. E188, Ross Sea; branch with ovicelled autozooid; ×45. C. NZOI Stn. E118; autozooids close to branch tip; ×45. D. Discovery Stn. 1660, Ross Sea; autozooids in late ontogeny; ×40. E, F. *Smittina glebula.* Discovery Stn. 456, East of Bouvet Id. E. Group of autozooids; ×50. F. Ovicelled autozooids; ×65.

thickens in later ontogeny. Avicularium lodged within peristome; rostrum slightly broadened distally, crossbar slender, without columella, palate with extensive foramen. Frontal wall coarsely granular, thickly calcified, developing a stout, conical umbo immediately proximal to peristome; densely and regularly perforated by large round pores. Ovicell about as wide as long, with one or more small frontal pores, becoming immersed in coarse, nodular calcification and developing a prominent frontal umbo.

This species forms small, thick crusts on hard substrata, especially pebbles and stones. It is presently known only from Bouvet Island and Cape Adare, and is probably an endemic Antarctic species.

Smittina incernicula Hayward and Thorpe — Fig. 161A–C

Smittina incernicula Hayward and Thorpe 1990: 144, pl.3, figs.a–c

Colony encrusting, forming small, irregular patches; or developing larger, loosely attached, folded, unilaminar sheets. Autozooids oval to hexagonal, convex, separated by distinct sutures; 0.75–0.90 × 0.5–0.6 mm. Primary orifice wider than long; lyrula short, rectangular, occupying about one-third width of orifice; condyles distinct, rectangular and flat. No oral spines. Peristome complete, the distal third continuous with the frontal calcification of the next autozooid; erect, thin, with a broad proximal pseudosinus. Avicularium enclosed by the peristome, its rostrum projecting into the pseudosinus; spatulate, with a short, thick columella on the crossbar, and a small palatal foramen. Frontal wall thickly calcified, densely perforated by small round pores, the marginal series larger and sometimes slit-like, especially in early ontogeny. Ovicell wider than long, prominent, slightly flattened frontally, with about six irregular pores; developing a sutured ooecial cover, but the central, perforate area remaining exposed.

Smittina incernicula is distinguished from *S. alticollarita* principally by its rectangular lyrula, flat, rectangular condyles, and by the smaller size of its autozooids. It is probably endemic to Antarctica. To date it has only been collected from South Georgia, the South Shetland Isles and the Ross Sea.

Smittina excertaviculata Rogick — Fig. 161 D, E

Smittina excertaviculata Rogick 1956d: 292, pl.26, figs.A–H

Smittina exertaviculata (*sic*): Hayward and Taylor 1984: 78, Figs.4A,B

Colony encrusting, developing broad, unilaminar or bilaminar sheets. Autozooids oval to hexagonal, convex, separated by shallow grooves; 0.7–1.1 × 0.5–0.6 mm. Primary orifice wider than long; lyrula short, rectangular, occupying half width of proximal border of orifice; condyles pointed, short and inconspicuous. No oral spines. Peristome thin, raised, entire, its distal portion continuous with the calcification of the next autozooid; without a marked proximal pseudosinus. Avicularium minute, 0.1 mm long, developing after the completion of the peristome rim, situated medio-proximally, its rostrum normal to the frontal plane and projecting above the level of the peristome; within the peristome the basal part of the avicularian cystid forms a low ridge extending towards the lyrula. Frontal wall finely granular, densely and evenly perforated by small round pores. Ovicell about as wide as long, depressed frontally, with finely granular surface, perforated by 10–20 small pores.

Smittina excertaviculata is especially characterized by its relatively large autozooids, with densely perforated frontal wall, and by its tiny, frontally projecting avicularium. The subfossil material described by Hayward and Taylor (1984) had ovicells with fewer pores than in those described by Rogick (1956d), although in other respects it was identical to Rogick's species. This endemic Antarctic species has been recorded

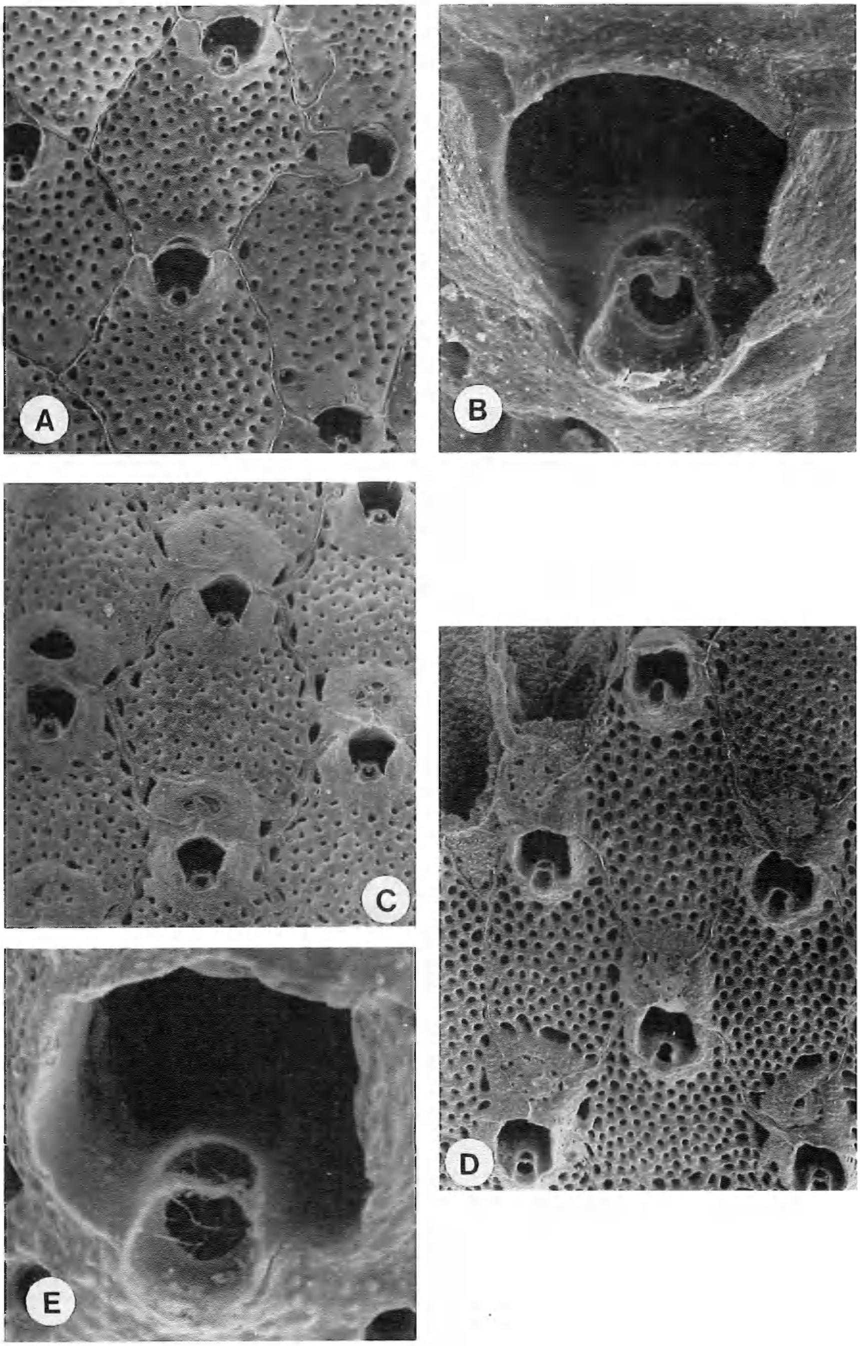


Fig. 161. A–C. *Smittina incernicula.* A. Terra Nova Stn. 335, Ross Sea; ×40. B. Discovery Stn. 1948, South Shetland Is.; primary orifice; ×230. C. Discovery Stn. 1948; ovicelled autozooids; ×40. D, E. *Smittina excertaviculata.* NZOI Stn. A457, Ross Sea. D. Ovicelled autozooids; ×35. E. Primary orifice and avicularium; ×190.

from the Australian Antarctic Territory, the Ross Sea, and Signy Island.

Smittina obicullata Rogick — Fig. 162E,F

Smittina obicullata Rogick 1956d: 294, pl.27, figs.A–L

Colony growing from an encrusting base to form broad, erect lobes, unilaminate or bilaminate, curved or twisted, dividing and anastomosing, and developing a complex three-dimensional structure, with maximum diameter often exceeding 60 mm. Autozooids hexagonal to rectangular, slightly convex, lightly calcified, the deep vertical walls showing frontally as thickened, raised sutures; 0.9–1.2 × 0.3–0.4 mm. Primary orifice slightly wider than long; lyrula short, rather square, with straight edge, occupying about one-third of proximal border of orifice; condyles very short, pointed, inconspicuous. No oral spines. Peristome low, complete, distal portion developed from frontal calcification of the next autozooid, extending onto frontal surface of ovicell in brooding autozooids. A deep, narrow pseudosinus proximally, accentuated in later ontogeny as inner face of peristome thickens, developing a ridge on each side of the pseudosinus (which extends towards the lyrula), and paired frontal flaps which eventually curve medially and fuse. Avicularia infrequent, often lacking from most autozooids; when present, unconnected with peristome, disto-proximally orientated, the oval rostrum normal to frontal plane. Frontal wall vitreous, densely perforated by large round pores. Ovicell as wide as long, smooth surfaced, with 15–20 small, irregularly shaped pores frontally; developing a marginal ooecial cover in later ontogeny, but not becoming immersed. Vertical walls with a single series of small septula basally.

Smittina obicullata develops thinly calcified, fragile colonies, often attached to erect substrata such as hydroids or gorgonaceans. It has not been reported since Rogick's (1956d) original account of material from Marguerite Bay. However, it occurs in the Ross Sea, and off the Palmer Archipelago, and is quite common around Signy Island. It is perhaps quite widely distributed in Antarctic Seas. *S. obicullatoidea* Liu and Hu (1991) does not seem to differ substantially from *S. obicullata.*

Smittina pileata (Waters) — Fig. 162A,B

Smittia pileata Waters 1904: 70, pl.4, figs.7a,b

Smittina scrupea Hayward and Taylor 1984: 80, Figs.5A–C

Colony encrusting, forming broad, thick sheets frequently exceeding 10 cm^2. Autozooids oval to hexagonal, strongly convex, separated by distinct sutures; 0.8–1.1 × 0.5–0.6 mm. Primary orifice wider than long; lyrula short, rectangular, with straight edge, occupying three-quarters total width of proximal border of orifice; condyles rectangular, small and rather inconspicuous. No oral spines. Peristome developed laterally and distally, the latter part continuous with frontal calcification of next autozooid, low and thickened, widely open proximally. Avicularia sporadic and infrequent; when present, lodged within peristome; rostrum broadly oval, crossbar slender, without columella, palatal foramen extensive. Frontal wall thickly calcified, coarsely granular, evenly perforated by small round pores; developing a low conical umbo immediately proximal to the orifice. Ovicell spherical, prominent, coarsely granular, with numerous small frontal pores, often occluded in later ontogeny.

Smittina pileata forms extensive, thickly calcified sheets on rock and large stones. It becomes grossly thickened in late ontogeny, and in the oldest parts of the colony autozooid orifices may be completely occluded by thick, granular calcification. Avicularia are very infrequent, and may be almost entirely absent

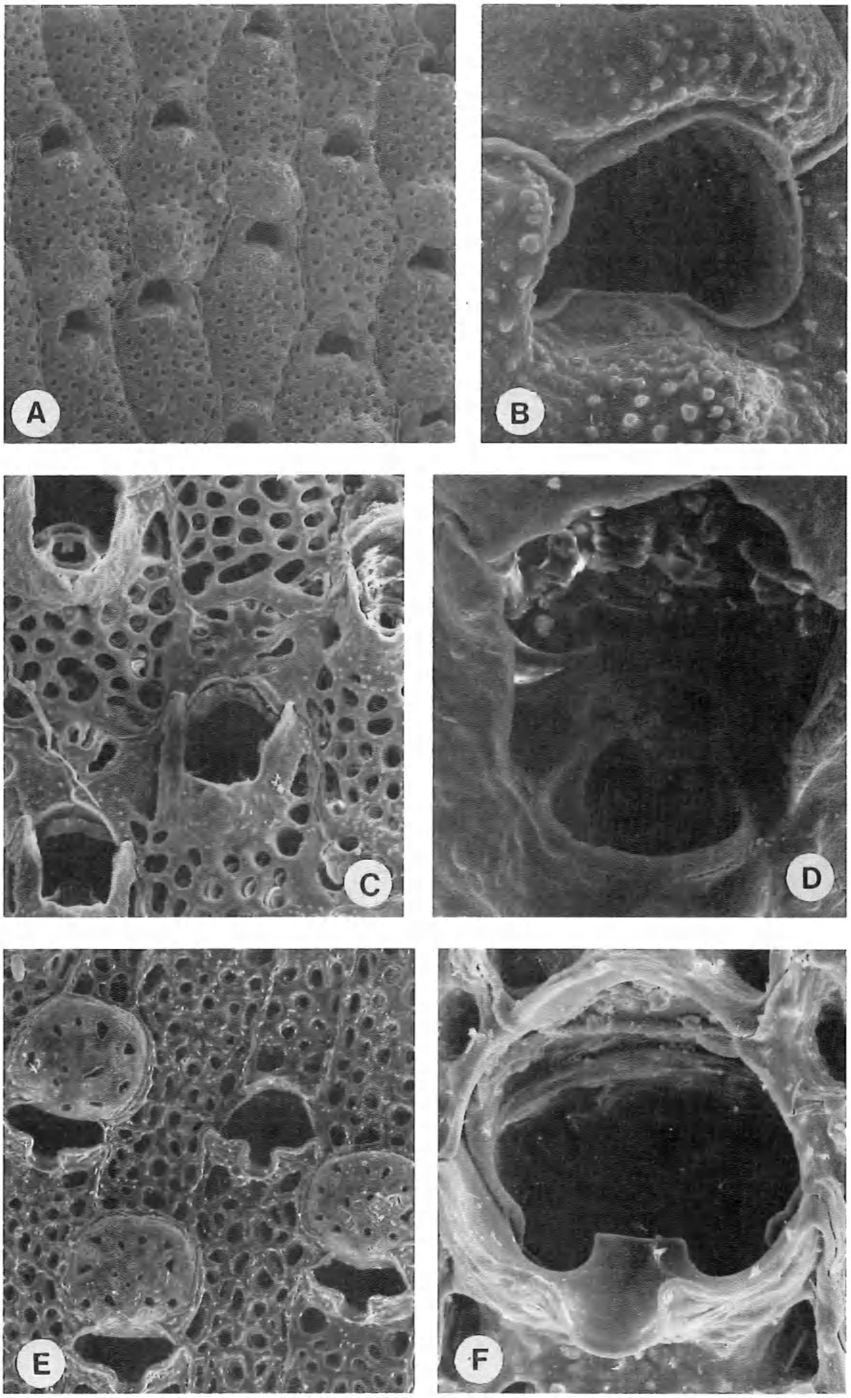


Fig. 162. A, B. *Smittina pileata.* McMurdo Sound, Ross Sea. A. Portion of colony, including ovicelled autozooids; ×24. B. Primary orifice; ×180. C, D. *Smittina pocilla.* Discovery Stn. 1873, South Shetland Is. C. Autozooids and ovicells; ×80. D. Primary orifice and avicularium; ×310. E, F. *Smittina obicullata.* Signy Id. E. Autozooids and ovicells; ×60. F. Primary orifice; ×200.

in some colonies. This is an endemic Antarctic species; first described from the Bellingshausen Sea, it has been recorded from Halley Bay, and seems to be widespread in the Ross Sea.

Smittina pocilla Hayward and Thorpe Fig. 162C,D

Smittina pocilla Hayward and Thorpe 1990: 154, pl.5, figs.e,f

Colony encrusting. Autozooids oval to hexagonal, convex, separated by distinct grooves; 0.65–0.85 × 0.35–0.45 mm. Primary orifice wider than long; lyrula occupying about half proximal width of orifice, short, anvil-shaped, with slightly concave edge, and distinctly cusped corners; condyles indistinct. No oral spines. Peristome entire, raised laterally as pronounced flaps, lower proximally and deeply cupped. Avicularium enclosed within peristome, comparatively large, slightly acute to frontal plane; rostrum spatulate, crossbar with stout, often bifid columella, palatal foramen moderate. Frontal wall coarsely granular, perforated by large, closely spaced, irregular pores and appearing reticulate; in later ontogeny thickening calcification reduces the size of the pores. Ovicell small, spherical, finely granular, with about six irregular frontal pores; developing a coarse ooecial cover, but the central perforated area remaining distinct.

Smittina pocilla is presently known only from the South Shetland Islands.

Smittina rogickae Hayward and Taylor Fig. 163A–C

Smittina ordinata: Rogick 1956d: 298, pl.29, figs.A–M, pl.30, figs.A–C
Smittina rogickae Hayward and Taylor 1984: 81, Fig.6B
Smittina ctenocondyla Hayward and Thorpe 1990: 141, pl.2, figs.a–c

Colony encrusting, forming small, rounded patches, white or pinkish. Autozooids oval to hexagonal, thickly calcified, convex, separated by deep grooves; 0.44–0.7 × 0.3–0.5 mm. Primary orifice wider than long; lyrula occupying about half proximal width of orifice, short, with straight edge and bluntly rounded corners; condyles prominent, rounded, with delicately toothed edge. Three or four impermanent oral spines present in earliest ontogeny. Peristome entire, distal portion continuous with frontal calcification of next autozooid; erect and thin, with a deep, narrow pseudosinus medio-proximally. Avicularium enclosed within peristome, very small (<0.1 mm), sometimes twinned; rostrum narrowly oval, crossbar lacking columella, palate with extensive foramen. Frontal wall thickly calcified, densely perforated by small round pores. Ovicell broader than long, globular, with a few scattered frontal pores, obscured by a granular ooecial cover in later ontogeny, but with a single large pore typically remaining conspicuous.

This rather inconspicuous species is at present known from a few localities in the Ross Sea, and from single localities in the Palmer Archipelago, the South Shetlands, and Halley Bay.

Smittoidea Osburn, 1952

Frontal wall of autozooid with marginal pores only. Primary orifice with lyrula and condyles. Peristome variously developed, oral spines present or absent. Avicularia median suboral, typically proximally orientated, sometimes polymorphic. Ovicell hyperstomial, prominent, with frontal perforations; not closed by autozooid operculum. Vertical walls with mural septula.

Type species: *Smittoidea prolifica* Osburn, 1952.

Species of *Smittoidea* occur in all the world's seas. Though taxonomically less diverse than *Smittina*, the Antarctic fauna includes several distinctive species. *Smittia tripora* Waters, 1904 clearly belongs to this genus. Judging from Waters' figures, it appears very similar to *Smittoidea malleata* (q.v.), but the type material cannot be traced and its

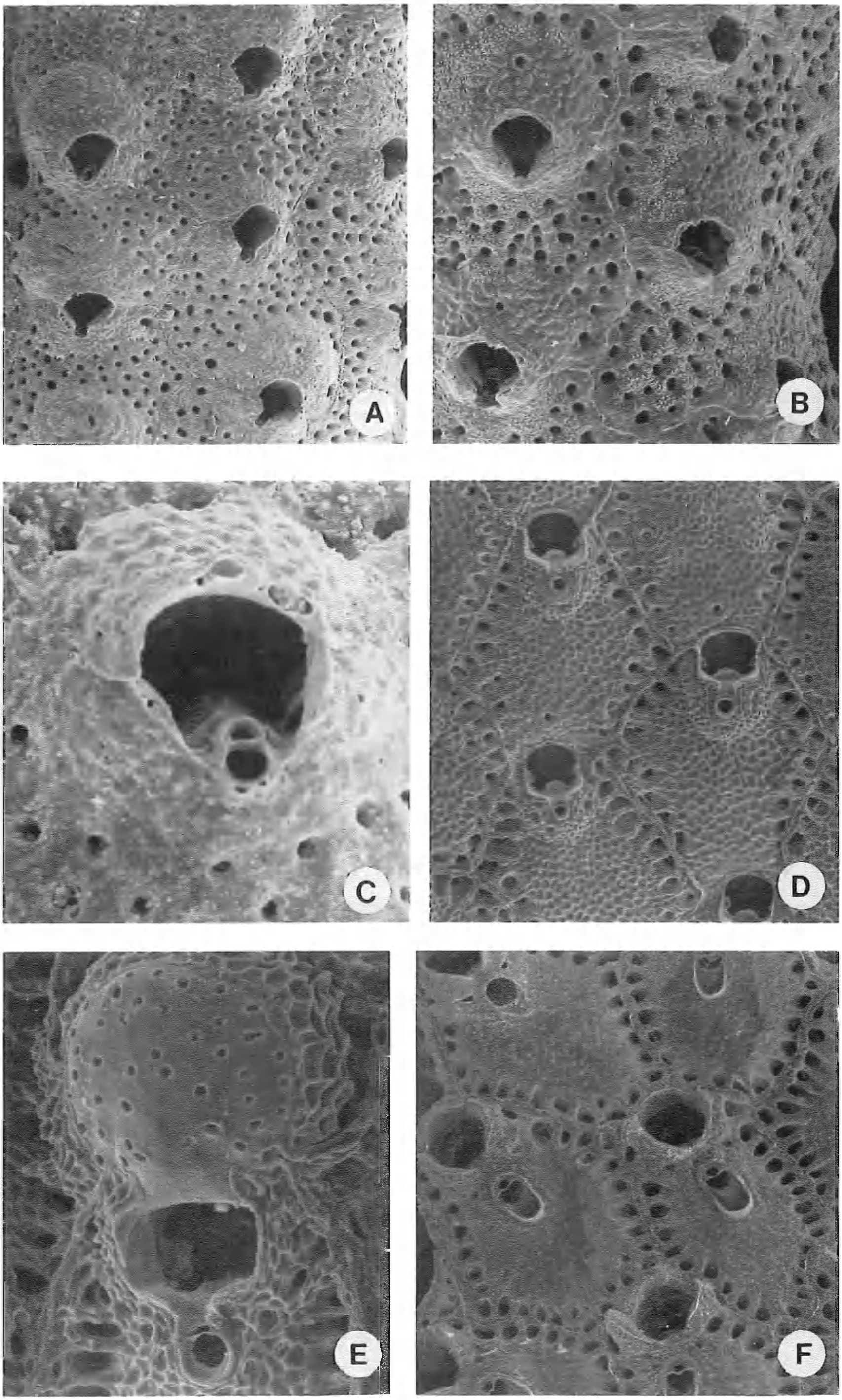


Fig. 163. A–C. *Smittina rogickae.* Halley Bay. A. Autozooids and ovicells; ×45. B. Detail of ovicelled autozooids; ×60. C. Primary orifice; ×190. D, E. *Smittoidea albula.* Terra Nova Stn. 295, Ross Sea. D. Group of autozooids; ×35. E. Ovicelled autozooid, showing primary orifice; ×80. F. *Smittoidea conspicua.* Terra Nova Stn. 355, Ross Sea; ×40.

taxonomic identity cannot therefore be resolved.

Key to Antarctic species

1. Suboral avicularium triangular 2
   Suboral avicularium oval, pear-shaped or rounded 3
2. Avicularium situated proximal to peristome, its rostrum normal to frontal plane of autozooid. Lyrula narrow, quadrangular; condyles rounded with denticulate edge .... *S. pugiuncula*
   Avicularium enclosed within peristome, acute to frontal plane, with hooked rostrum. Lyrula broad, anvil-shaped .... *S. rhynchota*
3. Avicularium elongate, oval or pear-shaped 4
   Avicularium short, rounded 5
4. Avicularium oval, with small, circular proximal foramen. Lyrula occupying almost entire proximal width of orifice; distal rim of orifice with basal denticulations ... *S. conspicua*
   Avicularium pear-shaped. Lyrula narrow, occupying less than half proximal width of orifice; distal rim of orifice smooth .... *S. ornatipectoralis*
5. Primary orifice with distinct quadrangular lyrula and large condyles; bordered by a low peristome. Autozooids <1.0 mm long .... *S. albula*
   Primary orifice with convex proximal lip, constituting a low, broad lyrula. No peristome. Autozooids >1.05 mm .... *S. malleata*

Smittoidea albula Hayward and Taylor — Fig. 163D,E

Smittoidea albula Hayward and Taylor 1984: 83, Fig.6C,D

Colony initially encrusting, developing loosely attached, partly erect, unilaminar sheets. Autozooids oval to hexagonal, rather flat, separated by distinct sutures; 0.75–1.0 × 0.5–0.65 mm. Primary orifice slightly wider than long; lyrula short and broad, with gently convex edge, occupying half proximal width of orifice; condyles large and distinct, quadrangular. Two thin, distal oral spines present in earliest ontogeny, obliterated by development of next distal autozooid. Peristome low but conspicuous, most evident proximo-laterally, as paired flaps flanking a median proximal pseudosinus. Avicularium located immediately proximal to pseudosinus, its proximal portion embraced by the peristomial flaps; rostrum normal to frontal plane, oval, 0.1 mm long; crossbar slender, palate with extensive foramen. Frontal wall with characteristic pitted, or shagreened, appearance; with a single series of well marked marginal pores. Ovicell longer than broad, convex, smooth surfaced with 30–40 small frontal pores; developing a peripheral ooecial cover.

Smittoidea albula is an endemic Antarctic species, at present known only from the Ross Sea. It is rather similar to *S. malleata*, which has larger autozooids than *S. albula*, and a broader, shorter lyrula, and does not develop a peristome. The colonies of *S. albula* are perhaps smaller than those of *S. malleata*; in specimens so far collected, they tend to be especially brittle, and rarely larger than 1 or 2 cm^2.

Smittoidea conspicua (Waters) — Figs. 163F, 164A,B

Smittia conspicua Waters 1904: 66, pl.4, fig.3
Smittina conspicua: Livingstone 1928: 64
Smittoidea sp. Hayward and Taylor 1984: 84, Fig.7D

Colony initially encrusting, developing loosely attached, partly erect unilaminar sheets. Autozooids oval to hexagonal, rather flat, separated by distinct sutures; 1.1–1.4 × 0.6–0.8 mm. Primary orifice as wide as long, disto-lateral borders with a basally directed, internal rim, with coarsely toothed edge; lyrula stout, anvil-shaped, with straight edge, occupying half proximal orifice width; condyles in

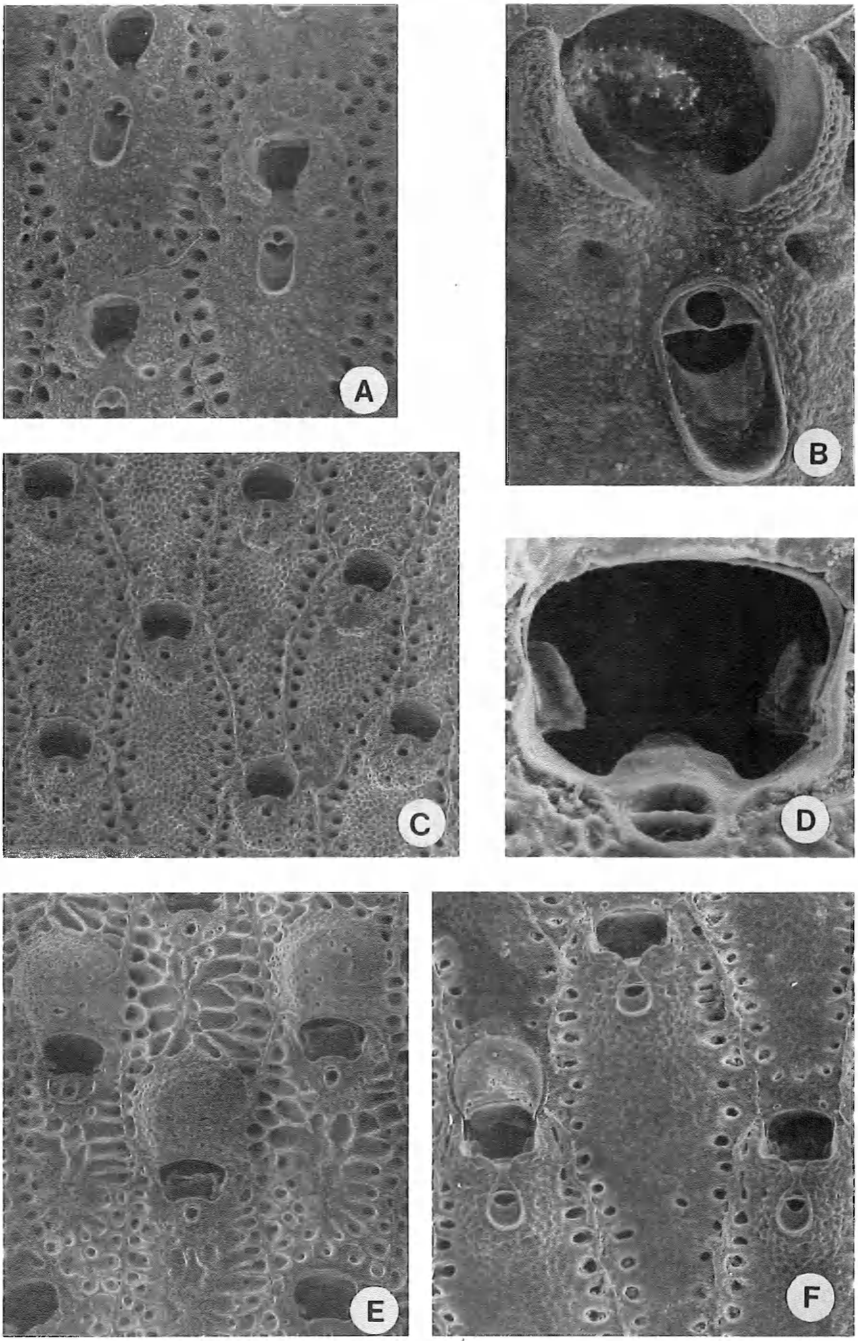
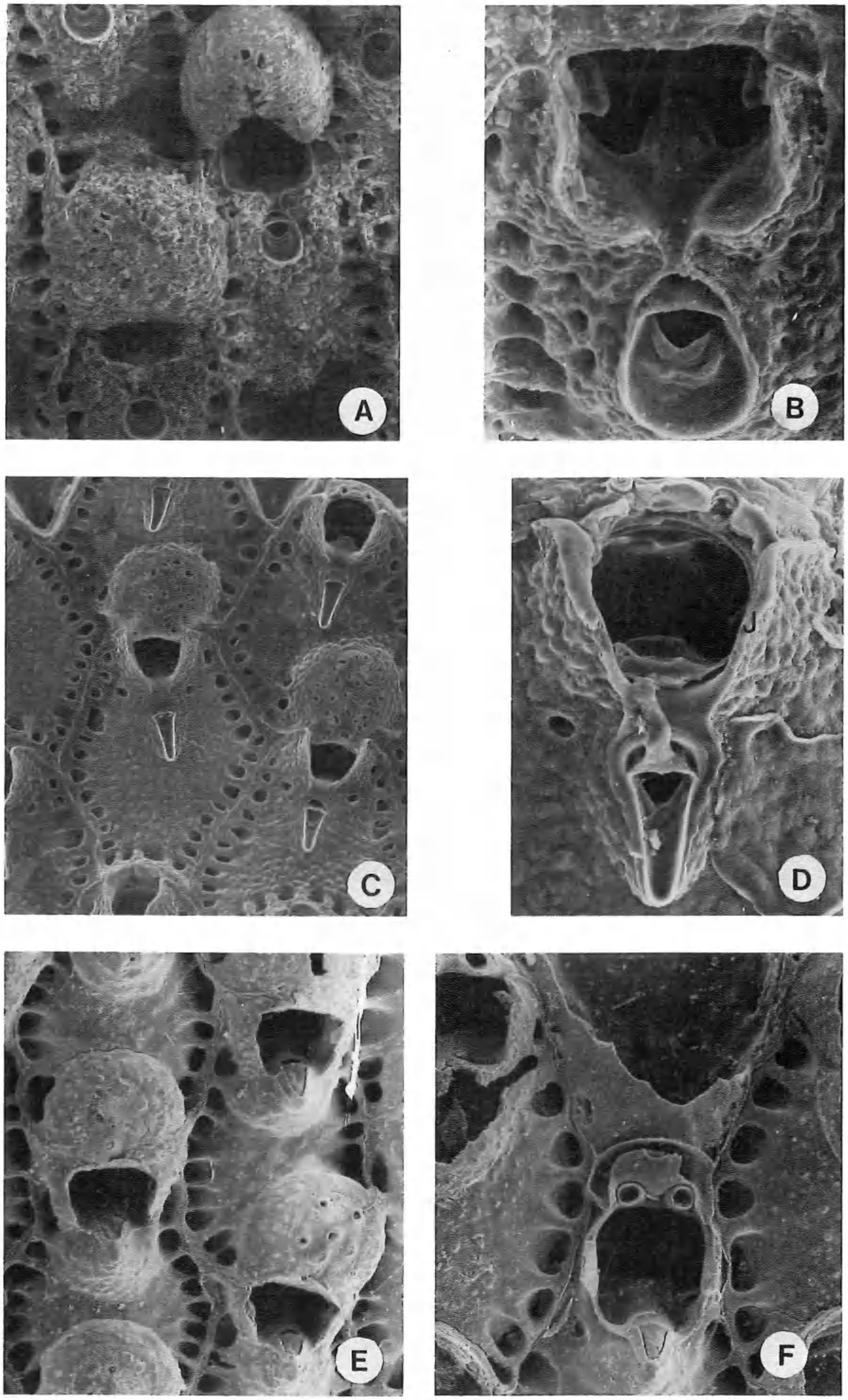


Fig. 164. A, B. *Smittoidea conspicua*. A. Terra Nova Stn. 316, Ross Sea; ovicelled autozooids; ×35. B. Terra Nova Stn. 355, Ross Sea; primary orifice and avicularium; ×120. C–E. *Smittoidea malleata*. C. Discovery Stn. 1652, Ross Sea; group of autozooids; ×29. D. NZOI Stn. A528, Ross Sea; primary orifice; ×200. E. Discovery Stn. 1660, Ross Sea; ovicelled autozooids; ×30. F. *Smittoidea ornatipectoralis*. Discovery Stn. 1660; group of autozooids; ×40.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the form of inconspicuous thickenings of the lateral orifice rim, continuous on each side with a slender medio-basally directed rod. No oral spines. Peristome developed as paired, thickened, lateral flaps, distal portion developed from calcification of next autozooid, incomplete proximally. Avicularium well proximal to peristome; rostrum elongate oval, with thin raised rim, normal to frontal plane; palate with a small, semicircular foramen; crossbar distinctive, in the form of a thin plate with a large, round, central foramen. Frontal wall finely granular, becoming irregularly nodular in later ontogeny; marginal pores large and round. Characteristically, a single round pore is visible, on each side, proximolateral to the peristome. Ovicell comparatively small, round, flattened frontally, with a few (<10) irregular frontal pores; developing a sutured ooecial cover which obscures all but a small central area, and becoming rather indistinct.

Few specimens of this species have been collected and the form and maximum dimensions of the colony are still unknown. Described originally from the Bellingshausen Sea, it has since been recorded from Adelie Land, the coasts of Australian Antarctic Territory, and from the Ross Sea.

Smittoidea malleata Hayward and Thorpe — Fig. 164C–E

Smittoidea evelinae: Rogick 1956d: 305, pl.32
Smittoidea malleata Hayward and Thorpe 1989a: 366, Figs.2C–E

Colony attached by an encrusting base, developing erect, folded or enrolled, unilaminar or bilaminar sheets; occasionally anastomosing, and sometimes developing multilaminar growths through frontal budding. May exceed 60 mm high, with equivalent spread. Autozooids elongate, rectangular or hexagonal, rather flat, separated by distinct sutures; 1.05–1.30 × 0.55–0.7 mm. Primary orifice wider than long, appearing rather rectangular; lyrula scarcely demarcated from proximal border of orifice, short and broad, occupying about three-quarters of proximal orifice width; condyles small, angular, downcurved. No oral spines or peristome. Avicularium immediately proximal to lyrula, rostrum normal to frontal plane, oval, 0.1 mm long; crossbar slender, palate with extensive foramen. Frontal wall finely granular, with a hammered, or shagreened, surface; bordered by large marginal pores, often in double series proximally; with thick interareolar ridges which extend across the frontal wall in later ontogeny, anastomosing to give a reticulate effect. Ovicell longer than wide, convex, smooth surfaced, with about 20 small, irregular pores frontally; developing a peripheral ooecial cover.

This endemic Antarctic species has been reported from the South Shetland Isles, Graham Land and the Ross Sea.

Smittoidea ornatipectoralis Rogick — Figs. 164F, 165A,B

Smittoidea ornatipectoralis Rogick 1956d: 307, pl.33, figs.A–F
Smittoidea ornatipectoralis brevior Rogick 1956d: 309, pl.34, figs.A–G

Colony initially encrusting, developing loosely attached, or partly erect, folded, unilaminar sheets; maximum dimensions unknown. Autozooids elongate, rectangular, rather flat, separated by well marked sutures; 1.1–1.6 × 0.5–0.6 mm. Primary orifice slightly broader than long, almost quadrangular; lyrula stout, tapered or rounded, occupying about one-third proximal orifice width; condyles

Fig. 165. A, B. *Smittoidea ornatipectoralis.* Discovery Stn. 1660, Ross Sea. A. Ovicelled autozooids; ×40. B. Primary orifice; ×110. C, D. *Smittoidea pugiuncula.* Discovery Stn. 1948, South Shetland Is. C. Autozooids and ovicells; ×40. D. Primary orifice; ×130. E, F. *Smittoidea rhynchota.* Discovery Stn. 366, South Sandwich Is. E. Ovicelled autozooids; ×70. F. Autozooids at the colony margin; ×90.

large and conspicuous, rectangular. No oral spines. Peristome minimal, developed as two thin, proximo-lateral flaps, with a shallow, median, pseudosinus between. Avicularium with conspicuous tumid cystid immediately proximal to peristome, extending across whole width of autozooid; rostrum normal to frontal plane, 0.2–0.4 mm long, broadly drop-shaped, with stout crossbar and small palatal foramen. In some autozooids the rostrum is directed proximo-laterally. Frontal wall finely nodular; marginal pores large and distinct, with thick interareolar struts, which thicken and become especially conspicuous in later ontogeny. Ovicell about as wide as long, globular and prominent, with numerous fine perforations frontally; developing a granular, peripheral ooecial cover.

Rogick (1956d) had very little material of both this species and her subspecies *brevior*, which was described in the same paper. The only firm distinction between the two taxa was the length of the avicularian rostrum, which had a mean of 0.4 mm in the nominal species and 0.2 mm in the subspecies. In material from the Ross Sea a range of 0.2 to 0.4 mm may be found within a single colony, and there seem to be little grounds for maintaining any distinction between the two taxa. *S. ornatipectoralis* is distributed from Graham Land and the Palmer Archipelago, to the Ross Sea and the Knox coast, but is probably present off all Antarctic coasts.

Smittoidea pugiuncula Hayward and Thorpe — Fig. 165C,D

Smittoidea pugiuncula Hayward and Thorpe 1989a: 368, Figs.1D,E

Colony encrusting. Autozooids broadly oval to hexagonal, gently convex, separated by distinct, thickened sutures. Primary orifice about as wide as long; lyrula occupying about half proximal width of orifice, with slightly convex edge and distinct corners; condyles very distinctive: large, oval, downcurved, with delicately scalloped edge. Two short, distal oral spines present in early ontogeny. Peristome well developed, erect, with a broad, proximal pseudosinus. Avicularium situated proximal to pseudosinus, not incorporated into the peristome; rostrum normal to frontal plane, elongate, dagger-shaped; crossbar slender, with a slight median thickening, palate with only a short, proximal foramen. Frontal wall thick, with fine-grained, nodular calcification; marginal pores conspicuous, with distinct ridges between in early ontogeny, but quite rounded in later ontogeny. Ovicell longer than wide, convex, smooth surfaced, with the frontal area finely punctured by numerous small, irregular pores; developing a nodular, peripheral ooecial cover.

This species was described from the South Shetland Islands, encrusting hydrocorallines, and additional material has since been recognized in samples from the Ross Sea.

Smittoidea rhynchota Hayward and Thorpe — Fig. 165E,F

Smittoidea rhynchota Hayward and Thorpe 1990: 163, pl.9, figs.d–f

Colony encrusting, developing small, round, unilaminar patches. Autozooids broadly oval to hexagonal, convex, separated by distinct sutures; 0.55–0.7 × 0.4–0.5 mm. Primary orifice slightly wider than long; lyrula broad and deep, occupying about half proximal orifice width, anvil-shaped, with straight edge and sharply cusped corners; condyles lacking. Two short, distal oral spines present in early ontogeny. Peristome developed as paired lateral flaps, slightly flared, extending onto frontal surface of ovicell as a slight ridge. Avicularium situated within proximal gap in peristome, cystid swollen, developing a conical, apical, suboral umbo; rostrum acute to frontal plane, elongate triangular, with hooked tip; proximal portion located within peristome, hooked distal portion abutting the suboral umbo. One to three additional avicularia may develop on the proximolateral edges of the peristome in later ontogeny. Frontal wall smoothly calcified, with large, conspicuous marginal pores separated by stout ridges; becoming thicker and coarser in later ontogeny. Ovicell slightly wider than long, prominent, with up to eight small frontal pores; developing a finely granular ooecial cover in later ontogeny, which covers and obscures most of the frontal pores.

Smittoidea rhynchota is immediately recognized by its large, hooked suboral avicularia, up to four of which may be present in the peristomes of the oldest autozooids of a colony. Specimens are known from Burdwood Bank, and from the South Sandwich Islands, but its wider distribution in Antarctic or Subantarctic waters is unknown.

Aimulosia Jullien, 1888

Colony encrusting. Autozooid frontal wall with marginal pores. Large basal pore chambers present. Primary orifice with indistinct condyles and low proximal lyrula; distal oral spines present. Avicularium frontal, suboral, with voluminous cystid budded from lateral marginal septula. Ovicell recumbent on distally succeeding autozooid, hyperstomial, closed by autozooidal operculum; imperforate, ectooecium membranous, entooecium thinly calcified.

Type species: *Aimulosia australis* Jullien, 1888.

Porella andrejashevi Gontar (1993) perhaps belongs in this genus.

Key to Antarctic species

1. Primary orifice with angular lyrula, longer than the condyles. Ovicell smooth to finely granular. Marginal pores especially pronounced .... *A. antarctica*

   Primary orifice with rounded lyrula, shorter than the very conspicuous condyles. Ovicell coarsely nodular .... *A. australis*

Aimulosia antarctica (Powell) Fig. 166A–C

Smittia marsupium: Waters 1904: 61, pl.4, fig.4; Calvet 1909: 30
Smittina marsupium: Livingstone 1928: 65
Porella marsupium: Rogick 1959b: 238, figs.8–13, 16–19
Porella antarctica Powell 1967: 334, pl.11, fig.C
Aimulosia antarctica: Hayward and Thorpe 1990: 171, pl.12, Figs.a–c

Colony a small, rounded, unilaminar patch. Autozooids oval to hexagonal, steeply convex, separated by deep grooves; 0.35–0.42 × 0.20–0.30 mm. Primary orifice wider than long; proximal edge sinuous, with a short, angular median lyrula; condyles short, wide, rounded; four to seven oral spines, long, slender, antenniform, often curved, two persist in ovicelled autozooids. Frontal wall smooth, finely granular in late ontogeny; marginal pores large, interspaced with distinct ridges that become especially pronounced in late ontogeny. Suboral avicularium prominent; rostrum semielliptical, acute to frontal plane, proximally directed; crossbar complete, without columella; cystid developing a spinous apical umbo in later ontogeny. Prominent, lateral peristomial flaps enclose the primary orifice. Ovicell wider than long, finely granular, with a stout frontal umbo in later ontogeny.

This species is widely distributed in Antarctica. It has been recorded from Adelie Land, the Ross Sea, the South Orkneys, South Georgia and Bouvet Island. At Signy island it occurs commonly on rock substrata at 8–15 m depth.

Aimulosia australis Jullien Fig. 166D–F

Aimulosia australis Jullien 1888: 59, pl.1, fig.5, pl.9, figs.3–4
Aimulosia australis: Calvet 1904b: 29; Hayward and Thorpe 1990: 169, pl.12, Figs.d–f

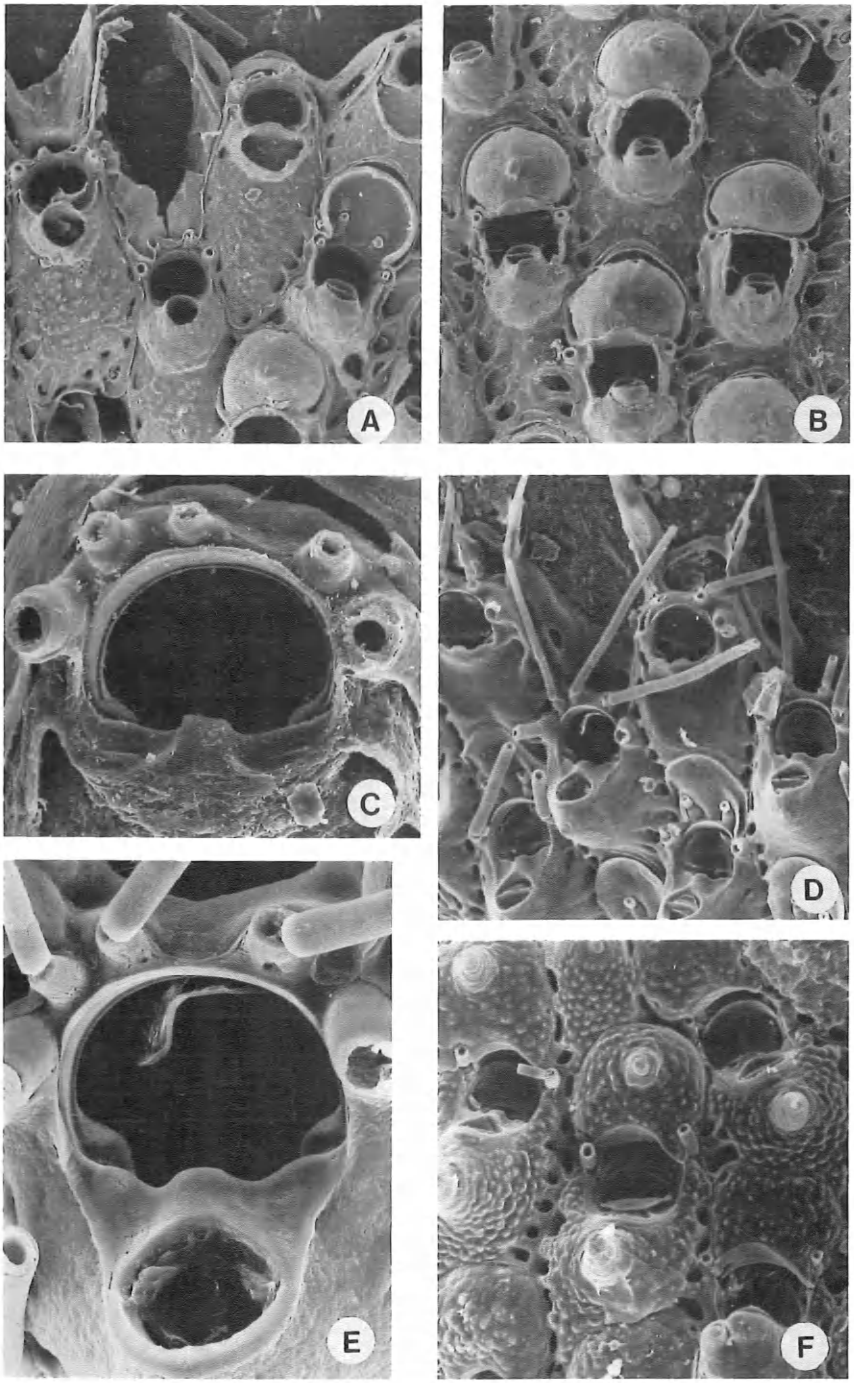


Fig. 166. A–C. *Aimulosia antarctica.* A. Discovery Stn. 366, South Sandwich Is.; autozooids at colony margin; ×80. B. Discovery Stn. 366; ovicelled autozooids; ×70. C. Discovery Stn. 456, Bouvet Id.; primary orifice; ×300. D–F. *Aimulosia australis.* South Georgia. D. Autozooids at the colony margin; ×80. E. Primary orifice; ×325. F. Ovicelled autozooids; ×100.

Colony forming broad, unilaminar sheets. Autozooids hexagonal to rectangular, steeply convex, separated by deep grooves; commonly 0.4–0.5 × 0.25–0.30 mm. Primary orifice broader than long; proximal border arched frontally, the edge sinuous, with a short, rounded, medio-proximal lyrula; condyles rounded, conspicuous; four or five slender, distal oral spines, two persisting in ovicelled autozooids. Frontal wall at first smooth, becoming coarsely nodular in later ontogeny, with a single series of large marginal pores, conspicuous at all ontogenetic stages. Suboral avicularium prominent, acute to frontal plane, proximally directed; rostrum semielliptical, with a finely denticulate edge, crossbar complete, without a columella; cystid of avicularium develops a blunt, spike-like, apical umbo in later ontogeny. Ovicell broader than long; at first smooth, with a small frontal umbo; becoming coarsely nodular in later ontogeny, with the umbo spinous and prominent.

Aimulosia australis is distributed from Tierra del Fuego, southwards along the Scotia Arc to the northern tip of the Palmer Archipelago.

Hippadenella Canu and Bassler, 1917

Colony encrusting, unilaminar. Frontal wall of autozooids with marginal pores, in well developed areolae. Aperture with indistinct condyles, proximal edge concave or slightly convex; no oral spines. Avicularia adventitious, suboral and/or lateral oral in position. Ovicell spherical, imperforate, not closed by autozooidal operculum. Multiporous septula present in vertical walls.

Type species: *Flustra margaritifera* Quoy and Gaimard, 1824.

The type species is distributed from Tierra del Fuego, across the Southern Patagonian Shelf and eastwards to Kerguelen. It does not occur in Antarctic waters. Two other species of *Hippadenella*, *H. rouzaudi* (Calvet) and *H. falklandensis* Hayward, occur in Subantarctic areas of the south-west Atlantic but, again, do not seem to reach Antarctic seas. *Hippadenella inerma* is the only species present in Antarctica.

Hippadenella inerma (Calvet) Fig. 167A–C

Porella clivosa var. *inerma* Calvet 1909: 32, pl.2, figs.12–14
Porella clivosa inerma: Moyano 1984a: 81
Hippadenella inerma: Hayward 1991: 317, Fig.6A–C.

Colony encrusting hard substrata, forming small, rounded, unilaminar patches. Autozooids hexagonal to rectangular, steeply convex, with indistinct boundaries; 0.45–0.55 × 0.3–0.35 mm. Aperture wider than long, with small, knob-like, proximo-lateral condyles; proximal edge gently convex. A single suboral avicularium present; rostrum oval, almost perpendicular to frontal plane, with complete crossbar; additional, identical avicularia sporadically present, developed on proximo-lateral border of some autozooids, with rostrum almost perpendicular to frontal plane and orientated to face aperture of adjoining autozooid; one to three additional avicularia may thus ring the aperture of an autozooid. Frontal wall smoothly calcified, with large marginal areolae, separated by stout ridges which thicken in later ontogeny, converging on a prominent umbo developed from the cystid of the suboral avicularium. An erect, thin-rimmed, asymmetrical peristome develops later in ontogeny, enclosing the avicularia but passing distal to the umbo. Ovicell slightly wider than long, rather flattened frontally, but developing a conical median umbo.

Hippadenella inerma is an endemic Antarctic species. It was listed from the Ross Sea by Moyano (1984a) but is otherwise known from Signy Island, where it is common in shallow habitats encrusting rock surfaces, and from a few localities in the South Shetland Islands and the Palmer Archipelago.

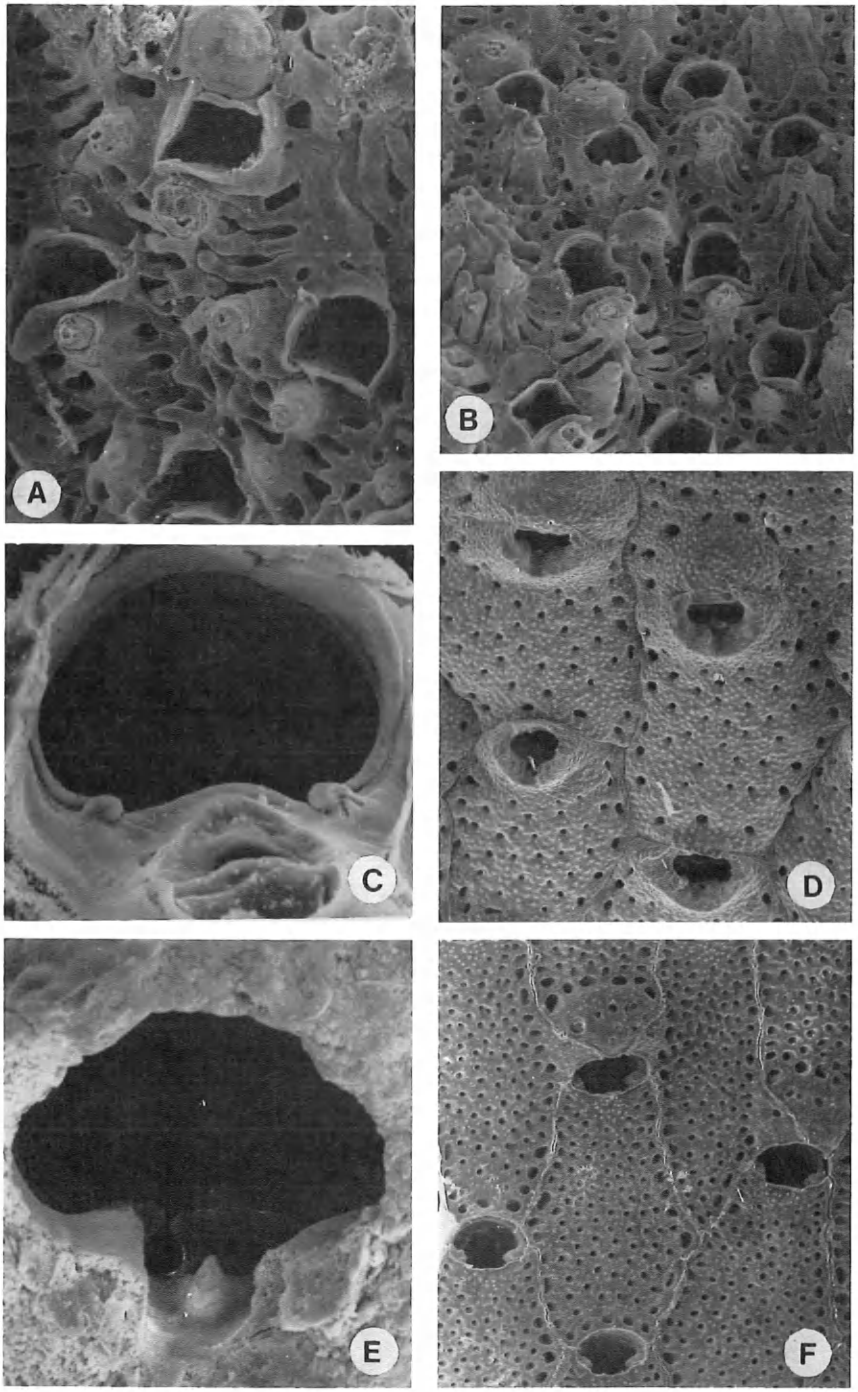


Fig. 167. A–C. *Hippadenella inerma.* Signy Id. A. Oblique view of peristomes; ×70. B. Autozooids and ovicells; ×45. C. Primary orifice; ×260. D, E. *Smittinella rubrilingulata.* South Shetland Is. D. Autozooids and ovicells; ×40. E. Primary orifice and peristome; ×300. F. *Thrypticocirrus contortuplicata.* Ross Sea; ×30.

Smittinella Canu and Bassler, *in* Bassler, 1934

Colony erect or encrusting. Autozooid frontal wall evenly perforated. Primary orifice with lyrula and condyles; immersed in a deep peristome, with a narrow groove on its inner proximal face, opening frontally as a pseudosinus or a pseudospiramen. Ovicell immersed, imperforate.

Type species: *Eschara tatei* Tenison-Woods.

The type species of *Smittinella* is a Middle Miocene fossil from South Australia. Additional species were described from the Miocene and Oligocene of New Zealand by Brown (1952). Rogick (1956d) was not certain that her species *rubrilingulata* was correctly placed in *Smittinella*, but reassessment of its systematic relationships awaits a redescription of the type species.

Smittinella rubrilingulata Rogick Fig. 167D,E

Smittinella rubrilingulata Rogick 1956d: 302, pl.31, figs.A–K

Colony encrusting, forming a thick, unilaminar crust. Autozooids oval to hexagonal, convex, separated by distinct grooves; 0.8–0.9 × 0.5–0.6 mm. Primary orifice transversely oval, proximal edge with a short lyrula occupying about half its width, the sides concave and the free edge convex; condyles rounded; no oral spines. A thick, deep peristome completely encircles primary orifice, completely hiding it; medio-proximally a deep channel extends down the inner face of the peristome, flanked on each side by thickened ridges, at its base a short, concave denticle is situated immediately frontal to the lyrula. Frontal wall coarsely granular, regularly perforated by small round pores, the marginal series slightly larger than the rest. Ovicell wider than long, imperforate, except for a small foramen in the ectooecium, in early ontogeny only; covered and partially obscured by an ooecial cover derived from the frontal calcification of the distally succeeding autozooid.

S. rubrilingulata was described by Rogick (1956d) from Marguerite Bay. It has since been collected by *Discovery* Investigations from South Georgia, the South Sandwich Islands and the South Shetlands, and from the Ross Sea by the National Antarctic Expedition.

Thrypticocirrus Hayward and Thorpe, 1988

Colony initially encrusting, developing erect, brittle, unilaminar sheets, variously folded or enrolled, and often overlapping basally to produce loosely organized bilaminar plates; strictly bilaminar in one species; periodic growth checks marked by transverse bands of blind kenozooids, similar to autozooids but lacking orifices. Frontal wall of autozooid evenly perforated by small, round pseudopores, and with a marginal series of larger frontal septula. Primary orifice with short, bluntly rounded condyles; proximal border shallowly concave, or developing a projecting, convex lip. No oral spines. Avicularia, when present, adventitious, infrequent, small; situated proximal to orifice, proximally directed. Ovicell recumbent on distally succeeding autozooid, regularly perforated, developing a sutured, perforated ooecial cover from adjacent autozooids. Vertical walls of autozooids with multiporous septula.

Type species: *Mucronella contortuplicata* Calvet, 1909.

Key to Antarctic species

1. Primary orifice almost twice as wide as long, with a pronounced, convex, proximal lip. Colony regularly bilaminar .... *T. phylactelloides*

   Primary orifice slightly wider than long, or as wide as long; proximal edge concave or convex, but not with a pronounced lip. Colony unilaminar, or loosely bilaminar 2

2. Primary orifice as wide as long, proximal border slightly convex; condyles short and peg-like, situated midway along length of orifice. With infrequent suboral avicularia .... *T. rogickae*
   Primary orifice wider than long, proximal border shallowly concave; condyles massive, rounded, situated in proximo-lateral corners. No avicularia .... *T. contortuplicata*

Thrypticocirrus contortuplicata(Calvet) Fig. 167F

Mucronella contortuplicata Calvet 1909: 36, pl.3, figs.4,5
Emballotheca contortuplicata: Livingstone 1928: 54, pl.5, fig.5, pl.7, fig.7; Rogick 1955a: 105
Thrypticocirrus contortuplicata: Hayward and Thorpe 1988b: 285, pl.2, figs.C,D

Colony forming brittle, erect, unilaminar sheets, typically lobed, folded or enrolled, and often overlapping basally to give irregular, bilaminar plates. Autozooids elongate, hexagonal to rectangular, flat, separated by thin ridges; 1.2–2.0 × 0.4–0.7 mm. Primary orifice wider than long; proximal edge rather irregular, usually shallowly concave, but sometimes developing a short, median convexity; condyles bluntly rounded, large and conspicuous, in proximolateral corners of orifice. Frontal wall densely perforated by small, round pseudopores. No suboral avicularium. Ovicell wider than long, with about ten, irregular, frontal pores; completely covered by a sutured, granular ooecial cover, but with pores remaining distinct. In later ontogeny ovicelled autozooids may develop a low, proximal, peristomial lip.

T. contortuplicata seems to be quite widespread in Antarctic waters, having been recorded from Adelie Land, Australian Antarctic Territory, the Ross Sea, and from western Antarctica. Its brittle colonies do not withstand dredging; most specimens collected are fragmentary, and the actual size and form of the colony are unknown.

Thrypticocirrus phylactelloides (Calvet) Fig. 168A

Mucronella phylactelloides Calvet 1909: 34, pl.2, figs.10,11
Mucronella phylactelloides: Livingstone 1928: 66
Emballotheca phylactelloides: Rogick 1955a: 108, figs.2A–J; Moyano 1966a: 118; Hayward and Taylor 1984: 72
Thrypticocirrus phylactelloides: Hayward and Thorpe 1988b: 285, pl.2, figs.E,F

Colony developing erect, brittle, bilaminar plates, narrow and strap-like, or broadly frondose; typically twisted or curved. Autozooids elongate rectangular, flat or slightly convex, separated by thin sutures; 1.5–2.5 × 0.5–0.6 mm. Primary orifice twice as wide as long, proximal border with a pronounced, rounded or rectangular lip; condyles small and knob-like. Frontal wall granular, irregularly perforated by small, round pseudopores, sometimes sparsely distributed. Avicularia rare, usually absent from most autozooids; situated close to proximal edge of orifice, the rostrum elongate oval, 0.1 mm long, normal to frontal plane, proximally directed. Ovicell wider than long, rather flattened frontally, with about a dozen irregular pores, developing a granular, sutured, peripheral ooecial cover. Ovicelled autozooids developing a thick, proximal peristomial lip.

Colonies of *T. phylactelloides* perhaps exceed 50 mm in height, but their form remains unknown as only fragments have been collected. The species is widely distributed in Antarctic waters, from the Ross Sea to the Palmer Archipelago.

Thrypticocirrus rogickae Hayward and Thorpe Fig. 168B

Thrypticocirrus rogickae Hayward and Thorpe 1988b: 286, figs.3A,B

Colony developing brittle, erect, unilaminar sheets, folded or enrolled, and occasionally overlapped to form bilaminar

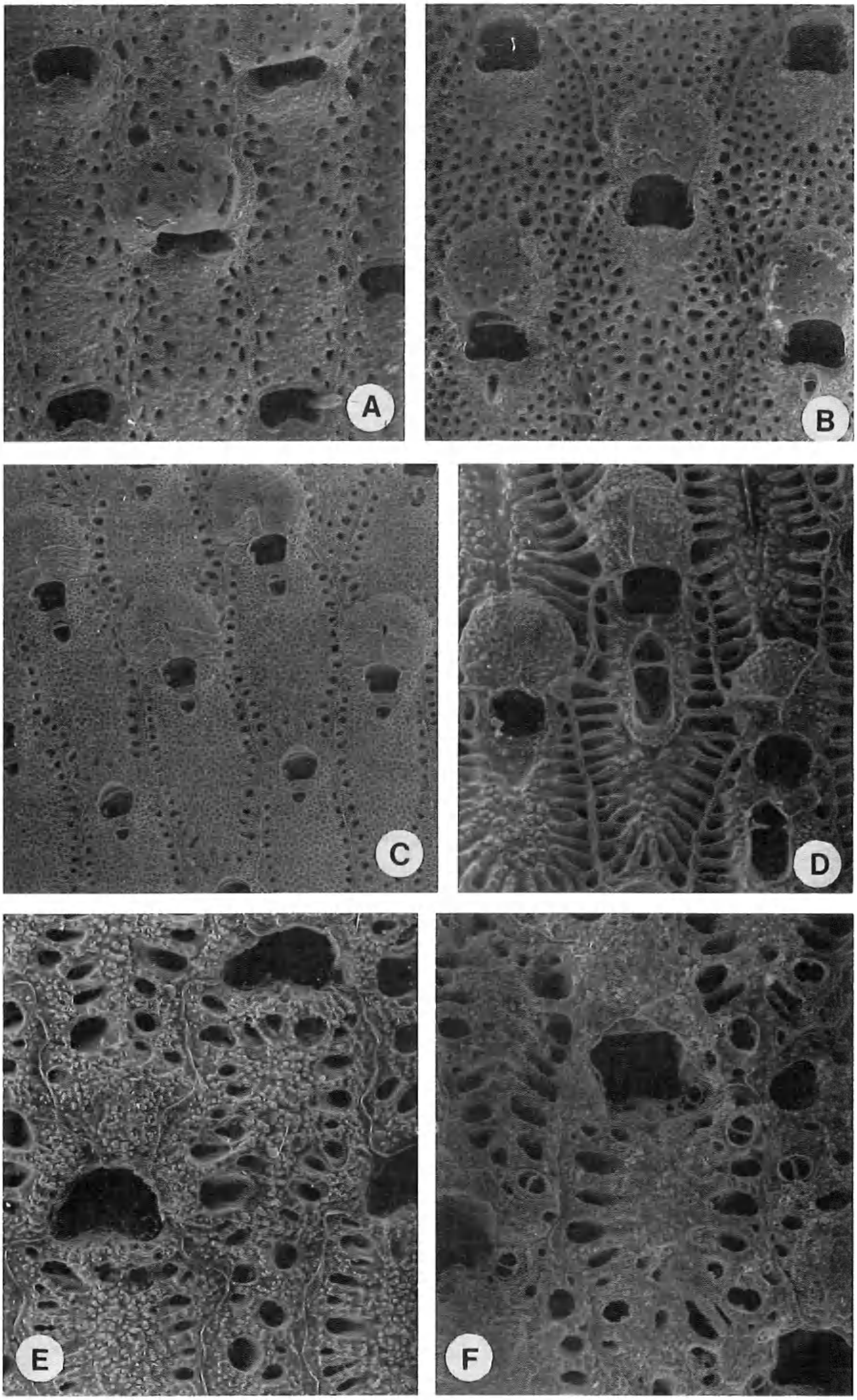


Fig. 168. A. *Thrypticocirrus phylactelloides.* Ross Sea; ×30. B. *Thrypticocirrus rogickae.* Ross Sea; ×29. C, D. *Pemmatoporella marginata.* Ross Sea. C. Autozooids with ovicells and small avicularia; ×25. D. Ovicelled autozooids with enlarged avicularia; ×30. E, F. *Bostrychopora dentata.* Ross Sea. E. Ovicelled autozooids; ×40. F. Autozooids and an ovicell, with frontal avicularia; ×45.

plates. Autozooids hexagonal to rectangular, flat, separated by low ridges; 1.1–1.4 × 0.6–0.75 mm. Primary orifice as wide as long, almost rectangular; proximal border slightly convex and gently arched frontally; condyles short, peg-like, basally deflected, situated midway along lateral borders of orifice. Frontal wall densely perforated by small, round pseudopores, except for a triangular area of granular calcification immediately proximal to orifice. Avicularia infrequent; situated close to proximal edge of orifice; rostrum short (<0.1 mm), narrow, oval, normal to frontal plane and proximally directed. Ovicell elongate oval, smooth surfaced, with about 20 small frontal pores; ooecial cover enveloping distal and lateral margins only.

The colonies of *T. rogickae* are very brittle; fragments 2–3 cm^2 are often all that survive in dredged samples and the actual maximum size, and form, of the colony remain unknown. This species is presently known only from the Ross Sea.

Pemmatoporella Hayward and Taylor, 1984

Colony forming brittle, unilaminar sheets, loosely encrusting or erect and folded. Autozooid frontal wall imperforate centrally, with large marginal pores. Primary orifice lepralioid, with conspicuous lateral condyles. Avicularia adventitious, dimorphic; suboral, but only sparsely present. No oral spines. Ovicell recumbent on distally succeeding autozooid; imperforate; developing a sutured ooecial cover, sometimes with a small frontal foramen; closed by autozooid operculum. Vertical walls with large multiporous septula.

Type species: *Lepralia marginata* Calvet, 1909.

Pemmatoporella marginata Fig. 168C,D (Calvet)

Lepralia marginata Calvet 1909: 24, pl.2, figs.7–9

Lepralia marginata: Livingstone 1928: 60, pl.7, figs.4,6

Porella marginata: Rogick 1959b: 233, figs.1–7,14,15

not *Pemmatoporella marginata*: Hayward and Taylor 1984: 76, Figs.2A–C

Pemmatoporella marginata: Hayward and Thorpe 1988b: 289, pl.4, Figs.C,D

Colony forming brittle, unilaminar sheets; loosely attached to the substratum, or erect, foliaceous, folded or enrolled. Autozooids hexagonal to rectangular, flat or gently convex, separated by distinct ridges; 1.0–1.4 × 0.5–0.6 mm. Primary orifice as wide as long, with proximal edge almost straight; condyles conspicuous, angular, situated about halfway along lateral margins of orifice. Frontal wall finely shagreened, with distinct, round, marginal pores; becoming coarsely nodular in later ontogeny, with stout ridges developing between the pores. Avicularia very infrequent, suboral, normal to frontal plane, proximally directed; either small, 0.12 mm long, with oval rostrum, or about 0.5 mm long, with elongate oval rostrum. Ovicell about as wide as long, prominent, imperforate; developing a complete, coarsely granular, ooecial cover, with well-marked sutures, and often a small, median foramen.

The colonies of this species form loosely ordered sheets, encrusting sponges or other bryozoans, and often enveloping the substratum completely, developing erect, folded or tubular growths. It is always damaged by collecting and the maximum size of the species is unknown, although fragments may exceed 15 cm^2. *P. marginata* is an endemic Antarctic species; it is widely distributed in Antarctic coastal waters, and ranges north to South Georgia.

Bostrychopora Hayward and Thorpe

Colony attached by an encrusting base, developing erect, broad, folded, unilaminar sheets. Autozooid frontal wall imperforate centrally, bordered by deep areolae incorporating distinct frontal septula. Vertical walls with small, recessed, multiporous septula. Primary orifice with well developed lyrula and short condyles. Avicularia adventitious, dimorphic; typically one on each side of orifice, enclosed within peristome, of similar size, or with one much larger than the other; present along lateral margins of autozooid in later ontogeny, budded from frontal septula. No spines. Ovicell hyperstomial, partly immersed; coarsely granular, imperforate, developing a thick, sutured, ooecial cover.

Type species: *Smittia dentata* Waters, 1904.

Bostrychopora dentata (Waters) Fig. 168E,F

Smittia dentata Waters 1904: 71, pl.4, fig.8
Umbonula dentata Rogick 1956d: 274, pl.19; Moyano 1966a: 119; Hayward and Taylor 1984: 77, Fig.1B
Bostrychopora dentata: Hayward and Thorpe 1988b: 288, Figs.3C,D

Colony forming large, brittle, unilaminar plates, variously folded or enrolled, frequently wrapped around and incorporating other erect organisms; form thus infinitely variable, maximum dimensions not known, but single plates exceeding 10 cm^2 have been recorded. Basal surfaces often encrusted with numerous other bryozoan species. Autozooids broadly oval or hexagonal, markedly convex, separated by well marked grooves; 1.3–1.8 × 0.6–0.8 mm. Primary orifice wider than long; lyrula short, quadrangular, occupying about half orifice width, often with corners sharply cusped, and sometimes with one or more sharp, median processes; condyles prominent, blunt. Peristome developed distally and laterally, widely open proximally; enclosing paired, lateral oral avicularia, with oval, disto-laterally directed rostrum; 0.1 mm long; one or other sometimes replaced by a larger avicularium, with inflated cystid and rostrum up to 0.2 mm long. Frontal wall coarse and thick, distinctly nodular, bordered by large, deep areolae, within which frontal septula are clearly visible; in later ontogeny one or more areolae may be capped by newly budded avicularia, up to twice size of lateral oral avicularia. Ovicell about as wide as long, partially immersed, rapidly obscured by a granular, sutured ooecial cover, and rather indistinct.

Benthic samples from areas of the Ross Sea may be dominated by large, brittle fragments of this species, and entire colonies seem rarely to survive the process of sampling. In most cases, however, the material was alive at the time of collection, and *B. dentata* thus seems common and abundant through large areas of Antarctica. It has been reported from Graham Land, the Bellingshausen Sea, from Oates Land, and from many stations across the Ross Shelf.

Rhamphosmittina Hayward and Thorpe, 1988

Colony initially encrusting, developing erect, folded unilaminar sheets. Autozooid frontal wall bordered by small areolar pores. Primary orifice with lyrula and condyles; no oral spines. Avicularia adventitious: median suboral, laterally directed; also developed in later ontogeny along borders of autozooids. Ovicell hyperstomial, budded from distal wall of brooding autozooid, recumbent on frontal wall of succeeding autozooid, not closed by autozooid operculum; with two or three small pores close to aperture; developing a sutured ooecial cover. Vertical walls with small, recessed septula.

Type species: *Rhamphostomella bassleri* Rogick, 1956.

Rhamphosmittina bassleri (Rogick) Fig. 169A–C

Rhamphostomella bassleri Rogick 1956d: 282, pl.22, figs.A–O
Rhamphostomella bassleri: Hayward and Taylor 1984: 72
Rhamphosmittina bassleri: Hayward and Thorpe 1988b: 289, Figs.4A,B

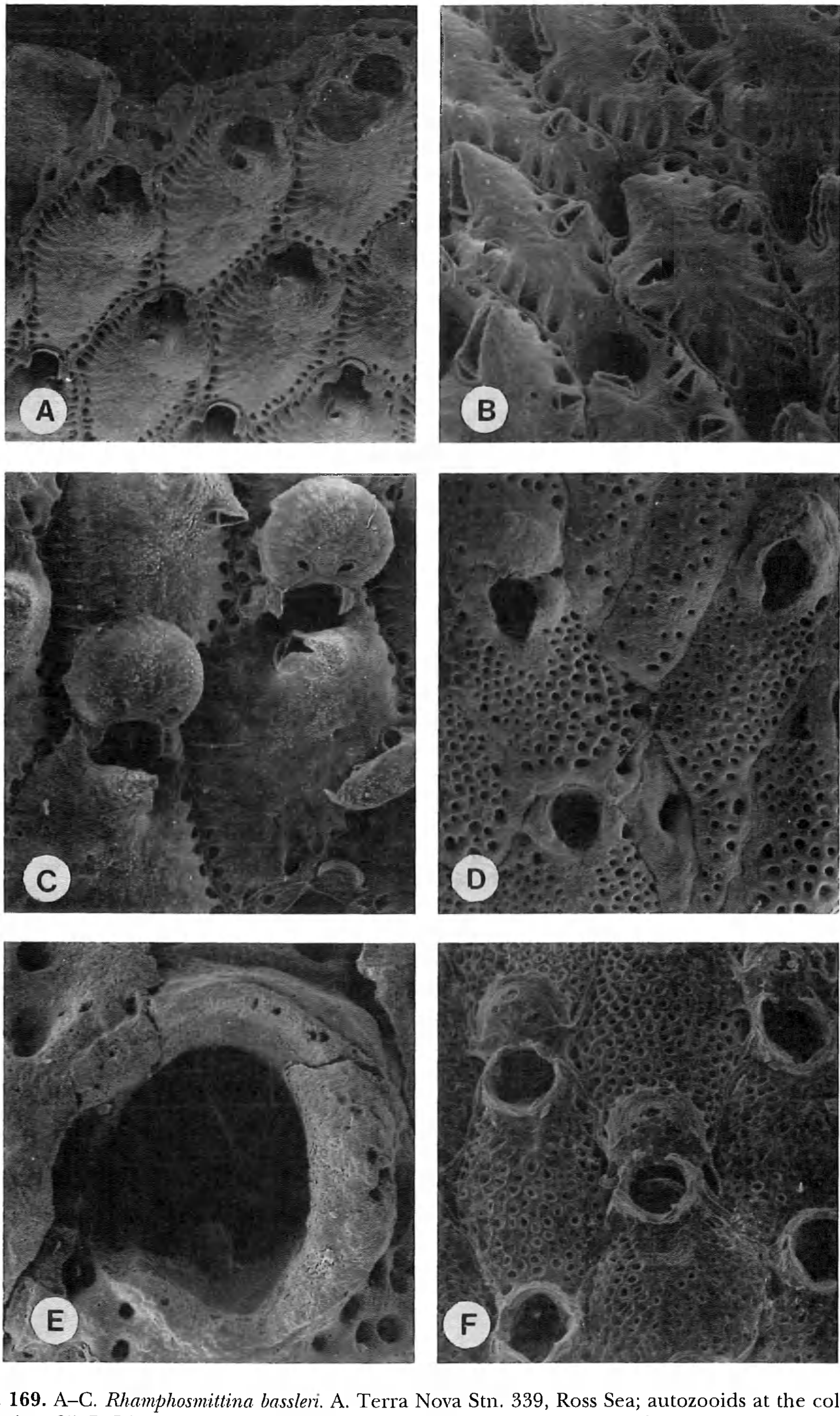


Fig. 169. A–C. *Rhamphosmittina bassleri.* A. Terra Nova Stn. 339, Ross Sea; autozooids at the colony margin; ×25. B. Discovery Stn. 160, Shag Rocks; ×40. C. Discovery Stn. 1948, South Shetland Is.; ovicelled autozooids; ×40. D, E. *Aspericreta crassatina,* locality unknown. D. Part of colony, with ovicells; ×33. E. Primary orifice; ×140. F. *Aspericreta favulosa.* Discovery Stn. 339, Ross Sea; ×25.

Colony developing spreading sheets, especially on other erect bryozoa; or erect, folded, unilaminar plates, exceeding 3–4 cm^2. Autozooids oval to hexagonal, convex, separated by distinct sutures; 0.8–1.2 × 0.5–0.9 mm. Primary orifice slightly wider than long, broadest proximally; lyrula short and broad, with straight edge, occupying about half proximal width of orifice; condyles subrectangular, large and conspicuous; paired, lateral peristomial flaps present. Frontal wall finely granular; marginal pores distinct, accentuated in later ontogeny by thickened ribs. Suboral avicularium prominent, rostrum facing laterally, almost perpendicular to frontal plane, elongate triangular, sharply hooked distally. Smaller avicularia developed along lateral margins of autozooids in later ontogeny; rostrum triangular, acute to frontal plane, laterally directed. Ovicell slightly wider than long, prominent; smooth surfaced, typically with a pair of large, drop-shaped pores close to the aperture, developing a sutured ooecial cover in later ontogeny.

The erect plates developed by *R. bassleri* are particularly brittle and easily damaged by collection; consequently, the maximum size, and architecture, of erect colonies are unknown. This is an endemic Antarctic species; it is widely distributed in Antarctic Shelf seas, and is common in the Ross Sea.

Aspericreta Hayward and Thorpe, 1989

Colony encrusting, or developing loosely attached, partly erect sheets; unilaminar to multilaminar. Frontal wall of autozooids thickly calcified, with numerous irregular pores. Vertical walls with small, recessed septula. Primary orifice with proximal lyrula, characteristically variably developed; lacking clearly defined condyles. No oral spines. No avicularia. Ovicell hyperstomial, partly immersed; with few, irregular frontal pores, developing a coarsely granular, peripheral ooecial cover.

Type species: *Smittia crassatina* Waters, 1904.

The three species assembled in this genus resemble each other in the structure of the ovicell and the form of the primary orifice, the proximal lyrula of which typically varies greatly in degree of development within a single colony. Other points of similarity are the densely perforated, cryptocystidean frontal wall, and the interzooidal communication pores, which appear to be small, uniporous (or pauciporous) septula recessed between basal buttresses of the vertical walls. Good material of all three species has been lacking, precluding a comprehensive comparative study of their morphology.

Key to Antarctic species

1. Lyrula represented by a tiny median peak on the almost straight proximal border of the orifice. Frontal pores very small, giving a speckled appearance to frontal wall .... *A. georgensis*

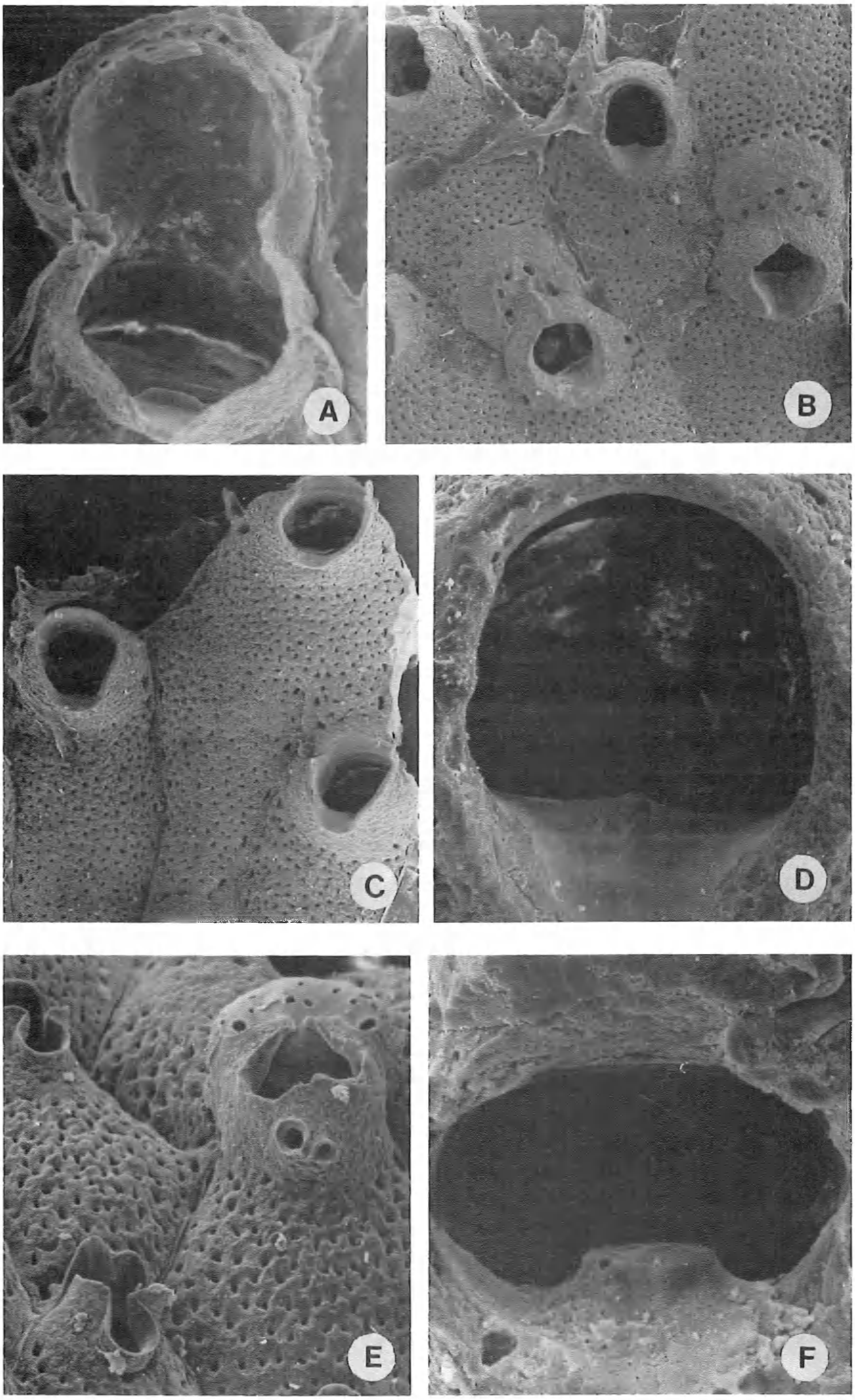
   Lyrula well developed and conspicuous. Frontal perforation coarse . 2
2. Lyrula short, peg-like. Autozooids large (1.5–2.0 mm), clearly visible to unaided eye .... *A. crassatina*

   Lyrula variable, but most often with truncate edge. Autozooids 1.0–1.5 mm long .... *A. favulosa*

Aspericreta crassatina (Waters) Fig. 169D,E

Smittia crassatina Waters 1904: 70, pl.4, fig.9, pl.3, fig.7
Aspericreta crassatina: Hayward and Thorpe 1990: 166, pl.11, figs.a–c

Colony encrusting, forming extensive, thick, flat sheets; initially unilaminar, but lobes of colony overlapping to form multilaminar sheets. Autozooids very large, visible to unaided eye, broadly oval or irregular, separated by well marked grooves; 1.5–2.0 × 0.9–1.2 mm. Primary orifice wider than long, with thickened rim; lyrula narrow, thickened and peg-


A
B
C
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F

like, very variable in form; condyles lacking. Peristome low and thick, with a deep pseudosinus proximally. Frontal wall thick, densely perforated by large pores; often much larger at the proximal end of the autozooid than the distal. Irregular ridges of thick calcification develop between autozooids in late ontogeny. Ovicell relatively small, as wide as long, partially immersed; slightly depressed frontally with few (<10) small irregular pores; developing a coarse ooecial cover which eventually envelops and obscures the entire ovicell.

Aspericreta crassatina forms thick sheets, exceeding 5 cm^2, on rock and large cobbles. It was described by Waters (1904) from four stations in the Bellingshausen Sea between 435 and 500 m. The material described by Hayward and Thorpe (1990) was from an unrecorded Antarctic locality.

Aspericreta favulosa (Hayward and Thorpe) — Figs. 169F, 170A

Smittina sp. 1 Hayward and Taylor 1984: 81
Smittina favulosa Hayward and Thorpe 1989a: 365, fig.1F

Colony encrusting, loosely attached, and sometimes forming erect unilaminar sheets. Autozooids oval, convex, separated by thickened sutures; 1.10–1.4 × 0.7–1.0 mm. Primary orifice slightly wider than long; lyrula variable: a short, quadrangular tooth occupying about one-quarter orifice width, or a pointed, peg-like process; condyles lacking. Peristome complete, erect, thin and flaring, with a shallow, proximal pseudosinus, extending onto frontal surface of ovicell in brooding autozooids. Frontal wall densely perforated by large, round pores, accentuated by thickened, angular rims as frontal wall thickens; a broadly triangular area of granular, imperforate calcification immediately proximal to pseudosinus. Ovicell about as wide as long: smooth frontally, with four to six irregular foramina; developing a coarsely granular ooecial cover distally and laterally.

This species is known from Oates Land, from several stations in the Ross Sea, and from a single specimen collected at Halley Bay, Coats Land.

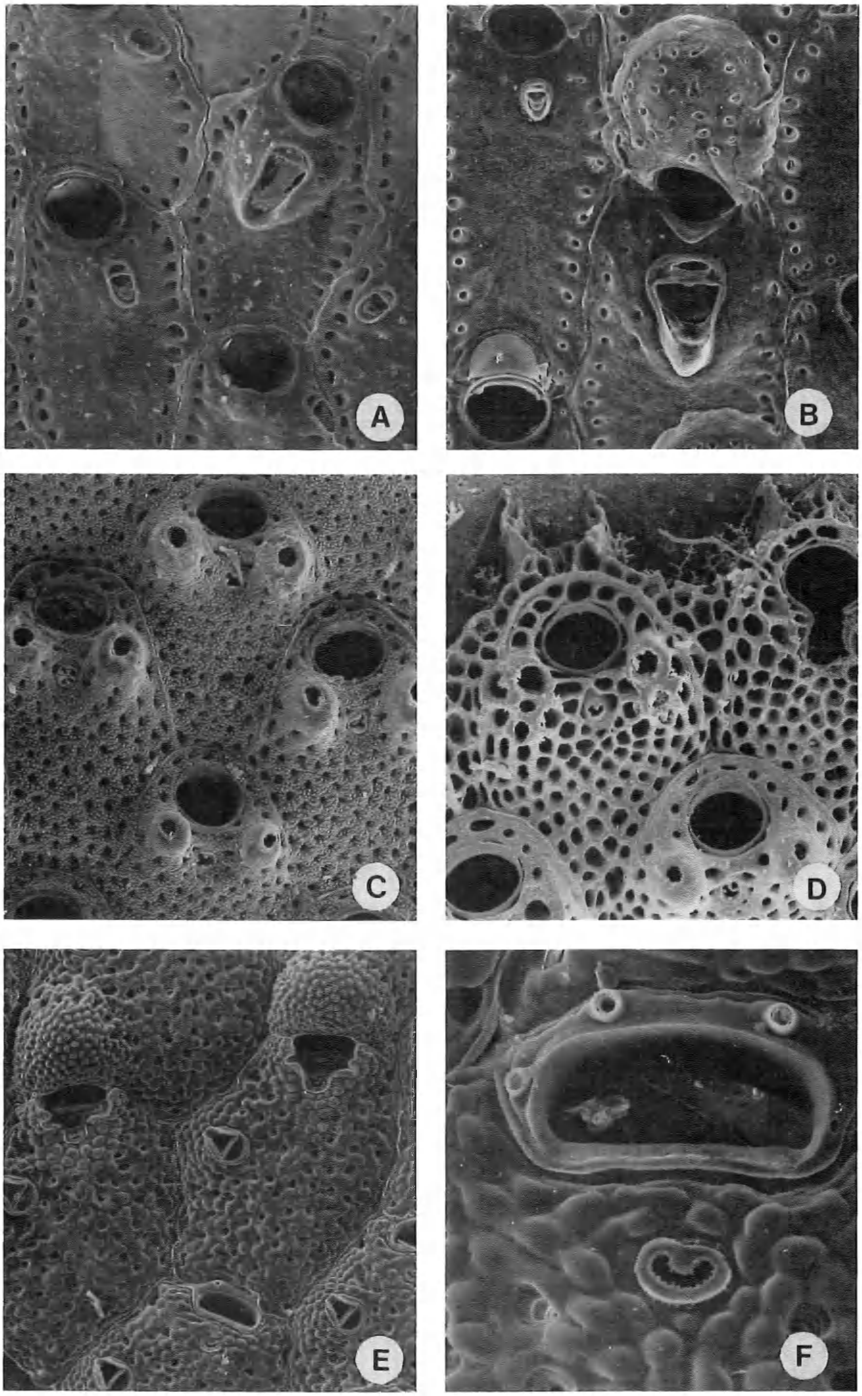
Aspericreta georgensis Hayward and Thorpe — Fig. 170B–D

Aspericreta georgensis Hayward and Thorpe 1990: 168, pl.11, figs.d,e

Colony encrusting. Autozooids irregularly oval, convex, separated by deep grooves; 1.2–1.6 × 0.65–0.90 mm. Primary orifice longer than wide; proximal edge almost straight, the lyrula minimally developed, sometimes absent, at most only a short, pointed peg; condyles lacking. Peristome forming a thick, granular rim completely encircling the primary orifice, enclosing a broad area of smooth calcification proximal to the orifice; medio-proximal border deeply concave; extending onto frontal surface of ovicell to form a complete tube. Frontal wall thick. finely granular, densely perforated by small round pores. Ovicell about as wide as long, coarsely granular except for a smooth, crescentic frontal area, perforated by a few (<10) large, irregular pores. In later ontogeny, sutures between autozooids become conspicuously thickened by coarse secondary calcification.

Aspericreta georgensis is probably an endemic Antarctic species, although at present it is known only from a single specimen encrusting a stone, from South Georgia.

Fig. 170. A. *Aspericreta favulosa.* Discovery Stn. 339, Ross Sea; primary orifice; ×80. B–D. *Aspericreta georgensis.* Discovery Stn. 152, South Georgia. B. Autozooids at the colony margin, two with ovicells; ×30. C. Autozooids in early ontogeny; ×30. D. Primary orifice; ×170. E, F. *Tracheloptyx antarctica.* NZOI Stn. A526, Ross Sea. E. Autozooids and an ovicell, with characteristic forms of the peristome; ×60. F. Primary orifice; ×270.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Tracheloptyx Hayward

Autozooids with evenly perforated frontal wall. Primary orifice with lyrula and condyles. No oral spines. Peristome raised, developing a pronounced proximal fold which in brooding autozooids closes distally to define one or more spout-like pseudospiramina. Ovicell prominent, evenly perforated, not closed by autozooid operculum. No avicularia. Basal pore chambers present.

Type species: *Tracheloptyx antarctica* Hayward, 1993.

Tracheloptyx antarctica Hayward Fig. 170E,F

Tracheloptyx antarctica Hayward 1993: 290, Fig. 2A, B

Colony encrusting, unilaminar, forming small, irregular patches. Autozooids oval to hexagonal, convex, separated by distinct sutures; 0.70–1.00 × 0.45–0.65 mm. Frontal wall thick, granular, evenly perforated by small, round pores. Primary orifice almost twice as wide as long; lyrula short, angular, occupying about half proximal width of orifice; condyles conspicuous, elongate, rounded at tip, downcurved. Peristome comprising a curved distal portion, and a trilobed proximal portion incorporating a deep, medio-proximal fold. Ovicell spherical, smooth, with numerous frontal pores of varying size; peristome especially well developed, its rim raised and flared, extending onto frontal surface of ovicell, medio-proximal fold closing distally to form one or two thick-rimmed, projecting pseudospiramina.

This species is presently known from four localities in the Ross Sea, encrusting pebbles and hydrocorallines.

Hippomonavella Canu and Bassler, *in* Bassler, 1934

Colony encrusting, or developing loosely attached, partly erect, unilaminar sheets. Autozooid frontal wall with marginal pores only. Primary orifice concave proximally, with lateral condyles, but lacking a lyrula. No oral spines. Avicularia adventitious, polymorphic, typically suboral; lacking in some species. Ovicell hyperstomial, perforated. Vertical walls with multiporous rosette plates.

Type species: *Lepralia praeclara* MacGillivray, 1895.

The type species, *Lepralia praeclara* MacGillivray (1895), was described from Miocene deposits of Victoria, and Recent specimens were reported from South Australia by Wass and Yoo (1983). Two further species are known from the New Zealand region (Gordon 1984, 1989a), but *H. pellucidula* (Calvet) is the only representative of the genus known from the western hemisphere. *Codonellina armagillae* d'Hondt and Redier (1977), from Kerguelen, is possibly the same species as *H. pellucidula*.

Hippomonavella pellucidula (Calvet) Fig. 171A,B

Schizoporella pellucidula Calvet 1904b: 27, pl.2, figs.3a,b

Hippomonavella pellucidula: Hayward and Ryland 1991: 249, pl.5, figs.C–D

Colony forming folded, brittle unilaminar sheets, loosely encrusting sponges, cnidarians and other biotic substrata; occasionally developing erect, irregular lobes. Autozooids elongate, rectangular, flat, separated by distinct sutures; 0.7–0.85 × 0.3–0.45. Primary orifice slightly wider than long; anter trans-

Fig. 171. A, B. *Hippomonavella pellucidula*. Discovery Stn. WS27, South Georgia. A. Autozooids and the two types of avicularium; ×50. B. Ovicelled autozooid with large avicularium; ×60. C, D. *Inversiula nutrix*. Discovery Stn. 456, Bouvet Id. C. Autozooids in late ontogeny; ×40. D. Autozooids at the colony margin; ×40. E, F. *Microporella stenoporta*. Terra Nova Stn. 316, Ross Sea. E. ×50. F. Primary orifice; ×210.

versely oval, poster with broadly concave edge between conspicuous, bluntly pointed condyles. Frontal wall smoothly calcified, with a single series of large marginal pores. Avicularia dimorphic, usually short, oval, 0.1 mm long, lateral suboral or sutural in position, the rostrum normal to frontal plane and proximally directed; or enlarged, 0.25 mm long, median suboral in position, the rostrum slightly tapered distally, proximally directed. Both types of avicularia arise from distal marginal pores of the autozooid. Ovicell hyperstomial, prominent, slightly wider than long, slightly flattened frontally, closed by autozooid operculum; ectooecium membranous frontally, entooecium smoothly calcified, with about 30 small round pores.

This species is presently known only from South Georgia.

INVERSIULIDAE Vigneaux, 1949

Autozooids with evenly perforated, tuberculate frontal wall; with cryptocystidean development. Primary orifice D-shaped, with reversed orientation, the operculum hinged along its straight distal edge. Ascopore present, suboral. Avicularia adventitious, lateral oral, paired. No ovicells, embryos brooded internally, often in morphologically distinct brooding zooids. Vertical walls with small basal pore chambers.

Inversiula Jullien, 1888

Colony encrusting. Autozooid frontal wall evenly perforated by large, simple pores. Ascus communicating with exterior via a stellate ascopore, immediately proximal to primary orifice. Operculum hinged along distal edge; orifice simple, lacking condyles. No oral spines. Paired lateral suboral avicularia present; typically columnar, with a very small, indistinct rostrum at the apex. No ovicells. Large, strongly buttressed basal pore chambers present.

Type species: *Inversiula nutrix* Jullien.

This southern hemisphere genus is represented in Antarctic waters by a single species, *I. nutrix* Jullien, first described from the Beagle Channel, Tierra del Fuego. *I. nutrix* is common on the coasts of the Antarctic Peninsula, northwards to Signy Island and South Georgia, and occurs also at Bouvet Island. Its wider distribution in Antarctica is presently unknown. *I. patagonica* Hayward and Ryland (1991) differs from *I. nutrix* in its finely granular frontal wall, which in young autozooids has a single series of large marginal pores, and numerous, much smaller, frontal pores. It is presently known only from a single locality on the southern Patagonian shelf. A third species, *I. fertilis* Powell, occurs in New Zealand seas, while *I. inversa* (Waters) is a tropical species ranging from New South Wales north to Indonesia and the Philippine Islands.

Inversiula nutrix Jullien — Fig. 171C,D

Inversiula nutrix Jullien 1888: 44, pl.4, fig.8.

Inversiula nutrix: Calvet 1909: 22; Livingstone 1928: 59; Moyano 1972c: 106; Hayward 1980: 703; Hayward and Ryland 1991: 247, pl.4, figs.C,D.

Colony forming a thick crust, often extensive, exceeding 5 cm^2. Autozooids oval to hexagonal, thickly calcified, convex, separated by distinct grooves; 0.5–0.7 × 0.4–0.5 mm. Primary orifice transversely oval, with smooth, continuous rim; operculum deep horn-colour, conspicuous. Frontal wall coarsely granular, evenly perforated by numerous small, closely spaced pores; ascopore distinct, with circular rim and stellate lumen. Proximo-lateral to the orifice a pair of stout, columnar processes, frequently broken short in old autozooids; when undamaged, the apex of each bears on its distal face, a tiny, oval avicularian rostrum. Embryos brooded internally; female polymorphs not known.

Inversiula nutrix forms thick yellowish-brown crusts on hard substrata, especially pebbles, or larger rock substrata. Originally described from Tierra del Fuego, it occurs on the Southern Patagonian shelf, eastwards to Bouvet Island, and along the Scotia Arc to Graham Land, where it is common, and has been collected from between the tides. Livingstone (1928) reported it from Adelie Land, but otherwise its distribution in Antarctic Shelf Seas remains unknown.

MICROPORELLIDAE Hincks, 1880

Colony encrusting or erect. Primary orifice of autozooid semicircular or D-shaped; ascus opening via an independent, usually conspicuous, ascopore, situated proximal to the orifice. Oral spines present or absent. Frontal wall with marginal pores only, or with randomly scattered pores. Avicularia present or absent. Embryos brooded in conspicuous hyperstomial ovicells.

Microporella Hincks, 1877

Colony encrusting, unilaminar, or erect, bilaminar. Autozooid frontal wall with scattered pores; ascopore distinct. Primary orifice semicircular; oral spines present. Avicularia adventitious, with acute or setiform mandibles. Ovicell prominent, hyperstomial, imperforate, closed by autozooidal operculum. Large basal pore-chambers present.

Type species: *Eschara ciliata* Pallas, 1766.

One species of this ubiquitous genus occurs in Antarctic waters.

Microporella stenoporta Hayward and Taylor — Fig. 171E,F

Microporella stenoporta Hayward and Taylor 1984: 86, figs.7,9.
Microporella stenoporta: Hayward and Ryland 1990: 1282, figs.10C,D.

Colony forming extensive, flat encrustations on hard substrata. Autozooids large, oval to hexagonal, rather flat, separated by distinct grooves; 0.8–1.1 × 0.5–0.9. Frontal wall thickly calcified, finely nodular, with numerous, evenly spaced pores Primary orifice transversely oval, about 0.2 mm wide, with width 2.5 to 3 × length; two to four short, delicate oral spines present in early ontogeny, lost in older autozooids. Ascopore close to primary orifice, separated by a distance less than half orifice length; oval with a crescentic, finely denticulate lumen. Avicularium in distal half of autozooid, proximo-lateral to orifice, with setiform mandible, 0.6 mm long, laterally directed; many autozooids may lack avicularia. Ovicell large, spherical, with finely nodular surface, its aperture overhanging the primary orifice, frequently with a stout frontal umbo; in later ontogeny a pair of lateral flaps of calcification may extend from the ovicell aperture, meeting medially, and fusing, just proximal to the ascopore. All calcification thickens greatly in later ontogeny, obscuring spine bases and avicularia.

Microporella stenoporta develops extensive thickly calcified sheets on rock substrata, often exceeding 10 cm². It is an endemic Antarctic species, distributed from the South Sandwich Islands, through the Palmer Archipelago, to the Ross Sea, and may be expected to occur off all Antarctic coasts.

Fenestrulina Jullien, 1888

Colony encrusting, unilaminar. Autozooids with cryptocystidean frontal wall development; frontal wall with scattered pores, sometimes with the central area imperforate, but often entirely covered with closely spaced perforations; ascopore distinct. Primary orifice with straight proximal edge, lacking condyles; oral spines present or absent. Ovicell prominent, hyperstomial, closed by autozooidal operculum; entooecium calcified, imperforate, except for a basal ring of pores; ectooecium largely membranous, with a variably developed calcified basal rim, characteristically produced as short flutings between the entooecial pores. Avicularia absent. Large basal pore chambers present. Ancestrula tatiform.

Type species: *Cellepora malusii* Audouin, 1826.

Species of *Fenestrulina* occur in all the world's seas, most usually in shallow, shelf environments, and encrust a wide range of substrata, from seaweeds and sea-grasses, to biogenic carbonates and rock. In the past, many species records have been attributed to *F. malusii* (Audouin) which has thereby gained a spurious cosmopolitan distribution. Many species of *Fenestrulina* are indeed confusingly similar, but all may be distinguished by the size and shape of the primary orifice, the presence or absence, and number, of oral spines, the form of the ascopore and its position relative to the primary orifice, and the morphology of the ovicell. Seven species are presently known from Antarctic waters, and at least as many more probably occur in adjacent Subantarctic seas. A number of Antarctic or Subantarctic species of *Fenestrulina* have been described by Hayward and Ryland (1990). *F. reticularis* Liu and Hu (1991) is poorly characterized and requires re-examination.

Key to Antarctic species

1. Primary orifice with two or more lateral or distal oral spines 2
   No oral spines, even in earliest ontogeny 6
2. Two short oral spines, one on each side of the transversely oval primary orifice. Ovicell hemispherical, its surface with thick, bifurcating longitudinal ridges .... *F. rugula*
   At least four oral spines present 3
3. Four oral spines present, the proximal pair bifurcate. Ascopore surmounting a prominent mound, its lumen narrowly elliptical, with a smooth rim .... *F. cervicornis*
   Six or eight oral spines present 4
4. Eight oral spines (six in ovicelled zooids). Ovicell as wide as long. Ascopore with thick, projecting proximal rim .... *F. exigua*
   Six oral spines present. Ovicell longer than wide 5
5. Primary orifice wider than long. Ascopore small, indistinct, consisting of one or two simple pores in a shallow concavity .... *F. proxima*
   Primary orifice as wide as long. Ascopore thick-rimmed, distinct; oval, with a slit-like foramen .... *F. parvipora*
6. Frontal wall with large stellate pores over much of its surface 7
   Frontal wall with single or multiple series of marginal pores, but with the central area largely imperforate 8
7. Ascopore with narrowly crescentic, finely denticulate rim. Ovicell longer than wide, with finely granular surface .... *F. antarctica*
   Ascopore broadly crescentic, with a smooth rim. Ovicell small, wider than long, its surface finely wrinkled, often developing short peaks .... *F. fritilla*
8. Ovicell with finely granular surface and indistinct basal pores. Ascopore small, inconspicuous, with short crescentic foramen ....*F. crystallina*
   Ovicell with distinctive spongiforme surface and conspicuous basal pores. Ascopore large, in the form of a shallowly curved slit ....*F .jocunda*

Fenestrulina antarctica Hayward and Thorpe — Fig. 172A–C

Fenestrulina antarctica Hayward and Thorpe 1989a: 371, figs.1A–C

Colony forming broad, spreading sheets. Autozooids large, visible to the unaided eye, oval to hexagonal, strongly convex, separated by deep grooves; 0.95–1.1 × 0.6–0.75 mm. Frontal wall thickly calcified, opaque white, with numerous

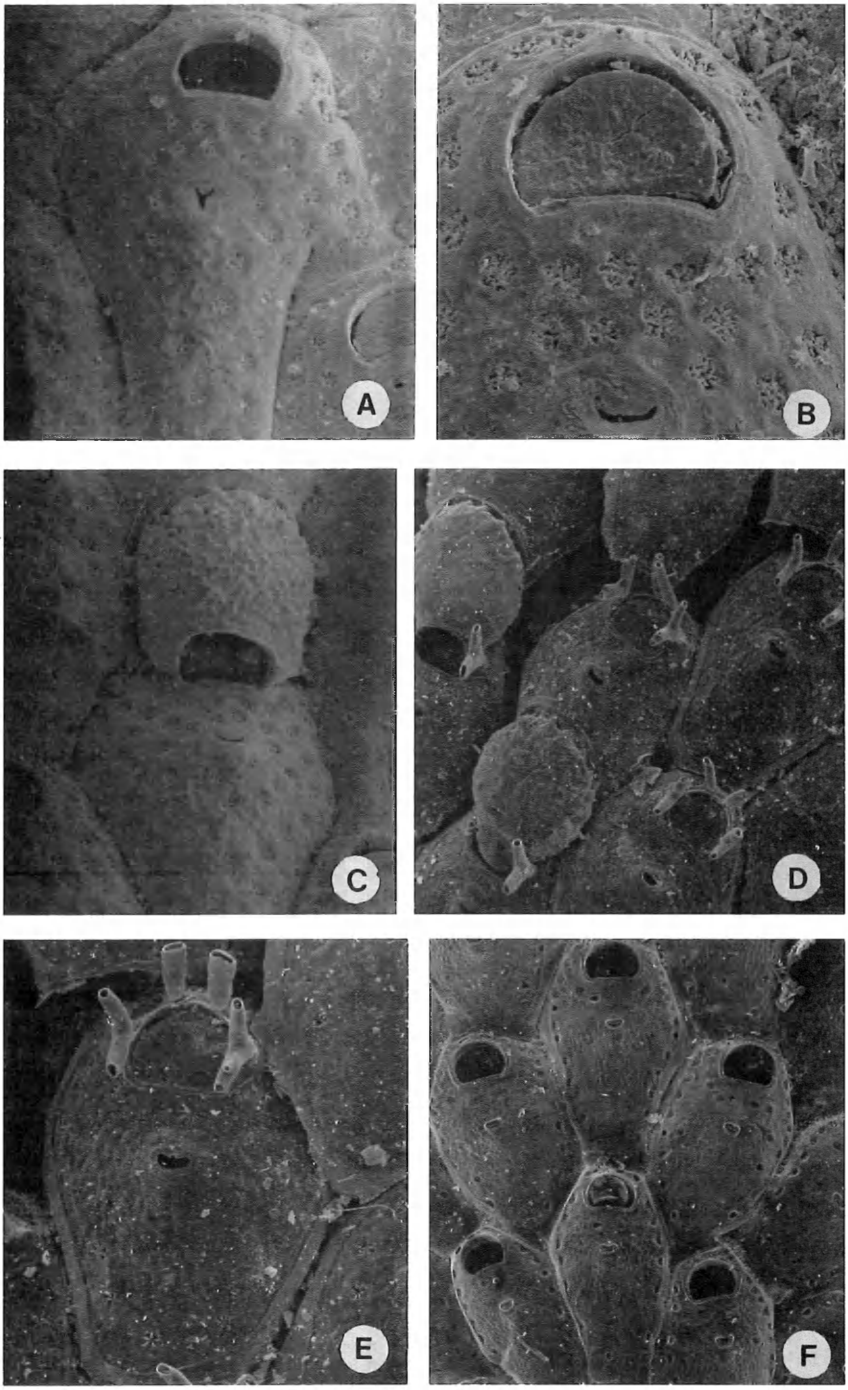
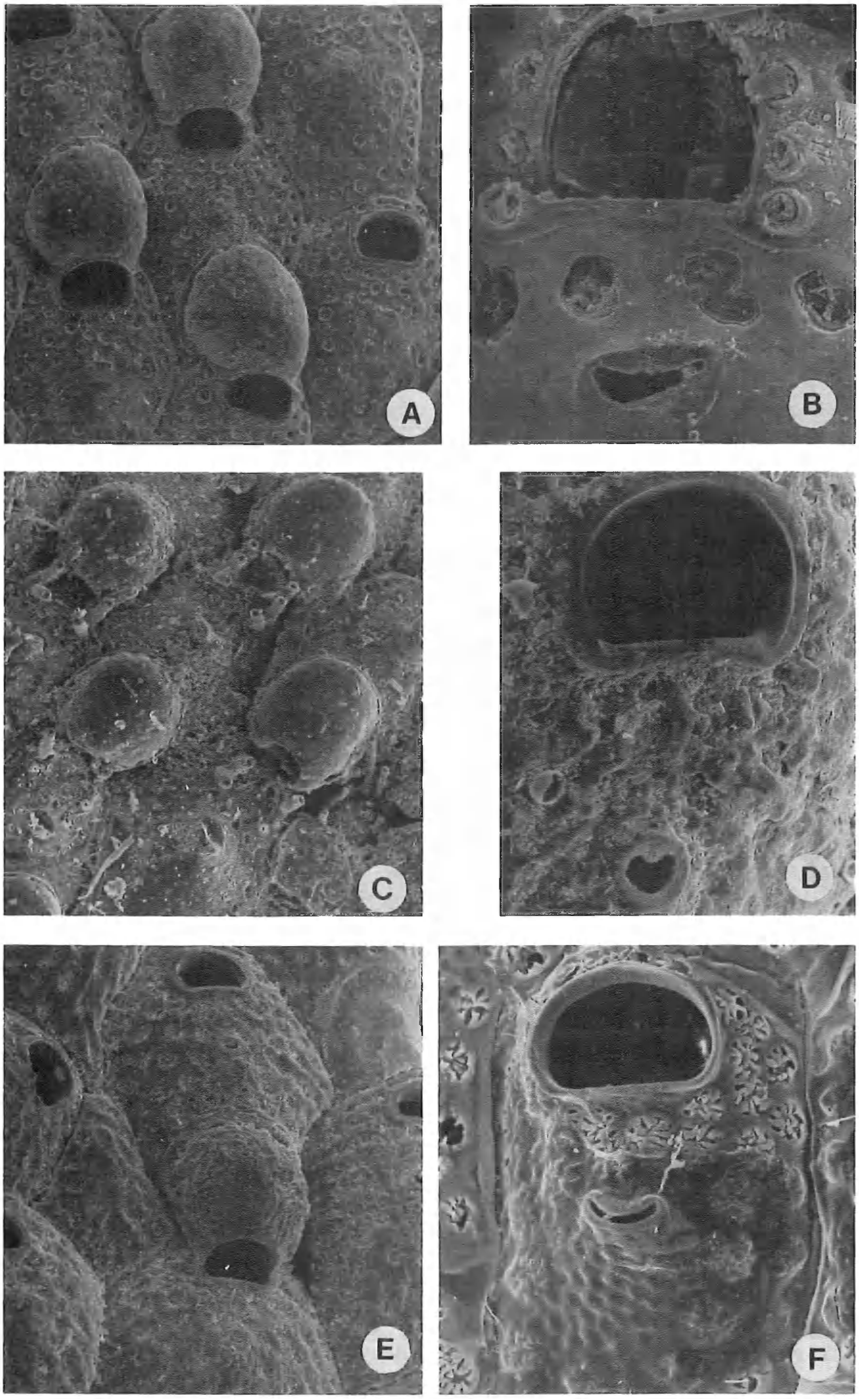


Fig. 172. A–C. *Fenestrulina antarctica.* Ross Sea. A. An autozooid; ×50. B. Detail of orifice and ascopore; ×120. C. Ovicelled autozooid; ×40. D, E. *Fenestrulina cervicornis.* Terra Nova Stn. 316, Ross Sea. D. Autozooids and ovicells; ×40. E. Detail of single autozooid; ×60. F. *Fenestrulina crystallina.* Terra Nova Stn. 194, Ross Sea; ×31.



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large, closely spaced stellate pores over its whole surface. Primary orifice wider than long, 0.15 × 0.23 mm; no oral spines. Ascopore separated from orifice by a distance equivalent to 1.5 × orifice length, situated close to longitudinal midpoint of autozooid; narrowly crescentic, finely denticulate, its proximal rim slightly thickened in later ontogeny. Ovicell slightly longer than wide, recumbent on distally succeeding autozooid; calcification finely granular, with marginal pores and flutings only faintly developed.

Fenestrulina antarctica has been recorded from the Palmer Archipelago, the Bellingshausen Sea and the Ross Sea, most usually encrusting large, erect bryozoans.

Fenestrulina cervicornis Hayward and Ryland — Fig. 172D,E

Fenestrulina cervicornis Hayward and Ryland 1990: 1267, figs.2A,B

Colony forming a flat, spreading sheet. Autozooids large, oval to hexagonal, convex; separated by deep grooves, the vertical walls of each autozooid apparent as a smooth border to the frontal wall; 0.8–0.9 × 0.6–0.7 mm. Frontal calcification finely granular, with a single marginal series of large, widely spaced, stellate pores, and a single series passing proximal to the orifice. Primary orifice as wide as long; four stout oral spines present, proximal pair strongly bifurcate, occasionally trifurcate, the distal pair with cylindrical bases, spatulate apically, with the tips occasionally notched or divided. Ascopore prominent, surmounting a low, conical eminence, separated from orifice by a distance just less than the orifice length; lumen narrowly elliptical or slightly crescentic, with a smooth rim. Ovicell globular, slightly wider than long, with an irregularly nodular surface; basal pores indistinct, with very indistinct ridges between, ectooecial rim thin and inconspicuous.

This species is presently known only from the Ross Sea, encrusting erect, flexible bryozoans.

Fenestrulina crystallina Hayward and Ryland — Figs. 172F, 173A

Fenestrulina crystallina Hayward and Ryland 1990: 1267, figs.2C,D.

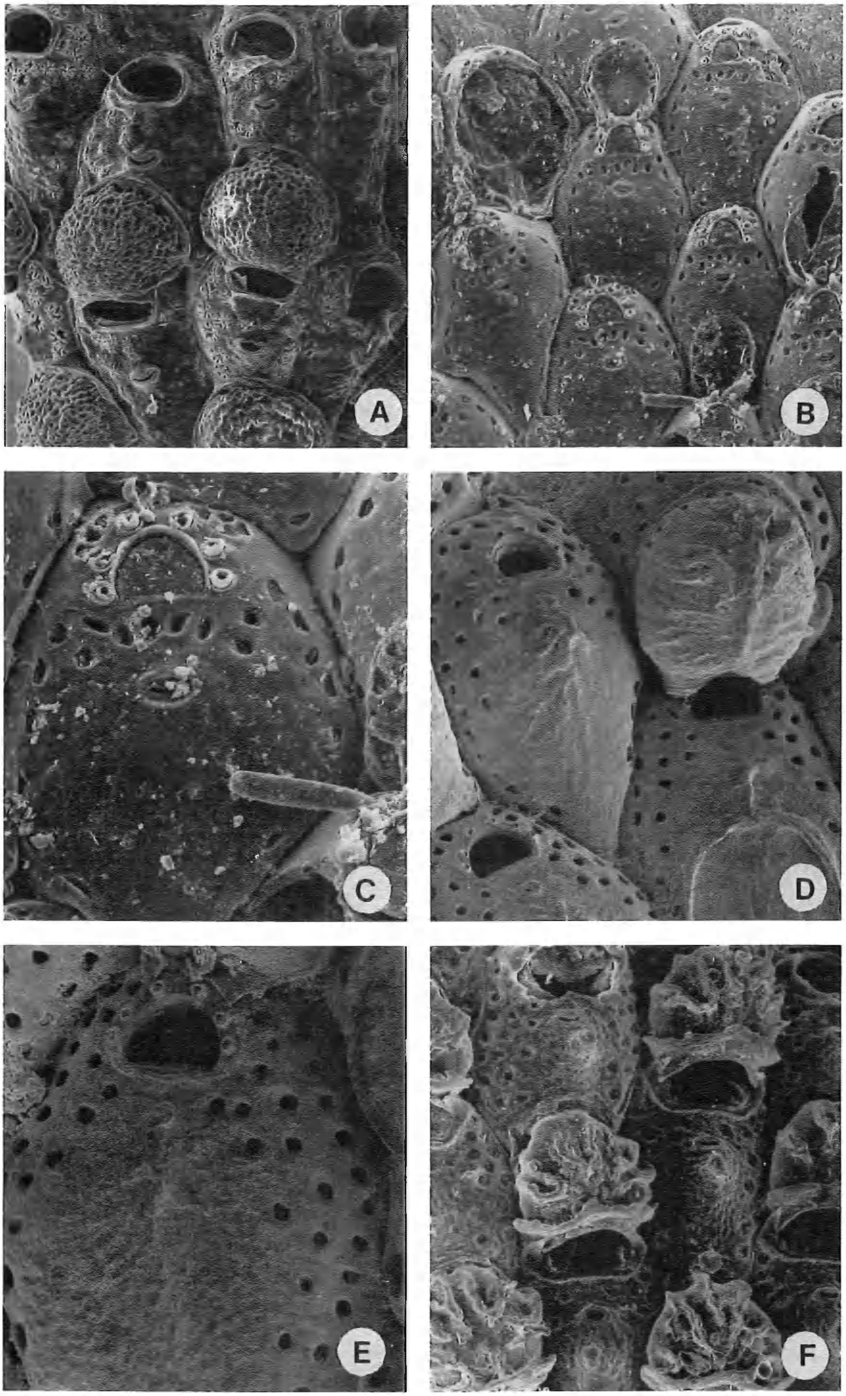
Colony forming broad, thin sheets. Autozooids large, elongate oval to hexagonal, lightly calcified; convex, separated by deep, wide grooves, with the vertical walls of each autozooid forming a conspicuous border to the frontal wall; 0.9–1.0 × 0.5–0.67 mm. Frontal wall with a finely dimpled surface; marginal pores in a single linear series in early ontogeny, later autozooids with a few additional pores on the proximal frontal wall, and with a double or triple series passing between the orifice and ascopore. Primary orifice wider than long, with a thin, raised rim; no oral spines. Ascopore separated from orifice by a distance greater than orifice length; rather indistinct, narrowly oval, with a curved, smooth-rimmed lumen. Ovicell relatively small, spherical, with finely nodular surface; basal pores indistinct, no vertical fluting, ectooecial rim thin and narrow.

Fenestrulina crystallina is known from just two Antarctic localities, in the Palmer Archipelago and the Ross Sea. Specimens were encrusting the erect bryozoans *Larvapora mawsoni* and *Bostrychopora dentata*.

Fenestrulina exigua (Waters) — Fig. 173B,C

Microporella exigua Waters 1904: 44, pl.3, figs.3a,b.

Fig. 173. A. *Fenestrulina crystallina*. Discovery Stn 190, Bismarck Strait; ×40. B, C. *Fenestrulina exigua*. Discovery Stn. WS33, South Georgia. B. Primary orifice and ascopore; ×220. C. Ovicelled autozooids, with spines intact; ×45. D, E. *Fenestrulina fritilla*. Discovery Stn. 160, Shag Rocks. D. Primary orifice and ascopore; ×150. E. Autozooids and an ovicell; ×45. F. *Fenestrulina jocunda*. Discovery Stn. WS177, South Shetland Is.; a single autozooid; ×110.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Fenestrulina exigua: Livingstone 1928: 58; Moyano 1984a: 80; Hayward and Taylor 1984: 88, fig.10; Hayward and Ryland 1990: 1270, fig.5A

Colony forming small, loosely encrusting patches. Autozooids broadly oval to hexagonal, convex, separated by distinct grooves, with lateral walls forming a conspicuous border around each frontal wall; 0.6–0.72 × 0.4–0.5 mm. Frontal wall smoothly calcified, with pores in a single series around the margins, and between the orifice and ascopore. Primary orifice slightly wider than long, with eight, stout, cylindrical spines closely spaced around its distal and lateral borders; six spines persist in ovicellate autozooids. Ascopore separated from orifice by a distance equivalent to less than half orifice length, conspicuous; transversely oval, not denticulate, its rim thickened, especially on its proximal side where it may form a prominent, projecting, angular process. Ovicell recumbent on distally succeeding autozooid, as wide as long, smooth surfaced; basal pores small, ectooecial rim only minimally developed, not producing conspicuous fluting.

Fenestrulina exigua typically forms inconspicuous patches on hard substrata, especially small pebbles. It is presently known from a few localities in the Ross Sea and the Bellingshausen Sea, and off South Georgia.

Fenestrulina fritilla Hayward and Ryland — Fig. 173D,E

Fenestrulina fritilla Hayward and Ryland 1990: 1272, figs.4A,B

Colony forming broad, flat sheets. Autozooids broadly hexagonal, convex, separated by shallow grooves; 0.7–0.85 × 0.5–0.6 mm. Frontal wall perforated over its entire surface by large, regularly spaced, stellate pores, each with a thickened rim; calcification irregularly ridged or corrugated between the pores and appearing distinctly speckled at low magnification. Primary orifice wider than long, with a raised, thickened rim; no oral spines. Ascopore separated from orifice by a distance greater than orifice length; small, transversely oval, with a smooth rim, and a crescentic lumen. Ovicell comparatively small, slightly wider than long, surface finely wrinkled and occasionally produced into small peaks; basal pores indistinct, without noticeable fluting between, ectooecial rim smooth.

Fenestrulina fritilla forms flat sheets on hard substrata, especially pebbles. It has been collected from two stations off South Georgia and two on the Burdwood Bank, and is perhaps primarily a Subantarctic species.

Fenestrulina jocunda Hayward and Ryland — Figs. 173F, 174A

Fenestrulina jocunda Hayward and Ryland 1990: 1274, fig.6

Colony forming small, cylindrical encrustations on erect substrata, such as bryozoans and hydroids. Autozooids oval to hexagonal, or rectangular, convex, separated by well-marked grooves; 0.55–0.7 × 0.35–0.45 mm. Frontal wall finely granular, with a dimpled appearance; with a single marginal series of large, cribriform pores, occasionally a few similar pores elsewhere on the frontal wall, and a single line passing between the orifice and ascopore. Primary orifice relatively large, wider than long, with a thin, raised rim; no oral spines. Ascopore separated from orifice by a distance equivalent to orifice length; conspicuous, in the form of a narrow, cres-

Fig. 174. A. *Fenestrulina jocunda.* Discovery Stn. WS177, South Shetland Is.; ×40. B, C. *Fenestrulina parvipora.* NZOI Stn. A527, Ross Sea. B. Autozooids at the colony margin; ×40. C. Detail of a single autozooid; ×95. D, E. *Fenestrulina proxima.* Discovery Stn. WS482, east of South Sandwich Is. D. Autozooids and an ovicell; ×50. E. Detail of a single autozooid; ×90. F. *Fenestrulina rugula.* Discovery Stn. 164, South Orkney Is.; ×55.

centic slit, mounted on a slight eminence. Ovicell distinctive, wider than long, its surface deeply pitted and wrinkled; basal pores indistinct, without obvious fluting between, ectooecial rim thin.

Fenestrulina jocunda seems to be locally abundant around South Georgia, encrusting erect bryozoans and hydroids, but has not been reported from elsewhere in Antarctic or Subantarctic waters.

Fenestrulina parvipora (Waters) Fig. 174B,C

Microporella parvipora Waters 1904: 43, pl.3, figs.2a,b
Microporella parvipora: Calvet 1904b: 22.

Colony forming small, round patches. Autozooids oval to hexagonal, convex, separated by deep grooves; 0.6–0.7 × 0.4–0.45 mm. Frontal wall smooth; marginal pores small, elongate or slit-like, extending around entire periphery of autozooid, with a single series passing between orifice and ascopore. Primary orifice as wide as long; six, evenly spaced oral spines present. Ascopore transversely oval, thick-rimmed, with a slit-like foramen; distance between orifice and ascopore equivalent to orifice length. Ovicell elongate oval, surface texture unknown.

The type material of this species no longer exists. It was listed by Calvet (1909) from a single locality off Wiencke Island, but has not been described or illustrated again. The description and figures given here are of a single small colony collected from the Ross Sea by the New Zealand Oceanographic Institute (Stn. A527). It seems to correspond to Waters' (1904) description and figures, but further good specimens are required from the type locality, and elsewhere in Antarctica, in order for the taxon to be formally redescribed.

Fenestrulina proxima (Waters) Fig. 174D,E

Microporella proxima Waters 1904: 44, pl.2, fig.16
Fenestrulina proxima: Hayward and Ryland 1990: 1280, figs.8C,D.

Colony forming spreading sheets on hard substrata. Autozooids broadly oval, convex, separated by deep grooves; widely spaced and occasionally almost disjunct, with a space between each autozooid filled by granular calcification; 0.65–0.8 × 0.4–0.5. Frontal wall smooth, except for a few fine, radiating ridges proximally, and often with a low, ridged umbo proximal to ascopore; marginal pores simple, rounded, in double or triple series, not extending between orifice and ascopore. Primary orifice relatively small, wider than long; six, evenly spaced, oral spines. Ascopore small and indistinct, close to proximal border of orifice, separated by a space equivalent to half orifice length; consisting of a shallow crescent of one or two simple, round pores, situated in an oval concavity, with indistinct rim. Ovicell elongate oval, with a few irregular rugosities, and typically a longitudinal carina; basal pores small and indistinct, ectooecial rim thin and narrow.

F. proxima is still known from very few specimens, collected from the Bellingshausen Sea (the type locality) and the South Shetland Islands.

Fenestrulina rugula Hayward and Ryland Figs. 174F, 175A,B

Fenestrulina rugula Hayward and Ryland 1990: 1280, fig.9.

Colony forming extensive, spreading sheets. Autozooids oval to hexagonal, convex, separated by distinct sutures; 0.55–0.7 × 0.35–0.45 mm. Frontal wall distinctly nodular, developing a stout, conical umbo immediately proximal to the ascopore; marginal pores small, rimmed, stellate, in single series in proximal half of autozooid, sometimes in three or four series distally, with a single line passing between orifice and ascopore. Primary orifice wider than long, with a low, slightly flared rim; a single pair of short, tapered, lateral oral spines

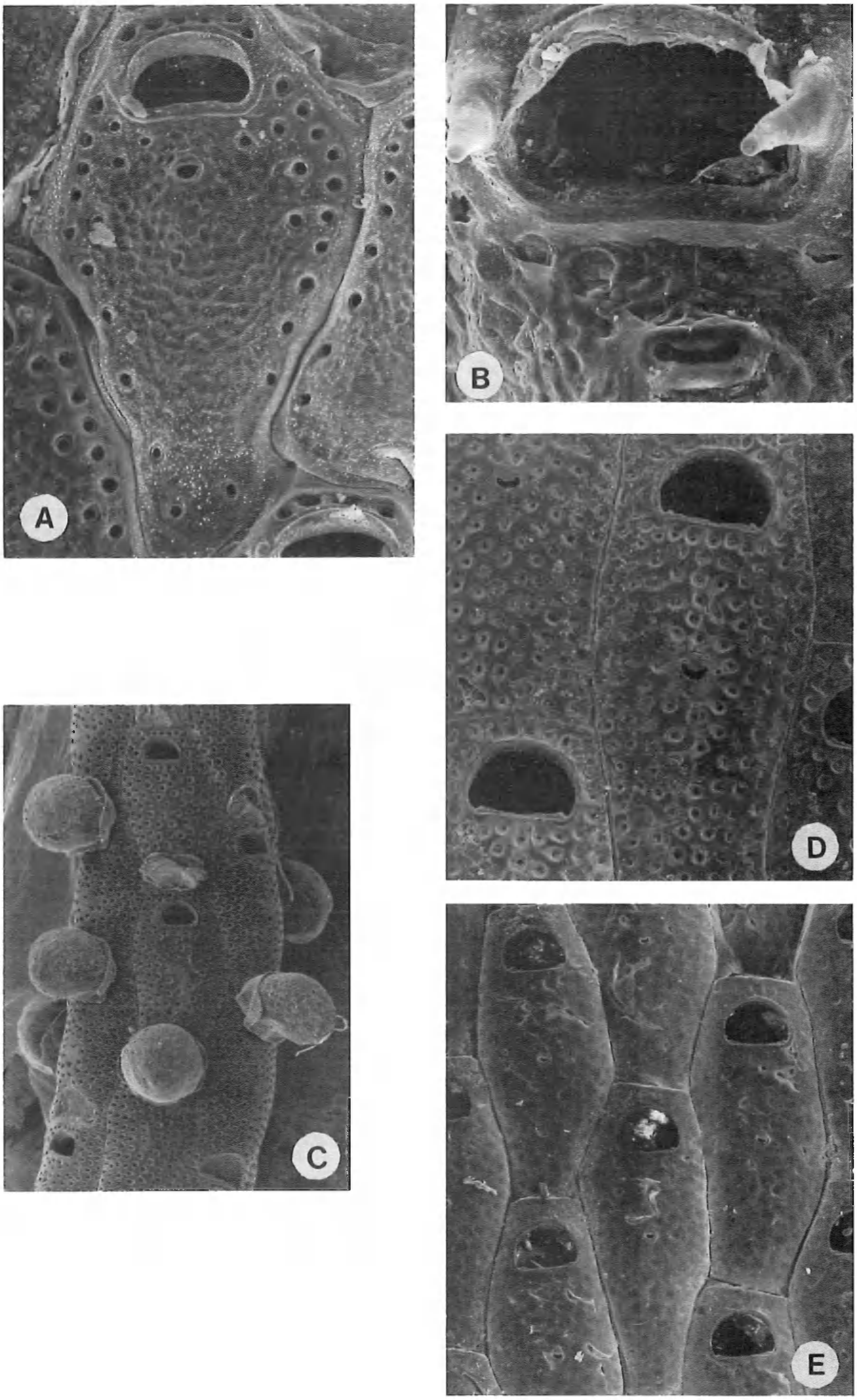

Fig. 175. A, B. *Fenestrulina rugula.* A. NZOI Stn. A456, Ross Sea; an autozooid at the colony margin; ×110. B. Discovery Stn. 164, South Orkney Is.; detail of orifice and ascopore; ×190. C, D. *Adelascopora jeqolqa.* Terra Nova Stn. 316, Ross Sea. C. Branch with ovicelled autozooids; ×20. D. Detail; ×50. E. *Adelascopora secunda.* Discovery Stn. 1952, South Shetland Is.; ×35.

present. Ascopore separated from orifice by a distance equivalent to less than half orifice length; transversely oval, narrow, with smooth-rimmed lumen. Ovicell hemispherical, distinctive: its surface with a number of thickened, bifurcating ridges, disto-proximally orientated, and forming a prominent, transverse lip bordering its aperture; basal pores and ectooecial rim indistinct.

This species is presently known from South Georgia, the South Orkney Islands, Graham Land and the Palmer Archipelago, and favours rock as a substratum. It is probably limited to Antarctic waters. The magellanic species *F. horrida* Moyano is similar to this, but has finer, transverse corrugations on the ovicell, which extend over the frontal wall of the autozooid in later ontogeny, an inconspicuous ascopore, and four oral spines. *F. reticulata* Powell is a New Zealand species also characterized by coarsely corrugated calcification.

Adelascopora Hayward and Thorpe, 1988

Colony erect, bilaminate, branching, with or without chitinous nodes. Autozooids with cryptocystidean frontal calcification, perforated by numerous small pseudopores; ascopore simple, crescentic, distant from primary orifice. Vertical walls of autozooids with large, multiporous septula. Primary orifice more or less semicircular; proximal edge straight, with an indistinct condylar ridge. No spines. No avicularia. Ovicell globular, prominent, budded from the proximal frontal wall of the autozooid distally succeeding the maternal autozooid; entooecium thinly calcified, ectooecium entirely membranous; aperture small, overhanging orifice of maternal autozooid.

Type species: *Microporella divaricata* Canu, 1904.

The type species of *Adelascopora* was described by Canu (1904) from Tertiary fossil deposits of Patagonia. It was first recorded as a Recent species by Waters (1904), from the Bellingshausen Sea, and subsequently by other authors from numerous Antarctic localities. Moyano (1989) showed that these Recent records in fact represented a separate species, *A. jeqolqa*, and that *A. divaricata* (Canu) must be considered extinct.

Key to Antarctic species

1. Colony cellariiform, with chitinous nodes present at some dichotomies. Primary orifice with well marked condylar ridge along proximal border .... *A. jeqolqa*

   Colony flustriform, lacking chitinous nodes. Primary orifice with scarcely discernible condylar ridge proximally .... *A. secunda*

Adelascopora jeqolqa Moyano — Fig. 175C,D

Microporella divaricata: Waters 1904: 46, pl.3, figs.1a–c; Livingstone 1928: 56, pl.2, fig.5; Androsova 1972a: 101

not *Microporella divaricata* Canu 1904: 11, pl.2, fig.25

Adelascopora divaricata: Hayward and Thorpe 1988: 293, Figs.5A–D

Adelascopora jeqolqa Moyano 1989: 164, Figs.2,4,5,7–9, pls.1(Ad,Md,Dd), 2(Ad,Md)

Colony slender, cellariiform, branching dichotomously at intervals of 5–10 mm, up to or exceeding 50 mm high; branches cylindrical, or oval sectioned, comprising four to ten alternating, longitudinal series of autozooids, opening around the entire branch circumference, broadest immediately prior to a dichotomy, usually abruptly narrowed above it. Nodes developed distal to the point of dichotomy (but sometimes not developed at all) comprising the cuticularized proximal portions of the autozooids at the base of the new ramus. Autozooids lightly calcified, elongate, rectangular, flat or slightly convex, separated by thin sutures; 1.0–2.5 × 0.4–0.6 mm. Frontal wall smooth, vitreous, densely perforated by small pseudopores, each in a distinct pit, giving a speckled appearance under low magnification; ascopore situated midway along autozooid length, small, simple, crescentic, rather inconspicuous. Primary orifice D-shaped, about 0.17 × 0.25 mm; proximal edge with a thin inner ridge, produced at each proximo-lateral corner as a tiny condyle; distal edge with fine denticulations on its basal side. Ovicell prominent, globular, the lightly calcified entooecium very finely striated.

Adelascopora jeqolqa is an endemic Antarctic species. It has been collected from 140 m off Signy Island, and has been recorded frequently from the South Shetlands, the Palmer Archipelago and the western coasts of the Antarctic Peninsula, the Bellingshausen Sea, Queen Mary Land, Adelie Land, Oates Land and the Ross Sea.

Adelascopora secunda Hayward and Thorpe Fig.175E

Adelascopora secunda Hayward and Thorpe 1988b : 293, Figs.5E,F

Adelascopora secunda: Moyano 1989: 166, Figs.1,3,6, pls.1(Ai,Mi,Di), 2(Ai,Mi, Di,Dd)

Colony developing flat, flabellate, dichotomously branching fronds, exceeding 100 mm height; branches narrowest proximally, broadening to 7 or 8 mm distally, dividing at intervals of about 10 mm. Autozooids lightly calcified, elongate, hexagonal, flat or slightly convex, separated by thin sutures; 1.2–1.6 × 0.45–0.65 mm. Frontal wall smooth, hyaline, densely punctured by small, round pseudopores, each in a shallow pit, imparting a speckled appearance under low magnification; ascopore situated midway along autozooid length, simple, crescentic, indistinct. Primary orifice D-shaped, about 0.18 × 0.25 mm; mid-distal portion with very fine denticulation on inner rim, proximal edge straight or very slightly concave, with delicate lip, scarcely thickened in each proximal corner to form minute condylar processes. Ovicell slightly longer than wide; entooecium lightly calcified, with radiating striations, ectooecium membranous except for a lightly calcified area framing the aperture.

This species is presently known from the South Shetland Isles, the Palmer Archipelago and the western coasts of the Antarctic Peninsula, but may prove to be more widely distributed in Antarctic coastal waters.

CELLEPORIDAE Johnston, 1838

Colony encrusting, or erect, attached by an encrusting base; multilaminar, pisiform, nodular or massive, or developing stout, branching elkhorn forms. Autozooids of superposed layers without regular orientation; frontal wall with marginal pores only. Primary orifice sinuate or not, condyles present, denticles lacking; oral spines present or absent. Avicularia adventitious, vicarious and/or interzooidal, frequently polymorphic; often associated with orifice, incorporated within a well developed peristome. Ovicell hyperstomial, not closed by autozooid operculum; with one or more pores, larger fenestrae, and often radial striations.

***Osthimosia* Jullien, 1888**

Colony form varied. Autozooids with sinuate primary orifice and well developed condyles; no oral spines; typically with a well developed peristome, completely encircling orifice, incorporating one or more adventitious avicularia, with elongate, columnar cystids. Additional adventitious avicularia, and spatulate vicarious avicularia present, often abundant. Ovicell prominent, ovoid or spherical; ectooecium with a single fenestra, occupying most of frontal surface, or reduced to a thick-rimmed pore; entooecium smooth, entire, without pores. Small basal pore chambers present.

Type species: *Osthimosia evexa* Jullien, 1888 = *Cellepora eatonensis* Busk, 1881.

The type species, *O. eatonensis* (Busk) is widely distributed in cold southern hemisphere seas, from Kerguelen westwards to Tierra del Fuego, but does not occur in Antarctic waters. By contrast, *O. bicornis* (Busk) occurs from the Marion Island group to Tierra del Fuego, and throughout Antarctica. *Osthimosia* is a remarkably speciose genus, entirely confined to southern cold temperate, Subantarctic and Antarctic regions. There is a rich New Zealand fauna (Gordon 1984, 1989a), and ten species are presently known from the Antarctic, all except one of which appear to be endemic. Colony form may be particular to a species, but all species of *Osthimosia* are most easily identified by the size and shape of the primary orifice. Liu and Hu (1991) described a new species, *O. erecta*, from peninsular Antarctica, but their description and figures do not allow a clear distinction between it and the species described here.

Key to Antarctic species

1. Peristome with a pair of columnar adventitious avicularia, proximolateral with respect to orifice. Colony domed or pisiform, generally <5 mm diameter .... *O. bicornis*

   Peristome with single or multiple avicularia, but not constantly paired 2

2. Peristome low and thickened, with one to four short, columnar avicularia on its rim. Vicarious avicularia infrequent, rostrum oval or egg-shaped. Primary orifice as wide as long, with short, broad condyles and a narrow U-shaped sinus .... *O. fusticula*

   Peristome variously developed, but always with just a single medio-proximal avicularium 3

3. Vicarious avicularia elongate oval or almost circular 4

   Vicarious avicularia narrowly or broadly spatulate 5

4. Vicarious avicularia elongate oval, rostrum hooded distally. Primary orifice with broad, deep condyles, forming edges of sinus .... *O. clavata*

   Vicarious avicularia almost circular, the distal portion of the rostrum slightly acute to proximal portion. Primary orifice with inconspicuous rounded condyles above a well defined sinus .... *O. claviformis*

5. Sinus broad and shallow, occupying most of proximal border of primary orifice. Vicarious avicularia gigantic, with narrowly spatulate rostrum. Colony erect, branching .... *O. curtioscula*

   Sinus narrow, U- or V-shaped, occupying less than three-quarters total proximal edge of primary orifice 6

6. Sinus deep, comprising one-third to one-half total length of primary orifice 7

   Sinus short, comprising just a shallow U-shaped notch on proximal border of primary orifice 9

7. Primary orifice wider than long, the anter more or less semicircular. Vicarious avicularia elongate, narrowly spatulate .... *O. phalacrocoraca*

   Primary orifice longer than wide, the anter more than a semicircle 8

8. Sinus comprising one-third total orifice length. Vicarious avicularia narrow proximally, broadly spatulate distally. Ovicell with elongate triangular frontal fenestra .... *O. notialis*

   Sinus comprising one-half total orifice length. Vicarious avicularia elongate, parallel-sided, scarcely spatulate distally. Ovicell with broad triangular frontal fenestra. .... *O. rudicula*

9. Colony large, forming thick, mamillate sheets, nodules and cylinders. Peristome consisting of well-developed proximo-lateral flaps, incoporating a columnar medio-proximal avicularium, but not obscuring primary orifice from view .... *O. malingae*
   Colony developing tiny pisiform or cylindrical growths, the former rarely exceeding 5 mm diameter. Peristome deep, hiding primary orifice from view 10
10. Colony tiny, 1–2 mm diameter. Peristome flared, with lateral lobes abutting ovicell. Ovicell with narrow, transversely oval fenestra .... *O. mariae*
   Colony up to 5 mm diameter, or 10 mm long if cylindrical. Peristome forming a complete closed tube, its distal rim in a U-shape. Ovicell with large fenestra occupying most of frontal surface .... *O. milleporoides*

Osthimosia bicornis (Busk) Fig. 176A–C

Cellepora bicornis Busk 1881: 362, pl.27, fig.4; 1884: 202, pl.30, figs.1,12, pl.36, figs.13,15
Osthimosia otopeta Jullien 1888: 64, pl.1, fig.3
Osthimosia bicornis: Rogick 1959a: 14, pl.1, figs.1–5; Hayward 1992: 284,pl.1, figs.a–f, pl.2, figs.a,b.

Colony encrusting, forming small domed patches; or, more typically, small pisiform growths, <5 mm diameter, attached to a variety of erect substrata. Autozooids closely packed, almost cylindrical, with terminal orifices; bordered by distinct marginal pores. Primary orifice longer than wide, commonly 0.13 × 0.10 mm; proximal edge with a small, rounded, median sinus occupying about one-third its width, bounded by prominent, thickened condyles. Peristome well developed laterally and proximally, incorporating the tubular cystids of paired, lateral suboral avicularia, with oval, proximo-laterally directed rostra. Vicarious avicularia frequent, 0.2–0.3 mm long, with broadly spatulate rostrum and slender crossbar; less often, with oval rostrum about twice the size of those of the suboral avicularia. Ovicell spherical, situated on distal peristome rim, well above primary orifice; frontal ectooecium with a small, thick-rimmed, central foramen, of variable shape.

This species has been reported from Heard Island, Marion Island, the Falkland Isles, and widely across the southern Patagonian shelf to the Magellan Strait and Tierra del Fuego. It also occurs off South Georgia and in the Ross Sea, and perhaps elsewhere in Antarctica. New Zealand specimens figured by Gordon (1984, 1989a) do not belong to *O. bicornis*. Its small, pisiform colonies are often abundant on hydroids and erect Bryozoa.

Osthimosia clavata Waters Fig. 176D,E

Osthimosia clavata Waters 1904: 74, pl.7, figs.1a–g
Osthimosia clavata: Hayward 1992: 291, pl.4, fig.f

Colony erect, attached by an encrusting base, forming a stout, club-shaped growth up to 10 mm high; occasionally lobed distally, with two or three rounded heads arising from a narrow, thickly calcified stalk. Autozooids with thick, smooth calcification, marginal pores small and sparse. Primary orifice slightly wider than long, the proximal border only scarcely concave medially, but with wide, deep condyles delimiting a conspicuous, broad, U-shaped sinus. Peristome low and thick, with a single median suboral avicularium, the rostrum oval, acute to plane of orifice, proximally directed. Identical avicularia abundant over the surface of the colony; larger vicarious avicularia less frequent, rostrum oval, 0.2–0.3 mm long, with stout crossbar and extensive palatal foramen.

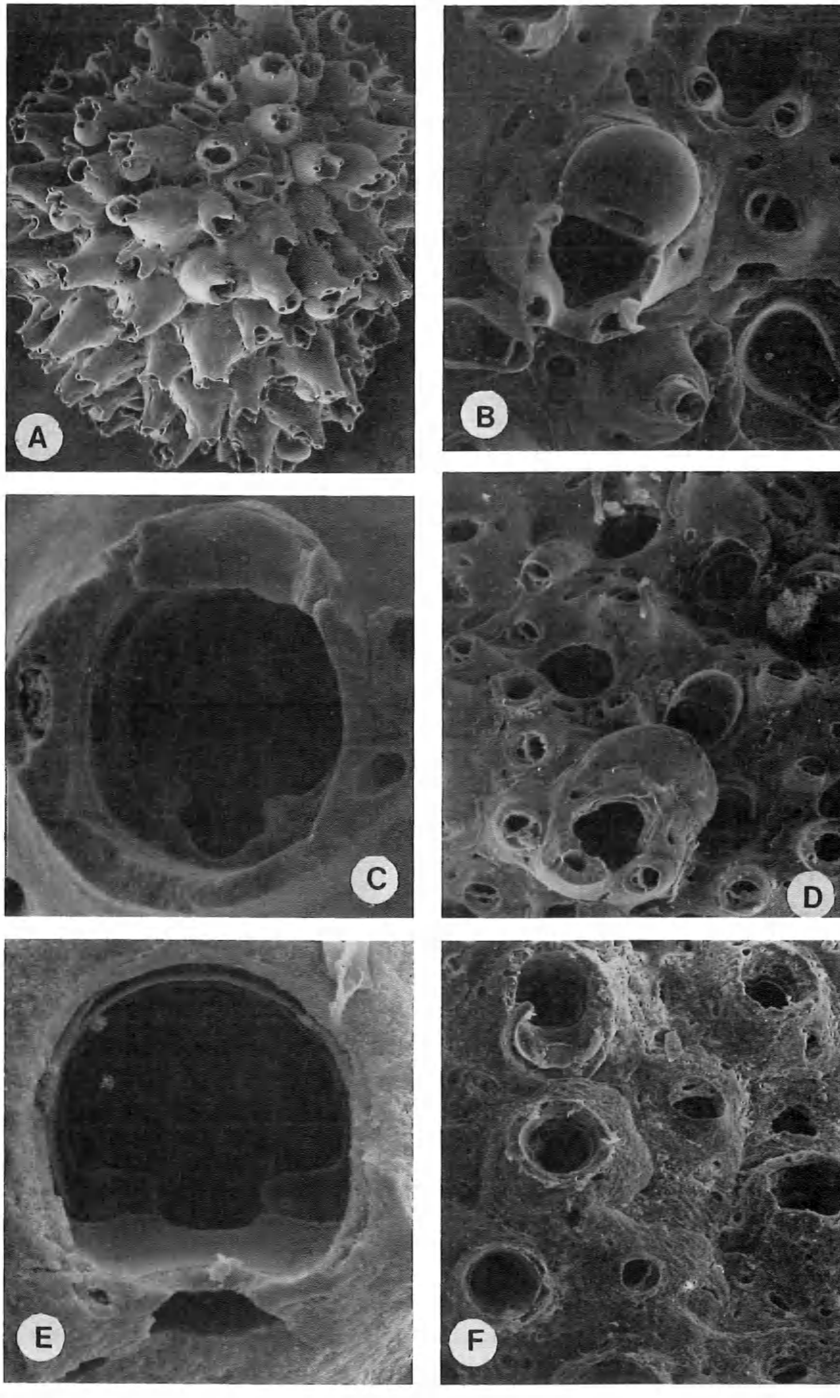

Fig. 176. A–C. *Osthimosia bicornis.* A. Terra Nova Stn. 194, Ross Sea; entire colony; ×17. B. Discovery Stn. 1564, Prince Edward Id.; ×80. C. Discovery Stn. 1564; primary orifice; ×230. D, E. *Osthimosia clavata.* D. McMurdo Sound, Ross Sea; showing ovicells and characteristic avicularia; ×60. E. Discovery Stn. 170, South Shetland Is.; primary orifice; ×240. F. *Osthimosia claviformis.* NZOI Stn. A531, Ross Sea; ×50.

Ovicell domed, prominent, with very small ectooecial foramen frontally, sealed over in later ontogenetic thickening.

Osthimosia clavata appears to be endemic in Antarctica. It was described by Waters (1904) from the Bellingshausen Sea, and further specimens have been collected from the South Sandwich Islands, the South Orkneys, and the Ross Sea.

Osthimosia claviformis Hayward — Figs. 176F, 177A,B

Osthimosia claviformis Hayward 1993: 297, Fig.5A,B

Colony erect, club-shaped, with short, thickened branches, attached by an encrusting base; at least 10 mm high, perhaps larger. Autozooids thickly calcified, closely packed, with varying orientation, separated by thin, indistinct sutures; frontal calcification granular, with distinct, widely spaced marginal pores. Primary orifice orbicular, 0.12–0.13 mm long, with short, U-shaped sinus occupying about half proximal width; condyles rounded, conspicuous; no oral spines. A single, medio-proximal, suboral avicularium present in some autozooids; rostrum oval, 0.1 mm long, acute to orifice plane, proximally directed. Peristome prominent, forming an erect tube, with thick, smooth-rimmed, circular aperture, enveloping and obscuring suboral avicularium when present. Frontal adventitious avicularia abundant; monomorphic but varying in size, 0.08–0.15 mm long, almost circular, with semicircular mandible; proximal opesia at marked angle to mandible, crossbar thick, flat, without a columella. Ovicell as wide as long, with a broad frontal area of uncalcified ectooecium; at first prominent, eventually enclosed and hidden by peristome.

This species is presently known from a single specimen collected in the Ross Sea.

Osthimosia curtioscula Hayward — Fig. 177C–E

Osthimosia curtioscula Hayward 1992: 286, pl.2, figs.c–e

Colony attached by an encrusting base, developing an erect, dichotomously branching form, exceeding 20 mm high; branches 4–5 mm wide proximally, broadening distally to 10 mm or more, appearing distinctly palmate. Autozooids large, lightly calcified, with few, widely spaced, marginal pores. Primary orifice wider than long, commonly 0.14 × 0.16 mm; proximal border shallowly concave between short, rounded condyles. Peristome thin, rising from lateral borders of orifice to envelop a long, columnar, proximal suboral avicularium; rostrum of avicularium terminal in position, acute to plane of orifice, proximally directed. Vicarious avicularia frequent, larger than autozooids; rostrum 0.55–0.70 mm long, narrowly spatulate, hooded distally; crossbar stout, palate with an extensive foramen. Ovicell slightly broader than long, thinly calcified; frontal foramen of ectooecium occupying almost whole width of ovicell.

O. curtioscula is presently known only from South Georgia.

Osthimosia fusticula Hayward — Figs. 177F, 178A,B

Osthimosia fusticula Hayward 1992: 291, pl.4, figs.c–e

Colony encrusting hard substrata, forming a solid pisiform growth up to or exceeding 10 mm diameter. Autozooids thickly calcified, convex, with distinct boundaries; marginal pores few and small. Primary orifice about as wide as long; proximal border straight, with a narrow U-shaped median sinus occupying less than one-quarter its total width; condyles broad and deep, accentuating sinus. Peristome low, the orifice remaining distinct in frontal view; a short, small, columnar avicularium immediately

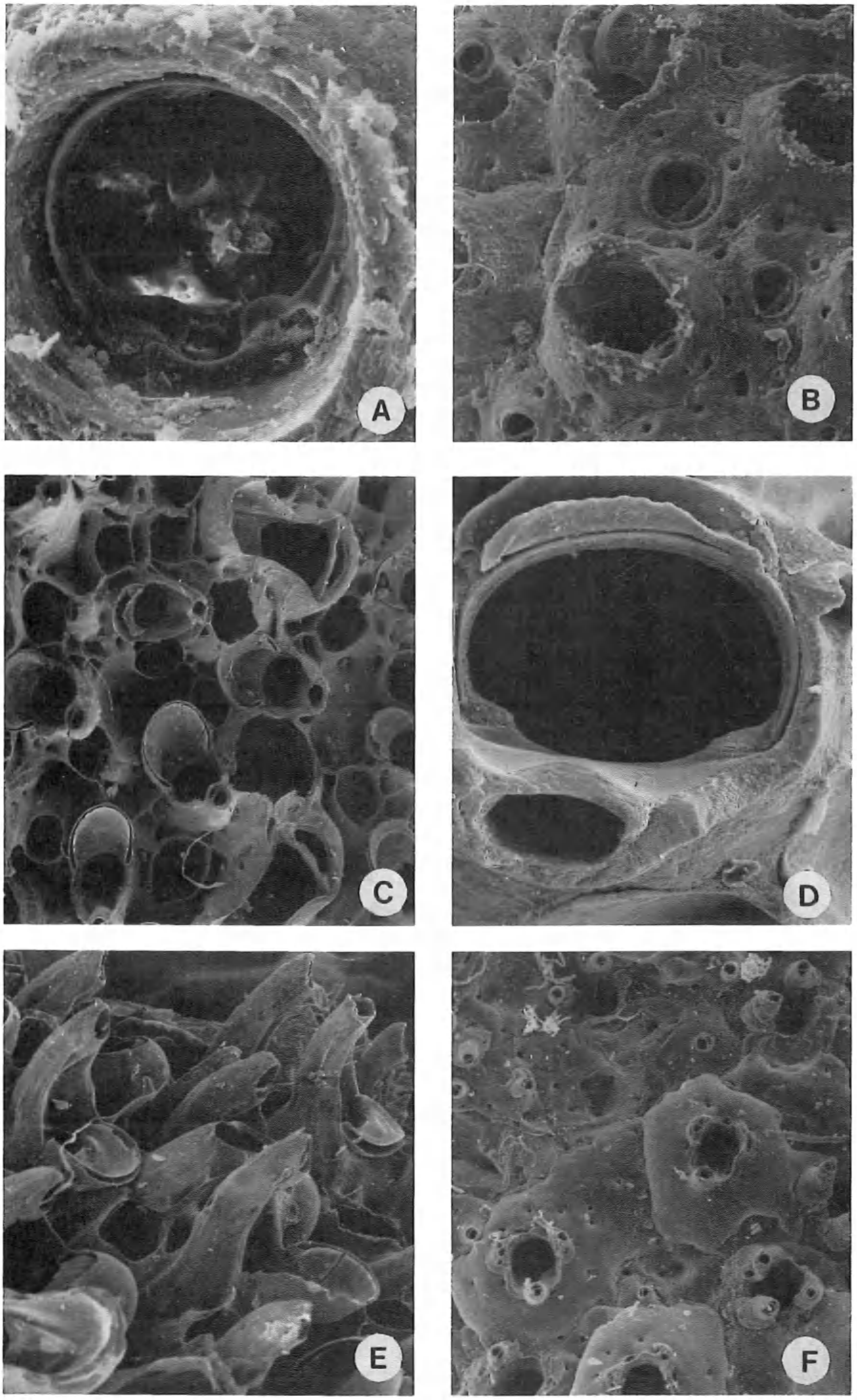

Fig. 177. A, B. *Osthimosia claviformis.* NZOI Stn. A531, Ross Sea. A. Primary orifice; ×280. B. Autozooids, avicularia and an ovicell; ×50. C–E. *Osthimosia curtioscula.* Discovery Stn. WS27, South Georgia. C. Part of a colony; ×30. D. Primary orifice; ×195. E. Profile to show suboral avicularium; ×50. F. *Osthimosia fusticula.* Discovery Stn. 1948, South Shetland Is.; ×40.

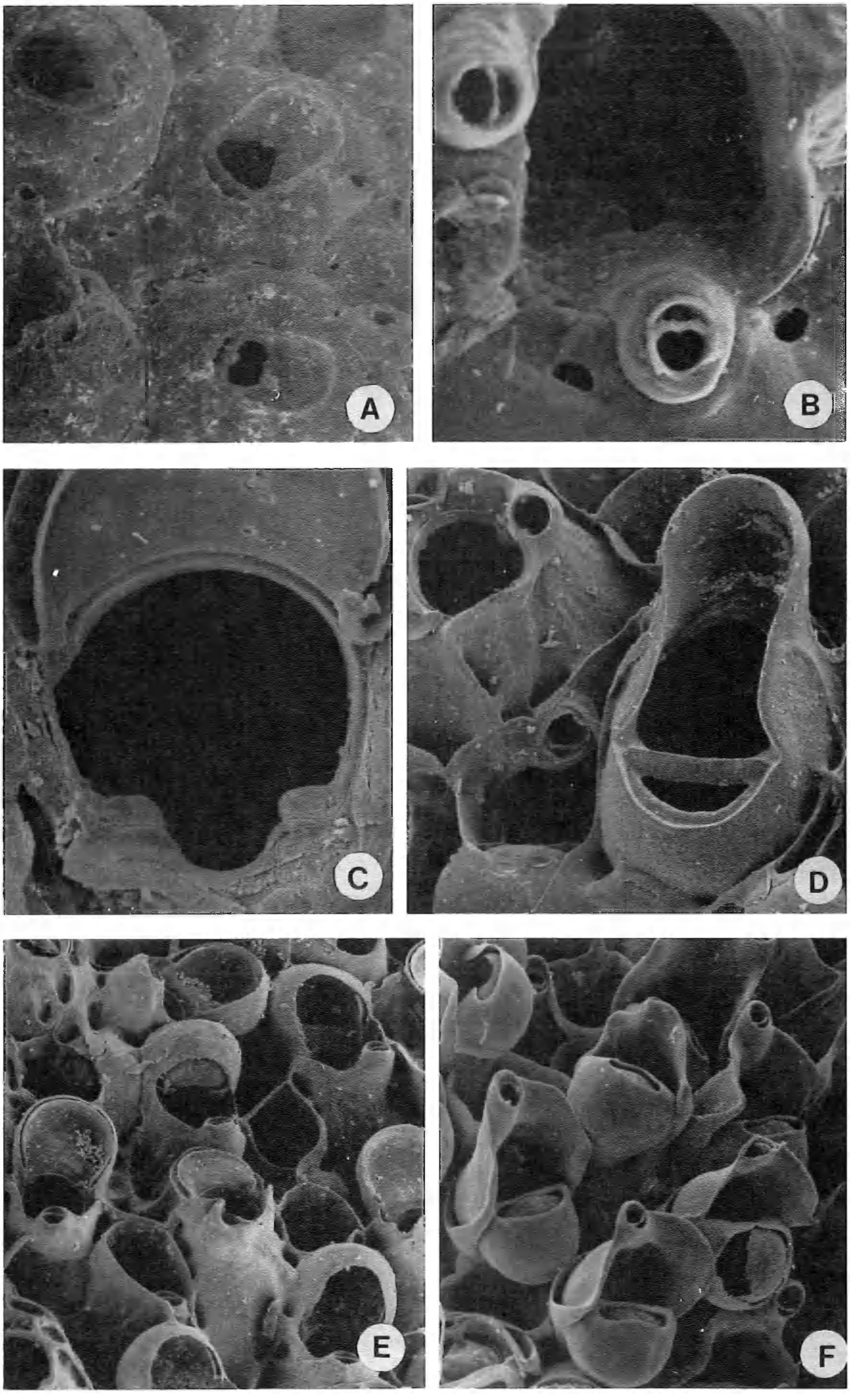

Fig. 178. A, B. *Osthimosia fusticula.* Discovery Stn. 1948, South Shetland Is. A. Vicarious avicularia; ×60. B. Primary orifice; ×220. C–E. *Osthimosia malingae.* Signy Id. C. Primary orifice; ×230. D. Vicarious avicularium; ×80. E. Autozooids and ovicells; ×50. F. *Osthimosia mariae.* McMurdo Sound, Ross Sea; ×70.

proximal to sinus, with oval rostrum proximally directed; typically, two or three further, identical, avicularia developed elsewhere on peristome rim, most usually laterally, and similar avicularia present sporadically along margins of autozooids. Large vicarious avicularia infrequent; rostrum 0.25 mm long, slightly broadened distally, with broad, flat, crossbar, and palatal foramen less than half total rostrum length. Ovicell undescribed.

This species is superficially similar to *O. clavata*, from which it is distinguished by its primary orifice and its complement of three or more peristomial avicularia. *O. fusticula* is presently known only from around the South Shetland Islands.

Osthimosia malingae Hayward — Fig. 178C–E

?*Osthimosia eatonensis*: Rogick 1959a: 18, pl.2, figs.16–26

Osthimosia malingae Hayward 1992: 291, pl.5, figs.a–d.

Colony large, mamillate or nodular, frequently developing thick, cylindrical encrustations on erect substrata, exceeding 40 mm length. Autozooids with few, large marginal pores. Primary orifice about as wide as long, commonly 0.18 × 0.16 mm; sinus a deep, symmetrical U-shape, occupying about half width of proximal edge of orifice; condyles broad, extending to edges of sinus. Peristome thin, flaring, highest proximally where it enfolds a columnar medio-proximal avicularium, with oval rostrum almost perpendicular to orifice plane and thus facing distally. Vicarious avicularia frequent, as large as autozooids, with broadly spatulate, distally hooded rostrum, 0.5 mm long; crossbar thickly calcified, palatal foramen extending to hooded distal portion of rostrum. Ovicell slightly wider than long, lightly calcified; with a large area of uncalcified ectooecium frontally, extending the whole width of the ovicell.

This is possibly the species reported from 14 Antarctic localities by Rogick (1959a), as *O. eatonensis* (Busk), which does not in fact occur in Antarctic seas. *O. malingae* is otherwise known from Signy Island, where it seems to be quite common, the South Shetlands and the Ross Sea.

Osthimosia mariae Hayward — Figs. 178F, 179A

Osthimosia granum: Rogick 1959a: 23, pl.3, figs.27–42

Osthimosia mariae Hayward 1992: 294, pl.5, figs.e,f.

Colony forming tiny pisiform growths on hydroids and other slender, erect substrata; commonly 1–2 mm diameter, rarely exceeding 3 mm. Autozooids closely packed, with successive frontally budded generations radiating from the colony centre, only the orifices, peristomes and ovicells immediately visible. Primary orifice about as wide as long, 0.1 mm diameter, the proximal border almost entirely occupied by a broad, U-shaped sinus; condyles rather inconspicuous. Peristome developed from a suborificial fold, produced proximally and laterally as a tall, flaring structure, incorporating medio-proximally an elongate, tubular avicularian cystid; rostrum apical, oval, its plane normal to that of the orifice, proximally directed. A short, denticle-like process projects from the base of the avicularian cystid, above the orificial sinus. Small vicarious avicularia, with spatulate rostrum, described by Rogick (1959a). Ovicell situated close to distal rim of primary orifice; small, spherical, smooth, with a transversely oval frontal fenestra.

This tiny species is presently known only from Graham Land and the Ross Sea.

Osthimosia milleporoides (Calvet) — Fig. 179B,C

Cellepora milleporoides Calvet 1909: 38, pl.3, figs.11–13

Osthimosia milleporoides: Rogick 1959a: 26, pl.4, figs.43–55; Moyano 1966a: 118;

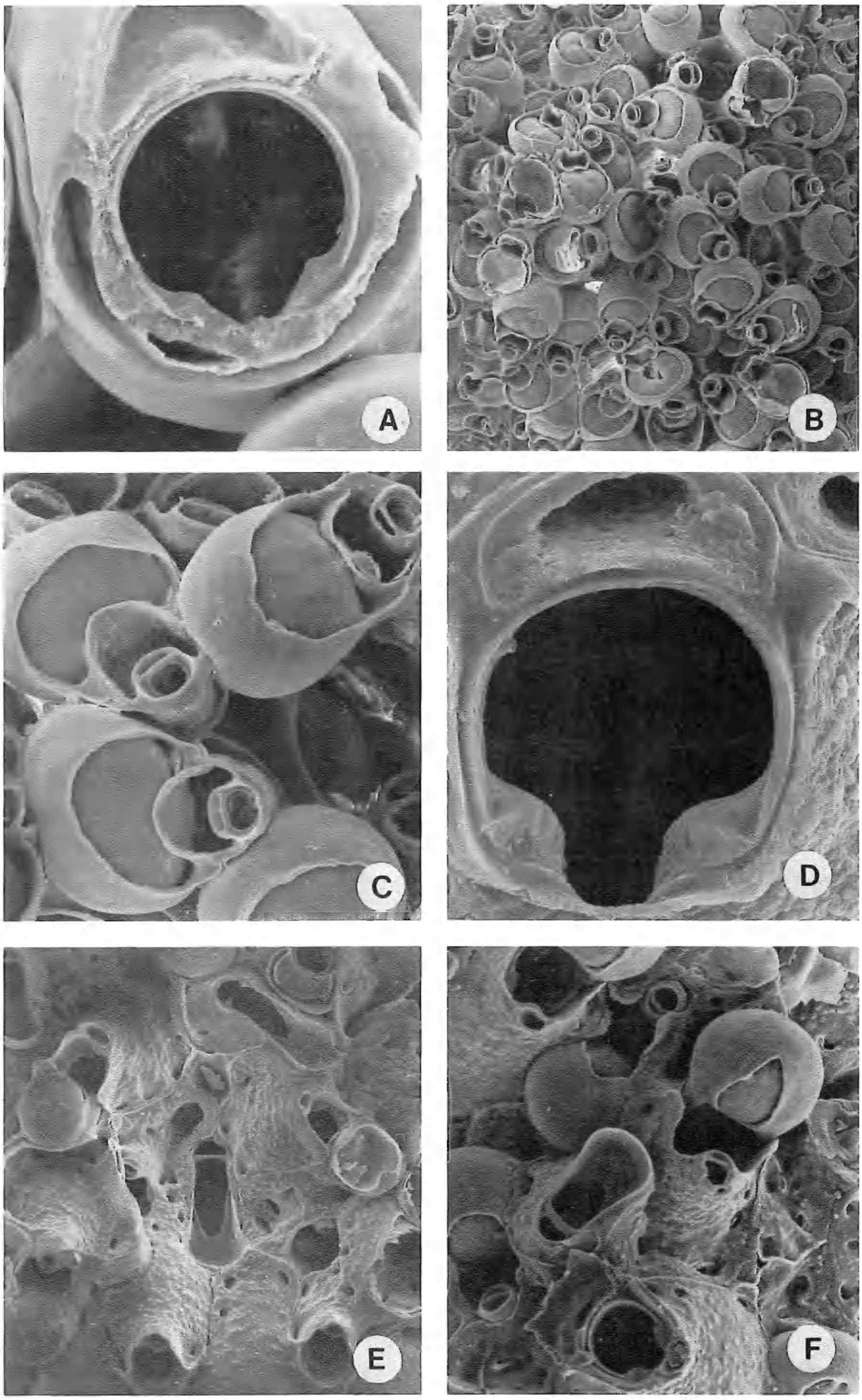

Fig. 179. A. *Osthimosia mariae.* McMurdo Sound, Ross Sea; primary orifice; ×285. **B**, C. *Osthimosia milleporoides.* McMurdo Sound, Ross Sea. **B.** Entire colony; ×40. C. Detail of ovicells; ×120. D–F. *Osthimosia notialis.* McMurdo Sound, Ross Sea. D. Primary orifice; ×310. E. Autozooids, ovicells and avicularia; ×45. F. Detail; ×70.

1984a: 81; Hayward and Taylor 1984: 72.

Colony pisiform, up to 5 mm diameter, or forming slender cylinders, up to 10 mm long, or small, encrusting domes; often common on bryozoans, hydroids and other erect substrata. Autozooids closely packed, erect, only the ovicells, peristomes and avicularia visible. Primary orifice wider than long, about 0.09 × 0.10 mm; a short, U-shaped sinus occupying half width of proximal border, condyles short, rounded. Peristome deep, tubular, completely hiding primary orifice, continuous distally with a broad band of ectooecial calcification above aperture of ovicell; median suboral avicularium with a stout, tubular cystid, enclosed within peristome, rostrum broadly oval, proximally directed. Ovicell spherical, conspicuous, almost the whole of the entooecium exposed frontally, except for a narrow band above the aperture, where the peristome forms a complete, U-sectioned tube.

This distinctive species is widely distributed in Antarctic waters, from the Ross Sea to the Antarctic Peninsula, and northwards along the Scotia Arc to South Georgia.

Osthimosia notialis Hayward — Fig. 179D–F

Osthimosia notialis Hayward 1992: 295, pl.5, fig.g, pl.6, figs.a,b.

Colony form various: small pisiform growths, 2–4 mm diameter, slender cylinders up to 10 mm long, or small, encrusting domes; most often on bryozoans, cnidarians, sponge spicules or other erect substrata. Autozooids thickly calcified, convex, with distinct boundaries; frontal wall finely nodular, with few, large, marginal pores. Primary orifice longer than wide, 0.15–0.13 mm, a deep, U-shaped sinus comprising one-third its total length; condyles deep, thickened, prominent. Peristome well developed laterally and proximally, with a stout, medio-proximal avicularium, the broadly oval rostrum slightly acute to orifice plane, proximally directed. Vicarious avicularia frequent, as large as autozooids; rostrum narrow, parallel-sided proximally, abruptly expanded to a slender spoon shape distally; crossbar slender, palate with extensive foramen. Ovicell spherical, prominent, smooth, with a broadly triangular area of entooecium exposed frontally.

Osthimosia notialis has been reported from the South Sandwich Islands, Signy Island, the South Shetlands, the Palmer Archipelago, and the Ross Sea.

Osthimosia phalacrocoraca Hayward — Fig. 180A–C

Osthimosia phalacrocoraca Hayward 1992: 297, pl.7, figs.a–c.

Colony a rounded, clavate or elongate rod-shape, attached by an encrusting base, or developing thick cylinders around upright substrata. Autozooids thickly calcified, the frontal wall coarsely granular, with a single series of large frontal pores. Primary orifice wider than long, commonly 0.16 × 0.17 mm; the proximal edge shallowly concave, with broad, deep condyles delimiting a U-shaped sinus comprising half total length of orifice. Peristome consisting of low, thickly calcified lateral lobes; proximally, the sinus is obscured by a thick, prominent, median suboral avicularium, with broadly oval rostrum, acute to orifice plane and proximally directed. Vicarious avicularia frequent, as large as autozooids; rostrum 0.5–0.6 mm long, narrowly spatulate, with complete crossbar and large palatal foramen. Ovicell spherical, prominent, thickly calcified, with nodular surface; a small triangular foramen frontally.

This distinctive species was described from Shag Rocks, South Georgia, and from the Ross Sea.

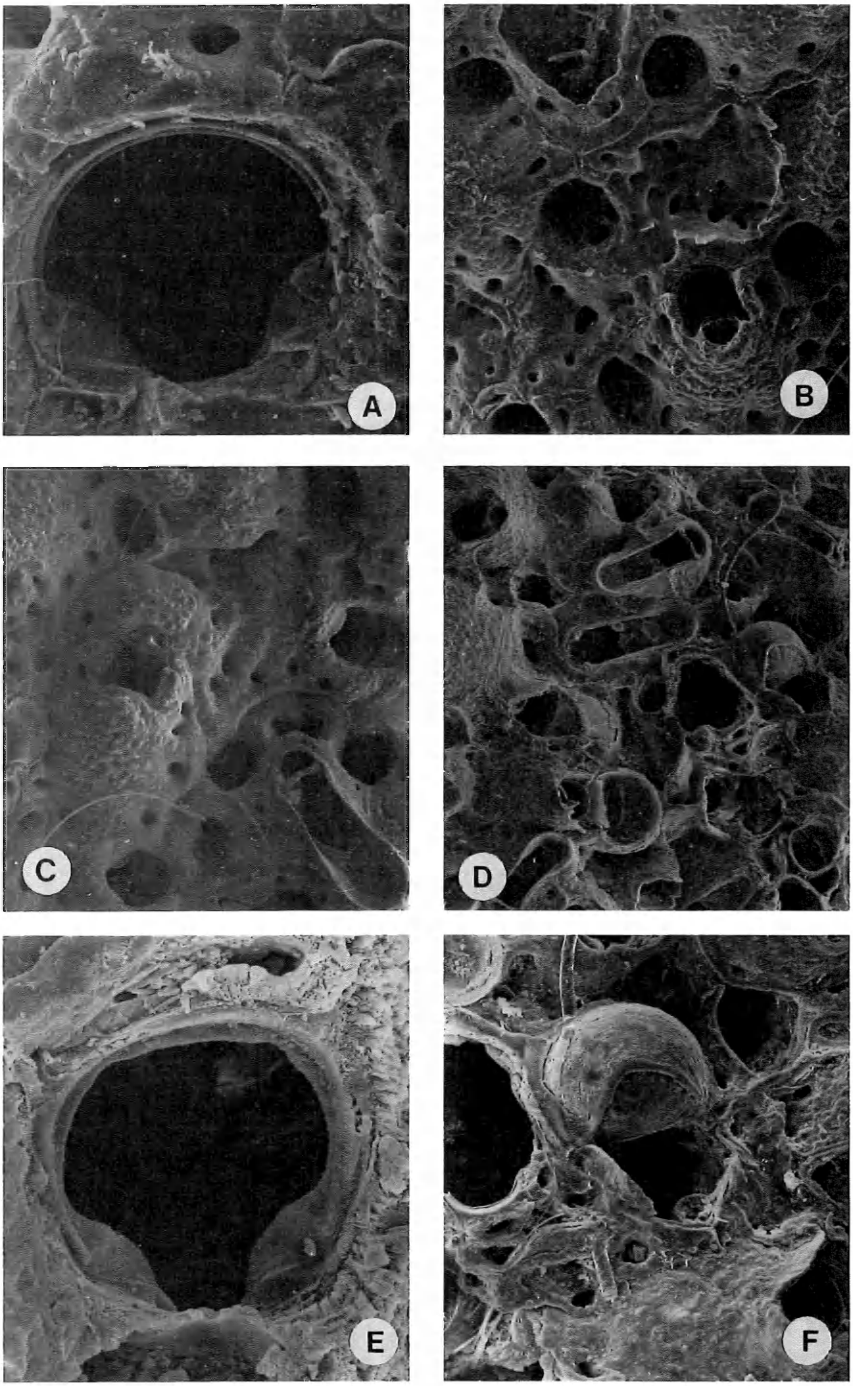

Fig. 180. A–C. *Osthimosia phalacrocoraca.* Discovery Stn. 160, Shag Rocks. A. Primary orifice; ×220. B. Group of autozooids; ×50. C. Ovicells and a vicarious avicularium; ×45. D–F. *Osthimosia rudicula.* Discovery Stn. 190, Bismarck Strait. D. Part of colony, with ovicells and vicarious avicularia; ×40. E. Primary orifice; ×280. F. Ovicelled autozooid; ×90.

Osthimosia rudicula Hayward — Fig. 180D–F

Osthimosia rudicula Hayward 1992: 298, pl.8, figs.c–e.

Colony an encrusting, nodular sheet. Autozooids thickly calcified, convex, distinct; frontal wall coarsely granular, with few, inconspicuous marginal pores. Primary orifice longer than wide, 0.13 × 0.10 mm, with a deep U-shaped sinus occupying half total proximal width, accentuated by thickened, rounded condyles and comprising almost half total orifice length. Peristome low and thick, completely encircling orifice, enclosing a single, median suboral avicularium, with broadly oval, proximally directed rostrum. Vicarious avicularia frequent, as large as autozooids; rostrum 0.35– 0.45 mm long, narrow, rounded but scarcely spatulate distally; crossbar slender, palate with short, rounded foramen. Ovicell prominent, spherical; entooecium exposed across whole of frontal surface, bordered by a thickened ectooecial rim.

Osthimosia rudicula is presently known from just a single locality in the Bismarck Strait, Palmer Archipelago.

Buffonellaria Canu and Bassler, 1917

Colony encrusting. Autozooid frontal wall with marginal pores. Primary orifice with sinus and condyles, no oral spines. Avicularia adventitious, single or paired, lateral suboral; larger (interzooidal/vicarious?) avicularia occur in some species. Ovicell hyperstomial, ectooecium uncalcified frontally; entooecium calcified, imperforate. Basal pore chambers present.

Type species: *Hippothoa divergens* Smitt, 1873.

Buffonellaria frigida (Waters) — Fig. 181A–C

Lepralia frigida Waters 1904: 47, pl.3, figs.9a,b, pl.8, fig.9.

Colony encrusting, forming thick unilaminar sheets, most frequently on pebbles. Autozooids thickly calcified, oval to irregularly polygonal, convex, separated by distinct sutures; 0.6–0.8 × 0.4–0.45 mm. Primary orifice slightly longer than wide; anter orbicular, poster broadly triangular, condyles rounded, knoblike. Peristome developed as paired lateral flaps, thickened in later ontogeny, not extending proximally. Median suboral avicularium orientated almost perpendicular to orifice plane; rostrum elongate, pointed distally, facing distolaterally; cystid thickly calcified, produced apically to form a stout umbo, hiding the rostrum from frontal view. Frontal calcification finely nodular, with few (1–5) large marginal pores. Ovicell prominent, wider than long, entooecium coarsely granular, exposed over entire frontal surface, bordered by a narrow band of smooth ectooecium.

This species was described from the Bellingshausen Sea by Waters (1904), and there have been no further reports of its occurrence. It has since been collected from a few localities in the Palmer Archipelago and the Ross Sea.

Galeopsis Jullien, *in* Jullien and Calvet, 1903

Colony encrusting, or erect and branching. Frontal wall of autozooids with few marginal pores. Primary orifice sinuate, with well marked condyles. Peristome typically well developed, incorporating paired lateral-suboral avicularia, often converging medially to delimit a pseudospiramen. No oral spines. Ovicell prominent, hyperstomial, not closed by autozooid operculum; frontal surface with an imperforate entooecial tabula, sometimes with a short labellum. Basal kenozooids present in some erect species. Vertical walls with multiporous septula.

Type species: *Galeopsis rabidus* Jullien, *in* Jullien and Calvet, 1903.

The systematic placing of this genus was discussed by Gordon (1984), who has also (Gordon 1989a) described and figured a number of New Zealand

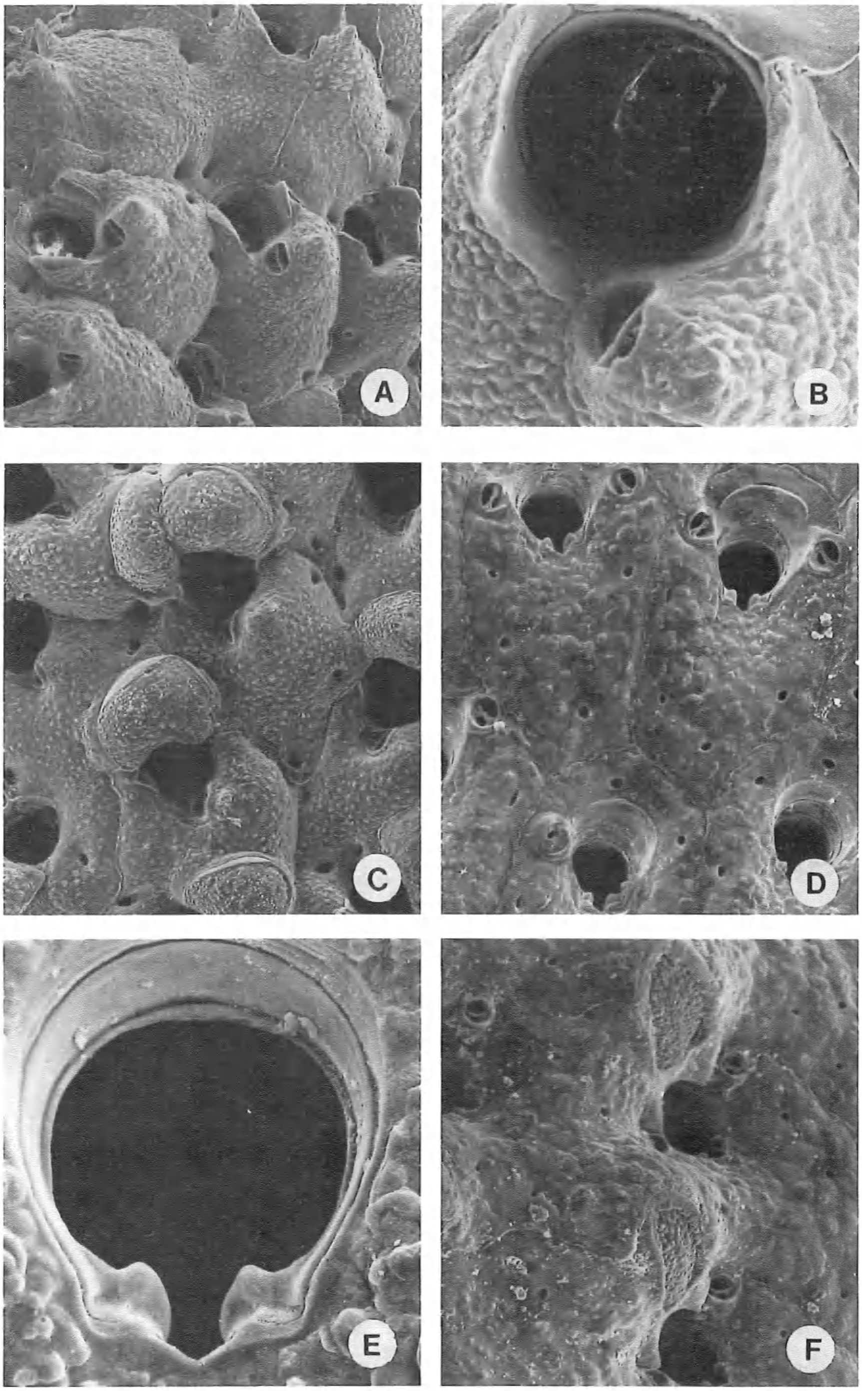

Fig. 181. A–C. *Buffonellaria frigida*. A. McMurdo Sound, Ross Sea; ×45. B. NZOI Stn. A520, Ross Sea; primary orifice; ×160. C. NZOI Stn. A520; ovicelled autozooids; ×45. D–F. *Galeopsis bullatus*. Discovery Stn. 160, Shag Rocks. D. Group of autozooids; ×60. E. Primary orifice; ×300. F. Ovicelled autozooids; ×65.

species. Magellanic and Patagonian species have been treated by Moyano (1985a). A single, endemic species is known from Antarctica.

Galeopsis bullatus Hayward Fig. 181D–F

Galeopsis bullatus Hayward 1993: 294, Fig.4A–C

Colony erect, branching, bilaminar. Maximum size and architecture unknown, but exceeding 39 mm high, with flat-sectioned, curved or twisted branches, 2–3 mm wide, developing a three-dimensional arborescent form. Autozooids in regular, alternating longitudinal series; hexagonal to pyriform, convex, separated by distinct sutures at first, but boundaries later obscured by ontogenetic thickening of frontal wall; 0.75–0.95 × 0.4–0.5 mm. Frontal wall coarsely granular, with a few large, widely spaced, marginal pores. Primary orifice longer than wide, broadest distally; proximal border with a short, triangular median sinus, accentuated by massive, faceted condyles. No oral spines. Avicularia single or paired, disto-lateral to orifice, acute to frontal plane, disto-laterally directed; rostrum oval, crossbar complete, with a columella. Ovicell prominent, slightly longer than wide, narrowing towards orifice; tabula elongate oval, imperforate, finely granular.

This species is presently known only from a single locality off Shag Rocks, South Georgia.

Spigaleos Hayward, 1992

Colony erect, attached by an encrusting base, developing a slender, irregularly branching form. Autozooids opening on a defined frontal surface; basal surface of colony smooth, with scattered pores but no sutures. Autozooid frontal wall with marginal pores only. Primary orifice orbicular, with well-developed condyles defining a narrow, medio-proximal sinus. No oral spines. Avicularia adventitious, suboral. Ovicell with imperforate area of entooecium exposed frontally. Uniporous mural septula present.

Type species: *Cellepora horneroides* Waters, 1904.

Spigaleos horneroides (Waters) Fig. 182A–D

Cellepora horneroides Waters 1904: 73, pl.4, figs.12a–f

Spigaleos horneroides: Hayward 1992: 307, pl.10, figs.d–f.

Colony erect, branching, cylindrical. Autozooids in whorls of four, elongate, convex, separated by indistinct grooves; commonly 1.0 × 0.5 mm. Frontal wall finely granular, with fine longitudinal grooves and wrinkles, thickening in later ontogeny and becoming quite smooth; marginal pores few, indistinct. Primary orifice orbicular, as wide as long, with broad, flat condyles defining a narrow, U-shaped sinus. Peristome deep, developing rapidly and hiding orifice, enclosing a single medio-proximal avicularium, with triangular rostrum acute to frontal plane and proximally directed. Peristome rim distinctly notched on either side of avicularium. Ovicell prominent in early ontogeny but soon immersed and obscured. In late ontogeny the colony surface is quite smooth, the orifice and avicularium become deeply immersed and the resulting secondary orifice has a characteristic horse-shoe shape.

This inconspicuous species is known only from Waters' (1904) 'Belgica' specimens, from the Bellingshausen Sea, and from a single colony collected in the Ross Sea.

PHIDOLOPORIDAE Gabb and Horn, 1862

Colony encrusting; or erect, branching or reticulate. Autozooid frontal wall with few marginal pores. Primary orifice sinuate, or lepralioid, typically with a finely beaded or denticulate distal margin; condyles usually conspicuous.

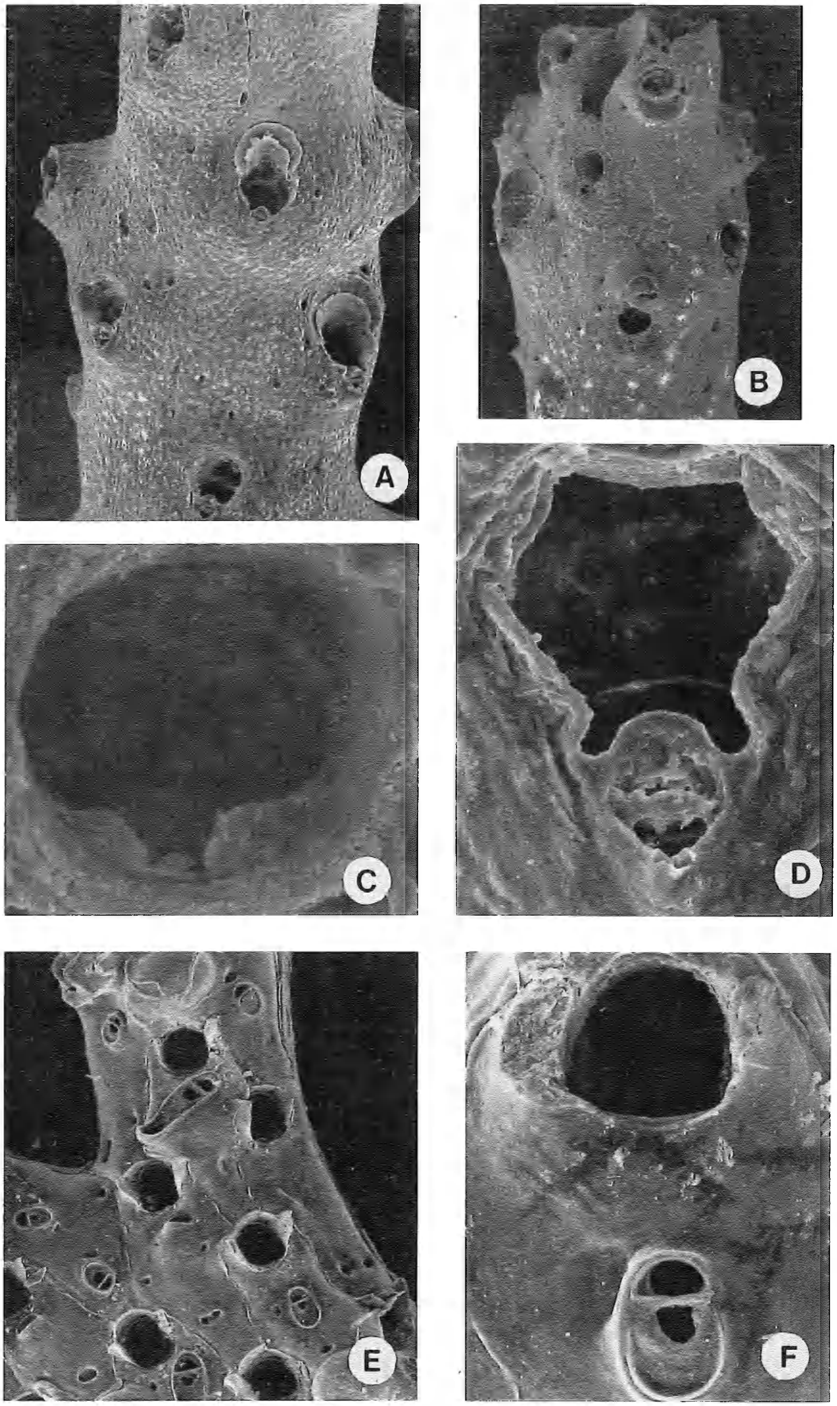

Fig. 182. A–D. *Spigaleos horneroides*. Terra Nova Stn. 316, Ross Sea. A. Portion of a branch; ×40. B. Branch tip, with ovicells; ×30. C. Primary orifice; ×300. D. Peristome and avicularium; ×255. E, F. *Reteporella antarctica*. Ross Sea. E. Portion of a colony, with ovicell, and characteristic avicularia; ×40. F. Primary orifice and avicularium; ×170.

Oral spines present. Avicularia adventitious, polymorphic, and/or vicarious. Ovicell hyperstomial, prominent, not closed by autozooid operculum; frequently fissured, or widely open frontally, sometimes with a labellum, but imperforate.

The Antarctic phidoloporids are individually distinctive, yet sufficiently similar to be accommodated within a single genus. Within this group of species the primary orifice varies in shape from transversely oval to bell-shaped; the rim of the anter is beaded and condyles are generally large and obvious. Oral spines are present in some species, missing in others, and the peristome may consist simply of projecting lateral flaps, or a prominent proximal lip, or may completely enclose the primary orifice and display a proximal fissure which closes distally to define a small pore. In all but one species the ovicell bears a longitudinal median fissure. Canu and Bassler (1917) introduced *Hippellozoon* for *Retepora novaezelandiae* Waters, and subsequently (Canu and Bassler 1920) assigned three of Waters' (1904) Antarctic *Retepora* species to this new genus without comment or discussion.

H. novaezelandiae is characterized by a more or less cleithridiate primary orifice, a peristome with paired symmetrical processes that define a medio-proximal pseudosinus, and an ovicell with a widely arched aperture and no frontal fissure. It is known only from New Zealand seas, and from Miocene deposits of New Zealand (Gordon 1989a). None of the Antarctic species conforms with the diagnosis of *Hippellozoon*, as defined by its type species, and all are here assigned to *Reteporella* Busk, 1884 (= *Sertella* Jullien *in* Jullien and Calvet 1903). *R. erugata* possesses a short, broad ovicell, with an arched aperture, but its frontal surface bears a small foramen, which closes in later ontogeny, and its oval orifice and asymmetrically developed peristome also suggest an affinity with the other species described here rather than with *Hippellozoon novaezelandiae.*

Dakaria vicariata, described by Liu and Hu (1991), seems to be a juvenile colony of a phidoloporid, but the authors' account is so poor that the species' identity will only be resolved by examination of a larger selection of specimens. The two species of '*Sertella*' introduced by the same authors also require re-examination.

Reteporella Busk, 1884

Colony erect, branching; typically reticulate, with the branches (trabeculae) fusing at regular intervals, leaving elongate spaces (fenestrulae) between. In a minority of species the trabeculae do not fuse, and form at the most, infrequent anastomoses. Colony architecture thus tree-like, or a reticulate cup, or with fenestrate sheets folded and anastomosing to develop complex three-dimensional structures. Autozooids in alternating longitudinal series on the defined frontal surface of the colony; basal surface consisting of kenozooids bounded by prominent sutures (vibices) and bearing adventitious avicularia, or rarely consisting of a second sheet of autozooids. Frontal wall of autozooids imperforate except for a few widely spaced marginal pores. Primary orifice oval or bell-shaped, the proximal border concave below pronounced condyles. Oral spines present or absent. Peristome variously developed, typically asymmetrical proximally, with a prominent lip, and often with a slit or fissure which partly closes to define a labial pore. Adventitious avicularia polymorphic, often numerous: peristomial, suboral and frontal in position. Enlarged avicularia (? vicarious/interzooidal) present in most species. Ovicell hyperstomial, prominent, not closed by autozooid operculum, with a variously developed longitudinal frontal fissure, the aperture sometimes overhung by a short labellum. Mural septula present.

Type species: *Reteporella flabellata* Busk, 1884.

Gordon (1989a) argued that the more familiar *Sertella* Jullien *in* Jullien and Calvet, 1903 should be regarded as a junior synonym of *Reteporella* Busk, 1884, which had been introduced for two non-reticulate, branching species collected by the *Challenger* Expedition.

Key to Antarctic species

1. Primary orifice longer than wide 2
   Primary orifice transversely oval, with width exceeding length 5
2. Primary orifice broadest proximally, appearing bell-shaped. Peristome consisting of projecting lateral flaps only, the orifice clearly seen in frontal view. Avicularia normal to frontal plane; oval, with varying orientation, or elongate triangular, transversely orientated ....*R. antarctica*
   Primary orifice broadest distally, or parallel-sided. Peristome consisting of a medio-proximal spike or asymmetrical proximal lip 3
3. Peristome consisting of a stout medio-proximal spike. Primary orifice broadest distally, with very large condyles, so appearing keyhole-shaped .... *R. hippocrepis*
   Peristome consisting of an asymmetrical, proximal lip 4
4. Primary orifice parallel-sided. Transversely orientated suboral avicularia present in many autozooids, with massive, hooked rostrum. Frontal calcification smooth ....*R. lepralioides*
   Primary orifice broadest distally. No suboral avicularia. Frontal calcification nodular .... *R. gelida*
5. Peristome consisting of a projecting, asymmetrically developed proximal lip 6
   Peristome complete proximally, incorporating an asymmetrical fissure or pore which becomes pronounced in later ontogeny 7
6. Frontal calcification smooth. Ovicell wider than long, with arched aperture and indistinct foramen. Avicularia various, including a massively enlarged type with hooked, triangular rostrum, perpendicular to frontal plane ....*R. erugata*
   Frontal calcification nodular. Ovicell longer than wide, with longitudinal frontal fissure. Avicularia sparse, various, most typically oval, proximal to peristome lip and acute to frontal plane ....*R. protecta*
7. Proximal lip of peristome with a round spiramen close to its edge; inner face of peristome distinctly tuberculate. Frontal avicularia sparse, slender triangular with abruptly hooked rostrum ....*R. parva*
   Proximal lip of peristome with spiramen distinct from its edge, linked by an elongate closed fissure. Not tuberculate on inner face 8
8. Two oral spines on newly developed autozooids. Ovicell as wide as long, without a labellum. Enlarged avicularia with acute, triangular rostra .... *R. frigida*
   Three oral spines on newly developed autozooids. Ovicell longer than wide, with a distinct labellum. Enlarged avicularia with elongate oval, distally hooded rostra........................... *R. longichila*

Reteporella antarctica (Waters) Fig. 182E,F

Retepora antarctica Waters 1904: 80, pl.6, figs.1a–k
Retepora antarctica: Livingstone 1928: 69
Sertella lepralioides: Hayward and Taylor 1984: 91, fig.8B.

Colony robust, heavily calcified, formed from folded, anastomosed, reticulate sheets; maximum size and architecture, unknown, but exceeding 70 mm height. Fenestrulae broadly oval, commonly 1.0–1.5 mm long; trabeculae consisting of three to six autozooid series. Autozooids 0.6–0.8 × about 0.3 mm, convex, separated by raised sutures which remain distinct in late ontogeny;

frontal calcification initially smooth, later finely nodular, with two or three conspicuous marginal pores. Primary orifice widest proximally, appearing distinctly bell-shaped; proximal border gently concave, distal rim finely denticulate, condyles rounded and prominent. No oral spines. Peristome developed as projecting lateral flaps only, the primary orifice remaining distinct in frontal view. One or more frontal adventitious avicularia present on each autozooid: most often oval, 0.15 mm long, with stout crossbar and extensive palate, but no columella, normal to frontal plane or, rarely, acute, and proximally directed; some autozooids with an elongated triangular avicularium, its rostrum normal to frontal plane, orientated transversely and directed obliquely proximally. Ovicell short, oval, broadest distally, with a narrow, indistinct frontal fissure, lacking a labellum. Basal surface of colony granular, with conspicuous sutures; with numerous short, oval or scaphoid avicularia. Elongate triangular avicularia, identical to those occurring on the frontal surface, occasionally present within the fenestrulae.

This endemic Antarctic species is presently known from Queen Mary Land, the Ross Sea, the Bellingshausen Sea and South Georgia.

Reteporella erugata Hayward — Fig. 183A–C

Reteporella erugata Hayward 1993: 299, Fig.5E,F

Colony forming a concave fan or cup shape, sometimes folded and fused to form complete tubes; definitive architecture and maximum size unknown, but exceeding 50 mm in height, and 40 mm spread. Fenestrulae broadly oval, commonly 1.5–2.0 × 0.75–1.0 mm; trabeculae with four to eight longitudinal autozooid series. Autozooids 0.5–0.75 × 0.3 mm, convex, separated by indistinct sutures. Frontal wall smooth, with two or three small, inconspicuous marginal pores. Primary orifice wider than long; proximal border shallowly concave, distal border coarsely denticulate; condyles very small, rounded, inconspicuous. No oral spines. Peristome developed simply as a projecting angular lobe on one side of the proximal edge of the orifice, which remains partly visible in frontal view. Avicularia numerous and varied: oval or triangular, 0.1–0.15 mm long, normal to frontal plane, with varying orientation, crossbar stout, without a columella, palate with only a small foramen. Gigantic avicularia frequent, with swollen cystid occupying whole of frontal surface of autozooid; rostrum triangular, sharply hooked distally, 0.3–0.35 mm long, almost perpendicular to frontal plane of colony; orientation varies so that the rostral plane may face distally, laterally or proximally. Ovicell broader than long, rather globular, with a widely open aperture, lacking a labellum, and with a short median fissure. Basal surface of colony finely granular, with distinct sutures, bearing numerous small, oval avicularia; one or more of the gigantic triangular avicularia occurs within each fenestrula.

This species has been collected from South Georgia, the Palmer Archipelago and the Ross Sea.

Reteporella frigida (Waters) — Fig. 183D,E

Retepora frigida Waters 1904: 82, pl.6, figs.4a–f
Retepora frigida: Livingstone 1928: 68
Sertella frigida: Moyano 1984a: 81; Hayward and Taylor 1984: 89, figs.11a–c.

Colony formed from folded, reticulate sheets, anastomosing frequently to develop a complex, three-dimensional coralliform structure. Maximum size unknown, but exceeding 150 mm high, with equivalent horizontal spread. Generally lightly calcified and rather brittle. Fenestrulae elongate oval, rather irregular, 1.5–2.0 × 0.5–1.0 mm; trabeculae consisting of four to eight autozooid

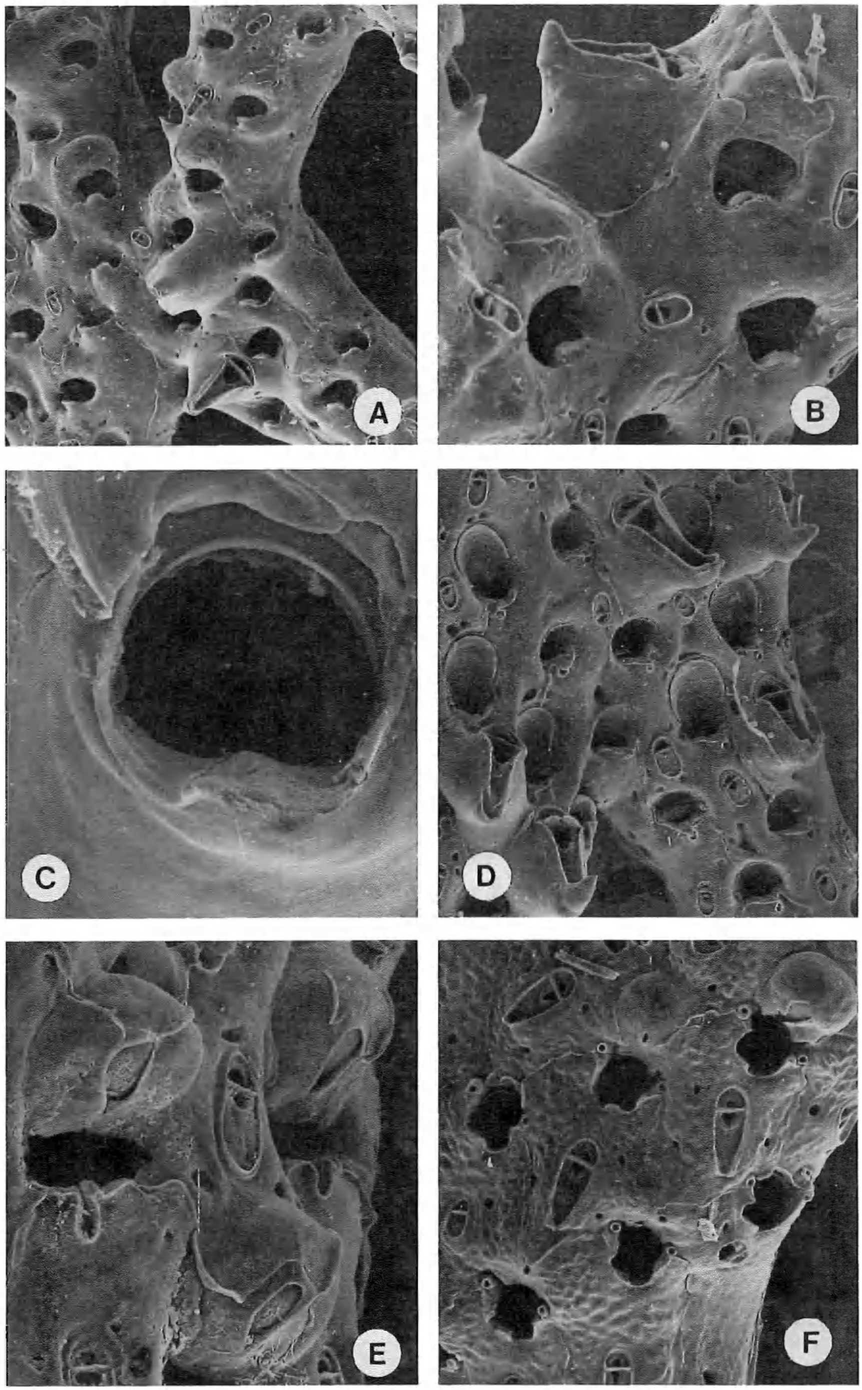

Fig. 183. A–C. *Reteporella erugata.* Discovery Stn. 160, Shag Rocks. A. Portion of colony; ×25. B. Ovicells, and an enlarged avicularium; ×50. C. Primary orifice; ×195. D, E. *Reteporella frigida.* Ross Sea. D. Part of a colony, with large and small avicularia; ×40. E. Ovicelled autozooids; ×90. F. *Reteporella gelida.* Terra Nova Stn. 316, Ross Sea; with ovicells and characteristic avicularia; ×55.

series. Autozooids 0.5–0.7 × about 0.25 mm, convex; separated by indistinct sutures, clearly visible only at the growing edge. Frontal wall smoothly calcified, with two or three large, conspicuous marginal pores. Primary orifice clearly visible only at growing edge, becoming deeply immersed early in ontogeny; broader than long, almost quadrilateral, proximal edge more or less straight, distal edge finely denticulate, condyles indistinct. Peristome developed proximally as a folded, reflected lip, with a rounded, eccentrically placed notch which closes distally to form a pseudospiramen. A stout lateral oral spine protrudes on each side. Avicularia numerous, one or more present on the frontal wall of each autozooid; most frequently elongate oval, 0.1–0.25 mm long, with stout crossbar, lacking a columella, and an extensive palate, normal to frontal plane and proximally directed. Many autozooids additionally with a grossly enlarged avicularium immediately proximal to peristome, with a slender triangular rostrum, 0.5 mm long, sharply hooked at its tip, projecting at an acute angle to the frontal plane. Occasionally, these enlarged avicularia may be orientated so that the rostral plane faces obliquely laterally, or even proximally. Ovicell about as wide as long, flattened frontally, with a short, rounded median fissure, but without a labellum; not very conspicuous, and becoming immersed and obscured in later ontogeny. Basal surface of colony with pronounced sutures, and numerous oval avicularia of variable size; an enlarged avicularium, with hooked, triangular mandible may occur within each fenestrula, most usually located within the proximal axil.

This species develops the largest colonies seen in any Antarctic phidoloporid. It appears to be widespread and common in Antarctica, having been reported from numerous localities from the South Shetlands, the Palmer Archipelago and the Bellingshausen Sea, to the Ross Sea.

Reteporella gelida (Waters) Figs. 183F, 184A,B

Retepora gelida Waters 1904: 84, pl.6, figs.7a–d
Retepora gelida: Livingstone 1928: 70
Hippellozoon gelidum: Moyano 1966a: 118
Sertella protecta: Hayward and Taylor 1984: 91, figs.7c, 11d–f.

Colony robust, forming a shallow cup or fan shape, the growing edges undulated but not folded or anastomosed; up to 30–40 mm high, with a horizontal spread of 60–70 mm. Fenestrulae 1.0–1.5 × about 0.75 mm; trabeculae comprising three to six longitudinal autozooid series. Autozooids 0.5–0.6 × about 0.25 mm, convex, separated by narrow sutures. Frontal wall finely nodular, with two or three large marginal pores. Primary orifice longer than wide, broadest distally; proximal border shallowly concave; distal border with coarse denticulation; condyles rounded, large and conspicuous. A single long, slender spine present on each side of orifice. Peristome low and thin, variably developed, typically consisting of a short tapered, eccentrically placed lobe on the proximal side of the orifice, and a few smaller lobes laterally and distally. Avicularia numerous; oval, 0.1–0.15 mm, or elongate triangular, up to 0.3 mm; both types normal to frontal plane, with thick crossbar, lacking a columella, and only a small, rounded palatal foramen; orientation varying, but the large triangular type is most often directed obliquely proximally. Ovicell globose, broadest distally, with a slender median fissure and a well developed labellum; initially prominent, but later immersed and obscured. Basal surface of colony nodular, with prominent sutures and numerous oval and elongate triangular avicularia; both types occur within the fenestrulae.

This species occurs in the Palmer Archipelago and the Bellingshausen Sea, and is especially common in the Ross Sea.

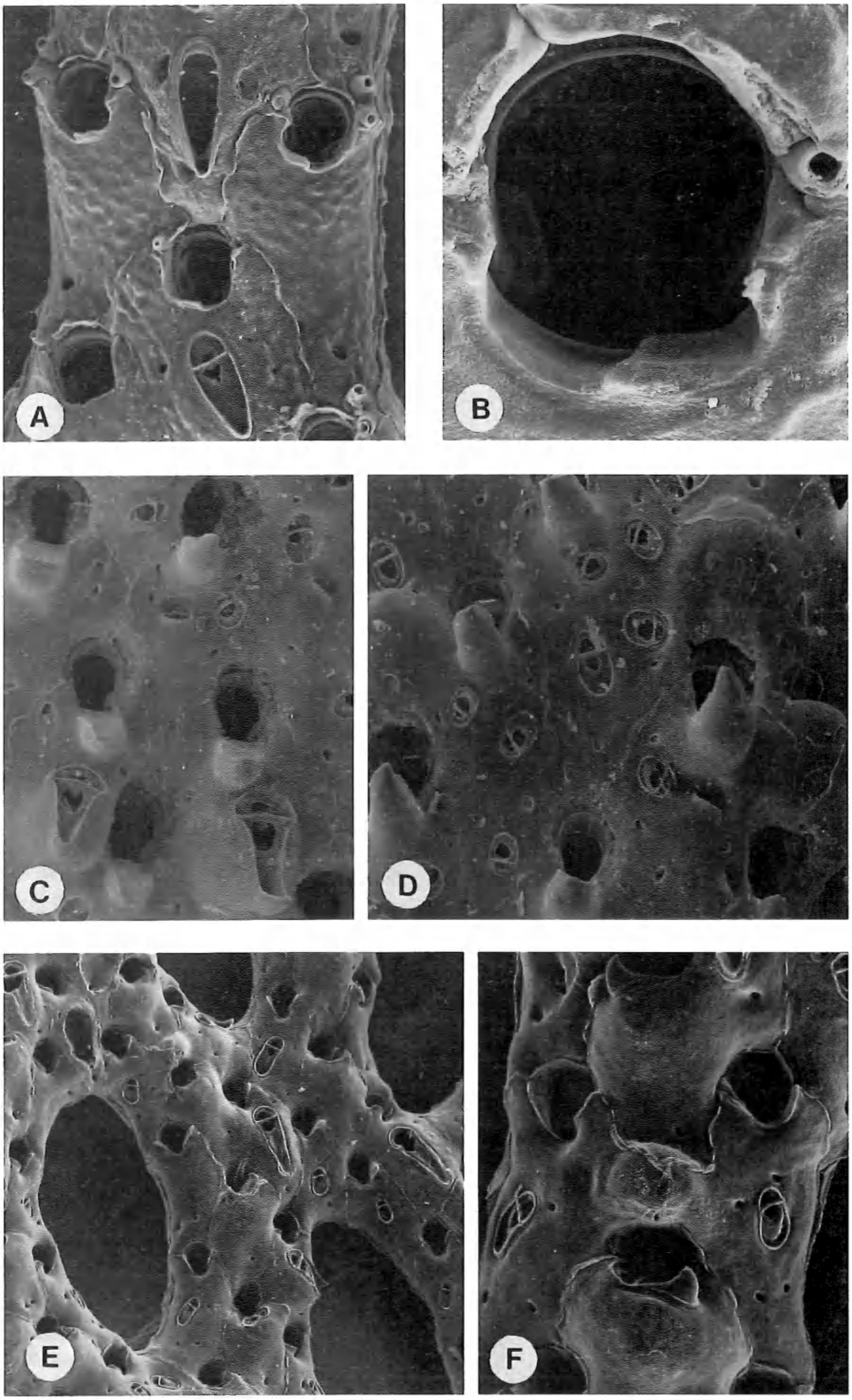

Fig. 184. A, B. *Reteporella gelida.* Terra Nova Stn. 136, Ross Sea. A. Autozooids close to growing tip; ×80. B. Primary orifice; ×325. C, D. *Reteporella hippocrepis.* Ross Sea. C. Autozooids with characteristic suboral spikes, and frontal avicularia; ×50. D. Ovicelled autozooids; ×55. E, F. *Reteporella lepralioides.* Ross Sea. E. Part of a colony; ×23. F. Detail showing ovicell and transverse suboral avicularium; ×55.

Reteporella hippocrepis (Waters) Fig. 184C,D

Retepora hippocrepis Waters 1904: 84, pl.6, figs.10a–g
Retepora hippocrepis: Livingstone 1928: 70
Hippellozoon hippocrepis: Moyano 1966a: 118
Sertella hippocrepis: Hayward and Taylor 1984: 88, figs.7a,b.

Colony lightly calcified, brittle; formed from irregularly folded reticulate sheets, occasionally anastomosed, developing a compact three-dimensional structure. Maximum size not known, but exceeding 70 mm high, with equivalent spread. Fenestrulae elongate oval, 1.5–2.5 × 0.5–1.0 mm; trabeculae slender in comparison to fenestrulae, consisting of three to six autozooid series. Autozooids 0.7–0.8 × about 0.2 mm, flat or slightly convex, separated by indistinct sutures. Frontal wall smoothly calcified, with a few small marginal pores. Primary orifice clearly visible in frontal view, longer than wide, broadest distally, with prominent condyles giving it a keyhole-shaped outline; proximal border slightly concave, distal border indistinctly denticulate. No oral spines. Peristome scarcely developed distally or laterally, but produced medio-proximally as a stout spike, up to 0.5 mm long, with a flattened distal face, perpendicular to the frontal plane. Avicularia numerous, usually two or more on the frontal wall of each autozooid; most frequently short, oval, 0.1 mm long, with stout crossbar lacking a columella, normal or acute to frontal plane, with varying orientation. Larger avicularia often common, with narrowly triangular, distally hooked rostrum, up to 0.4 mm long, acute to frontal plane, proximally or proximo-laterally directed. Ovicell elongate oval, with a short frontal fissure but no labellum; initially prominent, but later immersed and inconspicuous. Basal surface of colony finely granular, with thickened sutures and numerous oval avicularia. A large, triangular avicularium often occurs within the proximal edge of each fenestrula.

This distinctive species is immediately recognized by its pronounced peristomial spikes, which are sufficiently large to be seen with the unaided eye. It has been reported from numerous Antarctic localities and seems to be especially common in the Ross Sea.

Reteporella lepralioides (Waters) Fig. 184E,F

Retepora lepralioides Waters 1904: 83, pl.6, figs.3a–d
Retepora lepralioides: Livingstone 1928: 70
not *Sertella lepralioides*: Hayward and Taylor 1984: 91 (= *R. antarctica*).

Colony brittle, delicate, formed from folded, reticulate sheets, anastomosing frequently and developing closely grouped tubular growths; colony architecture not known, but probably a compact bun shape not exceeding 30 mm height. Fenestrulae elongate oval, rather irregular, 1.0–2.0 mm long; trabeculae consisting of three to six autozooid series. Autozooids 0.6–0.8 × about 0.3 mm, gently convex, separated by indistinct sutures which become even less apparent in late ontogeny. Frontal wall smooth with few, scattered marginal pores. Primary orifice longer than wide, almost parallel-sided; proximal rim slightly concave, distal rim with coarse denticulation; condyles conspicuous, elongate, proximally rounded. Two widely spaced, distal oral spines present in early ontogeny only. Peristome developed as a complete, low, slightly flared rim, notched medio-proximally, but partly hiding the orifice in frontal view. Each autozooid with one or more adventitious avicularia frontally: most frequently oval, 0.1–0.15 mm long, with stout crossbar, lacking columella, and an extensive palate, normal to frontal plane and proximally directed; some autozooids with a massively enlarged avicularium immediately proximal to peristome, with abruptly hooked, narrowly triangular rostrum, 0.25 mm long, almost perpendicular to frontal plane. Ovicell globose, conspicuous, slightly flattened frontally, with a small median foramen and a short labellum. Basal surface of colony smooth, with pronounced sutures, typically bearing numerous oval avicularia identical to those on frontal surface. Most fenestrulae with a broadly triangular, massively hooked avicularium in proximal axis.

Sertella lepralioides is known only from the Bellingshausen Sea, and from a few localities in the Ross Sea.

Reteporella longichila Hayward — Fig. 185A–C

Reteporella longichila Hayward 1993: 297, Fig.5C,D

Colony forming an open cup- or fan-shape, often irregularly folded but with few anastomoses; generally irregularly planar, with a spread of at least 50 mm. Rather large-meshed: fenestrulae 2.0–2.5 × 1.0 mm, irregularly oval; trabeculae commonly 0.5 mm wide, comprising three to five longitudinal autozooid series. Autozooids 0.5–0.7 × about 0.3 mm, slightly convex, separated by indistinct sutures. Frontal calcification finely granular, with three or four large, conspicuous marginal pores. Primary orifice clearly visible only at the growing edge, obscured in early ontogeny by a deep, proximal peristome; wider than long, proximal border shallowly concave, distal border with a short series of coarse denticulations medially; condyles indistinct. Three oral spines present, one distal, two lateral, all of which may persist in late ontogeny; up to 0.5 mm long, bluntly pointed. Proximal peristome deep, developing a rounded notch in early development which closes over to form a pseudospiramen, connected to the medially peaked peristome rim by a laterally curved fissure. Avicularia numerous, oval, normal to frontal plane, with stout crossbar, lacking a columella, and an extensive palate, most frequently 0.1–0.15 mm long; large avicularia common, up to 0.4 mm long, similar to the smaller type but with a thickened columella on the crossbar, and with the distal end of the rostrum cupped. Ovicell inconspicuous; elongate oval, with a short median fissure and a pronounced labellum. Basal surface of colony with thickened sutures, and bearing numerous oval avicularia; the larger avicularia may occur along the inner edges of the fenestrulae.

This species is presently known from a single locality in the Palmer Archipelago, and from six stations in the Ross Sea.

Reteporella parva Hayward — Fig. 185D,E

Reteporella parva Hayward 1993: 300, Fig.6A,B

Colony a small, deep, irregular cup; maximum size not known, but exceeding 10 mm high, with spread of 15 mm. Small meshed: fenestrulae oval, 1.0–1.5 × 0.5–0.75 mm; trabeculae 0.25–0.5 mm wide, comprising two to four longitudinal autozooid series. Autozooids 0.6–0.75 × 0.25–0.3 mm, convex, separated by indistinct sutures. Frontal calcification smooth, with two to four large, conspicuous marginal pores. Primary orifice wider than long, commonly 0.08 × 0.12 mm; proximal edge shallowly concave, distal edge coarsely denticulate; condyles small and indistinct. One distal and two lateral oral spines present, the lateral pair persisting in late ontogeny, projecting above peristome rim. Peristome deep, thick, with an oval, eccentrically placed pseudospiramen close to the rim, linked to it by an open fissure; distal edge of peristome distinctly tuberculate on its inner face. Avicularia infrequent, 0.35 mm long, triangular, with thick crossbar bearing a knob-like columella, palatal foramen large and round, rostrum abruptly hooked distally; orientation variable, normal or acute to frontal plane, the rostral plane facing distally, laterally or proximally; shorter, oval avicularia occur sparingly on the basal surface of the colony.

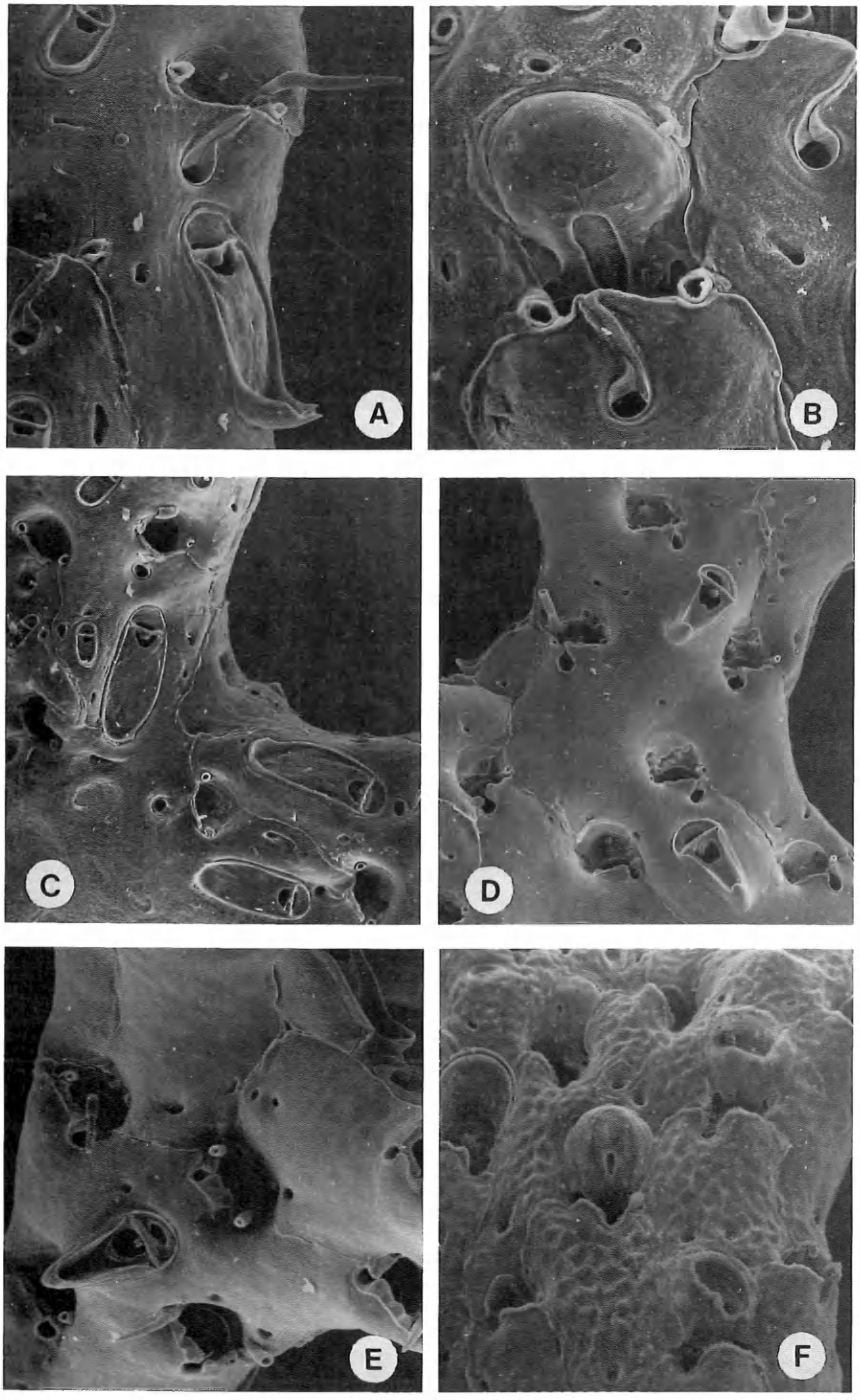

Fig. 185. A–C. *Reteporella longichila.* NZOI Stn. E176, Ross Sea. A. Autozooids and frontal avicularia; ×80. B. Ovicelled autozooid; ×120. C. Autozooids and avicularia in later ontogeny; ×50. D, E. *Reteporella parva.* Discovery Stn. 1652, Ross Sea. D. Portion of colony; ×45. E. Oblique view showing peristome structure; ×60. F. *Reteporella protecta.* Discovery Stn. 42, South Georgia; ×60.

R. parva is presently known from a single locality in the Ross Sea.

Reteporella protecta (Waters) Figs. 185F, 186A

Retepora protecta Waters 1904: 81, pl.6, figs.2a–e
not *Sertella protecta*: Hayward and Taylor 1984: 91 (= *R. gelida*).

Colony developing a delicate cup-shape, with irregularly folded rim, remaining open and not forming anastomoses; up to 20 mm high, with a horizontal spread of 30 mm, perhaps larger. Fenestrulae 0.75–1.5 × about 0.5 mm; trabeculae comprising three to eight longitudinal autozooid series. Autozooids 0.45–0.5 × about 0.25 mm, convex, separated by indistinct sutures. Frontal wall coarsely nodular, with three to five large marginal pores. Primary orifice slightly wider than long; proximal border deeply concave, distal border finely denticulate; condyles bluntly rounded, conspicuous. One mid-distal and two disto-lateral oral spines. Peristome consisting of a single, prominent proximal lobe, with straight edge, adjacent to a deep, rounded notch.

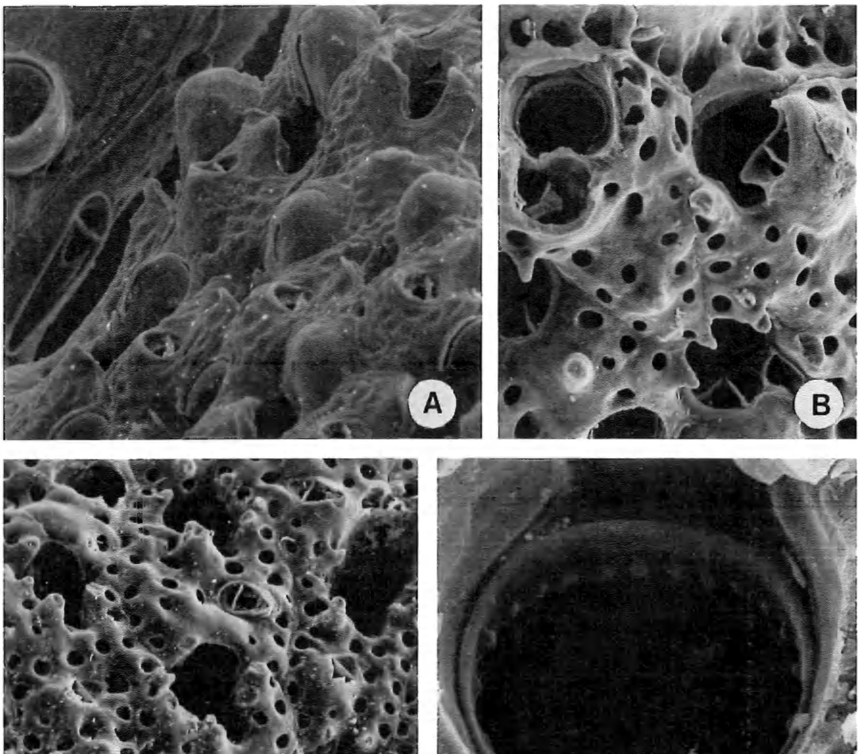

Fig. 186. A. *Reteporella protecta.* Discovery Stn. 42, South Georgia; ovicelled autozooids; ×80. B–D. *Rhynchozoon fistulosum.* Discovery Stn. 153, South Georgia. B. Autozooids in early ontogeny; ×120. C. Autozooids in late ontogeny; ×90. D. Primary orifice; ×400.

Avicularia sparsely developed on frontal surface of colony, 0.05–0.1 mm long, broadly oval, supporting a semicircular mandible; typically situated proximal to peristome, acute to frontal plane. Larger avicularia, with slender triangular rostrum, 0.2–0.25 mm long, sporadically present on older regions of colony. Ovicell elongate oval, with short frontal fissure, and a relatively long labellum; conspicuous only when newly developed, rapidly immersed and hidden. Basal surface of colony finely granular, with conspicuous sutures, bearing numerous oval and triangular avicularia; both types occur also within the fenestrulae.

This small species is presently known from South Georgia, the South Shetland Isles, the Palmer Archipelago and the Bellingshausen Sea.

Rhynchozoon Hincks, 1895

Colony encrusting, sheet-like or nodular, often massive. Autozooid frontal wall with marginal pores only. Primary orifice with denticulate or beaded distal margin, well marked condyles, and concave or sinuate proximal margin. Oral spines present or absent. Peristome well developed, typically with an asymmetrical proximal notch, a suboral avicularium and a stout uncinate process projecting over the orifice from the avicularian cystid; often with thickened mucrones around its edge in later ontogeny. Avicularia adventitious, polymorphic, often numerous; enlarged avicularia (? vicarious/interzooidal) characteristic. Ovicell hyperstomial, prominent, not closed by autozooid operculum; imperforate, but with an uncovered area of entooecium frontally, frequently with a labellum. Basal pore chambers present.

Type species: *Lepralia bispinosa* Johnston, 1847.

Rhynchozoon fistulosum Hayward — Fig. 186B–D

Rhynchozoon fistulosum Hayward 1993: 302, Fig.6C–E

Colony encrusting, multilaminar. Autozooids small, 0.4 × 0.25 mm, closely packed, convex, with boundaries visible only at the growing edge. Primary orifice slightly wider than long, 0.08 × 0.1 mm; distal edge finely denticulate, proximal edge with a shallow, U-shaped sinus between prominent, knob-like condyles. A single lateral-suboral avicularium, 0.1 mm long, rostrum hooked at tip, mandible elongate triangular; proximally, the avicularian cystid develops a stout tooth (uncinate process) projecting above the orifice. Peristome rim deeply notched adjacent to the avicularium; in later ontogeny a stout umbo, rarely a second avicularium, develops on the other side of the notch, and others may develop elsewhere on the peristome rim. Frontal calcification smooth, with a single series of large, conspicuous marginal pores which become broader and deeper as calcification thickens, so that the frontal wall appears uniformly porous. A single frontal adventitious avicularium present on most autozooids, 0.1 mm long, diamond-shaped, with elongate triangular mandible, laterally directed. Ovicell deeply immersed, inconspicuous; orifice widely open, without a labellum.

R. fistulosum is known only from South Georgia, and at present represents the only occurrence of the genus in Antarctica and the Subantarctic south-west Atlantic.

LEKYTHOPORIDAE Levinsen, 1909

Colony erect, attached by an encrusting base. Autozooid with terminal primary orifice, with reversed orientation, the morphologically proximal sinus directed towards the branch axis, the distal anter directed frontally. All vertical calcified walls arise as cryptocystidean shields beneath an exterior hypostegal coelom. Adventitious and/or interzooidal avicularia present. Ovicell developed on frontal side of autozooid, thus apparently proximal but actually normally orientated with respect to orifice.

Turritigera Busk, 1884

Colony branching, often with anastomoses, in some species regularly fenestrate. Branches dichotomous, or originating from adventitious frontal buds, frequently in more than one plane. Autozooids in alternating longitudinal series. Frontal wall thickly calcified, with distinct marginal pores, developing as elongate slits as calcification thickens. Primary orifice with sinus. Peristome prominent, obscuring orifice, frequently tubular, with one to many small adventitious avicularia around its rim. Adventitious avicularia and larger interzooidal avicularia present elsewhere on colony. Ovicell spherical, imperforate, opening into peristome; becoming immersed by later ontogenetic thickening, but usually remaining distinct.

Type species: *Turritigera stellata* Busk, 1884.

Both the genus *Turritigera* and the family Lekythoporidae are limited to the southern hemisphere, often occurring in deep shelf habitats. Few are represented by more than a dozen or so museum specimens, and almost all described species are covered by Cook and Hayward (1983), Moyano (1985b) and Gordon (1989a). *T. stellata* is known from off Uruguay and from South Chile, while similar species are known from South Africa and Marion Island. A single species has been described from Antarctica.

Turritigera cribrata Hayward — Fig. 187

Turritigera stellata: Waters 1904: 76, pl.5, figs.3a–c, pl.8, fig.13
Turritigera cribrata Hayward 1993: 302, Figs.6F, 7A,B

Colony form variable, irregularly and sparsely branched, with occasional anastomoses, or with branches fusing more regularly to develop a reticulate structure; overall form dendritic, cup-shaped, or as a curved or twisted reticulate plate; exceeding 30 mm high, with equivalent spread. Branches form by simple dichotomy, and through adventitious budding of one or more autozooids at all levels on the colony. Autozooids in two to four alternating longitudinal series, thickly calcified, smooth surfaced, with individual boundaries indicated only by marginal pores; frontal dimensions 0.8–1.0 × 0.3–0.4 mm. Primary orifice only visible in developing autozooids at growing tips of branches; anter wider than long, with straight proximal border, sinus as wide as long, occupying about one-quarter total proximal width. Peristome deep, tubular, entirely obscuring primary orifice from early ontogeny; rim with a number of projecting, columnar avicularia, typically three in newly budded autozooids, increasing to six or more in later ontogeny, rostra triangular, 0.05–0.1 mm long. Identical avicularia occur elsewhere on frontal surface of autozooids in later ontogeny. Larger frontal avicularia occur sporadically, with broadly triangular rostrum, 0.2 mm long. Ovicell spherical, smooth, 0.4 mm wide; conspicuous in early ontogeny, later obscured by thickening calcification. In late ontogeny the peristome in a proportion of autozooids becomes completely occluded, often developing additional small, columnar avicularia.

Turritigera cribrata is known from South Georgia, the Bellingshausen Sea and the Ross Sea, and will probably prove to be widely distributed throughout Antarctica.

Orthoporidra Canu and Bassler, 1927

Colony erect, branching; with cylindrical or claviform branches, dividing dichotomously; attached by encrusting base. Autozooids budded axially and frontally; frontal calcification thick, with frontal pores (septula) marginal or scattered. Primary orifice with condyles, sinus present or absent. Peristome incorporat-

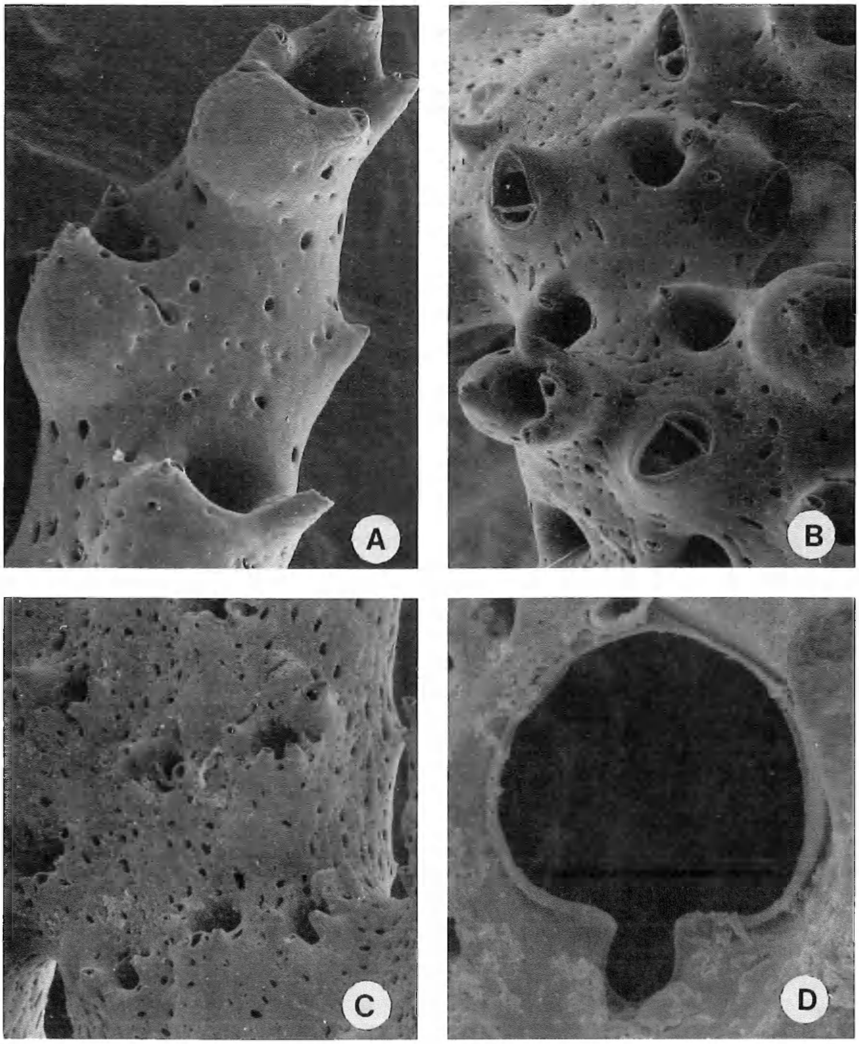

Fig. 187. *Turritigera cribrata.* A. Terra Nova Stn. 355, Ross Sea; ovicelled autozooids at a branch tip; ×65. B. NZOI Stn. A579, Ross Sea; part of colony, with large frontal avicularia; ×34. C. Discovery Stn. 474, South Georgia; autozooids in later ontogeny; ×35. D. Discovery Stn. 474; primary orifice; ×210.

ing a medio-proximal (topologically distal) avicularium, with a columnar cystid. Small adventitious avicularia abundant; large interzooidal avicularia, with spatulate mandible, sporadic. Ovicells imperforate, typically bearing small adventitious avicularia.

Type species: *Orthopora compacta* Waters, 1904.

Three species of this distinctive genus are known from Antarctica. A fourth, *O. petiolata* (Waters) has a magellanic distribution, with a single record from off South Africa, while *O. solida* (Busk) is known from a single station, at abyssal depth, SW of Tasmania. All species are described and figured by Cook and Hayward (1983) and Moyano (1985b).

Key to Antarctic species

1. Primary orifice with a straight or slightly convex proximal (topologically distal) border. Colony large, with thick branches exceeding 10 mm diameter .... *C. compacta*
   Primary orifice with a distinct sinus 2
2. Primary orifice as wide as long, sinus a narrow U-shape. Colony rarely larger than 10 mm, with short, cylindrical branches ....*O. brachyrhyncha*
   Primary orifice distinctly wider than long, with broad, rounded U-shaped sinus. Colony slender, up to 30 mm high ...... *O. stenorhyncha*

Orthoporidra compacta (Waters) Fig. 188A,B

Orthopora compacta Waters 1904: 75, pl.5, figs.4a–i
Cellepora setosa Thornely 1924: 17, fig.5; Livingstone 1928: 76, text figs.18–20, pl.3,8
Orthopora compacta: Redier 1965: 32
Orthoporidra compacta: Cook and Hayward 1983: 71, Figs.14g,21,22; Moyano 1985b: 112, text figs.2a,3a,f, pl.4, figs.4–9, pl.6, fig.8.

Colony robust, exceeding 50 mm in height, with equivalent horizontal spread; consisting of thick, cylindrical branches, broadening apically, dividing dichotomously at regular intervals, branching in several planes to give a three-dimensional form. Branches often more than 10 mm diameter. Autozooids large, convex, opening on all surfaces of branch; budding both axially and frontally, to give a multilamellar branch section, but with uniform orientation along branch axis; approximately 1.0 × 0.5 mm, but individual boundaries not always apparent. Calcification thick and smooth, with small pores around autozooid margins, around base of peristome, and scattered elsewhere. Primary orifice wider than long, the topologically distal edge almost straight, condyles rounded and inconspicuous; readily visible only in newly developed autozooids, rapidly obscured by the peristome. Peristomial avicularium prominent, columnar, commonly 1.0 mm long, cylindrical or broadened distally, the apical rostrum 0.4 mm long, elongate triangular, hooked at tip, distally directed. Tiny oval avicularia, 0.05 mm long, budded from pores on peristomial avicularium; similar avicularia often abundant on frontal surfaces of autozooids. Ovicell spherical, smooth, with a few marginal pores, which often bud small oval avicularia. Frontal calcification thickens in later ontogeny, and the basal parts of large colonies are less spiky than the distal branches, with autozooid orifices largely occluded and the large, triangular peristomial avicularia being practically flush with the surface. Small oval avicularia are very abundant; less frequently, a larger avicularium occurs, with random orientation, the mandible 0.35 mm long and broadly spatulate.

This is a common, endemic species widely distributed throughout Antarctic shelf seas. It ranges northwards along the Scotia Arc to the South Orkney Islands but does not seem to reach South Georgia.

Orthoporidra brachyrhyncha Moyano Fig. 188C,D

Orthoporidra brachyrhyncha Moyano 1985b: 116, text figs.2k,3c,h,l,p, pl.6, figs.1–7.

Colony slender, perhaps rarely exceeding 10 mm height, with cylindrical branches, 1–3 mm wide, branching dichotomously in several planes. Autozooids convex, small, visible frontal dimensions commonly 0.6 × 0.4 mm, with individual boundaries visible only in early ontogeny. Calcification thick and smooth, with few, indistinct pores, usually around the margins of the autozooid.

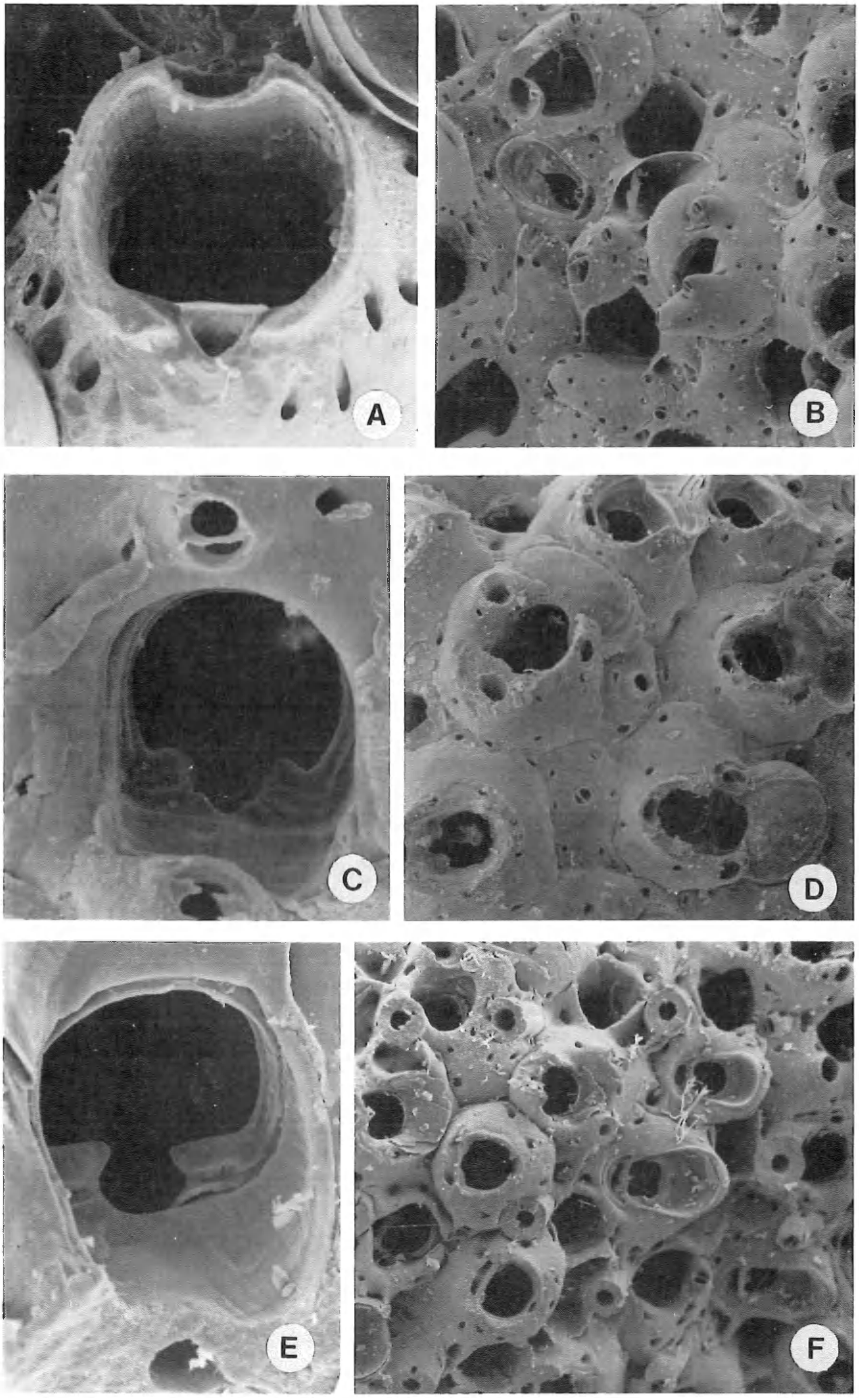

Fig. 188. A, B. *Orthoporidra compacta.* Ross Sea. A. Primary orifice; ×115. B. Autozooids, ovicells and avicularia; ×30. C, D. *Orthoporidra brachyrhyncha.* NZOI Stn. E217, Ross Sea. C. Primary orifice; ×150. D. Autozooids, ovicells and avicularia; ×40. E, F. *Orthoporidra stenorhyncha.* Discovery Stn. 175, South Shetlands. E. Primary orifice; ×220. F. Autozooids and avicularia; ×45.

Primary orifice as wide as long, the topologically distal edge notched medially, with broad, deep condyles defining a narrow, U-shaped sinus. Peristome low and thickened, not entirely obscuring primary orifice; peristomial avicularium short, columnar, with triangular, distally directed avicularium at apex; rostrum about 0.1 mm long, hooked at tip. Smaller oval avicularia, with rostrum 0.04–0.05 mm long, present elsewhere on peristome rim, on frontal surface of autozooids, and often abundant on basal areas of colony. A broadly spatulate avicularium occurs rarely, with randomly orientated rostrum, 0.4 mm long. Ovicell broader than long, flattened frontally, the aperture visible in frontal view.

Few specimens of this distinctive species have been collected and it is possible that its colony architecture is incompletely known. No specimen so far known exceeds 10 mm in height. At present *O. brachyrhyncha* is known only from Marguerite Bay, western Antarctica, and from the Ross Sea.

Orthoporidra stenorhyncha Moyano Fig. 188E,F

Orthoporidra stenorhyncha Moyano 1985b: 115, text figs.1d,h, 3d,g,k,n,o, pl.5, figs.1–9.

Colony developing a slender, branching form, 20–30 mm high; with cylindrical branches 2–3 mm wide, dividing dichotomously in several planes. Autozooids convex, small, visible frontal dimensions commonly 0.6 × 0.4 mm, with individual boundaries visible only at growing tips. Calcification thick and smooth, with few large, conspicuous pores around autozooid margins. Primary orifice wider than long, the topologically distal border shallowly concave medially, with broad, short condyles defining a rounded sinus equivalent to half proximal orifice width. Peristome low and thick, not entirely hiding primary orifice in frontal view; peristomial avicularium columnar, commonly 0.4 mm high, but up to 0.75 mm (Moyano 1985b), with triangular, distally directed avicularium; rostrum 0.07 mm long. Oval avicularia frequent, rostrum 0.05 mm long; larger avicularia also frequent, with spatulate rostrum, 0.3 mm long, deeply cupped distally. Ovicell spherical, smooth, usually bearing a number of small, oval avicularia.

This species was described by Moyano (1985b) from Marguerite Bay. Additional specimens have since been collected from the South Shetlands and from the Ross Sea, suggesting it has a wide distribution within Antarctica.

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TAXONOMIC INDEX

Correct names of genera and species are italicized.