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The Marine Fauna of New Zealand:

Stylasteridae (Cnidaria: Hydroida)

Stephen D. Cairns

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FRONTISPIECE. Top, *Errina dendyi* Hickson, NZOI Stn S235, 22 m, Long Sound, Preservation Inlet, Fiordland, with brachiopods (*Liothyrella neozelanica* Thomson). Bottom, *Errina novaezelandiae* Hickson, NZOI Stn M764, 28 m, Milford Sound, Fiordland. [Photos: Top, R.J. Singleton; Bottom, P.J. Hill]

[COVER PHOTO. *Stylaster brunneus* Boschma, Norfolk Island. [Photo: S.D. Cairns]]

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by

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Smithsonian Institution, Washington, D.C.

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ABSTRACT

Sixty-two species of stylasterids are known from the New Zealand region, consisting of 59 Recent and three exclusively fossil species, making it the most diverse stylasterid fauna known. Fifty-eight of the 59 Recent (except *Distichopora violacea*) and one of the fossil species are described and illustrated herein. Only 24 stylasterid species had previously been reported from the New Zealand area. Thus, 38 species are new records for the region, including 34 new species and 2 new genera. Two taxa (facies) are elevated to species rank : *Errina cooki* and *E. dendyi*. This revision is based on 427 lots of new material from 225 stations, primarily collected by NZOI vessels and, to a much lesser extent, by the USNS *Eltanin*. Several new skeletal descriptive terms are introduced, including : types of opercular articulation, platelet polarity, pseudotabulae, dactyloridges, and radial-imbricate coenosteal texture.

The New Zealand stylasterids are predominantly a deepwater (lower shelf and slope to 2355 m) group, 47 (80%) of the 59 Recent species not yet known outside the region. Seven patterns of species distribution are discerned: widespread, disjunct, Cookian, Aucklandian, Antipodean, Subantarctic, and primarily tropical. Few species occur directly off the coasts of New Zealand, most preferring the nonterrigenous, calcareous substrates characteristic of the surrounding submarine ridges, seamounts, and lesser islands. Consequently, the Aucklandian Province (including Three Kings, southern Norfolk, and Kermadec Ridges) is the most common distribution with 39 species occurring in this province, 23 of them characteristic of it. Five species (31% of total known from the Kermadecs) are endemic to the Kermadec Islands, supporting a designation as a separate province for these islands. The Antipodean fauna is closely related to that of the north Macquarie Ridge and is, in general, more closely related to the Subantarctic fauna than that of New Zealand. The 13 species occurring off Macquarie Island show a mixture of New Zealand, Subantarctic, and endemic elements.

Keywords: Stylasteridae, calcified hydroids, classification, distribution, new species, new genera, marine fauna, New Zealand, zoogeography, biodiversity.

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INTRODUCTION

Stylasterids are common in the New Zealand region but not often found directly off the coasts of North and South Islands, clearly preferring the deep shelf and slope depths of the surrounding submarine ridges, seamounts, and smaller islands. This explains why the first record of a stylasterid from New Zealand waters resulted from a deep-sea dredge of the *Gazelle* at a relatively late date (Studer 1878). It is becoming increasingly apparent that stylasterids prefer open oceanic habitats and are rarely found off large land masses. The numerous ridges, seamounts, plateaus, and small islands that surround New Zealand make an ideal environment for stylasterids and support the highest diversity of stylasterid species yet known.

Once considered as the hydrozoan order Stylasterina, or lumped with the Milleporidae as the Hydrocorallia, the Stylasteridae is more accurately considered as one of five families in the athecate hydroid superfamily Hydractinioidea (*see* Bouillon 1985). Petersen (1979) considered the Hydractiniidae to be its sister family, the Milleporidae being only a distant relative. Cairns (1984, 1987b) discussed the relationships among the genera. Including this study, there are approximately 258 valid species and 25 genera of stylasterids (Cairns 1991b), consisting of 234 Recent and 24 exclusively fossil species.

Stylasterids are ubiquitous marine invertebrates, known from the Arctic Circle to continental Antarctica at depths of 0–2789 m, but clearly are more abundant between 200 and 1200 m. They are exclusively sessile, benthic, colonial organisms that require a hard substrate for original settlement and subsequent anchorage. They also all have a calcareous skeleton, a synapomorphy for the family, that usually consists of aragonite but in some genera is calcite (Lowenstam 1964). The majority of species have white coralla, but many species are brightly pigmented, the colors orange, red, and pink being most common in the New Zealand species.

Previous Studies

The earliest record of a stylasterid from the New Zealand region was a tentative identification of *Stylaster sanguineus* Milne Edwards and Haime, 1850 by Pourtalès (1871: 83), who reported three specimens from off Florida and one from "New Zealand." The New Zealand record was reiterated by Moseley 1881 : 86), Lendenfeld (1885: 615), Hutton (1904:38), and Boschma (1953, 1957, 1964b: 184). Pourtalès' Floridian specimens were figured in 1880 (Pourtalès *in* Agassiz 1880 : pl. 3, figs 18–24) and subsequently reidentified as *Stylaster filogranus* Pourtalès, 1871 by Cairns (1986a) based on these illustrations. The four specimens of *S. sanguineus* reported by Pourtalès (1871, 1880) from Florida and New Zealand were recently examined on loan from the Museum of Comparative Zoology and all were found to be typical *S. sanguineus*. Although *S. sanguineus* is widespread in the western Pacific (Boschma 1964b), it is definitely not known from the Atlantic Ocean (Cairns 1986a), which casts doubt on the nominal localities of all four of Pourtalès' specimens. Joined with the fact that specimens of *Stylaster sanguineus* have not been subsequently reported from the New Zealand region, its occurrence there is considered to be unlikely.

The first unequivocal record of stylasterids from the New Zealand region was that of Studer (1878) of four deep-water species collected from two stations of the S.M.S. *Gazelle* off North Cape, North Island. Studer reported *Cryptohelia pudica* Milne Edwards and Haime, 1849 (= *Crypthelia studeri* n.sp.), *Stylaster laevis* n.sp. (= *Conopora laevis*), *Stylaster verrucosus* n.sp. (= *Conopora verrucosa*), and *Stylaster obliquus* n. sp. (= *Conopora laevis*). Studer's specimens are deposited at the Zoologisches Museum, Berlin.

In a postscript to a larger paper, Moseley (1879: 503) described *Conopora tenuis*, n.gen. n.sp., from a *Challenger* station in the Kermadec Islands; the species was later considered to be a junior synonym of *Conopora laevis* (Studer 1878).

Tenison-Woods (1880) described the fossil species *Sporadopora marginata* from the Chatham Islands, the age estimated to be Upper Eocene by Boschma (1953) and later revised to Late Pliocene (*see Remarks* on *Sporadopora micropora*). This specimen was recently rediscovered in the bryozoan collection of the New Zealand Geological Survey (DSIR Geology and Geophysics).

In reporting the stylasterids collected on the *Challenger* expedition, Moseley (1881) listed six species from two deep-water stations (*Challenger* Stns 170, 171) off the Kermadec Islands: *Stylaster laevis* Studer, 1878 (= *Conopora verrucosa* (Studer, 1878)); *Stylaster erubescens* Pourtalès, 1868 (= *Conopora verrucosa*); *Stylaster gracilis* Milne Edwards and Haime,

1850; *Stenohelia profunda* Moseley, 1881 (listed as *Stenohelia* sp. cf. *S. profunda* in this paper); *Conopora tenuis* Moseley, 1879 (= *Conopora laevis);* and *Cryptohelia pudia* Milne Edwards and Haime, 1849 (= *C. cymas* in part, *Challenger* Stn 171). Due to synonymy with *C. verrucosa,* of the six species reported, only five are valid, two of which were new records for the New Zealand region. All *Challenger* specimens are deposited at The Natural History Museum, London (British Museum (Natural History)).

Hutton (1904), in his index of the New Zealand fauna, reiterated the records of Pourtalès (1871), Studer (1878), and Moseley (1881), but incorrectly listed *Allopora profunda* Moseley, 1881 for New Zealand, meaning instead to cite *Stenohelia profunda* Moseley, 1881, a different species (*see* Boschma 1953: 171). Hutton also listed two unidentified species of *Errina* as present at the Canterbury Museum, the first indications of this widespread and speciose genus in the New Zealand region.

Although the *Siboga* expedition did not enter New Zealand waters, Hickson and England's (1905) account of the stylasterids from this expedition forms the basis of our knowledge of deep-water Western Pacific stylasterids. Some of the species they described from Indonesia were subsequently also found in the New Zealand region.

Hickson (1912) was the first to turn his attention to the shallow-water stylasterids of the New Zealand fiords, reporting one new species, *Errina novaezelandiae,* with four "facies." Two of the four facies are herein elevated to species rank, resulting in the equivalent addition of three species to the fauna.

Broch (1942) described three new species from relatively shallow water (91–119 m) off North Cape that were collected on Thomas Mortensen's Pacific Expedition (1914–1916): *Sporadopora mortenseni, Errina rubra,* and *Errina cervicornis* (= *Lepidotheca cervicornis*). Because *E. rubra* is considered to be a junior synonym of *E. dendyi* Hickson, 1912, this results in only two additional species records. These specimens are deposited at the Zoologisk Museum, Copenhagen. Broch also redescribed and figured one of the facies of Hickson's *Errina novaezelandiae.*

In his handbook of the native animals of New Zealand, Powell (1947) reported one stylasterid: *Errina* sp., from Chatham and Stewart Islands; the specimen from Chatham Island is undoubtedly *Errina chathamensis* n.sp. described herein.

Ralph (1948), in a popular article on New Zealand corals, was the first to report and figure *Distichopora* from New Zealand, as well as additional records of *E. novaezelandiae* (probably facies *cooki*) from Cook Strait. These specimens have not been reexamined and their deposition is unknown.

Broch's (1950) report on the *Discovery* stylasterids from the Southern Ocean includes one record from the New Zealand region: *Errina antarctica* (Gray, 1872) from Antipodes Island, reidentified as *Errina hicksoni* n.sp. herein. Although most of the *Discovery* corals are deposited at The Natural History Museum, London, this particular specimen could not be found.

In his listing of all stylasterids reported from the Pacific Ocean, Boschma (1953 : 173, 177) listed 17 species and facies as present in the New Zealand region, but his list was uncritical, including dubious identifications and synonyms, and did not add any new records to the New Zealand fauna. Likewise, his uncritical listing of all described stylasterid species (Boschma 1957) refers to all species previously reported from New Zealand, but does not add new records or taxonomic information.

Squires (1958) described *Sporadopora cleithridium* from the Upper Miocene of Port Craig, New Zealand; the species was subsequently transferred to *Axopora* by Cairns (1983d). Being exclusively fossil and known only from poorly preserved type specimens, it is not included in the species account.

Boschma (1959 : 142) reported *Distichopora violacea* (Pallas, 1776) from the mouth of the Rangitiki [sic] River, North Island (122 m), an unusually deep record for this species. Ralph's (1948) *Distichopora* specimen may also have been the same species. Otherwise, specimens of *Distichopora* appear to be very rare in the New Zealand region and the aforementioned records are not included in the species account. Boschma's unusual specimen is stated to be deposited at the Manchester Museum but was not present in 1990.

As a complement to his earlier paper in 1958, Squires (1962) reported three additional fossil stylasterid taxa from New Zealand: *Distichopora* sp. from the Miocene of Kaipara Harbour; *Paraerrina* sp. from the Middle Oligocene of Gee's Point, Kakanui; and *Sporadopora mortenseni* Broch, 1942 from the Pliocene of the Ruahine Range. Hayward (1977) also reported fossil (Lower Miocene) *Distichopora* from North Auckland. Squires (1965) later described *Pliobothrus grantmackiei* from the Middle Oligocene of Kakanui, New Zealand, this species later being identified as a bryozoan (*see* Cairns 1983b).

Toward the end of his career, H. Boschma began to study the stylasterid collections made by NZOI, describing four new species from three NZOI stations off the Antipodes and Auckland Islands. He described *Calyptopora reticulata* Boschma, 1968a; *Errina cruenta* Boschma, 1968b (= *E. novaezelandiae* Hickson, 1912); *Errina sarmentosa* Boschma, 1968c (= *Lepidopora sarmentosa*); and *Stenohelia conferta* Boschma,

1968e. Documentation of the type specimens pertaining to these species is found in Dawson (1979) and Vervoort and Zibrowius (1981); the type specimens are deposited primarily at NZOI and the Rijksmuseum van Natuurlijke Historie, Leiden. In his last paper on stylasterid corals, Boschma (1970) described *Stylaster brunneus* from off New Caledonia, a species reported from off Norfolk Island in this paper.

Both Richardson (1981) and Grange *et al.* (1981) reported *Errina novaezelandiae* from shallow water southern fiords, both records herein interpreted as *E. dendyi.*

Also in 1981, Zibrowius reported five new records of *Conopora laevis* from the New Zealand region, four of them based on NZOI stations, and provided a useful discussion of the synonymy of that species.

In my revision of the Antarctic and Subantarctic stylasterids (Cairns 1983a), based primarily on the collections of the *Eltanin* but also on selected NZOI material (station series A–F), I described three new species from the New Zealand region: *Errina cheilopora, Errina fascicularis* (= *Lepidotheca fascicularis*), and *Crypthelia fragilis*; added three new records to the region: *Errina gracilis* Marenzeller, 1903, *Errina labiata* Moseley, 1879 (= *Inferiolabiata labiata*), and *Allopora eguchii* Boschma, 1966 (= *Stylaster eguchii*); and reported additional records of three species: *Lepidopora sarmentosa* Boschma, 1968c, *Conopora pauciseptata* Broch, 1951a (= *Conopora verrucosa*), and *Calyptopora reticulata* Boschma, 1968a (*see* Cairns 1983a : Table 1). Altogether, six additional species were recognised from the New Zealand region. Type specimens of newly described species and nontype specimens were deposited at the U.S. National Museum. Also in 1983 (Cairns 1983b), I discussed and figured many species from the New Zealand region in the context of a generic revision of the Stylasteridae, but no new records were reported. Finally, in 1985, I described two new species of *Lepidopora* from the vicinity of Three Kings Islands, based on specimens collected by NZOI (station series E and P). Additional specimens of both species are reported herein, considerably expanding on our knowledge of their geographic range and morphological variation.

To summarise, the major advances in our knowledge of New Zealand stylasterids resulted primarily from deep-water expeditionary collections: the *Gazelle* (Studer 1878), *Challenger* (Moseley 1879, 1881), *Siboga* (Hickson and England 1905), Mortensen's South Pacific Expedition (Broch 1942), the *Eltanin* (Cairns 1983a), and, most recently, the NZOI collections (Boschma 1968a, b, c, e; Zibrowius 1981; Cairns 1985; present work). Twenty-four species had previously (1878–1985) been reported from the New Zealand region, including three exclusively fossil species but not including four subsequently reidentified species (i.e., *Errina* sp. of Powell 1947; *Errina antarctica* of Broch 1950; and *Cryptohelia pudica* of Studer 1878, and Moseley 1881). As a result of this study, 38 new records are added, resulting in a total of 62 species (59 Recent and 3 fossil) for the region, making it the most diverse stylasterid fauna known in the world.

MATERIAL AND METHODS

Material

This study is based primarily on the examination of 427 previously unpublished lots of stylasterids collected throughout the New Zealand region from 225 localities (Maps 1–2). Most of the specimens (88% of the localities) were collected by NZOI from 1958 to 1988 (*see* List of Stations); specimens from 17 stations (8% of the localities) resulted from the *Eltanin;* the remaining 4% of the localities derive from a variety of sources (*see* List of Stations and text).

In addition to this new material, previously reported specimens were examined from the following museums: BM(NH) (Moseley 1879, 1881; Hickson and England 1909; Hickson 1912); MCZ, Harvard University, Cambridge (Pourtalès 1871); NMNH (Squires 1958, 1962, 1965; Cairns 1983a, b, 1985); NZGS (Tenison-Woods 1880); NZOI (Boschma 1968c, e; Zibrowius 1981); RMNH (Boschma 1966 — examined in 1982); ZMA (Hickson and England 1905); ZMB (Studer 1878 — examined in 1982); and ZMC (Broch 1942 — examined in 1982).

Types of all stylasterid species reported from the New Zealand region were examined, with the exceptions of: *Distichopora violacea* [and Boschma's (1959) New Zealand specimen], *Stylaster gracilis*, and *Errina novaezelandiae* facies *benhami.*

Methods

Stylasterid corallum morphology was reviewed and illustrated by Cairns (1983b, 1986a); however, several additional terms are introduced in this paper. **Open** (Plates 9c, d, 10d) and **closed** (Plate 12a, c) **opercular articulations** are described in the generic remarks of *Adelopora*. Coenosteal platelet **polarity** describes the growing direction of coenosteal plate-lets, particularly in species of *Lepidotheca*. **Normal polarity**, the most frequently observed condition is when the platelet leading (growing) edges are orientated distally; **reverse polarity** (Plate 18d-g) indicates that the leading platelet edges are orientated proximally; **alternating polarity** (Plates 20g, 23a, 31d) indicates that the platelet polarity of adjacent coenosteal strips or even the same strip frequently alternate. In the description of *Lepidotheca robusta*, incomplete dactylopore tabulae are termed **pseudotabulae** (Plate 21b–d). The thin, elongate, lamellar medial ridges that occur in dactylopores of *Distichopora dispar* are called **dactyloridges** (Plate 31a, b). Finally, a peculiar type of imbricate coenosteal texture found in *Errina sinuosa* is described as **radial-imbricate** (Plate 40e, g).

Internal skeletal structures, such as gastrostyles, dactylostyles, and ring palisades, are best revealed along branch fractures, but, where material was scarce or the structures exceedingly delicate, an ultra-high-speed precision air grinder (Dentsply 300KS) with a 1-mm-diameter burr was used carefully to remove overlaying calcium carbonate. Scanning electron microscopy was done by the author using a Cambridge Stereoscan 100. Stereo views are often presented in order to appreciate the three-dimensional topography of skeletal characters.

Species synonymies are usually complete; if not, a reference is given to a more exhaustive synonymy. Efforts were made to verify most of the historically important records (both type and non-type) by personal observation, but when specimens were not available and the publication unclear, the synonymy entry and corresponding distributional record were queried.

Holotypes and most paratypes of new species are deposited at NZOI, their catalogue numbers prefaced by an H or P, respectively. Representative paratypes and a synoptic collection of nontype specimens are also deposited at the NMNH.

About 158 SEM stub preparations were made in conjunction with this study, numerically labelled in the Material Examined sections. All stubs were retained at the USNM and bear the USNM catalog number corresponding to the parent lot of the specimen if a specimen was retained at the USNM.

Tables of comparisons are provided for the species of some of the genera instead of dichotomous keys, since it is assumed that not all species are known from the New Zealand region and thus a dichotomous key might force an incorrect identification. Dichotomous and tabular keys to the stylasterid genera are presented by Cairns (1991b).

The following abbreviations are used in the text.

Museums

BM(NH)	British Museum (Natural History), London (The Natural History Museum)
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge
NMNH	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
NZGS	New Zealand Geological Survey, now DSIR Geology and Geophysics, Lower Hutt
NZOI	New Zealand Oceanographic Institute, Wellington
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden
USNM	United States National Museum, now the National Museum of Natural History, Smithsonian Institution, Washington, D.C.
WAM	Western Australian Museum, Perth
ZMA	Zoologische Museum, Amsterdam
ZMB	Zoologisches Museum, Berlin
ZMC	Zoologisk Museum, Copenhagen

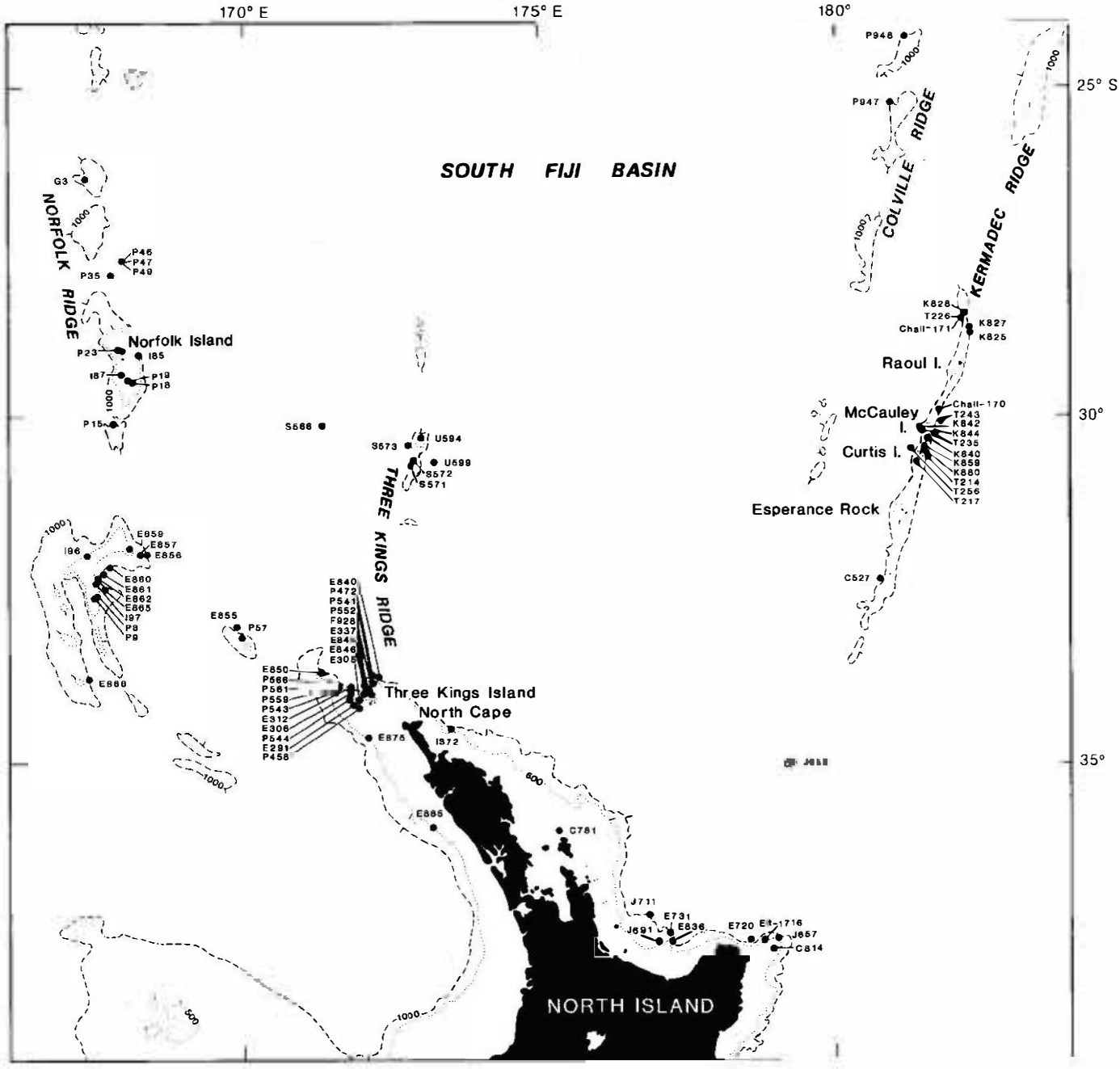
Other abbreviations

col.	colony
H : W	Height-to-width ratio of a gastrostyle
SEM	Scanning electron microscope/microscopy
σ	Standard deviation of sample (used with number of dactylopores per cyclosystem)

LIST OF STATIONS

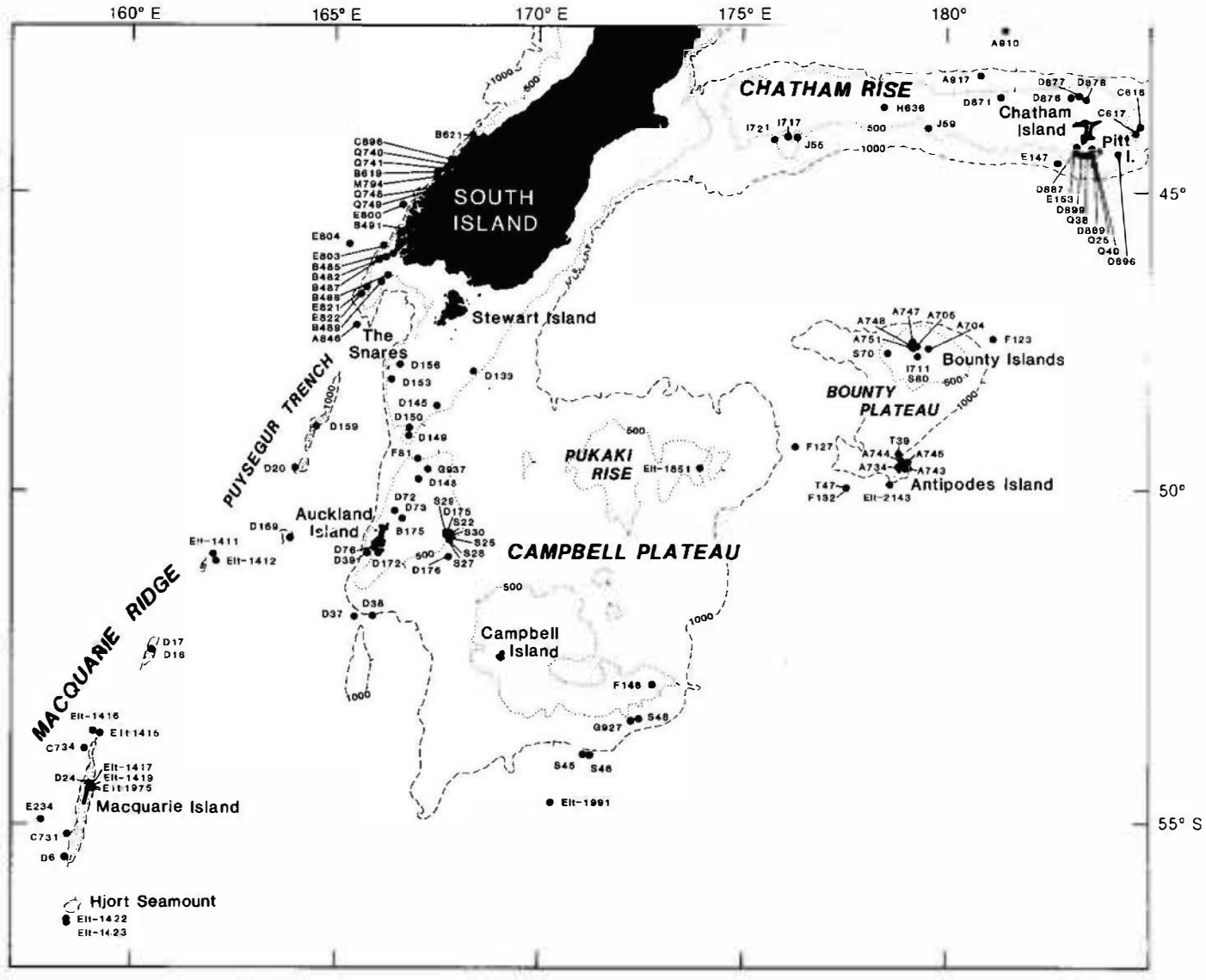
NZOI (New Zealand Oceanographic Institute)

Stn No.	Latitude (S)	Longitude	Depth (m)	Date
A444	41°21'	174°32' E	276–380	5 Oct. 1958
A502	41°30'	174°32.8'E	457	14 Oct. 1959
A704	47°42'	179°27' E	154	4 Nov. 1962
A705	47°41.6'	179°05.7'E	48	4 Nov. 1962
A734	49°42'	178°44.3'E	150	8 Nov. 1962
A743	49°39.8'	178°50.2'E	40	9 Nov. 1962
A744	49°36.7'	178°48.1'E	360	9 Nov. 1962
A745	49°36.7'	178°50.5'E	399	9 Nov. 1962
A747	47°40.9'	179°03.1'E	113	16 Nov. 1962
A748	47°41.2'	179°03.5'E	62	16 Nov. 1962
A751	47°44.6'	179°07.4'E	155	16 Nov. 1962
A846	47°19.2'	166°34.5'E	1485	27 Aug. 1963
A910	43°04'	178°39' W	549	13 Sept. 1963
A917	43°56'	179°15' W	203	15 Sept. 1963
B175	50°26.5'	166°37.5'E	95	8 Oct. 1959
B482	46°08.8'	166°06' E	91	5 June 1961
B485	46°04.1'	166°24.5'E	62	6 June 1961
B487	46°16'	166°03' E	196	6 June 1961
B488	46°28.7'	166°14.3'E	164	7 June 1961
B489	46°39'	166°09.5'E	198	7 June 1961
B491	45°48.4'	166°45.2'E	232	8 June 1961
B619	44°42'	167°33.3'E	95	19 Oct. 1962
B621	43°59'	168°20.4'E	117	19 Oct. 1962
C60	41°23'	174°25' E	143	7 June 1956
C527	32°30'	179°12' W	508	10 Sept. 1960
C617	43°58.4'	175°22.9'W	288–302	30 April 1961
C618	43°52'	175°20' W	623–688	30 April 1961
C731	55°11'	158°32' E	1500	24 Nov. 1961
C734	53°55'	158°55' E	360	25 Nov. 1961
C781	36°00'	175°20' E	93	21 Feb. 1962
C814	37°40'	178°56.4'E	194	25 Feb. 1962
C896	44°33'	167°43' E	95	3 Dec. 1962
D6	55°29'	158°31.5'E	415	20 April 1963
D17	52°31'	160°31' E	124	23 April 1963
D18	52°31'	160°31' E	128	22 April 1963
D20	49°39.8'	164°02.2'E	126	24 April 1963
D24	54°29.6'	158°59.2'E	459	29 April 1963
D37	51°58'	165°28' E	28	7 May 1963
D38	51°58'	165°58' E	252	7 May 1963
D39	50°58'	165°45' E	465–549	7 May 1963
D72	50°18.8'	166°24' E	163	11 May 1963
D73	50°18'	166°23.5'E	177	11 May 1963
D76	50°53.9'	165°54' E	168	12 May 1963
D133	48°11.5'	168°21' E	14	12 Jan. 1964
D145	48°42'	167°27' E	366	14 Jan. 1964
D148	49°48'	167°02.5'E	145	14 Jan. 1964
D149	49°10.5'	166°51' E	454	14 Jan. 1964
D150	49°04'	166°52' E	362	14 Jan. 1964
D153	48°15.5'	166°16' E	353	16 Jan. 1964
D156	48°01.5'	166°35' E	81	16 Jan. 1964
D159	49°01'	164°30' E	741	17 Jan. 1964
D169	50°47.5'	163°57.5'E	896	20 Jan. 1964
D172	51°00'	166°03' E	179	20 Jan. 1964
D175	50°38'	167°38' E	421	21 Jan. 1964
D176	51°06'	167°48.5'E	216	21 Jan. 1964
D216	67°14.6'	164°05.5'E	423	10 March 1964
D871	43°20'	178°40' W	454	24 March 1969
D876	43°20'	176°59' W	148	25 March 1969
D877	43°20'	176°48' W	148	25 March 1969
D878	43°25'	176°40' W	116	25 March 1969
D887	44°15'	176°50.5'W	156	27 March 1969
D889	44°16'	176°30.3'W	95	28 March 1969
D896	44°20'	175°50' W	106	29 March 1969
D899	44°23'	176°49' W	370	29 March 1969
E147	44°30'	177°20' W	766	17 Oct. 1964
E153	44°15'	176°50' W	91	18 Oct. 1964
E234	54°55.5'	157°47' E	220	27 Feb. 1965
E291	34°15'	171°50' E	410	8 April 1965
E305	34°10'	171°55' E	282	9 April 1965
E306	34°05'	171°47.5'E	263	9 April 1965
E312	34°00'	171°47.5'E	119	10 April 1965
E337	34°02.4'	172°03.2'E	198	12 April 1965
E636	37°28.5'	177°13' E	190	10 Oct. 1966
E720	37°33'	178°35' E	252–256	24 March 1967
E731	37°23.5'	177°12' E	503–602	25 March 1967
E751	41°39.7'	175°15' E	300–399	30 March 1967
E800	45°20.5'	166°41.5'E	695–1 003	20 Oct. 1967
E803	45°57'	166°09' E	514–534	21 Oct. 1967
E804	45°58.5'	166°18.5'E	183	21 Oct. 1967
E821	46°43.5'	165°46.5'E	302–549	23 Oct. 1967
E822	46°50.6'	165°36' E	682–781	23 Oct. 1967
E840	33°52'	172°16' E	729–757	16 March 1968
E845	34°07.5'	172°01' E	179–277	16 March 1968
E846	34°07.5'	171°57.5'E	343–417	16 March 1968
E850	33°49'	171°19' E	509–515	17 March 1968
E855	33°10'	169°56' E	716–742	17 March 1968
E856	32°11'	168°18' E	1157–1169	18 March 1968
E857	32°10'	168°16' E	951–954	18 March 1968
E859	32°01'	168°03' E	500	18 March 1968
E860	32°21'	167°41' E	1246-1258	18 March 1968
E861	32°25'	167°35' E	318-383	18 March 1968
E862	32°28'	167°31' E	130	18 March 1968
E865	32°41'	167°36' E	168	19 March 1968
E868	33°51'	167°20' E	672-751	19 March 1968
E875	34°39'	172°07' E	489-492	21 March 1968
E885	35°58'	173°16' E	449-462	23 March 1968
F81	49°32'	167°01' E	401	14 Jan. 1965
F123	47°38'	178°57' W	1280	27 Jan. 1965
F127	49°22'	176°16' E	1280	28 Jan. 1965
F132	49°59'	177°32' E	1335	29 Jan. 1965
F146	53°00'	172°45' E	435	1 Feb. 1965
F928	34°06.2'	172°06.8'E	388-406	14 Oct. 1968



Map of the northern New Zealand region, showing stations at which stylasterids were collected (500 and 1 000 m isobaths indicated).

G3	26°25'	167°15' E	710	27 Sept. 1966
G10	32°09.5'S	168°15.0'E	970	28 Sept. 1966
G927	53°32.8'	172°16.6'E	580	12 Jan. 1971
G937	49°41.3'	167°16.5'E	520	16 Jan. 1971
G941	39°59.7'	178°08' E	665	17 May 1973
H636	43°26.4'	179°34.9'E	395	10 March 1975
I85	29°07.9'	168°15' E	290	22 July 1975
I87	29°25'	167°50' E	89–170	23 July 1975
I96	32°10.8'	167°21.2'E	356	25 July 1975
I97	32°22.9'	167°28.2'E	540–544	25 July 1975
I372	34°32.2'	173°29.5'E	211–215	23 Nov. 1977
I711	47°50'	179°15' E	139	22 March 1979
I717	44°04.3'	176°06.9'E	200–300	25 March 1979
I721	44°07.4'	175°46.2'E	540	26 March 1979
I735	24°41.2'	159°37' E	291–360	11 May 1979
I739	23°57.9'	159°21.5'E	465–793	11 May 1979



Map of the southern New Zealand region, showing stations at which stylasterids were collected (500 and 1 000 m isobaths indicated).

I741	22°43'	159°16' E	328	12 May 1979
J55	44°05.5'	176°12' E	198	17 May 1970
J59	43°51'	179°25' E	309	20 May 1970
J657	37°28.2'	179°03.2'E	695–726	4 Sept. 1974
J659	35°00.6'	179°15.1'E	689–695	4 Sept. 1974
J691	37°33.5'	176°58.8'E	168	9 Sept. 1974
J711	37°15'	176°50.5'E	366-472	11 Sept. 1974
K800	29°11.9'	177°50.8'E	555	22 July 1974
K825	28°47.8'	177°47.8'W	145-160	25 July 1974
K827	28°43.4'	177°46.5'W	260-318	25 July 1974
K828	28°35.4'	177°50.7'W	440-510	26 July 1974
K839	30°15.4'	178°24.0'E	290	28 July 1974
K840	30°17.6'	178°25.3'W	398-412	28 July 1974
K842	30°10.2'	178°35.9'W	325-370	29 July 1974
K844	30°11.2'	178°33.8'W	290	29 July 1974
K859	30°34.9'	178°28.2'W	443-460	30 July 1974

Stn No.	Latitude (S)	Longitude	Depth (m)	Date
K860	30°35.8'	178°25.7'W	605-720	30 July 1974
M764	44°36.5'	167°49.5'E	28	29 March 1981
M794	44°39'	167°53.9'E	45	7 April 1981
P8	32°40.8'	167°26.8'E	660-757	25 Jan. 1977
P9	32°40.4'	167°27.7'E	374-406	25 Jan. 1977
P15	30°10.7'	167°44.2'E	949-952	25 Jan.1977
P18	29°34.6'	168°03' E	86-90	25 Jan. 1977
P19	29°33.6'	168°01.6'E	80-81	25 Jan.1977
P23	29°06.7'	167°56.9'E	15-24	27 Jan. 1977
P35	28°57.9'	167°45.5'E	392-423	28 Jan. 1977
P46	28°42.3'	167°56.7'E	450-475	30 Jan. 1977
P47	28°42.6'	167°55.3'E	310-375	30 Jan. 1977
P49	28°43.3'	167°53.6'E	85-110	30 Jan. 1977
P57	33°15'	169°59' E	563-614	4 Feb. 1977
P458	34°13.8'	171°56.4'E	200	21 June 1978
P472	33°52.2'	172°12' E	161	23 June 1978
P541	33°56.5'	172°08' E	490	27 June 1978
P543	34°05'	171°35' E	710	27 June 1978
P544	34°09.9'	171°49.5'E	290	27 June 1978
P552	33°54.3'	172°01.1'E	850	28 June 1978
P559	33°59.8'	171°41.6'E	197	28 June 1978
P561	33°58'	171°28' E	506	28 June 1978
P566	33°56.1'	171°27.2'E	514	29 June 1978
P842	32°34.4'	156°17.3'E	285-290	28 Nov. 1979
P947	25°13.7'	179°04.1'W	547-646	1 June 1980
P948	24°17.7'	178°50.1'W	589-591	1 June 1980
Q25	44°26.2'	176°30.4'W	360	22 March 1978
Q38	44°24.8'	176°43.6'W	345	24 March 1978
Q40	44°29.5'	176°32.5'W	345-380	24 March 1978
Q68	29°14'	159°00' E	1045-1212	1 June 1978
Q73	24°09.8'	159°29.8'E	20	3 June 1978
Q740	44°36.5'	167°49.7'E	25	12 July 1982
Q741	44°37.8'	167°51.7'E	30	13 July 1982
Q748	44°55'	167°25.7'E	60	16 July 1982
Q749	44°54'	167°26.2'E	40	16 July 1982
Q754	44°47.9'	167°33.7'E	15-42	18 July 1982
S22	50°39'	167°39.6'E	400	17 Sept. 1978
S25	50°41.8'	167°40.6'E	339	17 Sept. 1978
S27	50°41.3'	167°37.5'E	335	18 Sept. 1978
S28	50°41.1'	167°44' E	375	18 Sept. 1978
S29	50°40.7'	167°41.1'E	300	18 Sept. 1978
S30	50°41'	167°40.8'E	265	18 Sept.1978
S45	54°01.5'	171°04.5'E	1262	21 Sept. 1978
S46	53°59.8'	171°13.2'E	1075	21 Sept. 1978
S48	53°30.6'	172°24' E	625	22 Sept. 1978
S53	53°00.7'	172°59.9'E	450	23 Sept. 1978
S70	47°45.6'	178°30.8'E	353	26 Sept. 1978
S80	47°50.2'	179°15.2'E	126	23 Nov. 1978
S235	45°59'8'	166°48.7'E	22	15 Feb. 1980
S568	30°10'	171°20.2'E	650900	13 Aug. 1983
S571	30°47.3'	172°45.2'E	480-509	15 Aug. 1983
S572	30°45.5'	172°47.7'E	403-530	15 Aug. 1983
S573	30°29.7'	172°42.3'E	840-975	15 Aug. 1983
T39	49°30.2'	178°44.6'E	995	14 March 1981
T47	49°57.9'	177°32.6'E	1200-140	14 March 1981
T214	30°40.9'	178°25.5'W	565	18 March 1982
T217	30°44'	178°38.1'W	492	18 March 1982
T226	28°33'	177°50' W	800-930	22 March 1982
T235	30°19.3'	178°21' W	445-510	23 March 1982
T243	30°05'	178°15' W	1035	24 March 1982
T256	30°31'	178°39' W	710–814	27 March 1982
U567	35°00.3'	169°09.7'E	1480-1050	3 Feb. 1988
U581	31°51.3'	172°08.8'E	1170–1180	5 Feb. 1988
U582	31°52.0'	172°26.5'E	1058–988	5 Feb. 1988
U591	30°50.6'	172°48.3'E	486	7 Feb. 1988
U594	30°20.1'	172°59.6'E	406	7 Feb. 1988
U599	30°43'	173°16.9'E	590-640	8 Feb. 1988
U600	31°01.7'	173°22.7'E	620	9 Feb. 1988
		USNS *Eltanin*		
1411	51°01'	162°01' E	333-371	8 Feb. 1965
1412	51°07.2'	162°03' E	1647-1665	8 Feb.1965
1415	53°46'	159°12' E	750-996	9 Feb. 1965
1416	53°45'	159°09' E	787-842	9 Feb.1965
1417	54°24'	159°01' E	79-93	10 Feb. 1965
1419	54°32.5'	159°02' E	494-714	10 Feb. 1965
1422	56°19.4'	158°29' E	833-842	12 Feb. 1965
1423	56°21.4'	158°28' E	1574-1693	12 Feb. 1965
1536	54°29.5'	39°22.3'W	659-686	8 Feb. 1966
1716	37°35'	178°46' E	128-146	28 May 1966
1847	41°32'	174°34' E	192-238	19 Dec. 1966
1851	49°40'	178°53.9'E	476-540	3 Jan. 1967
1857	64°10.2'	177°35.5'E	1211-1336	8 Jan. 1967
1975	54°30.5'	159°00' E	443-549	15 Feb. 1967
1981	47°21.3'	147°52.8'E	910-915	24 Feb. 1967
1991	54°39.7'	170°22.1'E	1860-1940	2 Jan. 1968
		HMS *Challenger*		
170	29°55'	178°14' W	951-1152	14 July 1874
171	28°33'	177°50' W	1097	15 July 1874
214	4°33'N	127°06' E	914	10 Feb. 1875
320	37°17'	53°52' W	1097	14 Feb. 1876
		Other Vessels/Expeditions		
Albatross				
5569	5°33.3'N	120°15.5'E	555	22 Sept. 1909
BANZARE				
34	66°21' S	58°50' E	603	7 Jan. 1930
Chalcal 1, *Coriolis*				
D5	20°58' S	161°45.4'E	400	14 July 1985
Terra Nova				
90	Summit of Great King, Three Kings Islands, (S14°W, 8 miles)		183	25 July 1911
91	Summit of Great King, Three Kings Islands, (S14°W, 25 miles)		549	26 July 1911
96	11 km E of North Cape, N.Z.		128	3 Aug. 1911

ALPHABETIC CHECKLIST OF STYLASTERIDAE
known from the New Zealand Region

(+ = exclusively fossil species, * = not fully treated in this account,
! = new record for New Zealand region)

! *Adelopora crassilabrum* n. sp.
! *Adelopora fragilis* n. sp.
! *Adelopora moseleyi* n. sp.

! *Astya aspidopora* n. sp.

+* *Axopora cleithridium* (Squires, 1958)

Calyptopora reticulata Boschma, 1968
! *Calyptopora sinuosa* n. sp.

! *Conopora candelabrum* n. sp
! *Conopora gigantea* n. sp..
Conopora laevis (Studer, 1878)
! *Conopora tetrastichopora* n. sp.
! *Conopora unifacialis* n. sp.
Conopora verrucosa (Studer, 1878)
! "*Conopora*" (incertae sedis) *anthohelia* n. sp.

! *Crypthelia curvata* n. sp.
! *Crypthelia cymas* Cairns, 1986
Crypthelia fragilis Cairns, 1983
! *Crypthelia polypoma* n. sp.
! *Crypthelia robusta* n. sp.
! *Crypthelia studeri* n. sp.

! *Distichopora dispar* n. sp.
* *Distichopora violacea* (Pallas, 1766)
+* *Distichopora* spp. sensu Ralph (1948), Squires (1962), Hayward (1977)

! *Errina bicolor* n. sp.
! *Errina chathamensis* n. sp
Errina cheilopora Cairns, 1983.
Errina cooki Hickson, 1912 (new rank)
Errina dendyi Hickson, 1912 (new rank)
Errina gracilis Marenzeller, 1903
! *Errina hicksoni* n. sp.
! *Errina laevigata* n. sp.
Errina novaezelandiae Hickson, 1912
! *Errina reticulata* n. sp.
! *Errina sinuosa* n. sp.

Inferiolabiata labiata (Moseley, 1879)
! *Inferiolabiata lowei* (Cairns, 1983)
! *Inferiolabiata spinosa* n. sp.

Lepidopora cryptocymas Cairns, 1985
! *Lepidopora dendrostylus* n. sp.
! *Lepidopora microstylus* n. sp.
Lepidopora polystichopora Cairns, 1985
Lepidopora sarmentosa (Boschma, 1968)
! *Lepidopora symmetrica* n. sp.

! *Lepidotheca altispina* n. sp.
Lepidotheca cervicornis (Broch, 1942)
! *Lepidotheca chauliostylus* n. sp.
Lepidotheca fascicularis (Cairns, 1983)
! *Lepidotheca inconsuta* n. sp.
! *Lepidotheca robusta* n. sp.

! *Pseudocrypthelia pachypoma* (Hickson and England, 1905)

+* *Paraerrina* sp. sensu Squires, 1962

+* *Sporadopora marginata* Tenison-Woods, 1880
! *Sporadopora micropora* n. sp.
Sporadopora mortenseni Broch, 1942

Stenohelia conferta Boschma, 1968
* *Stenohelia* sp. cf. *S. profunda* Moseley, 1881

! *Stephanohelia praecipua* n. gen., n. sp.

! *Stylaster brunneus* Boschma, 1970
Stylaster eguchii (Boschma, 1966)
? *Stylaster gracilis* Milne Edwards and Haime, 1850
! *Stylaster horologium* n. sp.
! *Stylaster imbricatus* n. sp.

! *Systemapora ornata* n. gen., n. sp.

ZOOGEOGRAPHY

The area covered by the systematic and zoogeographic accounts extends from 24°S (northern Norfolk Ridge) to 57°S (Hjort Seamount) and from 157°E (Lord Howe Seamount Chain) to 175°W (Chatham Island). It is a topographically and zoogeographically diverse area, containing tropical, warm-temperate, cold-temperate, and Subantarctic regions, as defined by Briggs (1974), in its 33° of latitude. But more important to the distribution and diversity of stylasterids, it contains an abundance of submarine ridges, seamounts, and small islands, that provide hard, nonterrigenous substrates that are exposed to oceanic water circulation. These appear to be the ideal conditions for stylasterid growth (Cairns 1986a). Thus, it is not surprising that the 59 Recent species reported for this region constitute the most diverse fauna in the world, the second highest number of species (42) occurring in the northwest Atlantic (Cairns 1986a).

Because female stylasterids brood their larvae to an advanced planula stage, it is assumed that larval dispersal is limited. Probably for this reason, stylasterid species distributions are highly circumscribed, there being no cosmopolitan species and few with amphioceanic distributions. Therefore, stylasterids are good zoogeographic indicators for deep-water benthic distributional patterns as well as good palaeontological indicators of oceanic, insular environments. Among the 59 species described from the New Zealand region, 47 (80%) are endemic to the region or have not yet been found elsewhere. Of the 12 nonendemic species, six have extended distributions in the Subantarctic (pattern 6) and six are also found in more tropical waters to the north (pattern 7).

Patterns of Distribution and Affinities

Although there is substantial knowledge of the physical oceanography of the New Zealand region and collections of many invertebrates have been reviewed, very little is known about the patterns of distributions and affinities of deep-water (> 100 m) benthic invertebrates, with the notable exceptions of Millar (1982) and Dawson (1988), to be discussed later. Conventional zoogeographic analyses and province limits have been defined by the distributions of shallow-water organisms (*see* Briggs 1974 for a review). Although the distribution of deep-water invertebrates need not necessarily parallel those of shallow water, for the sake of convenience, the conventional shallow-water zoogeographic regions and provinces are used in this analysis.

There are seven basic patterns of distribution displayed among the 59 Recent New Zealand stylasterid species : 1, widespread (five species), 2, disjunct (five species), 3, Cookian (four species), 4, Aucklandian (23 species), 5, Antipodean (six species), 6, Subantarctic (six species), and 7, primarily tropical (eight species). Two species are unclassified (Table 1).

The first pattern (widespread) is represented by five species that are found throughout the New Zealand region in almost all provinces and geographic areas listed in Table 1. They are characteristic of the region and, for the most part, endemic to it. But, even though they are widespread, they rarely occur close to the coasts of North and South Islands, except off Fiordland, Bay of Plenty, and the North Cape area. These five species are predominantly deep water in distribution (depth ranges usually exceed 1000 m) and taxonomically diverse.

Pattern two, provisionally termed disjunct, comprises five species that occur on the seamounts, ridges, and islands north (Auckland Province) and south (Antipodean Province) of New Zealand, but not in the intervening Cookian Province of New Zealand proper, including the Chatham Rise. The pattern is similar to the widespread pattern, except for the complete absence from the terrigenous sediment of the New Zealand shelf and slopes in favour of the calcareous and volcanic sediments of the surrounding islands. These five species occur primarily between 400 and 800 m and are also taxonomically diverse.

Only four species are characteristic of the Cookian Province (pattern 3: southern North Island, South Island, Chatham Rise), comprising two species found in Cook Strait, one endemic to the Chatham Rise, and one commonest off Fiordland. This lack of species diversity from the longest coast line in the New Zealand region is not attributable to lack of collecting effort (*see* Beu 1978 : fig. 3), but rather to their apparent inability to live on the terrigenous sediment that occurs off most of New Zealand (Mitchell *et al.* 1989). The four Cookian species are all relatively shallow in distribution, three of the four species in the genus *Errina*. The Chatham Rise is considered by some to be a separate province (the

Moriorian Province), and by others to be a subregion of the Cookian Province (*see* Briggs 1974 : 172–173 for a discussion). Of the nine species that occur on the Chatham Rise, only one is endemic, one is Cookian, five are widespread (pattern 1), one is at the northern limit of a Subantarctic distribution (pattern 6), and one is unclassified. Based on its low endemicity and presence of a generalised fauna with one Cookian species, I consider the Chatham Rise as a part of the Cookian Province.

The Auckland Province (pattern 4) includes the northern half of North Island, Kermadec and Three Kings Ridges, and the southern half of Norfolk and Colville Ridges, and corresponds to Briggs's (1974) warm-temperate region of New Zealand. This is the best-defined and commonest pattern of stylasterid distribution in the region, found exclusively in 23 species, especially of the genera *Lepidopora*, *Adelopora*, *Lepidotheca*, and *Crypthelia* at depths of of 10–1000 m. *Lepidopora cryptocymas* occurs throughout and exclusively in this province; however, the remaining 22 species are not as uniformly distributed, some occurring on only one or two of the ridge systems. In all, 39 species occur in this province (Table 1), with a majority (23) endemic to it. The remaining 16 species include the five widespread species (pattern 1), the five disjunct species (pattern 2), and an element (four species) more characteristic of tropical waters (pattern 7). Furthermore, seven species that occur on the southern Norfolk Ridge also occur north of Norfolk Island, reinforcing its partial affinity with the tropics (pattern 7). Of the 16 species known from the Kermadec Islands, five (31%) are endemic, five occur elsewhere in the Auckland Province, three are widespread (pattern 1), two are disjunct in distribution (pattern 2), and only one is characteristic of more tropical waters (pattern 7). These results are in accordance with Briggs (1974), who considered the Kermadecs as a separate province having strong affinities to the Auckland Province.

The Antipodean Province (pattern 5) consists of the cold-temperate Campbell and Bounty Plateaus, and includes six species, but, based on their extended distributions, it is difficult to exclude the northern Macquarie Ridge (from Stewart Island to 50°S) from this province. Four of these six species belong to *Errina* and occur in relatively shallow water. In all, 22 Recent species occur in the Antipodean Province (Table 1) — 15 on the Campbell Plateau (none endemic), 11 on the Bounty Plateau (two endemic), and 13 on the northern Macquarie Ridge (none endemic). The fauna includes the 10 widespread and disjunct species (patterns 1 and 2), only one Cookian species (pattern 3), the six characteristic Antipodean species (pattern 5), and four of the six primarily Subantarctic species (pattern 6), showing its affinities to be more with the Subantarctic and Macquarie Island than with New Zealand. This conclusion is contrary to that of Briggs (1974) which was based on shallow-water organisms, but consistent with the distribution of ahermatypic Scleractinia (Cairns 1982a : 152) and brachiopods (Foster 1974).

Pattern 6 (Subantarctic) comprises six species having distributions in the Subantarctic, in some cases extending into the Antarctic region. The extent of the Subantarctic distributions is quite variable — three species are known from Magellanic South America and the South Georgia region, one species only from the South Tasmanian Rise, one only from the Pacific-Antarctic Ridge, and one is known only from Macquarie Island, where it may be endemic. Whether these species are attributed to a widespread circum-Subantarctic "Kerguelean" Province is not addressed here. Kusakin (1968), Briggs (1974), and Dawson (1988) have all argued for a distinct Macquarie Province, which is characterised by a small endemic element and affinities to both New Zealand and the Subantarctic. The 13 stylasterid species that occur off Macquarie Island and Hjort Seamount show a curious mixture — three are widespread (pattern 1), one is disjunct (pattern 2), three are Antipodean (pattern 5), one is endemic, four have widespread distributions in the Subantarctic (pattern 6), and one is unclassified. Macquarie Island thus appears to be a transitional region, with affinities to New Zealand (reinforced by the Macquarie Ridge), the Antipodean Province, and the Subantarctic fauna, with one endemic species.

Finally, there are eight species (pattern 7) that occur exclusively or predominantly in the "tropical" New Zealand region in the sense of Briggs (1974) — northern Norfolk and Colville Ridges, Lord Howe Seamount Chain, and points north. Technically, they occur in the region defined by this study but have affinities with more northern regions (e.g., New Caledonia, Micronesia, etc.).

One of the few zoogeographic analyses of a primarily deep-water benthic, sessile group of New Zealand invertebrates comparable to that of the stylasterids was that of Millar (1982), based on 159 species of ascidians. His patterns of distributions and affinities, however, show more differences than similarities. The ascidians have very few widespread species (pattern 1); no disjunct species (pattern 2); relatively few (only 9.4%) species with an Aucklandian distribution (pattern 3), which is so common (39%) among the stylasterids; and a much more distinct Moriorian fauna. However, the Antipodean

TABLE 1. Distribution, patterns, and depth ranges of New Zealand Stylasteridae (+ = fossil occurrence)

Species	TROPICAL 1	2	WARM TEMP. Aucklandian 3	4	5	COLD TEMPERATE Cookian 6	7	Antipodean 8	9	10	SUB-ANTARCTIC Mac 11	12	ANT-ARCTIC 13	Elsewhere	Pattern of distribution	Depth (m)
Axopora cleithridium						+									–	Upper Miocene
Lepidopora sarmentosa										x	x	x		South Tasmanian Rise	6	910–1665
Lepidopora dendrostylus			x	x			x		x						1	190–1258
Lepidopora microstylus		x	x		x										4	710–1258
Lepidopora symmetrica				x											4	282
Lepidopora cryptocymas			x	x	x										4	168–544
Lepidopora polystichopora		x	x												4	197–710
Adelopora crassilabrum			x	x											4	282–1169
Adelopora fragilis		x		x											4	400–710
Adelopora moseleyi	x														7	285–360
Lepidotheca fascicularis				?			x		x	x	x	x		Magellanic and South Georgia	6	282–2100
Lepidotheca inconsuta											x				6	787–1500
Lepidotheca chauliostylus		x	x	x											4	130–1169
Lepidotheca cervicornis				x											4	101–410
Lepidotheca altispina	x		x	?	x										4	445–1258
Lepidotheca robusta			x												4	356
Stephanohelia praecipua	x		x											Chesterfield Islands	7	318–793
Inferiolabiata labiata										x		x	x	Scott, Balleny, Magellanic	6	87–2100
Inferiolabiata spinosa			x	x	x			x	x						2	211-781
Inferiolabiata lowei			x	x				x				x		Magellanic, South Georgia	2	164–751
Paraerrina sp.						+									-	M. Oligocene
Sporadopora mortenseni				x		+								? Miocene of Australia	4	119-290
Sporadopora micropora								x	x						5	465–741
Sporadopora marginata							+								-	L. Pliocene
Distichopora dispar				x				x	x						2	465–741
Distichopora violacea						x								Indo-West		

Distichopora spp.				+										Pacific	3	122
															-	Miocene
Systemapora ornata		x													7	310–475
Errina novaezelandiae						x		x	x						3	15–177
Errina chathamensis							x								3	91–688
Errina laevigata								x			x				5	113–371
Errina hicksoni										x					5	40–155
Errina cooki						x	x								3	143–380
Errina gracilis											x	x	x	Crozet, South Georgia, Magellanic	6	100–1226
Errina sinuosa					x										4	290–814
Errina cheilopora						x	x	x	x	x	x				-	198–1400
Errina bicolor								x	x		x				5	95–625
Errina reticulata								x		x	x					579–145
Errina dendyi			x	x		x									-	17–30
Stylaster eguchii			x		x	x	x	x	x	x	x		x		1	15–1485
Stylaster brunneus		x													7	15–170
Stylaster horologium			x	x											4	179–1169
Stylaster imbricatus			x	x											4	128–665
? *Stylaster gracilis*				x	x									? Indo-West Pacific	7	?18–951
Calyptopora reticulata		x	x	x		x	x	x	x	x	x				1	216–2100
Calyptopora sinuosa					x										4	260–814
Stenohelia conferta										x					5	1335
Stenohelia cf. *S. profunda*					x										4	1097
Conopora verrucosa			x	x	x	x	x	x	x	x	x	x	x		1	198–2355
Conopora laevis		x	x	x	x		x		x					? Indo-West Pacific	1	130–1035
Conopora candelabrum		x	x	x				x							2	403–1170
Conopora tetrastichopora				x											4	282–710
Conopora unifacialis					x										7	547–646
Conopora gigantea			x												4	356
"Conopora" anthohelia					x										7	547–1170
Astya aspidopora				x											4	590-640
Crypthelia studeri				x	x			x	x	x	x				2	343–1940
Crypthelia robusta			x	x											4	128–757
Crypthelia polypoma		x		x	x										4	590-814
Crypthelia fragilis										x	x	x		Pacific-Antarctic Ridge	6	952–2329
Crypthelia curvata			x	x											4	282–1258
Crypthelia cymas		x	x		x									Galápagos Islands	4	263–757

Pseudocrypthelia pachypoma		x													Western Pacific	7	555–1089
	3	12	23	28	16	11	10	13	15	11	13	7	4				

1 Lord Howe Seamount Chain
2 New Caledonia and northern Norfolk Ridge, including Norfolk Island
3 Southern Norfolk Ridge
4 Three Kings Ridge and northern North Island
5 Colville and Kermadec Ridges
6 Southern North Island and South Island
7 Chatham Rise
8 Northern Macquarie Ridge (north of 50°S)
9 Campbell Plateau
10 Bounty Plateau
11 Southern Macquarie Ridge (south of 50°S) and Hjort Seamount
12 Elsewhere in Subantarctic
13 Antarctic

and Macquarie Island stylasterids have similar affinities to those of the ascidians but show a stronger tie than the ascidians to the Subantarctic than to the South Island.

Bathymetric Distribution

The bathymetric ranges of the New Zealand stylasterids are consistent with those of most other stylasterids, showing them to be a predominantly deep-water (lower shelf and slope depth) group most common between 200 m and 1200 m. Only nine species occur from 15–100 m : 47 from 100–500 m; 42 from 500–1000 m; 22 from 1000–1500 m; seven from 1500–2000 m; and only five from over 2000 m. Those found in shallow water often have much deeper bathymetric ranges, e.g., *Stylaster eguchii*, typical of 50–1400 m, is found in the cool upwelled waters off Fiordland at only 15 m. The deepest record of a New Zealand stylasterid is *Conopora verrucosa* at 2355 m. Genera characteristic of deep water (> 1000 m) are *Stenohelia* and *Crypthelia*; of shallow water, *Errina*.

CLASSIFICATION

Family STYLASTERIDAE Gray, 1847

Lepidopora Pourtalès, 1871

Coordination of gastro- and dactylopores lacking; however, in several species dactylopores arranged in two or more longitudinal rows on branches or grouped in short abcauline crescents beneath gastropores. Coenosteal texture variable, including reticulate-granular and linear-imbricate. Abcauline gastropore lip present in some species. Gastro- and dactylopore tubes axial. Gastrostyles unridged, usually with a moderately high H : W ratio and robust, simple spination; however, one species has imbricate platelets covering the gastrostyle and the style of another species is rudimentary. Dactylopores apically perforate cones or flush with coenosteum, sometimes linked by ridges; dactylostyles usually lacking. Ampullae usually superficial but internal in some species.

TYPE SPECIES: *Errina glabra* Pourtalès, 1867, by subsequent designation (Boschma 1963 : 336).

REMARKS: As previously discussed (Cairns 1983b, 1984, 1985), *Lepidopora* is an extremely variable genus, undoubtedly polyphyletic, and probably close to the ancestral stock of the stylasterids. No single synapomorphy unites the species; rather, a combination of characters, each of which is also found in other genera, must be used to diagnose the genus viz., apically perforate dactylopore mounds, unridged gastrostyles, and long, axial dactylopore tubes. No other genus has this combination of characters.

The same variable characters that make *Lepidopora* difficult to define allow for relatively easy differentiation of the 15 valid species in the genus [eight species listed by Cairns (1986b); two described by Cairns (1986a); and five remaining species included herein]. Characters of particular value in discriminating species are — degree of alignment of dactylopores; coenosteal texture; gastrostyle shape; colony and branch shapes; presence or absence of gastropore lips; and presence or absence of dactylostyles.

DISTRIBUTION: Worldwide in distribution, occurring from 60–1874 m (Cairns 1991b).

Lepidopora sarmentosa (Boschma, 1968) (Plate 1, a-g)

Errina (Lepidopora) sarmentosa Boschma, 1968c : 203–208, pl. 1, figs 1-4, text-figs 1–2; Dawson 1979 : 25; Vervoort & Zibrowius 1981 : 31.
Lepidopora sarmentosa: Cairns 1983a : 73, figs 1D–E, 6A–G, map 1; 1983b : 428.

MATERIAL EXAMINED: *Eltanin* Stn 1412, 2 col., USNM 60137; Stn 1857, 8 col., USNM 60135; Stn 1981, 3 male col., USNM 60136; Holotype NZOI H-50.

DISTRIBUTION: West of Antipodes Islands; Macquarie Ridge; South Tasmanian Rise; seamount north of Scott Island; 910–1665 m.

DESCRIPTION: Colonies small, delicate, and uniplanar, the largest colony examined (*Eltanin* Stn 1857) 3.45 cm tall and 4.15 cm broad, with a basal branch diameter of 4.15 mm. Terminal branches circular in cross

section, do not anastomose, and rarely exceed 0.6 mm in diameter. Small branchlets originate from the larger main branch, which always supports a commensal polynoid polychaete gall-tube formed by the coral. Smaller branches therefore appear to originate from the worm tube instead of the main branch. Worm tubes elliptical in cross section (e.g., 6.5 x 4.5 mm in diameter) and tend to make branches appear flattened. One side of worm tube often formed from the union of two slender, closely adjacent branches, whereas the other (outer) side is invariably solid. Narrow edges of tube have lateral openings at regular intervals. Coenosteum white and, in general, reticulate-granular in texture; however, toward branch tips coenosteal strips are linear and parallel, about 50 µm wide. Low irregularly shaped granules 6-10 µm in diameter cover coenosteal strips. Exterior surface of worm tube sometimes covered with numerous small spines (papillae), up to 0.31 mm tall and 0.10 mm in diameter, which have perforated apices.

Gastropores circular, about 0.25 mm in diameter, and occur on both faces of branches as well as at axils. Dactylopore spines usually uniformly distributed but occasionally form short adcauline rows of 2-4 dactylopore spines beneath a gastropore. Gastropore tubes cylindrical, slightly constricted in region of gastrostyle tip, and lack ring palisades. The gastrostyle occupies most of the gastropore tube. Illustrated gastrostyle (Plate 1, e) has a cylindrical, unadorned basal main shaft, which abruptly expands into a thick crown of spines about two-thirds distance to its tip. Gastrostyle spines cylindrical and blunt, about 20 µm long and 5 µm in diameter. A short, relatively bare tip projects from the crown. Illustrated style 0.42 mm tall, the crown 0.18 mm in diameter (H : W = 2.3), and the basal main shaft 0.13 mm in diameter. Dactylopore spines short and conical, of uniform height throughout colony, 0.13–0.20 mm in diameter and about 0.10 mm tall, with an apical pore diameter of 40-60 µm.

Female ampullae superficial hemispheres about 0.7 mm in diameter, each having a lateral efferent pore about 0.12 mm in diameter. Male ampullae internal or expressed only as low coenosteal bulges 0.35–0.5 mm in diameter. Male efferent pores apical and only about 20 µm in diameter. Both male and female ampullae often clustered within or on outer worm tube coenosteum.

TYPES: Holotype (Plate 1, a, b): NZOI Stn F132, NZOI H-50, also a fragment of holotype deposited at the RMNH (Coel. 13756) (*see* Vervoort and Zibrowius 1981).

TYPE LOCALITY: NZOI Stn F132, 49°49'S, 177°32'E, off Antipodes Islands; 1335 m.

REMARKS: Unfortunately, no additional specimens are reported herein. This description is based on specimens previously reported by Boschma (1968c) and Cairns (1983a); however, additional information is herein provided on the sizes of the male and female ampullae and their efferent pores. Otherwise, the description above is condensed from Cairns (1983a).

Among the New Zealand species of *Lepidopora*, *L. sarmentosa* superficially resembles *L. dendrostylus*, both species having commensal polychaete tubes paralleling their branches, and dactylopore spines that are often arranged in crescents beneath their gastropores. However, when closely compared, *L. sarmentosa* differs in having : 1) less robust branches and shorter dactylopore spines, 2) very differently shaped and shorter gastrostyle, 3) no dactylostyle, 4) granular, not imbricate, coenosteal texture, and 5) much smaller male and female ampullae, the male ampullae lacking tall, apical spines.

Lepidopora dendrostylus n. sp. (Plates 2, a–f, 3, a–f)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Norfolk Ridge; Three Kings Ridge; Bay of Plenty, North Island; Chatham Rise; Campbell Rise; 190–1258 m.

DESCRIPTION: Colonies large, firmly attached, and heavily branched in plane of flabellum. Largest colony (holotype) 8 cm tall, 10.3 cm wide, and 15 mm in basal branch diameter. All colonies, even very small ones, live in a commensal relationship with a polynoid polychaete, which induces the colony to form a large, perforated tube along its larger branches. Presence of worm tube tends to make branch cross section rectangular in shape, the longer axis perpendicular to colony plane. Coenosteum white, composed of coenosteal strips approximately 0.10 mm wide and arranged in a linear or reticulate fashion. Strips composed of well-defined imbricate platelets, only the distal 20 µm of the slightly corrugated leading edges being exposed.

Gastropores circular, 0.17-0.21 mm in diameter, and uniformly distributed on branch surfaces; however, dactylopore spines often tend to group in short abcauline crescents beneath gastropores or to completely encircle a gastropore. In the latter case, the proximal dactylopore spines are usually more highly developed, the upper ones rudimentary,

together resembling a cyclosystem or pseudocyclosystem with an adcauline diastema. Gastropore tubes cylindrical and slightly constricted near branch surface; no ring palisade. A uniquely shaped gastrostyle (Plates 2, e, f, 3, e) occupies about 90% of gastropore tube length, its sharp, slender tip easily visible in an intact gastropore tube. Gastrostyles supported by an unadorned cylindrical base, which supports a series of highly dissected, downward-projecting, imbricate fronds. Each frond appears to originate near the gastrostyle tip and grows downward as it enlarges to form a plate-like, dissected frond. Gastrostyle H : W ratio variable, ranging from 2–4. Dactylopore spines variable in height, ranging from flush to 0.6 mm tall, but invariably with a circular apical pore approximately 0.10 mm in diameter. The tall dactylopore spines give a distinctly spiny or prickly texture to the branches. Robust dactylostyles present, usually easily visible in an intact dactylopore spine. Each dactylostyle consists of a row of tall (about 0.10 mm), dissected platelets, very similar in size and shape to a gastrostyle frond.

Female ampullae large (1.0–1.2 mm in diameter) hemispheres, which often bear several dactylopore spines. Female efferent pores lateral, about 0.20 mm in diameter. Male ampullae largely internal (internal diameter 0.3–0.4 mm) but sometimes visible externally as a superficial mound 0.5–0.6 mm in diameter. Male efferent pore a tall spine very similar in size and shape to a dactylopore spine, but differing in lacking a terminal pore. Instead, each male efferent pore spine bears 1–3 subterminal pores 30–50 μm in diameter.

TYPES: Holotype: NZOI Stn F146, 1 male col., NZOI H-557, SEM stub 550A (USNM). Paratypes: NZOI Stn A910, 8 female col., NZOI P-786, 6 female col. and SEM stubs 549, 551, USNM 60251; Stn E636, 3 col., NZOI P-787; Stn E846, 3 branches, NZOI P-788; Stn E860, 3 col., NZOI P-789; Stn F146, 4 col. and branches, NZOI P-790, 4 col., USNM 85084; Stn Q40, 1 col., NZOI P-791, SEM stub 652A (USNM); Stn S53, 3 col. (1 in alcohol), NZOI P-792, 1 col. and SEM stub 550B, USNM 85085; Stn S571, 1 col., NZOI P-924; Stn S573, 1 col., NZOI P-793, SEM stub 652B (USNM).

TYPE LOCALITY: NZOI Stn F146, 53°00'S, 172°45'E, Campbell Rise; 435 m.

ETYMOLOGY: The species name *dendrostylus* (from the Greek *dendron*, tree + *stylos*, pillar) refers to the tree-like morphology of the gastrostyle, which resembles the snow-shedding branches of many coniferous trees.

REMARKS: *Lepidopora dendrostylus* is easily distinguished from the other 14 species in this genus by — having dactylostyles, having a uniquely-shaped gastrostyle, and having its male efferent pores elevated on tall apical spines. These characters (as well as the shape of the dactylostyles) are also unique within the Stylasteridae. It is one of three New Zealand species of *Lepidopora* that lives in association with polychaetes; comparisons to one of these, *L. sarmentosa*, are made in the account of that species.

Lepidopora microstylus n. sp. (Plates 3, g–h, 4, a–f)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Norfolk Ridge; off McCauley Island, Kermadec Ridge; 710–1258 m.

DESCRIPTION: Colonies small and bushy, attached by a short (0–3 mm), stout basal trunk, which supports a roughly spherical polynoid gall. Above the polychaete tube bolus no main vertical branches are formed; instead, numerous slender branches radiate in all directions from the worm tube, producing an almost spherical colony. Branches bifurcate infrequently and are long and slender (about 1 mm in diameter), gradually attenuating in diameter toward blunt branch tips. Holotype colony 17.0 mm tall, 22.5 mm wide, and 22.3 mm deep. Coenosteum white and reticulate-granular in texture, composed of strips 0.45–0.60 mm wide covered with small, very irregularly shaped granules.

Gastro- and dactylopores uniformly distributed on all branches. Gastropores circular and small (only about 0.18 mm in diameter), sometimes with a small abcauline lip. Gastropore tubes cylindrical in upper portion and of same diameter as gastropores; however, basally each gastropore tube expands into a wider (e.g., 0.35 mm in diameter) flattened chamber, which contains the gastrostyle. Gastrostyles unique and unusual in shape, more like a dactylostyle in construction, since they are basically lateral encrustations of the lower, inner gastropore tube, not a typical, free-standing, vertical gastrostyle structure. The gastrostyle is best appreciated by illustration (stereo view, Plate 4, a, c), being composed of a reticulum of interconnected, often bifurcating, spines; a H : W ratio does not apply to the gastrostyle of this species. Dactylopore spines short and conical, and of uniform height (about 50 μm) and width (0.13 mm in diameter, with a pore diameter of 65–70 μm); no dactylostyles.

Male ampullae internal, about 0.30–0.35 mm in diameter, communicating to branch surface by a

slender efferent tube about 40 µm in diameter. Female ampullae unknown.

TYPES: Holotype: NZOI Stn T243, 1 male col., NZOI H-558. Paratypes: NZOI Stn E857, 3 col., NZOI P-794; Stn E860, 1 col., NZOI P-795, SEM stub 552 (USNM); Stn G3, 1 col., NZOI P-796; Stn T243, 1 male col. and SEM stub 655, USNM 85086.

TYPE LOCALITY: NZOI Stn T24, 30°05'S, 178°15'W, off McCauley Island, Kermadec Ridge; 1035 m.

ETYMOLOGY: The specific name *microstylus* (from the Greek *micros*, small + *stylos*, pillar) refers to the tiny gastrostyle that is characteristic of this species.

REMARKS: *Lepidopora microstylus* is distinguished from its congeners by its distinctively rudimentary gastrostyle, quite unlike any other within the genus or the family. Among the New Zealand species of *Lepidopora*, three (*L. sarmentosa*, *L. dendrostylus*, *and L. microstylus*) live with commensal polychaetes. The worm tube, or centralised bolus, of *L. microstylus* confers a bushy growth form to this species, contrasted with the uniplanar growth form of the other two species in which the polychaete tube is rectangular in cross section and follows the main branches. The growth form of *L. microstylus* is characteristic of several stylasterids that live with commensal polychaetes, such as *Errina macrogastra* Marenzeller, 1904, *Stenohelia robusta* Boschma, 1964d, and *Stenohelia concinna* Boschma, 1964d, all three of these species from the Galápagos Islands and figured by Cairns (1986b).

Lepidopora symmetrica n. sp. (Plate 5, a–f)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: West of Three Kings Islands; 282 m.

DESCRIPTION: Unique holotype colony, corallum 23.1 mm tall, with equal, dichotomous branching — basal branch 2.75 mm in diameter, distal branches 1.70 mm in diameter. Branches circular in cross section, tapering gradually from base to tip. Central branch core very porous. No polychaete-induced corallum modifications. Coenosteum white, with a meandering linear-imbricate coenosteal texture. Coenosteal strips variable in width (32–94 µm) and separated by wide, shallow coenosteal slits, which are periodically penetrated by large, elliptical coenosteal pores up to 0.1 mm in greater diameter. Platelets broad, smooth, and slightly corrugated, only distalmost 20 µm of each platelet visible.

Gastro- and dactylopores uniformly distributed on all branch surfaces; dactylopores not concentrated near gastropores or aligned. Gastropores elliptical in shape, ranging from 0.32 x 0.16–0.20 mm in diameter, the greater axis parallel to branch axis. Gastropore tubes cylindrical and deep, slightly inclined toward branch tip, and lacking ring palisades and tabulae. Illustrated gastrostyle (Plate 5, e, f) 0.35 mm tall and 62 µm in diameter (H : W = 5.6); not ridged. Gastrostyles bear numerous large (up to 50 µm long and 8 µm in diameter), coarse, pointed spines. Dactylopore spines thin-walled, squat cylinders (not conical mounds as in most species of *Lepidopora*). Dactylopore spines 0.16–0.21 mm in diameter and variable in height (33–76 µm), having an apical pore diameter of 95–120 µm. Dactylostyles absent.

Ampullae unknown.

TYPE: Holotype: NZOI Stn E305, 1 branch, NZOI H-559, SEM stub 351 (USNM).

TYPE LOCALITY: NZOI Stn E305, 34°10'S, 171°55'E, west of Three Kings Islands; 282 m.

ETYMOLOGY: The species name *symmetrica* (from the Greek *symmetricos*, symmetrical) refers to the equal, dichotomous branching of the colony, which appears to produce a symmetrical branching pattern similar to that of various other stylasterids such as *Lepidopora cryptocymas* Cairns, 1985; *Sporadopora dichotoma* (Moseley 1876); and *Pliobothrus symmetricus* Pourtalès, 1868.

REMARKS: Ordinarily I would hesitate to base the description of a new species on one branch fragment; however, the characters of this specimen are so distinctive and it is so well preserved that an exception was made.

As previously discussed, the genus *Lepidopora* is extremely broadly defined and probably not monophyletic. The inclusion of *L. symmetrica* forces an even greater expansion of the generic definition to include thin-walled, cylindrical dactylopore spines (not conical as in most species), which is unique in the genus, but remarkably similar to those found in *Pliobothrus symmetricus* Pourtalès, 1868 from the North Atlantic (*see* Cairns 1986a). In fact, the colony shape, coenosteal texture, and arrangement of gastro- and dactylopores are virtually identical in these two species (the resemblance underlined by assigning the same species name), but *L. symmetrica* differs significantly in having gastrostyles.

The elongate, nonridged, coarsely spinose gastro-

style of *L. symmetrica* is characteristic of most of the species in the genus but only one other species, *L. eburnea* (Calvet 1903) from the northeast Atlantic shares with *L. symmetrica* the character of linear-imbricate coenosteal texture. *Lepidopora eburnea* differs in having gastropore lips and linearly arranged, conical dactylopore spines. *Lepidopora symmetrica* is easily distinguished from other New Zealand *Lepidopora* by its linear-imbricate coenosteum and its distinctive dactylopore spines (Table 2).

Lepidopora cryptocymas Cairns, 1985 (Plate 6, a–h)

Lepidopora cryptocymas Cairns, 1985 : 729–733, figs 1–11.

MATERIAL EXAMINED: NZOI Stn C527, 5 fragments, USNM 76361; Stn E306, 3 fragments, NZOI; Stn E845, 1 branch, NZOI; Stn E846, 6 col. and branches, NZOI, 4 col. and SEM stubs 548, 654, USNM 85087; Stn E850, 1 col. and 1 branch, NZOI; Stn E861, 4 col. and branches, NZOI, 1 col., branches, and SEM stub 547, USNM 85088; Stn E865, 4 col., NZOI; Stn I97, 1 col., NZOI; Stn P566, 2 worn fragments, USNM 72352 (incorrectly identified paratypes of *L. polystichopora*); Types, q.v.

DISTRIBUTION: Southern Norfolk Ridge; off Three Kings Islands; southern Kermadec Ridge; 168–544 m.

DESCRIPTION: Colonies uniplanar, largest corallum examined (NZOI Stn E861, Plate 6, a) 7.4 cm tall and 5.2 cm broad, with a basal branch diameter of 9.0 mm; however, a damaged colony from NZOI Stn E850 has an even larger basal branch diameter of 11.7 mm. Branching sparse, dichotomous, and equal, resulting in U-shaped axils. Branch diameter gradually decreases from base to blunt tips. Branch cross section circular to slightly elliptical, the greater axis of ellipse parallel to flabellar plane. Branch coenosteum light yellowish-brown up to a branch diameter of 2.5–3.0 mm; branches greater than 3.0 mm in diameter usually a darker chocolate brown, their inner core (2.5–3.0 mm) remaining a yellowish brown. Coenosteum composed of longitudinal strips 0.11–0.14 mm wide, which are delimited by circular to elongate coenosteal pores about 50 µm in diameter. Strips and inner surface of coenosteal pores also covered with broad, smooth, pointed spines 15–21 µm tall and about 17 µm in basal diameter. No indication of imbricate texture.

Dactylopores aligned in straight to slightly meandering longitudinal rows, 6 to 8 rows around the circumference of a larger branch. Dactylopore rows delimit longitudinal bands of coenosteum, each band composed of 6 to 9 coenosteal strips. Gastropores aligned midway on coenosteal bands defined by dactylopores, their centres 1.2–1.5 mm apart. Gastropores circular to slightly elliptical, 0.35–0.40 mm in diameter, their elongate tubes curving downward and running parallel to branch axis. Ring palisade and tabulae absent. Gastrostyles cylindrical, elongate, and unridged: invariably 0.10-0.11 mm in diameter and up to 0.75 mm tall (H : W = 7.5). Styles sparsely covered with simple, robust, cylindrical spines 45–61 µm tall and 11–15 µm in diameter; however, towards base of style, spines are much smaller, e.g., only 15–17 µm tall and about 2 µm in diameter. Spines of similarly small size and shape also cover the gastropore tube. Dactylopores circular, about 0.12 mm in diameter, and flush with coenosteal surface, not elevated or linked by ridges. Dactylopores spaced 0.2–0.6 mm apart.

Female ampullae internal and ellipsoidal in shape, about 1.0 x 0.6 mm in diameter. Each female ampulla located just distal to a gastropore, its efferent pore opening into gastropore tube via a slender efferent canal and pore, which penetrates the upper distal wall of the gastropore tube (Plate 6, f). Mature efferent pores about 0.15 mm in diameter. Male ampullae also internal, but spherical, and only 0.5–0.6 mm in diameter. Male efferent pores 40–50 µm in diameter, each opening into a shallow coenosteal depression about 0.12 mm in diameter and 0-40 µm deep, each located directly above an ampulla.

TYPES: The holotype (NZOI Stn E305) and most paratypes (NZOI Stns E305, P458, P544, P559, P561) are deposited at NZOI. Representative paratypes are also deposited at the USNM : NZOI Stns E305 (USNM 72342), P458 (USNM 72343), P559 (USNM 72345), and P561 (USNM 72346).

TYPE LOCALITY: NZOI Stn E305, 34°10'S, 171°55'E, west of Three Kings Islands; 282 m.

REMARKS: The additional NZOI specimens reported herein have allowed documentation of a broader geographic and bathymetric range for the species and providing additions to the original description, particularly regarding: maximum colony size, coenosteal colour, and gastrostyle dimensions.

The synapomorphy of multiple rows of linearly arranged dactylopores clearly unites *L. cryptocymas* and *L. polystichopora* and distinguishes them from the 13 other species of *Lepidopora*. Cairns (1985) hypothesised that they were sister species but offered five points of differentiation. To reiterate and expand,

L. cryptocymas differs in : 1) having a circular-to-elliptical branch cross section, not polygonal, 2) having chocolate-brown coenosteum, not white, 3) lacking abcauline gastropore lips, 4) having larger, more robust gastrostyle spines, 5) having flush dactylopores, not elevated and linked by ridges, 6) having flush female efferent pores that open into the gastropore tube, not opening externally and covered by a lid, and 7) having flush or recessed male efferent pores, not elevated on small mounds.

Lepidopora polystichopora Cairns, 1985
(Plates 7, a–h, 8, a–d)

Lepidopora polystichopora Cairns, 1985 : 733–735, figs 12–22 (not NZOI Stn P566, = *L. cryptocymas*).

MATERIAL EXAMINED: NZOI Stn E850, 1 female branch and SEM stub 544, USNM 85090; Stn E861, 2 male col. and several branches, NZOI, 1 col. and SEM stubs 545–547, USNM 85089; Stn G3, 1 small male col., NZOI, 1 col., USNM 85091; Types, q.v.

DISTRIBUTION: West and northwest of Three Kings Islands; Norfolk Ridge; 197–710 m.

DESCRIPTION: Colonies uniplanar, largest corallum (NZOI Stn E861, Plate 7, a) 8.1 cm tall with a basal branch diameter of 9 mm. Branching sparse, dichotomous, and equal, branches attenuating gradually toward blunt branch tips. Branch cross-section polygonal, each apex of polygon corresponding to a ridged row of dactylopore spines. Larger basal and intermediate-sized branches usually hexameral in cross section; distal branches usually four-sided (square) or compressed. Branch core quite porous. Coenosteum white but dried tissue brown. Original coenosteal texture apparently reticulate-imbricate, which is secondarily replaced on more mature branches by a linear-granular construction. Coeno--teal strips of imbricate texture about 0.10 mm in width and covered with narrow (4–28 µm), irregularly-shaped platelets. Linear-granular strips 0.10-0.12 mm wide, and delimited by circular to slightly elongate coenosteal pores 35–40 µm in diameter. These strips, as well as upper, inner surfaces of coenosteal pores and dactylopores, densely covered with smooth, robust, sharp spines 10–13 µm tall and about 7 µm in basal diameter.

Dactylopores arranged in straight longitudinal rows, 4 to 7 rows around circumference of branch, which delimit longitudinal bands each composed of 6 to 9 coenosteal strips. Gastropores aligned midway on coenosteal bands defined by dactylopores, their centres 1.2–2.0 mm apart. Gastropores circular to elliptical and 0.32–0.38 mm in diameter, some having a slight abcauline lip that alters the shape of the gastropore. Gastropore tubes cylindrical; ring palisade and tabulae absent. Gastrostyles elongate and unridged. Styles 90-110 µm in diameter and up to 1.1 mm tall, resulting in a H : W up to 12. Styles covered with elongate, tapered spines up to 36 µm long and about 6 µm in midheight diameter. Dactylopores circular, 0.08–0.10 mm in diameter, and elevated about 0.12 mm. On distal branches low ridges unite dactylopores, these ridges absent or reduced on larger-diameter branches. Low ridges of same size sometimes also link gastropores. Dactylopores spaced about 0.4 mm apart.

Female ampullae internal, 0.4–0.5 mm in diameter. Female efferent pores quite large (about 0.32 mm in diameter), each covered by a broad (about 0.52 mm wide), concave lid, which covers most of the pore. Orientation of lid is such that its free edge is directed proximally (adcauline), in the opposite direction of the gastropore lips, with which it might otherwise be confused. In addition to the lid, female efferent pores are further guarded by a dense cluster of bifurcating spines (Plate 8, d) that occur between the lid and the coenosteum. Male ampullae also internal and 0.4–0.5 mm in diameter, communicating to surface by a narrow efferent pore 35–50 µm in diameter, each pore elevated on a small mound about 0.16 mm in diameter and 0.07 mm tall. Male efferent pores located about midway between dactylopore rows, sometimes up to three between adjacent gastropores. Occasionally a male efferent pore opens into the upper gastropore tube.

TYPES: The holotype (NZOI Stn E305) and most paratypes (NZOI Stns E305, P458, P559, P561, P566) are deposited at NZOI. A fragment of the holotype (USNM 72347) and paratypes from NZOI Stns E305 (USNM 72348) and P566 (USNM 72352) are deposited at the USNM.

TYPE LOCALITY: NZOI Stn E305, 34°10'S, 171°55'E, west of Three Kings Islands; 282 m.

REMARKS: The additional NZOI specimens reported herein allow documentation of a broader geographic and bathymetric range for the species and provide additions to the original description, particularly regarding maximum colony size, original coenosteal texture, gastrostyle length, and nature of the female ampullae.

Comparisons to the morphologically and geographically similar *L. cryptocymas* are made in the account of that species; however, it should be noted

that the elaborate lid covering the female efferent pores and the polygonal branch cross sections are unique (autapomorphic) characters within the Stylasteridae.

Adelopora Cairns, 1982

Colonies uniplanar to bushy. Coenosteal texture replaced with a reticulate-granular texture. No coordination between gastro- and dactylopores; however, in some species gastropores are restricted to branch tips and axils. Gastropores cylindrical and relatively short; gastrostyles, ring palisades, and tabulae lacking; abcauline gastropore lip may be present. Gastropore covered by a moveable, sometimes hinged operculum. Dactylopores apically perforate mounds; dactylostyles lacking; dactylopore tubes long (axial). Female ampullae large superficial hemispheres, often with lateral efferent tubes. Male ampullae superficial or internal.

TYPE SPECIES: *Adelopora pseudothyron* Cairns, 1982b, by original designation.

REMARKS: *Adelopora* is readily distinguished from all other stylasterid genera by its free (not fixed), hinged opercula. Superficially, it resembles *Lepidopora*, or even *Pliobothrus*, but, in addition to having opercula, *Adelopora* differs in many other significant characters (*see* Cairns 1991). Although the hinged operculum is a very specialised character (synapomorphic for the species in the genus), *Adelopora* is grouped among the least-derived of the stylasterid genera (Cairns 1984).

The addition of three new species of *Adelopora* from the New Zealand region increases the number of species known in this genus to four, all of which are compared in Table 2. Characters found to be of particular value in discriminating species are hinge type, gastropore location, terminal branch diameter, operculum size and position, and ampullar size and position.

The articular edge of the opercula of two species (*A. pseudothyron* and *A. moseleyi*) have short nubs that fit into coenosteal depressions, such that even if a specimen was dead or bleached the operculum would swing open but remain locked in position. The opercula of *A. crassilabrum* and *A. fragilis* do not have this nub-and-socket locking morphology; instead, the opercula appear to be held in place by tissue, such that, if the specimen is dead or bleached, it is likely that the opercula will fall out. The former "locked in" type of articulation is herein termed **closed** (Plate 12, a, c), whereas the second type of free articulation is termed **open** (Plates 9, c–d. 10, d).

DISTRIBUTION: Subantarctic South Pacific seamounts; seamounts and ridges between New Zealand and New Caledonia; Lord Howe Seamount Chain; east of the Chesterfield Islands, off Brazil (Zibrowius 1988); 282–1169 m.

Adelopora crassilabrum n. sp. (Plates 8, e–g, 9, a–f)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Southern Norfolk Ridge and southern Three Kings Ridge off Three Kings Islands; 282–1169 m.

DESCRIPTION: Colonies from three stations were examined: those from the two shallower stations (NZOI Stns E305, E846) are more robust, with thicker branches (1.4 mm in branch tip diameter), have more robust gastropore lips, and more numerous gastropores. The more delicate deeper-water form (NZOI Stn E856), despite its much-smaller-diameter branches (0.6 mm in diameter), is considered to be conspecific based on copossession of all other characters. Colonies uniplanar, largest specimen examined (NZOI Stn E846) 39 mm tall and 23 mm broad, with a basal branch diameter of 4.4 mm. Branching dichotomous and equal, resulting in U-shaped axils; branches circular to slightly elliptical in cross section, gradually decreasing in diameter toward branch tips. Only one specimen (the holotype) shows evidence of an incipient commensal relationship with a polychaete. Coenosteum white and reticulate-granular in texture, having no evidence of an initial imbricate structure. Strips irregular in shape, approximately 80 µm wide, and covered with small, rounded granules 5–8 µm in diameter — altogether producing a relatively smooth, glossy texture.

Gastro- and dactylopores uniformly distributed on all branch faces of robust colonies; however, on small-diameter branches of delicate colonies, gastropores occur only on anterior face. Gastropores never occur at branch axils. Gastropores circular, 0.27–0.32 mm in diameter, and usually bordered by a broad, thick, triangular, abcauline lip; these are best developed on the robust branches of NZOI Stn E846. Gastropore tubes cylindrical, somewhat basally enlarged, and slightly curved. Dactylopore mounds conical, most highly developed near branch tips (0.12 mm tall) and almost flush on older, larger-diameter branches. Apical pore of dactylopore mounds approximately 40 µm in diameter and often

accompanied by a smaller accessory pore on the same mound of approximately 13 µm diameter.

Gastropore opercula deeply recessed, often difficult to see in an intact gastropore, making this species easily mistaken for a species of *Lepidopora*. Opercula elliptical in outline, approximately 0.27 mm long and 0.22 mm wide, and highly concave beneath. Its proximal edge (point of articulation with colony) is also highly concave, produced by a linear series of 4 or 5 contiguous indentations (Plate 9, f). These indentations are moulded to fit over the curved edge of a cylindrical bar that projects from the inner edge of the gastropore tube (Plate 9, d). In the closed position, the operculum is usually tilted upward as much as 45°. Opercula, therefore, need only swing approximately 45° in order to allow the gastrozooid to emerge. A linear depression (groove) adjacent (inward) to the gastropore bar allows the operculum to open to its full extent before being checked by the upper proximal opercular lip. The opercular articulation of *A. crassilabrum* is of the open type and thus opercula often fall free of the parent corallum when bleached or handled roughly.

Female ampullae hemispherical and 0.9–1.0 mm in diameter, opening through a short efferent tube and terminal efferent pore approximately 0.09 mm in diameter. Male ampullae (?) composite, consisting of large (about 1.5 mm diameter) ridged structures having a series of efferent pores approximately 30 µm in diameter around its perimeter.

TYPES: Holotype: NZOI Stn E846, 1 ?male col., NZOI H-560. Paratypes: NZOI Stn E305, 1 worn branch, NZOI P-797; Stn E846, 1 col., NZOI P-798, 1 col. and SEM stubs 554–555, 656, USNM 85092; Stn E856, 2 branches, NZOI P-799, 1 branch and SEM stub 553, USNM 85093.

TYPE LOCALITY: NZOI Stn E846, 34°08'S, 171°58'E, west of Three Kings Islands; 343–417 m.

ETYMOLOGY: The species name *crassilabrum* (from the Latin *crassus*, thick + *labrum*, lip) refers to the stout abcauline gastropore lips characteristic of this species.

REMARKS: Two of the four described species of *Adelopora* have an open opercular articulation (*Adelopora crassilabrum* and *A. fragilis*) — *A. crassilabrum* differs from *A. fragilis* in virtually every other character listed in Table 2, including colony shape, coenosteal texture, gastropore location, gastropore tube shape, opercular position, and male and female ampullar shape and position.

Adelopora fragilis n. sp. (Plates 10, a–g, 11, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Norfolk Ridge; Three Kings Ridge; east of Chesterfield Islands; 400–967 m.

DESCRIPTION: Colonies small and delicate, the largest specimen (holotype) only 18 mm tall, with a basal branch diameter of 2.3 mm. Branching uniplanar, dichotomous, and unequal; branches circular in cross section, gradually attenuating to very slender tips as small as 0.3 mm in diameter. Commensal polychaetes unknown in this species. Coenosteum white and linear-imbricate in texture, the strips 40-65 µm wide and separated by narrow slits about 5 µm wide. Platelets continuous across a strip and slightly corrugated, revealing only approximately 8–10 µm of their distal edge.

Dactylopores uniformly distributed on all branch surfaces but gastropores restricted to anterior side of branch axils, each gastropore flanked laterally by two branches, posteriorly by branch coenosteum, and anteriorly by a broad triangular lip. Gastropores assume size and shape of opercula, ranging from rectangular, to oval and triangular. Gastropore tubes cylindrical and relatively shallow (about equal to opercular width in depth). Dactylopore mounds abundant, up to 70 µm tall, with apical pores about 25 µm in diameter.

Opercula flush with coenosteum or slightly recessed, but always clearly visible. Opercular shape variable: rectangular (Plate 10, b), oval, or triangular with rounded edges (Plate 10, f, g); regardless, all opercula have a relatively straight articular edge (width) of 0.36-0.40 mm and a length of 0.40–0.55 mm. Opercula slightly concave beneath and distinctly thicker at articular edge than free edge. Articular edge of operculum concave, this concavity moulded around a bar that projects from the inner edge of the gastropore tube (Plate 10, d) and on which it pivots as the operculum opens and closes (i.e., open articulation as in *A. crassilabrum*). In closed position, operculum is horizontal.

Female ampullae large, smooth hemispheres 0.60–0.65 mm in diameter, usually clustered near gastropores (especially on gastropore lips) or on posterior branch surface opposite a gastropore. Female efferent pores 0.11-0.13 mm in diameter. Male ampullae internal and slightly ellipsoidal in shape (approximately 0.35 mm in greater diameter), and only visible in branch cross section.

TYPES: Holotype: NZOI Stn G3, 1 male col., NZOI H-561. Paratypes: NZOI Stn G3, 5 male branches,

TABLE 2. Characteristics of the four species of *Adelopora* (e.p. = efferent pore)

Character	*A. crassilabrum* n. sp.	*A. fragilis* n. sp.	*A. moseleyi* n. sp.	*A. pseudothyron* Cairns, 1982
Colony shape; terminal branch thickness	Uniplanar, robust; variable branch thickness: 0.6–1.4 mm	Uniplanar, small (delicate) 0.3 mm	Uniplanar, robust; 0.6 mm	Uniplanar to bushy (robust); 0.9 mm
Commensal polychaete	Absent (?)	Absent	Present	Absent
Coenosteal texture	Reticulate-granular (may be secondary texture)	Linear-imbricate	Primarily linear-imbricate, secondarily reticulate-granular	Linear-imbricate
Gastropore location and diameter; lip shape	Uniformly distributed, 0.27–0.32 mm; thick, triangular lips	Exclusively at branching axils, 0.35–0.55 mm; prominent triangular lips	Primarily on anterior surface (staggered on face and at axils), 0.2–0.3 mm; rounded lips	Exclusively at branch tips and axils, 0.4–0.65 mm; no lips
Gastropore tube	Elongate, curved, basally enlarged	Shallow	Elongate, basally enlarged	Elongate, cylindrical
Opercular articulation (hinge)	Open	Open	Closed	Closed
Opercular shape (length of articular edge); position	Elliptical (0.22-0.27 mm); tilted upward about 45° and deeply recessed	Variable: rectangular, oval, or triangular (0.36–0.40 mm), horizontal and flush or slightly recessed	Rectangular: rounded free edge (0.29-0.35 mm); horizontal	Rectangular with rounded free edge (0.55–0.64 mm); horizontal
Female ampullae	Smooth hemispheres, 0.9–1.0 mm, random placement, often with an e.p.	Smooth hemispheres, 0.6–0.65 mm, clustered near gastropores	Ridged hemispheres, 0.9–1.0 mm, both faces	Smooth hemispheres, 1.06-1.22 mm, lateral tube, random location
Male ampullae	Composite: large ridged hemispheres (1.5 mm) with several peripheral e.p.	Internal, approx. 0.3 mm	Unknown	Unknown
Distribution	Ridges between New Zealand and New Caledonia; 282-1169 m	Ridges between New Zealand and Chesterfield Islands; 400-710 m	Lord Howe Seamount Chain; 285–360 m	Subantarctic seamounts of South Pacific; 298-915 m

NZOI P-800, 2 male branches and SEM stubs 556, 659, USNM 85094; Stn U594, 1 col., NZOI P-933; Stn U599, 4 female branches, NZOI P-801, 2 female branches and SEM stub 557, USNM 85095; Chalcal 1, *Coriolis* D5, 1 col. and SEM stubs 359–360, 369, USNM.

TYPE LOCALITY: NZOI Stn G3, 26°25'S, 167°15'E, Norfolk Ridge north of Norfolk Island; 710 m.

ETYMOLOGY: The species name *fragilis* (from the Latin *fragilis*, fragile, brittle) refers to the delicate nature of the slender branches of this species, colonies usually collected in many pieces.

REMARKS: Some transported fragments, not included in the type series, were also found at NZOI Stn G10, at 967 m depth. For comparisons to other species, *see* Remarks of *A. crassilabrum* and Table 2.

Adelopora moseleyi n. sp. (Plates 11, c–g, 12, a–f)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Lord Howe Island Seamount Chain; 285–360 m.

DESCRIPTION: Colonies uniplanar, attached by a thin encrusting base. Basal (primary) branch 4–6 mm in diameter, dividing in half at a height of about 15 mm, the resulting two secondary branches diverging at a right angle. Subsequent branching less regular and often unequal; branch tips approximately 0.6 mm in diameter. A commensal polynoid polychaete invariably present, but confined to one face of the two large secondary branches, causing the coral to form large, semi-enclosed tubes that are rectangular in cross section and up to 2.5 x 1.5 mm in diameter. Coenosteum white to light orange and linear-imbricate in texture. Strips 40–60 µm wide and covered with platelets of variable width, only the distal 10 µm of any platelet exposed. Linear-imbricate coenosteum secondarily covered with a granular coenosteum resembling a reticulate-granular texture. Altogether, branch coenosteum quite dense and robust. *Pedicularia* (an obligate commensal gastropod) deposits about 3.3 x 1.8 mm in size occur on some specimens.

Gastro- and dactylopores invariably more abundant on anterior face and virtually absent from coenosteum forming worm tube on posterior face. Gastropores slightly staggered on anterior face and commonly occur at branch axils as well. Gastropores circular and 0.2–0.3 mm in diameter, each covered by a hinged (closed-type) operculum. Outer (abcauline) rim of gastropore enlarged as a broad, rounded, lower lip, which serves to check the free opercular edge in a closed horizontal position. Gastropore tube elongate and cylindrical, but slightly enlarged basally, and strongly inclined toward the branch tip such that the tube is virtually parallel to branch axis. Dactylopores broad-based (up to 0.2 mm wide) mounds up to 0.11 mm tall, with a circular apical pore 30–40 µm in diameter.

Gastropore opercula variable in shape, but primarily rectangular, with a rounded free edge, a straight articular edge, a flat top, and a concave underside. Typical opercula measure 0.29–0.35 mm broad, 0.32–0.35 mm long, and 35–60 µm thick at their outer edges. Straight articular edge rounded and smooth, with terminal nubs up to 40 µm long, the edge and nubs articulating with a correspondingly smooth coenosteal groove and terminal sockets (Plate 12, c) — a closed-type opercular articulation.

Female ampullae superficial hemispheres 0.9–1.0 mm in diameter, occurring on both anterior and posterior branch faces. Female ampullae covered with a series of 8–10 low, rounded ridges, which radiate from its apex. Female efferent pores lateral, 0.18–0.21 mm in diameter, and sometimes accompanied by a short efferent tubule or partially covered by a short spine. Male ampullae unknown.

TYPES: Holotype: NZOI Stn P842, 1 female col., NZOI H-562. Paratypes: NZOI Stn I735, 1 female col., NZOI P-802, 1 female col. and SEM stub 558B, USNM 85096; Stn I741, 1 female col., NZOI P-803; Stn P842, 2 female col., NZOI P-804, 2 fragments and SEM stubs 558A, 657–658, USNM 85097.

TYPE LOCALITY: NZOI Stn P842, 32°34'S, 156°17'E, southwest of Lord Howe Island; 285–290 m.

ETYMOLOGY: This species is named in memory of Henry Nottidge Moseley, naturalist on board HMS *Challenger*, who described and beautifully illustrated many new species of deep-water stylasterids from around the world (Moseley 1879, 1881).

DISCUSSION: Only two species of *Adelopora* are known to have the closed type of opercular articulation (*A. pseudothyron* Cairns, 1982, and *A. moseleyi*), these two species sharing several other characteristics, such as coenosteal texture, opercular shape, dactylopore shape and size, and female ampullar shape and size (Table 2). *Adelopora moseleyi* differs, however, in having a uniplanar corallum, consistent association with a commensal polychaete, gastropores staggered on anterior branch faces (not restricted to axils),

and a much smaller gastropore diameter and consequently smaller opercula.

Lepidotheca Cairns, 1983

Gastro- and dactylopores usually uniformly distributed; however, in some species gastropores restricted to branch axils and in other species dactylopores arranged unilinearly. Coenosteum white; texture invariably linear-imbricate. Abcauline gastropore lips common. Gastropore tubes cylindrical and usually lack a ring palisade. Gastrostyles usually needle-shaped (H : W ratio 4–11) and unridged. Dactylopore spines U-shaped and thin walled, their dactylotomes facing upward (abcauline); dactylostyles absent. Ampullae superficial; male efferent pores apical.

TYPE SPECIES: *Errina (Inferiolabiata) fascicularis* Cairns, 1983a, by original designation (Cairns 1983b)

DISCUSSION: As noted by Cairns (1983b), *Lepidotheca* is most similar to *Inferiolabiata*, both genera having uniformly distributed, abcauline dactylopore spines; elongate, unridged gastrostyles; similar growth forms; and similar coenosteal textures. *Lepidotheca* is distinguished by lacking dactylostyles and by having thinner-walled and smaller dactylopore spines. Fourteen valid species are recognised in the genus: seven listed by Cairns (1983b); *L. pourtalesi* Cairns, 1986a; *L. brochi* Cairns, 1986a; *L. macropoma* Cairns, 1986b; and four new species described herein. Characters of value in discriminating species include location of gastropores; presence or absence of gastropore lips; branching mode and resultant corallum shape; and size and location of male and female ampullae (Table 3). A useful first-order discriminator within the genus is the location of gastropores — nine species have uniformly distributed gastropores, four have gastropores restricted to branch axils, and one (*L. brochi*) has gastropores confined to the anterior face.

DISTRIBUTION: Indo-West Pacific, Subantarctic; Galápagos; Caribbean; 85–2010 m (Cairns 1991b).

Lepidotheca fascicularis (Cairns, 1983)
(Plates 13, a–h, 14, a, b)

Errina (Inferiolabiata) fascicularis Cairns, 1983a : 117–121, figs 22 h, 29 a–k, 30 a–e (not *Eltanin* Stn 1416 (in part) and *Eltanin* Stn 1422, both = *Lepidotheca inconsuta*).

Lepidotheca fascicularis: Cairns 1983b : 444–446, figs 5A–I, 24E, 25E.

MATERIAL EXAMINED: NZOI Stn E305, 1 col., NZOI; Stn Q25, 2 col., NZOI; Stn S46, 1 branch, NZOI; Stn S53, 2 col., NZOI, SEM stub 559 (USNM); Types, q.v.; Reference Material — Syntypes of *Errina ramosa* Hickson and England, 1905 (ZMA 8204) and *Errina horrida* Hickson and England, 1905 (ZMA 7827).

DISTRIBUTION: Off Tierra del Fuego, Burdwood Bank, and South Georgia; New Zealand Region from Macquarie Ridge, Campbell and Bounty Plateaus, Chatham Rise, and off Three Kings Islands; 282–2100 m.

DESCRIPTION: Colonies of moderate size, very delicate, and uniplanar, the holotypic colony 46.7 mm tall and 56.0 mm wide, with a basal branch diameter of 2.8 mm. About half of colonies examined lived in association with a commensal polychaete, *Polyeura laevis* McIntosh, which induces the stylasterid to form elongate cylindrical tubes, and, in general, to form a more robust corallum. Branching dichotomous but unequal, resulting in small-diameter branches diverging from much larger-diameter branches; no branch anastomosis. Branches circular in cross section, gradually decreasing in diameter to very slender branch tips of about 0.45 mm in diameter. Coenosteum white and linear-imbricate in texture. Coenosteal strips of larger-diameter branches quite wide (0.25–0.38 mm) and very convex (called "cords" by Cairns 1983a), bordered by deep slits 20–30 µm wide. Towards branch tips the bordering slits are obscure and the strips less convex, making the boundaries of the strips less pronounced or not visible. Platelets variable in width: some extend entirely across a coenosteal strip, whereas others are quite slender (e.g., only 13 µm wide) and irregularly arranged, the latter condition common at branch tips (Plate 13, e).

Gastropores circular (0.15–0.22 mm in diameter) occurring primarily at branch axils but also occasionally on branch faces. Axial gastropores usually flanked on each flabellar face by a prominent triangular lip up to 0.2 mm tall (Plate 13, g); however, occasionally only one lip is present or they may be lacking altogether. Facial gastropores invariably bear one wide (0.34–0.47 mm) abcauline lip, about twice as broad as a dactylopore spine. Gastropore tubes long and slender, lacking a ring palisade but often having at least one tabula to stabilise the elongate gastrostyle. Gastrostyles needle-shaped, up to 1.31 mm long, and usually about 0.12 mm in basal diameter (H : W ratio 11), with a sharply pointed

tip that terminates well below the coenosteal surface. Gastrostyles sparsely covered with tall, slender, sharp spines up to 32 µm tall. Dactylopore spines uniformly distributed over branch surfaces and ampullae, and are fairly uniform in size and shape: 0.13–0.20 mm tall and 0.16–0.19 mm wide, with a dactylotome (slit) width of 0.10–0.12 mm. Posterior edge of dactylopore spines inclined distally almost 45° from vertical, producing a triangular shape when viewed from the side.

Female ampullae large, smooth or spiny (latter shape caused by dactylopore spines) hemispheres approximately 0.9–mm in diameter, each mature ampulla having a lateral efferent pore 0.20-0.22 mm in diameter; however, mature ampullae are rare. Male ampullae of approximately same size (0.8–0.9 mm in diameter), hemispherical to slightly irregular in shape, and invariably spiny, caused by dactylopore spines. Each male ampulla has several (3–6) apical to subapical efferent pores 40–50 µm in diameter, each of which is usually partially covered by a short, curved spine. Both male and female ampullae scattered uniformly on all branch surfaces, often greater in diameter than the branch on which they occur.

TYPES: Holotype (Plate 13, a) and most paratypes (from 13 stations) deposited at the USNM. Paratypes from *Eltanin* Stn 1423 also deposited at the BM and RMNH (*see* Cairns 1983a : 120).

TYPE LOCALITY: *Eltanin* Stn 1423, 56°21'S, 158°28'E, Hjort Seamount; 1574–1693 m.

REMARKS: Of the 14 species of *Lepidotheca*, only four have their gastropores restricted to branch axils, the pores being flanked on either side by broad triangular lips, viz. L. *fascicularis*, *L. chauliostylus* n. sp., *L. horrida* (Hickson and England, 1905), and *L. ramosa* (Hickson and England, 1905). Comparisons to *L. chauliostylus* are made in the remarks of that species. *Lepidotheca ramosa* (off Timor, 520 m) and *L. horrida* (Philippines, 1089 m) are both very similar to *L. fascicularis* and all three may eventually prove to be synonymous; however, *L. ramosa* appears to differ in having its gastropores resticted to the anterior branch face adjacent to each axil (not in the axil) and thus flanked by only one abcauline lip instead of two. *Lepidotheca horrida* has larger gastropores (about 0.3 mm in diameter) and larger female ampullae (1.2–1.25 mm in diameter) with enormous, spongy efferent pores about 0.3 mm in diameter.

Paratypes from two *Eltanin* stations (1416, part; and 1422), originally referred to the "shallow water" form of this species (Cairns 1983a : 119–120), have been reidentified as *L. inconsuta* n. sp., which is discussed in the account of that species.

Lepidotheca inconsuta n. sp. (Plates 14, c–f, 15, a–c)

Errina (Inferiolabiata) fascicularis Cairns, 1983a : 117–121 (part, *Eltanin* Stns part of 1416 and all of 1422).

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Southern Macquarie Ridge; 787–1500 m.

DESCRIPTION: Colonies moderate in size, robust, and bushy in shape, undoubtedly caused by association with commensal polychaetes. Holotype colony 5.6 cm tall and 2.9 cm broad, with a basal branch diameter of 4.8 mm. Polychaete tubes large, with an internal diameter up to 4.5 x 2.8 mm. Branching dichotomous and unequal, slightly more robust than that of *L. fascicularis*. Coenosteum white and imbricate in texture; however, coenosteal strips and slits not present. Instead, coenosteum relatively smooth, the larger-diameter branches bearing large, aligned, but well-spaced, elliptical coenosteal pores occurring in the position of coenosteal slits. Platelets broad and corrugated.

Gastropores circular (0.25–0.36 mm in diameter) occurring uniformly on all branch surfaces but not at branch axils. Gastropores on distal branches each bordered by one broad abcauline lip; gastropores of larger-diameter branches unlipped. Gastropore tubes cylindrical, lacking a ring palisade. Gastrostyles consist of a massive, unadorned (smooth) basal main shaft up to 0.2 mm in diameter and 0.4–0.5 mm tall, which supports a very slender, rudimentary apical extension up to 0.2 mm tall and only 40–50 µm in diameter (H : W ratio of apical extension up to 5.3). Basal section usually firmly attached to internal coenosteum by coenosteal bridges, whereas distal portion free standing. Distal section bears small, irregularly shaped granules, not long enough to be considered as spines. The tiny distal gastrostyle and the relatively large gastropore diameter produce a relatively commodious gastropore tube. Dactylopore spines uniformly distributed on all branch surfaces, but less so on ampullae, and of about same size, shape, and orientation as those of *L. fascicularis* (*see* Table 3).

Female ampullae large (1.2–1.3 mm in diameter), relatively smooth hemispheres, each with a lateral efferent pore 0.18–0.21 mm in diameter. Male ampullae also large hemispheres (0.85–1.1 mm in

diameter), each bearing several apical to subapical efferent pores 60-65 µm in diameter. Both types of ampullae uniformly distributed on branch surfaces.

TYPES: Holotype: *Eltanin* Stn 1422, 1 male col. and SEM stub 666, USNM 60144 (also a paratype of *Errina fascicularis*). Paratypes: *Eltanin* Stn 1416, 6 male branches and SEM stub 665B, USNM 85099 (also paratypes of *Errina fascicularis*, ex. USNM 60145); NZOI Stn C731, 4 female branches, NZOI P-805, 1 female branch and SEM stub 665A, USNM 85098.

TYPE LOCALITY: *Eltanin* Stn 1422, 56°19'S, 158°29'E, Hjort Seamount; 833-842 m.

ETYMOLOGY: The species name *inconsuta* (from the Latin *inconsutus*, unseamed) refers to the relatively smooth coenosteum of the species, which is not divided into coenosteal strips bordered by slits (seams).

REMARKS: *Lepidotheca inconsuta* was previously identified as the more robust, "shallow water" form of *L. fascicularis* in the original description of the latter species (Cairns 1983a). Although very similar, reexamination of these specimens in the context of the New Zealand revision indicated several consistent differences between the two taxa. The most conspicuous differences are that *L. inconsuta* lacks gastropores at branch axils, has significantly larger gastropores, and has much smaller gastrostyles (Table 3). Furthermore, the coenosteal texture of *L. inconsuta* is smoother (consistently without strips and slits); its ampullae are, in general, larger; and its branches are more robust.

Lepidotheca chauliostylus n. sp.
(Plates 15, d–h, 16, a–g)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Norfolk Ridge and Three Kings Ridge; 130–1169 m.

DESCRIPTION: Colonies small and very delicate, the holotype only 33.4 mm tall and 22 mm broad, with a basal branch diameter of 2.3 mm. Colonies primarily uniplanar; however, if a commensal polychaete is present, a calcareous tubular gall is secreted by the stylasterid causing the colony to be slightly bushy and more ramose. Branching dichotomous and unequal, resulting in numerous small-diameter branches originating from larger-diameter branches. Main branches circular to elliptical in cross section; distal branches quite compressed (flattened), about 0.4 mm wide. No branch anastomosis. Coenosteum white and slightly translucent. Coenosteal strips absent. Primary coenosteal texture imbricate, composed of slender (e.g., as narrow as 11 µm, Plate 15, h) to broad, corrugated platelets (Plate 15, g), which are secondarily overlaid with granules. Granules of secondary texture small and rounded (8–9 µm in diameter) and roughly aligned in rows, corresponding to the underlying platelet structure.

Gastropores restricted to branch axils; dactylopore spines variable in location depending on whether or not the colony lives in association with a polychaete. If no worm is present, dactylopore spines are uniserially arranged on branch edges; if a worm is present, dactylopore spines are located on branch edges but not in rows and often occur on branch faces as well. Gastropores circular, small (0.16–0.21 mm in diameter), and always bordered on both flabellar sides by a small (0.11-0.13 mm tall), triangular lip, unless an ampulla is present at that axil, in which case the ampulla overgrows the adjacent lip. In one male colony from NZOI Stn G3 and several from NZOI Stn E856, gastropores are slightly offset from branch axils and the outer gastropore lip is greatly enlarged into a hood-like structure up to five times the size of the opposing lip. Gastropore tubes cylindrical, each bearing a relatively well-defined ring palisade near the gastropore aperture, composed of coarse elements approximately 32 µm in diameter. Gastrostyles needle shaped, each with a sharp tip extending above coenosteal surface. Illustrated gastrostyle (Plate 16, f) 0.54 mm tall and 0.067 mm in diameter (tip only 19 µm in diameter), for a H : W ratio of 8.05. Gastrostyles appear to be unridged and bear few spines. Dactylopore spines uniform in height (0.11-0.12 mm) and width (0.14– 0.15 mm), their dactylotomes approximately 50–60 µm wide. Dactylopore spines spaced 0.15– 0.20 mm apart when aligned on branch edges.

Female ampullae large smooth hemispheres about 0.75 mm in diameter, always occurring on branch faces adjacent to branch axils. Female efferent pores approximately 0.15 mm in diameter and positioned laterally on ampulla such that they face the gastropore. Male ampullae cylindrical, about 1 mm in diameter and 1 mm tall, with a flat to slightly concave top. Four to six efferent pores (27–30 µm in diameter) occur around the upper perimeter of the ampulla, each pore shielded by a semicircular hood, which opens toward the centre of the ampulla (Plate 16, d). Male ampullae also restricted to branch faces adjacent to branch axils, directly adjacent to gastropores. Worn male colonies, in which ampullae

have been damaged or discharged, reveal large (1.0–1.2 mm in diameter) concave coenosteal depressions at each branch axil. Diameters of both male and female ampullae often greater than that of branch on which they occur, appearing gall-like in shape.

TYPES: Holotype: NZOI Stn E862, 1 col., NZOI H-563, SEM stub 563 (USNM). Paratypes: NZOI Stn E846, 1 branch, NZOI P-806; Stn E856, 10 male col., NZOI P-807, 2 col. and SEM stub 667, USNM 85100; Stn E862, 1 col., P-927; Stn G3, 4 branches, NZOI P-808, 2 branches and SEM stub 564, USNM 85101; Stn U567, 1 col., P-932; Stn U581, 1 col., P-930; Stn U582, 8 col., P-937; Stn U599, 2 male col., NZOI P-809.

TYPE LOCALITY: NZOI Stn E862, 32°28.0'S, 167°31.0'E, Norfolk Ridge; 130 m.

ETYMOLOGY: The species name *chauliostylus* (from the Greek *chaulios*, prominent + *stylos* pillar) refers to the gastrostyles of this species, the tips of which actually extend above the coenosteal surface.

REMARKS: Among the four species of *Lepidotheca* that have gastropores restricted to branch axils (*see* Remarks on L. *fascicularis*), *L. chauliostylus* is easily distinguished by several characters — its tendency to have laterally aligned dactylopore spines; ampullae occurring near branch axils; its uniquely shaped male ampullae; its exsert gastrostyle tips; and its diffuse ring palisade. The only other species to have laterally aligned dactylopore spines is *L. brochi* Cairns, 1986 (Lesser Antilles, 545–864 m), but this species differs in is gastropore placement, coenosteal texture, and branching pattern, as well as many other characters.

Lepidotheca cervicornis (Broch, 1942)
(Plates 17, a–g, 18, a, b)

Errina (Labiata) cervicornis Broch, 1942 : 57–60, text-fig. 18, pl. 5, fig. 18.
Errina cervicornis: Boschma 1953 : 167; 1957 : 52; 1963 : 338.
Lepidotheca cervicornis: Cairns 1983b : 428, 446.

MATERIAL EXAMINED: NZOI Stn E291, 2 branches, 1 branch and SEM stub 562, USNM 85102; Stn E305, 2 branches; Stn P472, 3 branches; syntypes.

DISTRIBUTION: Known only off North Cape and Three Kings Islands; 101–410 m.

DESCRIPTION: Colonies uniplanar and relatively small, the figured syntype (Plate 17, a) a complete colony only 16.5 mm tall and 28.7 mm broad, with a basal branch diameter of 3.9 mm and an encrusting base; another syntype is 28.7 mm tall and 4.8 mm in basal branch diameter. Branching dichotomous and equal; branches circular in cross section and gradually decrease in diameter to blunt tips about 0.9 mm in diameter. Coenosteum white and linear-imbricate in texture, the strips 90–140 μm wide and often slightly convex. Coenosteal strips delimited by shallow grooves which are periodically penetrated by circular to elongate coenosteal pores about 25 μm wide and 25–100 μm long. Platelets longitudinally ridged and variable in width, ranging from 13–140 μm wide. Approximately distal 12 μm of each platelet exposed.

Gastro- and dactylopores occur uniformly on all branch surfaces, but are usually absent from branch axils. Ratio of gastropores to dactylopores quite high, as much as 1 : 2. Gastropores circular, 0.21–0.23 mm in diameter, and almost always bordered by a tall abcauline spine resembling a dactylopore spine. According to Broch (1942), gastropores are only occasionally bordered by small abcauline lips and more rarely are flush with the coenosteum. Gastropore tubes long and cylindrical, having a diffuse ring palisade and tabulae as well if the gastrostyle is elongate. Gastrostyles cylindrical to needle shaped, up to 0.62 mm tall and 75–85 μm in diameter, with H : W ratios of 4.1–8.0. Gastrostyles bear low ridges on which tall (23–24 μm tall, 8 μm basal diameter), sharp, upward-curving spines occur. Dactylopore spines thin walled and slightly anteriorly inclined, up to 0.4 mm tall and 0.21 mm in width, with a dactylotome width of about 0.12 mm. Spines associated with each gastropore identical in shape to dactylopore spines, but usually taller, up to 0.6 mm. Very rudimentary lateral dactylostyles appear to be present in some dactylopore spines, these elements being about 25 μm tall and 9–10 μm in diameter.

Ampullae of one kind present in study material — prominent, relatively smooth hemispheres 0.7–0.8 mm in diameter (not 1.0 mm as stated by Broch 1942), which are uniformly distributed on all branch surfaces. Each ampulla covered with numerous (15–25), small (30 μm tall) projections, most of which stand adjacent to tiny (e.g., 9 μm) pores. Furthermore, many ampullae were in various stages of disintegration, proceeding from the apex downward, which reveals the thick, porous underlying wall structure of each ampulla. Eventually only large concave coenosteal craters remain. Broch (1942) interpreted these ampullae as female and suggested

that the progressive dissolution of the ampullar wall was the method of larval release. The tiny pores covering the ampullae might then be interpreted as female efferent pores. On the other hand, the tiny pores may be male efferent pores. More specimens of both sexes are needed to resolve this issue.

TYPES: Four syntypes of *E. cervicornis*, including one whole colony, are deposited at ZMC (Plate 17, a).

TYPE LOCALITY: Two miles (3.2 km) east of North Cape, New Zealand; 55 fathoms (101 m).

DISCUSSION: Among the nine species of *Lepidotheca* that have uniformly distributed gastropores, only two have abcauline gastropore lips : *L. cervicornis* and *L. inconsuta*. The gatropore lips of *L. cervicornis* are unique in that they are quite tall and horseshoe-shaped in cross section, resembling a dactylopore spine in size and shape. *Lepidotheca cervicornis* is further distinguished from other species by having a ridged gastrostyle, a diffuse ring palisade (only *L. chauliostylus* is also known to have a ring palisade), and spongy, thick-walled ampullae which are frequently ruptured or persist only as concave coenosteal depressions.

Lepidotheca altispina n. sp. (Plates 18, c–g, 19, a–f)

MATERIAL EXAMINED: Types, q.v. Reference Material: Types of *Lepidotheca pourtalesi* Cairns, 1986a (USNM).

DISTRIBUTION: Lord Howe Seamount Chain; southern Norfolk Ridge; Three Kings Ridge; Kermadec Ridge off McCauley and Curtis Islands; 445–1258 m.

DESCRIPTION: Colonies small, delicate, and primarily uniplanar, the complete holotype colony 32.4 mm tall and 40.0 mm broad, with a basal branch diameter of 3.1 mm. Branching dichotomous, equal (branch axils 90°), and relatively closely spaced initially, often resulting in a regular pattern of branch anastomosis in the lower corallum. Branches circular in cross section, having a highly porous central core, and decreasing gradually in diameter to very delicate branch tips about 0.6 mm in diameter. Coenosteum white, with a well-defined linear-imbricate texture. Strips 0.11–0.20 mm wide, longitudinally or diagonally arranged on branches, and separated by deep, well-defined slits about 20 µm wide. The wide strips and deep slits are characteristic of the species and easily distinguished even in worn specimens. Platelets broad (extending across the strip) and slightly corrugated, each platelet exposing approximately 25 µm of its distal edge. Unlike most other stylasterids among which the leading platelet edges are usually directed distally, the leading edges of all coenosteal platelets of *Lepidotheca altispina* are directed proximally, toward the colony base (termed **reversed polarity**).

Gastro- and dactylopores uniformly distributed on all branch surfaces, having no preference for branch axils. Gastropores circular and small (0.15–0.17 mm in diameter), inclined slightly anteriorly, and often have a slender groove anterior to the gastropore; no gastropore lips. Gastropore tubes cylindrical, covered internally with an imbricate texture in upper half; no ring palisade or tabulae. Gastropore tube occupied entirely by a needle-shaped gastrostyle, the tip of which extends to or slightly above coenosteal surface. Illustrated gastrostyle (Plate 19, d) 0.63 mm tall and 0.08 mm in basal diameter (apical diameter 19 µm), for a H : W ratio of 7.9. Gastrostyles unridged and sparsely covered with sharp spines up to 32 µm long. Dactylopore spines extremely tall (up to 0.50 mm), especially in relation to the slender branch diameter. Abcauline dactylopore spines thin walled (approximately 0.13 mm wide); dactylotomes about half this width. Dactylopore spines that are closely adjacent to other branches sometimes hooded or crested proximally.

Female ampullae large hemispheres 1.0–1.1 mm in diameter and usually covered with dactylopore spines of various sizes; no efferent pores were observed in the study material. Male ampullae primarily internal (internal diameter 0.36–0.39 mm), each with a low superficial relief 0.5–0.6 mm diameter and usually studded with 2 or 3 dactylopore spines. Male efferent pores usually obscure, but approximately 32 µm in diameter. Both male and female ampullae uniformly distributed on all branch surfaces.

TYPES: Holotype: NZOI Stn E856, 1 ?male col., NZOI H-564. Paratypes: NZOI Stn E856, 3 col. (1 in alcohol), NZOI P-810, 2 col. and SEM stubs 561, 660–661, USNM 85103; Stn E857, 2 branches, NZOI P-811; Stn E860, 3 col. (1 in alcohol), NZOI P-812, 1 col., USNM 85104; Stn P8, 1 col., NZOI P-813, 1 col., USNM 85105; Stn Q68, 1 col., NZOI P-814; Stn T235, 2 col., NZOI P-815; Stn T256, 1 col., NZOI P-816; Stn U582, 14 col., P-929.

TYPE LOCALITY: NZOI Stn E856, 32°11'S, 168°18'E, southern Norfolk Ridge; 1157–1169 m.

ETYMOLOGY: The species name *altispina* (from the Latin *altus*, high + *spina*, spine) refers to the tall,

TABLE 3. Characteristics of the six New Zealand species of *Lepidotheca*
(dpsp = dactylopore spines, e.p. = efferent pores, H:W = height-to-width ratio of gastrostyle, gp = gastropore, ds = dactylostyles)

Character	*L. fascicularis* Cairns, 1983	*L. inconsuta* n.sp.	*L. chauliostylus* n.sp.	*L. cervicornis* (Broch, 1942)	*L. altispina* n.sp.	*L. robusta* n.sp.
Colony size and shape	Moderate, uniplanar	Moderate, uniplanar to slightly bushy	Small (delicate) primarily uniplanar	Small, uniplanar	Small, uniplanar	Large, robust,
Commensal polychaete	Occasionally	Present	Occasionally	Absent	Absent	Absent
Branching characteristics	Unequal, nonanastomosing, tips 0.45 mm	Unequal, nonanastomosing, tips 0.8 mm	Unequal, nonanastomosing, tips 0.4 mm	Equal, nonanastomosing, tips 0.9 mm	Equal, anastomosing tips to 0.6 mm	Unequal, nonanastomosing, sparse, tips 1.0 mm
Coenosteal texture	Linear-imbricate: strips quite broad and slightly convex	Imbricate, but without strips and slits	Imbricate, but without strips, slightly translucent	Linear-imbricate: strips slightly convex	Linear-imbricate: deep coenosteal slits; polarity of platelets reversed	Linear-imbricate: strips not apparent; platelet polarity variable
Gastropore distribution and diameter; lips	Primarily at branch axils, 0.15-0.22 mm; usually 2 lips per gp	Uniform; large (0.25–0.36 mm); lips only on distal gp	Exclusively at branch axils, 0.16-0.21 mm; 2 prominent lips per gp	Uniform; 0.21–0.33 mm; tall abcauline lip	Uniform, small (0.15–0.17 mm); no lips	Uniform, 0.20–0.22 mm); no lips but always bordered by tall dpsp
Gastrostyle	Tip nonexsert; needle shaped (H:W = 11)	Tip nonexsert; rudimentary, needle shaped (H:W = about 5)	Tip exsert; needle shaped (H:W about 8)	Tip nonexsert; needle shaped (H:W = 4–8)	Slightly exsert tip; needle shaped (H:W = 7–8)	Tip not exsert; cylindrical (H:W up to 15)
Dactylopore spines: distribution, height, width; special structures	Uniformly distributed, 0.15–0.20 mm, 0.16–0.19mm	Uniformly, 0.19 mm, 0.20-0.21 mm	Linear on branch edges or uniformly, 0.11-0.12 mm, 0.14–0.15 mm	Uniformly, 0.4 mm, 0.21 mm; rudimentary lateral ds	Uniformly, tall (0.5 mm), 0.13 mm	Uniformly (abundant) quite large (0.9 mm), 0.2 mm; pseudotabulae present
Female ampullae: shape, diameter, and distribution	Hemispherical, 0.9 mm, uniformly distributed	Hemispherical, 1.2–1.3 mm, uniformly	Hemispherical, 0.8 mm, adjacent to branch axils	Unknown	Hemispherical, 1.0–1.1 mm, uniformly	Hemispherical and ridged, large (1.31–1.4 mm) with large multiple e.p., uniformly

Male ampullae: diameter, and distribution; location of e.p.	Hemispherical to irregular, 0.8-0.9 mm, uniformly distributed; several apical e.p. per ampulla	Irregular hemispheres, 0.9–1.1 mm, uniformly; 2–3 apical e.p.	Cylindrical (distintinctive), 1 mm tall, adjacent to branch axils; e.p. in ring around top of ampulla	Hemispherical (spongy), often fractured; 0.7–0.8 mm, uniformly; e.p. apical and numerous	Primarily internal, 0.36–0.39 mm, uniformly; e.p. apical	Unknown
Other Characters			Diffuse ring palisade present	Diffuse ring palisade present	Dpsp quite tall in relation to branch diameter	Dpsp quite tall
Distribution	Subantarctic South America and New Zealand; 292–2100 m	South Macquarie Ridge; 787–1500 m	Ridges north of New Zealand; 130–1169 m	Off Three Kings Island; 101-410 m	Ridges and islands north of New Zealand; 445-1258 m	Southern Norfolk Ridge; 356 m

slender dactylopore spines of this species, which confer a prickly aspect to the branches.

REMARKS: The characters listed in Table 3 clearly distinguish *L. altispina* from other *Lepidotheca* in the New Zealand region, but it is remarkably similar to *L. pourtalesi* Cairns, 1986a (Straits of Florida, 123–368 m), particularly regarding its colony size and branch diameter, arrangement of gastro- and dactylopore spines, size of gastropores, lack of gastropore lips, and coenosteal texture. Close comparison, however, reveals that *L. altispina* differs in lacking ring palisades, having equal branching that often results in branch anastomosis, and having even taller dactylopore spines.

Lepidotheca robusta n.sp. (Plates 20, a–g, 21, a–f)

MATERIAL EXAMINED: Holotype, q.v.

DISTRIBUTION: Southern Norfolk Ridge; 356 m.

DESCRIPTION OF HOLOTYPE: Colony robust and bushy, 6.3 cm tall and 7.5 cm broad, with a basal branch diameter of 9.7 mm and a broad encrusting base. Branching dichotomous, unequal, and relatively infrequent, resulting in long, slender distal branches. Branches circular in cross section, gradually decreasing in diameter to tips of about 1 mm. Coenosteum white and imbricate in texture, but coenosteal strips and slits not present. Platelets thin, flat, and variable in width, ranging from 5 to 45 µm wide. Polarity of platelets variable, i.e., alternating, as illustrated in Plate 20, g.

Gastro- and dactylopores uniformly distributed on all branch surfaces. Gastropores circular, 0.20–0.22 mm in diameter, and invariably proximally bordered by a tall, anteriorly inclined dactylopore spine, which makes a gastropore difficult to distinguish from a dactylopore. Gastropore tubes cylindrical and much greater in diameter than their slender gastrostyles; no ring palisades. Gastrostyles needle shaped and elongate, held in position by a series of transverse tabulae. Gastrostyles 50–70 µm in diameter, but variable in length, some as long as 1.0 mm (H : W up to 15). Basal part of elongate styles (portion below uppermost tabula) nonspinose and massive, up to 0.14 mm in diameter; only distal 0.3–0.4 mm of style (portion above uppermost tabula) spinose, sparsely covered with blunt, cylindrical spines up to 20 µm tall and 7 µm in basal diameter. Dactylopore spines very abundant and quite tall, with very thin walls; up to 0.9 mm tall and 0.2 mm wide, with a dactylotome width of about 0.14 mm. Dactylopore spines usually slightly anteriorly inclined. Dactylostyles absent but, at and below coenosteal level, dactylopore tubes contain a series of incomplete tabulae (herein termed **pseudotabulae**), each approximately 10 µm thick and spaced 50–70 µm apart (Plate 21, c, d). Pseudo-tabulae originate from opposing lateral and sometimes anterior edges of the dactylopore tube but never quite meet to form complete tabulae.

Female ampullae large superficial hemispheres 1.3–1.4 mm in diameter, each with 1–3 enormous, porous efferent pores 0.4–0.5 mm in diameter. Ampullae ornamented with ornate, serrate ridges and numerous dactylopore spines. Ampullae occur uniformly on all branch surfaces. Male ampullae unknown.

TYPES: Holotype: NZOI Stn I96, 1 female col., NZOI H-565, 1 small fragment of holotype and SEM stubs 565566, 662, USNM 85106.

TYPE LOCALITY: NZOI Stn I96, 32°10.8'S, 167°21.2'E, southern Norfolk Ridge; 356 m.

ETYMOLOGY: The species name *robusta* (from the Latin *robustus*, solid, strong) is an allusion to the robust nature of both the colony and the large dactylopore spines of this species.

REMARKS: *Lepidotheca robusta* belongs to the group of seven species of *Lepidotheca* that have uniformly distributed gastropores and that lack gastropore lips. The gastropores of *L. robusta* are invariably bordered by a dactylopore spine but not as intimately connected as those of *L. cervicornis*. Otherwise, it is very distinctive within the genus, having several unique characters : a non-polychaete-induced robust, bushy corallum with thick branches; large dactylopore spines; dactylopore pseudotabulae; and very large, ridged female ampullae with large efferent pores. These characters, especially the dactylopore pseudotabulae, may justify the establishment of a new genus, but more specimens are needed before that step should be taken.

Another peculiarity of this species (specimen) is that when the corallum was immersed in bleach (sodium hypochlorite), its white coenosteum became a light silver-grey in colour. When dried, the colour disappears. The specimen gave this reaction repeatedly with no diminution of the effect. It is not known if this colour reaction is characteristic of the corallum of this species or a result of post collection preservation.

Stephanohelia n. gen.

Branching polychotomous, gastropores occurring exclusively at branch axils. Colonies irregular in shape; commensal polychaetes common. Coenosteum linear-imbricate. Gastrostyle massive, with a thick mid-section and pointed tip. Dactylopore spines inconspicuous, elliptical, and flush with coenosteum; no dactylostyles. Male ampullae superficial, each with several porous apical spines.

TYPE SPECIES: *Stephanohelia praecipua* n. sp., here designated.

ETYMOLOGY: The genus name *Stephanohelia* (from the Greek *stephanos*, crown + *helios*, sun) is an allusion to the crown-like shape that the small distal branches make surrounding each gastropore, *helia* being a previously used stylasterid genus suffix that literally means sun and is interpreted here as an allusion to the gastropores. Gender feminine.

REMARKS: The two characters that distinguish *Stephanohelia* from all other stylasterid genera (Cairns 1991) are its polychotomous branching and its inconspicuous, elliptical, flush dactylopores. It is perhaps most similar to *Lepidotheca*, both genera having linear-imbricate coenosteum, unridged gastrostyles, and gastropores at branch axils; however, *Lepidotheca* differs in having dichotomous branching and abcauline dactylopore spines. Furthermore, the gastrostyles of *Stephanohelia*, having broad midsections, and male ampullar spines, are unique among stylasterids.

DISTRIBUTION: Southern Norfolk Ridge; northern Lord Howe Rise; off Chesterfield Islands; 318–793 m.

Stephanohelia praecipua n.sp. (Plates 22, a–f, 23, a–c)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Same as that for genus.

DESCRIPTION: Colonies quite irregular in shape, composed of one or two main branches that give rise to several intermediate-sized branches and/or numerous tiny branchlets; larger branches sometimes anastomose. Holotype 32.5 mm tall and 22.7 mm wide, with a basal branch diameter of 3.5 mm; however, largest specimen (also from NZOI Stn E861) 61 mm tall and 34 mm wide. Colonies firmly attached by a thin encrusting base. Shape of colony strongly influenced by commensal polychaetes, which cause the coral to form flattened (1.0 x 0.55 mm internal diameter), laterally perforate tubes. Polychaete tubes do not form main branches, but are accessory to them and often occur in several different locations on a colony, indicative of several (up to at least four) different polychaetes. Small branchlets formed by polychotomous branching, each axil generating three to five (usually four) branchlets, all but one of which are short and unbranched, the remaining branchlet thickened and continuing to form the next axil (Plate 22, a, f). Terminal branchlets very slender and delicate, only 0.12–0.15 mm in diameter. Branch cross section circular. Coenosteum white and linear-imbricate in texture. Strips of main branches 65–90 µm wide and slightly convex; strips of branchlets narrower (30–40 µm) and highly convex to slightly ridged. Strips bordered by deep, discontinuous slits 5–6 mm wide. Platelets variable in width, often as wide as the strip, and smooth. Polarity of platelets variable but predominantly anterior.

Gastropores occur exclusively at branch axils; dactylopores occur only on branchlet faces and edges. Gastropores circular, 0.16–0.22 mm in diameter, and always nestled into a polychotomously formed axil of three to five branchlets. Gastropore tubes cylindrical, but with an expanded basal cavity; no ring palisade. Gastrostyles of very distinctive shape, consisting of a cylindrical basal main shaft, a greatly expanded midsection (up to 0.20 mm wide), and a slender apical tip that projects well above the branch coenosteum. Wide midsection virtually same dia-meter as gastropore, allowing little passage around the style to lower gastropore tube. Midsection densely covered with sharp, slender spines up to 15 µm tall, whereas upper stylifom process relatively smooth. Dactylopore spines quite small and inconspicuous — elliptical in shape (about 66 x 44 µm in diameter), essentially flush with coenosteum, and aligned on coenosteal slits on all branch surfaces. Adjacent ridged or convex strips sometimes give dactylopore spines the appearance of raised lateral edges, but both anterior and posterior dactylopore edges are flush.

Female ampullae unknown. Male ampullae superficial, irregularly shaped mounds 0.36–0.60 mm in diameter. Each ampulla bears 1–4 tall, apically porous spines, up to 0.16 mm tall and 60 µm in diameter. Coenosteal texture of ampullae more coarse than surrounding coenosteum (Plate 23, c).

TYPES: Holotype: NZOI Stn E861, 1 male col., NZOI H-566. Paratypes: NZOI Stn E859, 1 col., NZOI P-817, 1 col. and SEM stub 583, USNM 85107; Stn E861, 8 col., NZOI P-818, 3 col. and SEM stub 584,

USNM 85108; Stn I739, 7 col., NZOI P-819; 20°48'S, 160°58'E (Fairway Reef, Chesterfield Islands), 500 m, 3 col., Northern Territories Museum C3100.

TYPE LOCALITY: NZOI Stn E861, 32°25'S, 167°35'E, southern Norfolk Ridge; 318–383 m.

ETYMOLOGY: The species name *praecipua* (from the Latin *praecipuus*, peculiar, special) is applied to this species because of its peculiar branching mode and unusually shaped gastrostyles.

Inferiolabiata Broch, 1951

Gastro- and dactylopores uniformly distributed on all branch surfaces. Colony growth often modified by commensal polychaetes. Coenosteum white and linear-imbricate in texture. Gastropores unlipped; gastropore tubes cylindrical, often having a ring palisade. Gastrostyles elongate (H : W = 3–10) and unridged. Abcauline dactylopore spines tall, often longitudinally ridged, and having an abruptly truncate tip. Well-developed dactylostyles usually present, often accompanied by lateral dactylostyles. Ampullae superficial.

TYPE SPECIES: *Errina labiata* Moseley, 1879, by original designation.

REMARKS: As noted in the remarks for *Lepidotheca*, *Inferiolabiata* is very similar to that genus but differs in having dactylostyles (sometimes quite robust) and in having more robust, thicker-walled dactylopore spines. Only three species are attributed to *Inferiolabiata*, all of which are known from the New Zealand region. Characters of value in discriminating species include size and shape of male ampullae; location of male efferent pores; degree of development of dactylostyles; coenosteal texture; development of ring palisade; nature of female ampullae; and colony and branch shapes (Table 4).

DISTRIBUTION: Circum-Antarctic and Subantarctic; New Zealand region; 87–2100 m.

Inferiolabiata labiata (Moseley, 1879)

(Plates 23, d–h, 24, a, b)

Errina labiata Moseley, 1879 : 443–447, pl. 34, fig. 7, pl. 37, figs 9–11.
Errina (Inferiolabiata) labiata: Broch 1951b : 125.
Inferiolabiata labiata: Cairns 1983a : 111–113, figs 22D–E, 26A–I, 27A-C, map 8 (synonymy); 1983b : 428, 449–451, figs 1A–H, 25B, 28I (synonymy).

MATERIAL EXAMINED: NZOI Stn A745, 5 male col., NZOI, SEM stub 668 (USNM); Stn F127, 4 male col., NZOI, 1 col. and SEM stub 567, USNM 85109; Stn T39, 1 dead col., NZOI; *Eltanin* Stns 1851, 5 col., USNM 59972; 2143, 3 female col., USNM 60007. Other Material: specimens from 64 stations reported by Cairns (1983a), including syntypes.

DISTRIBUTION: Widely distributed in Antarctica and the Subantarctic, including southeastern South America, Scotia Sea, Ross Sea, Scott Island, Balleny Islands, and Antipodes Islands; 87–2100 m.

DESCRIPTION: Colonies uniplanar to slightly bushy, the largest specimen from the New Zealand region (NZOI Stn F127) a colony fragment 5.3 cm long. Most, but not all, colonies strongly modified in growth form by a commensal polynoid polychaete, which induces the coral to produce a highly porous tube along its main branches. Worm tube up to 7 mm in diameter, often larger than typical branch diameter, and composed of delicate, flattened stylasterid branches that envelop the worm and fuse together on the opposite side. Branching dichotomous and unequal, but not frequent away from worm tube. Branches circular in cross section, gradually decreasing to blunt tips 1.8–3.0 mm in diameter. Coenosteum white and imbricate in texture, the strips arranged in a reticulate fashion on large-diameter branches and worm tube coenosteum but linear-imbricate on lesser-diameter, terminal branches. Strips variable in width and frequently change width along a branch, ranging from 0.09 mm to as much as 0.19 mm wide, and bordered by wide (30 µm), shallow coenosteal slits (grooves) that clearly delineate strips. Slits punctured periodically with elliptical coenosteal pores up to 70 µm long and the width of the slit. Platelets as broad as strip, often continuing across slit and onto adjacent strip. Approximately 40 leading platelet edges per mm. The coenosteal texture, along with the porous ampullae, give this species a decidedly coarse and porous aspect.

Gastro- and dactylopores uniformly distributed on all branch surfaces; however, in some specimens dactylopore spines are united laterally, forming short, horizontal tiers encircling part of branch. Gastropores circular, 0.28-0.33 mm in diameter. Gastropore tubes cylindrical, as much as 1 mm long, and bear a diffuse ring palisade. Elements of ring palisade up to 30 µm tall and 23 µm in diameter, similar to dactylostyle elements in size and shape. Gastrostyles needle shaped and unridged, the

TABLE 4. Characteristics of the three species of *Inferiolabiata*

Characters	*I. labiata* (Moseley, 1879)	*I. spinosa* n. sp.	*I. lowei* (Cairns, 1983)
Branching	Delicate, profuse	Coarse, sparse	Coarse, very sparse
Polychaete commensal	Usually present	Usually absent	Absent
Coenosteal texture	Reticulate-imbricate (porous)	Imbricate, smooth	Imbricate, porcellanous
Dactylopore spines	Sometimes ridged	Unridged, edges serrate	Sometimes ridged; dactylotomes usually partially blocked
Dactylostyles	Robust lateral dactylostyles	Robust lateral dactylostyles	Rudimentary typical dactylostyles
Ring palisade	Present	Present	Absent
Female ampullae	Porous, apical efferent pore	Solid, lateral efferent pore	Solid, lateral efferent pore
Male ampullae	Porous, apical efferent pores	Solid, lateral efferent pores covered with spinules	Solid (mammiform), apical efferent pore
Distribution	Subantarctic; 87–2100 m	Throughout New Zealand region; 211–781 m	Off New Zealand; 164–751 m

illustrated style (Plate 24, a) 0.68 mm tall and 0.097 mm in diameter (H : W = 7.01). H : W ratios of New Zealand specimens range from 2.7–6.6. Gastrostyles bear sparse, blunt spines up to 36 µm long. Dactylopore spines tall (up to 0.7 mm) and slightly inclined distally; approximately 0.28–0.30 mm wide, with a dactylotome width of 0.13 mm. Dactylopore spines often ridged, caused by a continuation of the coenosteal slits onto the dactylopore spine and a narrowing and ridging of the enclosed strips. Each dactylopore has a robust dactylostyle, usually composed of three unilinear series (two lateral and one longitudinal) of large, blunt elements up to 50 µm tall and 25 µm in diameter, easily seen in an intact dactylopore spine.

Contrary to Cairns' (1983a) observation that there is no sexual dimorphism of ampullae, on closer examination of Antarctic and New Zealand specimens, there does seem to be a slight size dimorphism that is masked by the extreme porosity of the ampullae. Female ampullae large (0.8–1.1 mm in diameter), thin-walled, porous hemispheres having an apical efferent pore approximately 0.18 mm in diameter. These efferent pores are only observable for a relatively short time in ontogeny because soon after opening the entire ampullar cap disintegrates, ultimately resulting in a large concave depression. Male ampullae also roughly hemispherical but only 0.6–0.7 mm in diameter. They are also thin-walled and very porous, each with an apical pore 40–90 µm in diameter. Both male and female ampullae uniformly distributed on branches as well as polychaete tube coenosteum.

TYPES: Syntypes of *Errina labiata* are deposited at the BM(NH) (1880.11.25.172 and 1880.11.25.195).

TYPE LOCALITY: *Challenger* Stn 320, 37°17'S, 53°52'W, off Rio de la Plata, Uruguay; 1097 m.

REMARKS: *Inferiolabiata labiata* differs from the other two species of *Inferiolabiata* by having an extremely porous coenosteum and ampullae; a symbiosis with polychaetes and thus calcified polychaete galls; discrete coenosteal strips and slits on apical branches; and more delicate and profusely branching colonies (Table 4).

Inferiolabiata spinosa n. sp. (Plates 24, c–f, 25, a–e)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Found throughout the New Zealand region, including southern Norfolk Ridge; southern Kermadec Ridge; off North Cape; off Puysegur Point; and off Auckland Island; 211–781 m.

DESCRIPTION: Colonies robust and bushy, composed of relatively few, thick branches that gradually decrease to blunt branch tips 3–4 mm in diameter. Largest specimen (holotype) a colony fragment 5 cm tall composed of only five branches. Commensal polychaetes rarely present. Branching dichotomous and unequal; branch cross section circular. Coenosteum white, with an irregular linear-imbricate texture. Coenosteal strips and slits not apparent on specimens examined; however, some coenosteal pores persist, delimiting what were probably originally strips 0.17–0.20 mm wide. Coenosteum relatively smooth, covered with irregularly shaped, imbricate platelets.

Gastro- and dactylopores uniformly distributed on branch surfaces. Gastropores circular, 0.19–0.21 mm in diameter. Gastropore tubes cylindrical, each bearing a very diffuse but well-developed ring palisade consisting of elements up to 30 µm tall and 35 µm in diameter, the uppermost elements clearly visible in upper gastropore tube. Although gastropores are unlipped, some are surrounded by what appear to be several ring-palisade elements that project above the coenosteal surface. Gastrostyles long and cylindrical, their tips reaching to the coenosteal surface and their bases often stabilized by one or more horizontal tabulae. One gastrostyle measures 0.50 mm tall (estimated) and 0.067 mm in diameter (H : W = 7.5). Gastrostyles bear sparse, blunt spines up to 25 µm long. Dactylopore spines extremely numerous (Plate 24, c), tall (up to 0.6 mm), and slightly inclined distally; dactylopore spines about 0.26 mm wide, with a dactylotome width of 0.10-0.11 mm. Edges of dactylopore spines adjacent to dactylotome finely serrate in well-preserved coralla; dactylopore spines not ridged, but smooth. Each dactylopore contains a robust dactylostyle, composed of three unilinear series (two lateral and one longitudinal) of large, blunt elements similar in size and shape to the ring-palisade elements and usually easily seen in an intact dactylopore spine.

Female ampullae hemispherical and 1.2–1.4 mm in diameter, each having solid walls and a lateral efferent pore approximately 0.3 mm in diameter. Male ampullae smaller (0.6–0.7 mm in diameter), slightly irregularly shaped hemispheres, each with 2–4 lateral efferent pores located around its perimeter. Invariably there is a cluster of 8–10 slender, cylindrical spines (about 60 µm tall and 20–22 µm in diameter) that surround the male efferent pores and obscure it from view. Both male and female ampullae uniformly distributed on branch surfaces.

TYPES: Holotype: NZOI Stn E861, 1 male col. and a fragment in alcohol, NZOI H-567, branch fragment and SEM stub 569, USNM 85112. Paratypes: NZOI Stn C527, 1 col., USNM 76358; Stn D39, 1 branch, NZOI P-820; Stn E822, 1 col., NZOI P-821, 1 col., USNM 85111; Stn E861, 1 col., NZOI P-926; Stn I97, 1 female col., NZOI P-822; Stn I372, 1 female col., NZOI P-823, SEM stub 568 (USNM).

TYPE LOCALITY: NZOI Stn E861, 32°25'S, 167°35'E, southern Norfolk Ridge; 318–383 m.

ETYMOLOGY: The species name *spinosa* (from the Latin *spinosus*, spiny) refers to the abundant dactylopore spines that cover the branches.

REMARKS: *Inferiolabiata spinosa* is similar to *I. labiata* in having well-developed ring palisades and dactylostyles, but differs in having lateral male and female efferent pores; smooth, non-porous coenosteum; and sparse, blunt branches. It differs from *I. lowei* in having a ring palisade and well-developed dactylostyles; lateral male efferent pores; and dactylotomes that extend to the coenosteal surface (Table 4).

Inferiolabiata lowei (Cairns, 1983)
(Plates 25, f, g, 26, a–f)

Errina (Inferiolabiata) lowei Cairns, 1983a : 113–117, figs 22, F, G, 28, A–G (synonymy).
Inferiolabiata lowei: Cairns 1983b : 428, 451.

MATERIAL EXAMINED: NZOI Stn B488, 1 col., NZOI, 1 fragment, USNM 85110; Stn E305, 1 col. and 2 branches, NZOI, SEM stub 670 (USNM); Stn E868, 1 branch, NZOI; Stn P541, 1 col., NZOI; Types (USNM).

DISTRIBUTION: Off southern South America, Burdwood Bank, and South Georgia (250–960 m); New Zealand region — southern Norfolk Ridge, Three Kings Ridge, and southwest of South Island; 164–751 m.

DESCRIPTION OF NEW ZEALAND SPECIMENS: Colonies small and very sparsely branched, largest colony examined (NZOI Stn P541) 21 mm tall and 4 mm in basal branch diameter, consisting of only one main branch and two short secondary branches. Commensal polychaetes absent. Branches circular in cross section and robust; branch tips thick and blunt; no branch anastomosis. Coenosteum white and imbricate in texture; however, coenosteal strips and slits present only on basal 5–10 mm of main branch, which is reticulate in sculpture but lacking in platelets. Upper branches covered with well-defined imbricate platelets but very irregular in arrangement and variable in width, ranging from 20 to over 100 µm wide; platelet polarity primarily anterior. Overall, coenosteum dense and somewhat porcellanous.

Gastro- and dactylopores uniformly distributed on all branch surfaces. Gastropores circular, 0.20–0.35 mm in diameter. Gastropore tubes cylindrical, lacking ring palisades, but often bearing one or more transverse tabulae to help stabilise elongate gastrostyles (Plate 26, e). Gastrostyles needle shaped (with a sharp tip) and slightly ridged, the ridges bearing simple spines up to 40 µm long. Illustrated gastrostyle 1.19 mm tall and 0.155 mm in diameter (H : W = 7.67), but is broken basally so it would have had an even larger H : W ratio. Dactylopore spines tall and inclined distally; up to 0.7 mm tall and 0.17 mm wide, with a dactylotome width of about 0.09 mm. Lower portion of dactylotome often blocked with a plate of coenosteum, which results in a somewhat tubular dactylopore spine basally. Dactylopore spines of some specimens (e.g., those from NZOI Stns E305, P541, Plate 26, f) bear 8–10 low, longitudinal ridges on their exterior surface. Dactylostyles rudimentary.

Only one type of ampulla was present on the New Zealand specimens, consistent in shape with male ampullae reported from South American specimens, but slightly smaller in size: 0.55–0.60 mm in diameter, with an apical pore 0.10–0.15 mm in diameter. Ampullae ellipsoidal in shape, the greater axis perpendicular to coenosteal surface, and half submerged in coenosteum, the upper half appearing mammiform.

TYPES: Holotype and most paratypes deposited at the USNM. Some paratypes also deposited at the BM(NH) and RMNH (*see* Cairns 1983a).

TYPE LOCALITY: *Eltanin* Stn 1536, 54°29'S, 39°22'W, west of South Georgia; 659–686 m.

REMARKS: *Inferiolabiata lowei* differs from the other two species of *Inferiolabiata* in having mammiform, apically perforate male ampullae; feeble dactylostyles; no ring palisade; and tubular lower dactylopore spines (Table 4).

Sporadopora Moseley, 1879

Gastro- and dactylopores uniformly distributed on all branch surfaces. Branching dichotomous and

equal, resulting in U-shaped axils; branches robust and blunt. Coenosteal texture variable — porous, reticulate-granular, or reticulate-imbricate. Gastro- and dactylopores flush with coenosteal surface. Gastropores long (axial), lacking a ring palisade. Dactylopores also long (axial), lacking dactylostyles. Gastrostyles long (H : W ratio up to 21) and prominently ridged; tabulae often present. Ampullae internal; efferent pores open to coenosteal surface or upper gastropore tubes.

TYPE SPECIES: *Polypora dichotoma* Moseley, 1876, by monotypy.

REMARKS: Three Recent species belong to *Sporadopora*: *S. dichotoma* (Moseley 1876); *S. mortenseni* Broch, 1942; and *S. micropora* n. sp., the latter two known from the New Zealand region. Cairns (1983b) listed two additional, exclusively fossil species in the genus: *S. faxensis* Nielsen, 1919 (Paleocene of Denmark) and *S. marginata* Tenison-Woods, 1880 (Pliocene of Chatham Islands). The superficial ampullae of *S. faxensis* make it highly doubtful that it belongs to this genus (*see* Cairns 1983b) and *S. marginata* is discussed further in the account of *S. micropora*. Characters of value in discriminating among the species of *Sporadopora* include gastropore diameter, location of efferent pores, and coenosteal texture.

DISTRIBUTION: Restricted to austral temperate, subantarctic, and Antarctic regions. Miocene: Victoria, South Australia (Hall 1898). Pliocene: New Zealand (Squires 1962); Chatham Island (Tenison-Woods 1880). Recent: Subantarctic South America; Riiser-Larsen Peninsula, Antarctica (Eguchi 1964); New Zealand region; 119–1498 m.

Sporadopora mortenseni Broch, 1942
(Plates 27, a–f, 28, a, b)

[?] *Sporadopora dichotoma*: Hall 1898 : 177–178.
Sporadopora mortenseni Broch, 1942 : 29–32, text-fig. 8, pl. 3, fig. 9; Boschma 1953 : 167; 1957 : 61; Squires 1962 : 136, pl. 3, figs 1-4; ?Eguchi 1964 : 6-7, pl. 1, fig. 4; Boschma 1964a : 62; 1964c : 286; 1966 : 117; Cairns 1983a : 67; 1983b : 428, 438.

MATERIAL EXAMINED: NZOI Stn E305, 1 female branch, NZOI, 1 fragment and SEM stubs 574, 671, USNM 85113; Stn E306, 1 branch, NZOI; Stn P472, 1 male branch, NZOI, SEM stub 672 (USNM); Stn P544, 1 female branch, NZOI; two syntypes of *S. mortenseni* (ZMC, but not Broch's figured specimen).

DISTRIBUTION: Miocene: ?Victoria, Australia (Hall 1898). Pliocene: Ngaruroro River, North Island (Squires 1962). Recent: Off Three Kings Islands, 119–290 m; ?Gunnerus Bank and Riiser-Larsen Peninsula, Antarctica, 830 m (Eguchi 1964).

DESCRIPTION: Colonies robust, uniplanar to slightly bushy, and up to 10.5 cm tall and 6.5 cm broad, with a basal branch diameter up to 1 cm. Branching dichotomous and equal, resulting in U-shaped axils. Branches circular in cross section and blunt apically, with a highly porous central core. Branches decrease gradually in size to tips 2.0–2.5 mm in diameter. Coenosteum white and reticulate-imbricate in texture. Coenosteal strips uniformly 0.10–0.11 mm wide and irregularly bordered by circular to slightly elongate coenosteal pores about 20 µm wide. Platelets narrow (only 12–16 mm wide), often requiring 6–8 adjacent platelets to bridge a strip.

Gastropores circular to slightly elliptical, the greater axis of the ellipse longitudinally aligned, 0.32–0.36 mm in greater diameter. Gastropore tubes cylindrical, long, and curved about 90° just beneath coenosteal surface such that they run parallel to branch axis. Gastrostyles needle shaped and often quite long, the illustrated style (Plate 28, b) 1.38 mm long and 0.12 mm in diameter (H : W = 11.7), its sharp tip barely visible in an intact gastropore. Basal section of gastrostyle sometimes atrophied, the remainder of the style held in position by several thin tabulae. Gastrostyles highly ridged, the ridges bearing small spines or cluster of spines. Dactylopores variable in size, ranging from 0.07–0.13 mm in diameter, circular to slightly teardrop-shaped, and slightly elevated on mounds approximately 25–30 µm above coenosteum.

Female ampullae large, internal, ellipsoidal spheres up to 1 mm in greater diameter, usually located beneath coenosteum just distal to each gastropore. Each mature female ampulla communicates with an adjacent gastropore tube through a large (0.35 mm diameter), circular efferent pore in the upper gastropore tube at the inflexion point of the tube just above the gastrostyle tip. In an immature colony, an efferent pore is still clearly visible as a highly porous circle in this location. Male ampullae smaller (0.5 mm in internal diameter) and also internal, located in the same relative position as the female ampullae; however, coenosteum corresponding to male efferent pore is spongy, never perforate. In addition, a small pore (approximately 50 µm in diameter) opens at the coenosteal surface on the distal edge of each gastropore (Plates 27, f, 28, a), which is assumed to be the male efferent pore. The coenosteum overlaying male ampullae is

pitted, each pit about 0.25 mm in diameter and 0.10–0.12 mm deep, and having a very porous base (Plate 27, d).

TYPES: At least four syntypes of *S. mortenseni* are deposited at the ZMC, two of which were examined in 1982 (Plate 27, a).

TYPE LOCALITY: Off Three Kings Islands; 65 fathoms (= 119 m).

REMARKS: Although not examined, Hall's (1898) Miocene specimens of *S. dichotoma* from Victoria probably also pertain to *S. mortenseni*, although his description is inadequate to be certain.

In Broch's (1942) original description of *S. mortenseni*, he noted only "slight and unimportant" characters that differentiated it from *S. dichotoma* (Moseley 1876), the only other Recent congener known at the time. Squires (1962) also expressed some doubt about the validity of *S. mortenseni*, suggesting that it might simply represent a geographic variant of *S. dichotoma*. Boschma (1964a), however, distinguished the species based on differences of its raised gastropore margins, shape of branch cross section, and gastrostyle spination. Cairns (1983a) also maintained it as a separate species, but emphasised the differences in colony and branch robustness, gastrostyle tabulae, and gastropore diameter. Another fundamental can now be added to the list of distinctions — *S. mortenseni* has its ampullae located just distal to each gastropore, with its efferent pores opening into the gastropore tube, whereas ampullae of *S. dichotoma* are uniformly distributed and open directly to the coenosteal surface.

As discussed by Cairns (1983a : 67), the specimens of *S. mortenseni* reported by Eguchi (1964) from Antarctica are probably too worn for a confirmed identification (deposition unknown); however, nothing in Eguchi's description contradicts the possibility of his specimens being *S. mortenseni*.

Sporadopora micropora n. sp.
(Plates 28, c–e, 29, a–g)

MATERIAL EXAMINED: Types, q.v. Syntypes of *S. marginata*, NZGS CO 1424 and 1425 (Plate 29, h).

DISTRIBUTION: Puysegur Ridge; off Auckland Island; 465–741 m.

DESCRIPTION: Colonies robust and uniplanar to slightly bushy, the largest colony (holotype) 4.1 cm tall and 4.5 cm broad, with a basal branch diameter of 5.8 mm. Branching dichotomous and equal, resulting in U-shaped axils. Often, at the first-generation (and less commonly at the second) colony bifurcation, there lives a commensal polynoid polychaete, which produces a linear coenosteal depression about 1.6 mm wide that bifurcates the axil. In more fully developed associations, a semi-enclosed gall structure is present. Branches gradually attenuate to blunt tips 2.8–3.2 mm in diameter. Coenosteum white and reticulate-granular in texture. Coenosteal strips 55–70 µm wide and bordered by relatively broad (about 13 µm wide) coenosteal slits. Strips covered by very irregularly-shaped, coarse granules.

Gastropores small and circular, only 0.20–0.22 mm in diameter, and slightly inclined toward branch tip. Gastropore tubes cylindrical and straight, up to 1 mm long. Gastrostyles elongate-conical and pointed apically, the tip barely visible in an intact gastropore. Illustrated gastrostyle (Plate 29, d, e) 0.41 mm tall and 0.15 mm in diameter (H : W = 2.7),occupying only lower 40% of gastropore tube. Gastrostyles unridged, but bear coarse multitipped spines. Dactylopores circular, about 0.12 mm in diameter, and flush with coenosteum.

Female ampullae internal, ellipsoidal cavities up to 0.65 mm in greater diameter, the greater axis perpendicular to branch surface, the lesser axis about 0.45 mm in diameter. A very slight bulge often overlays each ampulla. Each female ampulla communicates to coenosteal surface through a narrow canal, but superficial efferent pores (about 90 µm in diameter) were rarely observed. Male ampullae also internal, ellipsoidal cavities up to 0.40 mm in greater diameter, which is perpendicular to branch surface, and about 0.25 mm in lesser diameter. Male efferent pores approximately 50 µm in diameter and scattered over coenosteal surface.

TYPES: Holotype: NZOI Stn D39, 1 col., NZOI H-568. Paratypes: NZOI Stn D39, 15 col., numerous branches, NZOI P-824, 10 col. and SEM stubs 573, 576, 673, USNM 85114; Stn D159, 2 col., 11 branches, NZOI P-825, 1 col. and 1 branch, USNM 85115.

TYPE LOCALITY: NZOI Stn D39, 50°58'S, 165°45'E, off Auckland Island; 465–549 m.

ETYMOLOGY: The species name *micropora* (from the Greek *mikros*, small + *poros*, orifice) refers to the small gastropores of this species.

REMARKS: *Sporadopora micropora*, although superficially similar to *S. mortenseni*, is readily distinguished from it and *S. dichotoma* by having very small gastro-

pores; reticulate-granular coenosteal texture; very short (H : W = 2–3), nonridged gastrostyles; straight gastropore tubes; and often a polychaete commensal. It is further differentiated from *S. mortenseni* by having efferent pores opening to the coenosteal surface (not into gastropore tubes) and in having a considerably more southern distribution and greater bathymetric range.

Sporadopora micropora is more similar to *S. marginata* Tenison-Woods, 1880 (Pitt Island, Late Pliocene, *fide* H. Campbell). The two worn syntypes of *S. marginata* have the same gastro- and dactylopore diameters and similar granular coenosteal texture (Plate 29, h). The only differences observed are that *S. marginata* has highly ridged, elongate gastrostyles and gastropore tabulae, much like those of *S. mortenseni* or *S. dichotoma*, not *S. micropoma*.

Distichopora Lamarck, 1816

Gastropores usually aligned and slightly recessed in a sulcus along branch edge, flanked on either side by a row of dactylopores, together forming the pore row. In some species, however, dactylopores occur only on one side of the gastropore row, or the gastropore row meanders over the branch face, or the gastro- and dactylopores are arranged in isolated pseudocyclosystems. Branches usually flattened in cross section, sometimes flabellate. Coenosteal texture variable, including reticulate-granular, linear-imbricate, and tuberculate. Gastro- and dactylopore tubes long; dactylopore tubes axial. Gastrostyles needle shaped and highly ridged, with relatively high H : W ratios (e.g., 5–15). Dactylopores elliptical; dactylostyles usually absent (present in only one species). Ampullae usually superficial, but internal in some species.

TYPE SPECIES: *Millepora violacea* Pallas, 1766, by monotypy.

REMARKS: Twenty-one Recent, valid species have been previously described : 16 species are listed by Cairns (1983b), four more by Cairns (1986a), and one more by Cairns (1986b). The inclusion of *D. dispar* requires a modification of the generic diagnosis to allow for the presence of a dactylostyle. As described in the species account, the dactylostyle of *D. dispar* is actually a long, thin ridge that bears spines along its top (Plate 31, a–b). It is unlike any other dactylostyle known in the Stylasteridae, which are customarily unilinear or multilinear rows of cylindrical, blunt pillars. Because of the unique nature of the dactylostyles of *D. dispar*, they are termed **dactyloridges** to distinguish them from typical dactylostyles.

Another characteristic of *D. dispar* that requires expansion of the generic diagnosis is its tendency to have isolated gastropores surrounded by dactylopores — pseudocyclosystems — scattered over branch faces and edges. Because of this character, some specimens might easily be mistaken for a species of *Stylaster*, but ultimately can be distinguished by their axial dactylopore tubes, tuberculate coenosteum, tendency to aggregate gastropores, and their dactyloridges (not dactylostyles).

Characters used to distinguish among the 22 species of *Distichopora* are summarised by Cairns (1986a : Table 1); to reiterate : location of dactylopores, coenosteal texture and colour, dactylopore shape, gastropore and pore-row widths, and ampullar structure.

Species of *Distichopora* have been reported at least four times previously from the New Zealand region, but always in a casual way and only once identified to species. Ralph (1948) reported Recent *Distichopora* sp. from New Zealand, but did not specify locality or depth. In his revision of the Indo-Pacific species of *Distichopora*, Boschma (1959) reported *D. violacea* (Pallas, 1766) from the mouth of the Rangitiki [sic] River, North Island, at 122 m, an usually great depth record for this species. Ralph's specimen may also have been *D. violacea*. There have also been two fossil records of *Distichopora* spp., by Squires (1962) from Middle to Lower Miocene of New Zealand, and by Hayward (1977 : 101) from the Lower Miocene of North Auckland. It is unlikely that any of these Recent or fossil records are conspecific with *D. dispar*, the latter having a much deeper bathymetric range and characteristic dactyloridges.

DISTRIBUTION: Indo-West Pacific, North Pacific, Laysan Island, New Zealand region, Galápagos, western Atlantic; primarily a shallow-water, reef genus, but several species known as deep as 741 m.

Distichopora dispar n. sp. (Plates 30, a–g, 31, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Three Kings Ridge and continental slopes southwest of New Zealand, including off Auckland Island; 465–741 m.

DESCRIPTION: Colonies uniplanar and of moderate size, the largest specimen examined (NZOI Stn

D159) 6 cm tall, with a basal branch diameter of 11 x 7 mm; holotype a colony fragment 25.5 mm tall and 18.2 mm broad. Branching dichotomous and equal; no branch anastomosis. Branches strongly compressed in cross section; branch tips broad and rounded. Coenosteum white, consisting of large, irregularly shaped, smooth granules 35–70 µm in diameter, the granules occurring individually or linked in series of 2-4 (tuberculate coenosteal texture). Depressions of equivalent diameter separate granules, which are penetrated at regular intervals by small, irregularly shaped coenosteal pores 6-8 µm in diameter. The large linked granules are presumed to be homologous to coenosteal strips; the wide depressions between granules, to coenosteal slits.

Coordination of gastro- and dactylopores quite variable; however, the predominant arrangement (as found in the holotype) is for gastro- and dactylopores to be arranged in pore rows (a row of gastropores flanked on either side by a row of dactylopores) that occur exclusively on lateral branch edges. Pore rows are best developed and continuous on branch tips; toward base of colonies, pore rows usually fragment into clusters of 1–5 gastropores that are completely surrounded by dactylopores. Pore rows 1.2–1.3 mm wide, the gastropores recessed about 0.2 mm in a medial sulcus. Some colonies, however, have additional dactylopore-enclosed clusters of 1–5 or 6 gastropores that occur randomly on branch faces. In still other colonies, lateral pore rows are absent entirely, the arrangement being exclusively dactylopore-enclosed clusters of 1–3 gastropores that resemble cyclosystems in arrangement. In these colonies, individual gastropores are usually surrounded by 4–6 dactylopores, with an adcauline diastema, or 6–8 dactylopores without the diastema. These "pseudocyclosystems" are usually flush with the coenosteum but may be elevated as much as 0.5 mm.

Gastropores circular to elliptical in shape and up to 0.47 mm in diameter, the greater axis of the ellipse parallel with branch edge. Gastropore tubes long and cylindrical, lacking a ring palisade. Gastrostyles needle shaped, the tip usually easily seen in an undamaged gastropore; illustrated gastrostyle (Plate 30, f) 1.32 mm long and 0.27mm in diameter (H : W = 4.89); no tabulae observed. Gastrostyles ridged, the thin ridges bearing a succession of tiny, sharp spines up to 16 µm tall and 4 µm in basal diameter. Dactylopores elliptical and 0.21-0.25 x 0.17-0.20 mm in diameter, the greater axis perpendicular to the gastropore row. Each dactylopore bears a prominent, medial dactyloridge, which is easily visible in an intact dactylopore. Dactyloridges 12–15 µm wide, up to 0.15 mm tall, and several mm long. Base of dactyloridge (basal 0.06–0.07 mm) lamellar, the upper edge giving rise to irregularly shaped, granular spines that radiate from the basal lamella in a 90° arc (Plate 31, a).

Ampullae internal and of two size classes: 0.35–0.38 mm in diameter (male ?) and 0.71–0.75 mm in diameter (female ?). Efferent pores not observed. Ampullae quite common on gravid branches, a cross section fracture revealing as many as 10.

TYPES: Holotype: NZOI Stn D159, 1 female col., NZOI H-569. Paratypes: NZOI Stn D39, 1 male branch, NZOI P-826, SEM stubs 633-634 (USNM); Stn D159, over 50 col., NZOI P-827, 7 branches and SEM stubs 606-607, USNM 85116; Stn G937, 2 col., NZOI P-828; Stn S572, 1 col., NZOI P-829.

TYPE LOCALITY: NZOI Stn D39, 49°01'S, 164°30'E, southwest of South Island; 741 m.

ETYMOLOGY: The species name *dispar* (from the Latin *dispar*, different, unlike) refers to the very distinctive nature of this species, the only species in the genus having dactyloridges and pseudocyclosystems.

DISCUSSION: *Distichopora dispar* is easily distinguished from the other 21 Recent congeners by its prominent dactyloridges and its tendency to have isolated pore rows both on branch edges and faces. Its internal ampullae are also a relatively rare character, one shared only with *D. anceps* Cairns, 1978.

Systemapora n. gen

Both gastro- and dactylopores relatively short and unilinearly arranged, the former on branch faces, the latter on branch edges. Colonies uniplanar or multiplanar and delicate. Coenosteum linear-imbricate. Gastropore bordered by a massive lower lip; gastropore tubes cylindrical, without a ring palisade. Gastrostyles conical and usually ridged, each with a massive apical spine. Dactylopores adcauline or flush; no dactylostyles. Ampullae superficial and highly sculptured.

TYPE SPECIES: *Systemapora ornata* n. sp., here designated.

ETYMOLOGY: The generic name *Systemapora* (from the Greek *systema*, order + *poros*, orifice) refers to the discrete, linear arrangement of both gastro- and dactylopores. Gender: feminine.

DISCUSSION: Two of the most important characters used to differentiate stylasterid genera are arrange-

ment and/or coordination of gastro- and dactylopores and dactylopore spine shape (Cairns 1991). It is on these criteria that *Systemapora* is established. The arrangement of gastropores on the branch faces and dactylopores on branch edges is not unique among the stylasterids: *Phalangopora* and some species of *Lepidopora* (e.g., *L. glabra* (Pourtalès, 1867)) also share this character. However, *Phalangopora* is quite different in lacking gastrostyles and in having abcauline (not adcauline) dactylopore spines; *Lepidopora glabra*, which also has large abcauline gastropore lips, also differs fundamentally in having conical dactylopore mounds, a well-developed ring palisade, and a very different coenosteal texture (*see* Cairns 1986a). The genus *Errina* resembles *Systemapora* in having adcauline dactylopore spines, but the spines are constructed very differently, being thick walled and tall vs thin walled and short. Furthermore, *Errina* lacks coordination of gastro- and dactylopores, has a ridged gastrostyle, and a granular (not imbricate) coenosteal texture.

Another unusual feature of *Systemapora* is its lateral branch edge sulcus. Two genera, *Distichopora* and *Gyropora*, sometimes have lateral edge sulci but their sulci enclose rows of gastropores, not dactylopores, and therefore these structures are not considered homologous. The gastrostyle of *Systemapora* is also very unusual, probably having the largest gastrostyle spines in relation to gastrostyle diameter of any known stylasterid. Finally, the regular alternation of platelet polarity is another unusual character, but of unknown taxonomic value.

DISTRIBUTION: North of Norfolk Island; 320-475 m.

Systemapora ornata n. sp.
(Plates 31, c–f, 32, a–f, 33, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Same as that for genus.

DESCRIPTION: Colonies uniplanar to bushy, the latter habit achieved by the formation of two or more flabella orientated in different planes. Holotype (largest specimen) 8 cm tall and 7.3 cm broad, with a basal branch diameter of 4 mm, the corallum composed essentially of three parallel, uniplanar flabella. Branching dichotomous and unequal; branches delicate, attenuating to tips as small as 0.5 mm in diameter; no branch anastomosis. Branch cross section rectangular in distal branches, but elliptical in older, larger-diameter branches. Coenosteum white and linear-imbricate in texture. Coenosteal strips broad (0.11-0.15 mm wide) and vary from flat to highly ridged. Platelets quite narrow (3–33 µm wide) and flat, their polarity regularly alternating with each row. Circular coenosteal pores 25-30 µm in diameter common on coenosteal slits and dactylopore sulcus; pores irregular in outline caused by a perimeter of slightly overreaching spines 10-15 µm long.

Gastropores unilinearly arranged on both branch faces; dactylopores also unilinearly arranged, but on branch edges. Gastropores circular (0.20-0.22 mm in diameter), each bordered by a prominent, wide (about 0.38 mm wide), thick, abcauline lip. Lips usually longitudinally ridged with two or three sharp, serrate carinae and bear 1–3 large (0.13–0.15 mm in diameter), flush pores (? modified dactylopores) between the carinae. Gastropore tubes cylindrical and lack a ring palisade; however, base of gastropore tubes bear numerous slender spines up to 20 µm tall and 5 µm in diameter. Gastrostyles elongate-conical, the tip easily seen in an intact gastropore; illustrated gastrostyle (Plate 32, c, d) 0.32 mm tall and 0.066 mm in diameter (H : W = 4.8). Gastrostyles bear large, robust, smooth spines, much larger toward the tip than basally, the apical ones up to 50 µm tall and 16 µm in basal diameter. Dactylopore spines adcauline (opposite to orientation of gastropore lips) to flush, both shapes often present on same specimen. Dactylopores circular, about 0.10 mm in diameter, the adcauline ones with a very low (about 50 µm tall), serrate anterior margin, the lower (proximal) margin flush with coenosteum. Dactylopore centres spaced about 0.3 mm apart, occurring along a broad (about 0. 3 mm wide), shallow sulcus on branch edges. Sulci bordered by tall lateral ridges, which are sometimes spinose as well, the spines up to 15 µm tall and similar in shape to gastrostyle spines (Plate 32, e). The sulci and bordering ridges cause distal branches to be rectangular in cross section. In larger-diameter branches, the lateral sulcal ridges are less prominent and the branches are thus elliptical in cross section.

Female ampullae large hemispheres 1.0–1.2 mm in diameter, bearing low, rounded ridges. Female efferent pores lateral : 0.35–0.40 mm in diameter. Male ampullae also roughly hemispherical (0.65–0.75 mm in diameter) and covered with tall, sharp ridges as well as small spines that surround the lateral efferent pores, the latter 0.05-0.10 mm in diameter. Both male and female ampullae abundantly scattered on branch faces, usually just off centre of the mid-line.

TYPES: Holotype: NZOI Stn P46, 1 male col., NZOI H-570. Paratypes: NZOI Stn P46, 25 col. (3 in alcohol)

and many branches, NZOI P-830, 5 col., branches, and SEM stubs 571-572, 674, USNM 85117; Stn P47, 1 male col., NZOI P-831.

TYPE LOCALITY: NZOI Stn P46, 28°42.3'S, 167°56.7'E, north of Norfolk Island; 450–475 m.

ETYMOLOGY: The species name *ornata* (from the Latin *ornatus*, ornate, decorated) refers to the ornate and beautifully formed corallum of this species, including its finely sculptured ampullae, coenosteum, sulcal ridges, gastrostyles, and dactylopore spines.

REMARKS: See remarks of the genus.

Errina Gray, 1835

Gastro- and dactylopores arranged uniformly on terminal and subterminal branches; pores scarce or absent on large-diameter branches. Colonies uniplanar or bushy, anastomosing in some species. Coenosteal texture usually reticulate-granular, but may also be linear-granular and linear-smooth, as well as linear-imbricate (four species). Coenosteum white, orange, red, or pink, some species having two colour forms. Gastropores bordered by lower lip in about half of species; ring palisade usually absent. Gastrostyle elongate-conical and of moderate H : W ratio (2–10), usually longitudinally ridged and spinose. Dactylopore spines thick walled (i.e., dactylotomes less than or equal to one-third dactylopore spine width) and primarily adcauline in orientation; dactylopore spines sometimes compound. Accessory conical dactylopores present in some species. Dactylostyles lacking. Ampullae usually superficial but in some species submerged in coenosteum; efferent pores rarely seen and sexual dimorphism not pronounced.

TYPE SPECIES: *Millepora aspera* Linnaeus, 1767, by monotypy.

REMARKS: Cairns (1983b) listed 16 Recent species (including 4 facies) of *Errina* in his generic revision, and another species was later described, *E. altispina* Cairns, 1986a, making a total of 17 Recent species (including 4 facies) in the genus. Five new species are described herein, two facies are elevated to species level, and one species is synonymised, which increases to 23 the number of valid Recent species of *Errina*. These additions from New Zealand were anticipated by Zibrowius as early as 1981 (*see* Cairns 1983b) and by Boschma earlier than that. Eleven of the 23 species of *Errina* are known from the New Zealand region, making it, along with the adjacent Subantarctic and Antarctic regions, the centre of species diversity of the genus.

Hickson (1912) made an elaborate argument for why he created four facies of *E. novaezelandiae* instead of four separate species, citing five lines of evidence. His arguments can be equally applied to what he considered to be intraspecific variation in *Errina*. To reiterate : 1) Hickson stated that dactylopore spine dimorphism was not a significant species level character. However, with many more specimens available from the New Zealand region, I consider this to be one of the most important characters at the species level. The presence or absence of accessory conical dactylopore spines appears to be consistent for most species of *Errina*, but variable in *E. novaezelandiae*. 2) Hickson stated that gastropore diameter was not of much value as a systematic character, being difficult to accurately measure and, in general, overlapping in range. Although they can now be easily measured, I concur that their size is of little discriminating value. 3) Hickson acknowledged that gastropore lips may or may not be present on species but, without much elaboration, apparently considered it as intraspecific variation. In general, this is a good species-level character, being easily observed and consistently present in 8 of the 23 species of *Errina*, but variable in expression in *E. sinuosa* and *E. novaezelandiae*. 4) As with gastropore diameter, Hickson considered dactylopore-spine height to be difficult to measure and overlapping in range. There are, however, species that consistently have tall dactylopore spines (over 0.5 mm) and those that are characterised by having short dactylopore spines (less than 0.2 mm), and this character can be used to discriminate some species. As a subsidiary point, Hickson implied that clustered dactylopore spines also comprised intraspecific variation, but, in fact, this character does help to characterise some species. 5) Finally, Hickson maintained that it was difficult to believe that more than one shallow-water species of *Errina* occurred off New Zealand, the gene flow being too steady to allow for speciation. However, given the heterogeneity of the environments surrounding New Zealand and the morphological differences that are now known to exist using the SEM, this statement becomes untenable. New Zealand appears to be the centre of an adaptive radiation of species of *Errina*, most of which are geographically isolated on the diverse ridges and seamount systems south of New Zealand, including some regions containing 3 or 4 sympatric species.

In addition to the previously discussed five character-suites, Hickson dismissed without dis-

cussion the characters of coenosteal texture and colony shape; however, colony shape and branching pattern are diagnostic for some species, and coenosteal texture as illustrated by SEM is also helpful in discriminating some species.

Characters not addressed by Hickson include coenosteal colour, ampullar shape, and gastrostyle shape. Although colour may be variable in some species, the colour or colours (two) of a species are believed to be characteristic of that species. Gastrostyle shape and ornamentation is of marginal value, but useful in discriminating several species. Unlike most stylasterid genera, little value was gained from a comparative examination of the ampullar structure and dimorphism of the various species of *Errina*.

DISTRIBUTION: Paleocene: Denmark. Recent: North Atlantic; off South Africa; Subantarctic and Antarctic; New Zealand region; 6–1772 m.

Errina novaezelandiae Hickson, 1912

(Frontispiece; Plates 33, c–g, 34, a–d)

Errina (Labiopora) novae-zelandiae facies *Ramosa* Hickson, 1912 : 882, 884–886, pl. 94, fig. 3, pl. 96, fig. 9.

Errina (Labiopora) novae-zelandiae facies *Benhami* Hickson, 1912 : 883, pl. 94, figs 1–2, pl. 96, fig. 13.

Errina (Eu-Errina) novae-zelandiae: Broch 1942 : 51–53, pl. 4, fig. 14, text-fig. 15 (in part: facies *ramosa* and *benhami*).

Errina novae-zelandiae: Boschma 1953 : 167 (in part : facies *ramosa* and *benhami*).

Errina novaezealandiae [sic] facies *ramosa* and *benhami*: Cairns 1983b : 428, 461.

Errina (Errina) cruenta Boschma 1968b : 109–113, pls 1–3, text-fig. 1; Dawson 1979 : 24–25; Vervoort and Zibrowius 1981 : 30.

MATERIAL EXAMINED: NZOI Stn B482, 1 col. and fragments, NZOI, fragments, USNM 85118; Stn B485, 1 col. and fragments, NZOI, 1 col. and SEM stub 586, USNM 85119; Stn B619, 1 branch, NZOI; Stn B621, 6 col. and branches, NZOI, 1 col., USNM 85120; Stn C896, 3 branches, NZOI; Stn D73, 1 col., NZOI; Stn D156, 10 branch fragments including male and female paratypes of *E. cruenta* and SEM stub 585, USNM 76879; Stn Q740, 1 col., NZOI; Stn Q741, 4 col., NZOI, 2 col. and SEM stub 679, USNM 85121; Stn Q748, 1 col. and branches, NZOI, 1 col. and SEM stubs 597–598, USNM 85122; Stn Q749, branches, NZOI; Stn Q754, 5 branches, NZOI, 1 branch, USNM 85123; 2 syntypes of *E. n. ramosa*, BM 1950.1.11.83.

DISTRIBUTION: Fiordland to Auckland Island; 15–177 m.

DESCRIPTION: Colonies uniplanar and often massive, the largest colony known (NZOI Stn Q748) 17 cm tall and 21 cm broad, with a thick basal branch diameter of 3 cm. Basal branches sometimes anastomose, forming a solid palmate frond; otherwise, branching is dichotomous and unequal. Branches circular to slightly elliptical in cross section and gradually taper to tips of variable diameter, ranging from 1.0–5.0 mm. Coenosteum red to red-orange, but branch core, ampullae, and regenerated branch tips white. Coenosteum coarse in construction and reticulate-granular in texture. Coenosteal strips 35–60 µm wide, bordered by deep, wide, discontinuous coenosteal slits about 16 µm wide. Strips covered by sparse, rounded granules 5–6 µm in diameter. On large-diameter branches, slender spiniform processes up to 0.5 mm tall occur in abundance. No polychaete commensals present.

Gastro- and dactylopores uniformly distributed on branches; however, pores of both kinds more abundant and better developed on anterior face. Gastropores numerous, circular in shape, variable in diameter (0.14–0.28 mm), and usually lack bordering lips. Gastropore tubes cylindrical and straight, often perpendicular to branch surface; ring palisade lacking. A conical to elongate-conical gastrostyle occupies about 60% of each gastropore tube, its tip easily seen from above. Gastrostyles up 0.43 mm tall and 0.20 mm in diameter (Boschma 1968b), the illustrated gastrostyle (Plate 34, c) 0.40 mm tall and 0.14 mm in diameter (H : W = 2.85). Gastrostyle prominently ridged, each thin, longitudinal ridge bearing elongate (up to 27 µm), sharp, multitipped spines.

Dactylopore spines primarily of two kinds : tall, thick-walled, primarily adcauline-orientated spines, and low, slightly raised, circular mounds, but intergradations between these 2 forms are also common. Adcauline dactylopore spines up to 0.6 mm tall and approximately 0.28 mm wide, with a dactylotome 75–80 µm wide (about one-third dactylopore-spine width). Although primarily adcauline in orientation, many of these dactylopore spines are also orientated in random directions; compound dactylopore spines rare. Distal edges of adcauline dactylopore spines usually perpendicular to coenosteal surface. Smaller, conical dactylopore spines have circular apertures 70–75 µm in diameter and are invariably only slightly raised above the coenosteum. Dactylopore spines intermediate in size appear to be modifications of the conical form, in which a tall, slender spine (up to 0.4 mm) occurs

directly adjacent to the circular dactylopore, the pore sometimes elongating into a dactylotome slit.

Female ampullae hemispherical, approximately 0.8 mm in diameter, with a relatively small lateral efferent pore about 0.13 mm in diameter. Female colonies rare in study material. Male ampullae also hemispherical and 0.54–0.61 mm in diameter; efferent pores were not observed. Both types of ampullae often support dactylopore spines that obscure their shape, and both types are quickly covered with coenosteum, resulting in layers of empty ampullar cavities easily seen in cross sections of large-diameter branches.

TYPES: Eight syntype branches (Plate 33, d) of *E. n.* facies *ramosa* are deposited at the BM(NH) (1950.1.11.83, 87). Two fragments are also deposited at the Zoological Museum, University of Oslo (B885).

One syntype branch of *E. n.* facies *benhami* is deposited at the BM(NH) (1964.9.17.4). Additional syntype branches (Plate 33, c) are at the Manchester Museum (Boschma #138).

The holotype and most paratypes of *E. cruenta* are deposited at NZOI (H-49, P-10, respectively). Paratypes are also deposited at the RMNH (Coel. 13755A,B) (*see* Vervoort and Zibrowius 1981) and USNM (76879).

TYPE LOCALITY: The type locality of both *Errina novaezelandiae* facies *ramosa* and *benhami* is Preservation Inlet; 6 m.

The type locality of *E. cruenta* is NZOI Stn D156, 48°01.5'S, 166°35'E, southeast of The Snares, south of Stewart Island; 81 m.

REMARKS: Although two facies of *Errina novaezelandiae* (*dendyi* and *cooki*) are considered as separate species, specimens pertaining to facies *ramosa* and *benhami* display a bewildering range of variation, which, I believe, supports Hickson's (1912) original interpretation of conspecificity. For instance, branch thickness is quite variable, some colonies having predominantly thick, robust terminal branches 3–5 mm in diameter, but also several lesser-diameter branches as small as 2 mm in diameter. The terminal branches of several syntypes of facies *ramosa* are 2.2–2.5 mm in diameter, but some of the smaller branches of the paratypes of *E. cruenta* are the same diameter. Other colonies from shallow-water fiord localities have even more slender terminal branches, as small as 1 mm in diameter. Branch anastomosis, reported as frequent in facies *benhami*, appears to be a relatively rare condition and not diagnostic. The presence of gastropore lips, which is usually consistent at the species level in this genus, is variable in expression in *E. novaezelandiae*, most specimens lacking lips, but some having small lips on gastropores on terminal branches. There is great variation in dactylopore spine width and shape but no consistent pattern among specimens or covariance with other characters. Accessory, conical dactylopore spines are more common on the "*benhami*" facies but also occur on the "*ramosa*" facies. Clustering of dactylopore spines occurs to some degree on all specimens examined.

To retain Hickson's characterisation, one might consider the "*ramosa*" form of *E. novaezelandiae* (the typical form) to have relatively slender branches; fewer conical dactylopores; broader adcauline dactylopore spines; and usually unlipped gastropores. The "*benhami*" form has thicker branches; abundant conical dactylopore spines; narrow adcauline dactylopore spines; and frequently lipped gastropores. However, intermediates occur between these forms. Perhaps analysis of the living coral or its tissue by observing its growth habit, colour when alive, reproductive biology, or analysis by means of histology or molecular techniques (e.g., electrophoresis) will reveal differences not apparent in the stony corallum.

The types of *E. cruenta* are interpreted as a robust growth form of *E. novaezelandiae*, the syntypes of *Errina novaezelandiae* facies *ramosa* being virtually identical to small-diameter paratype branches of *E. cruenta*.

Errina novaezelandiae is most similar to *E. chathamensis* n.sp. in colony size and branching pattern, but can be distinguished by having: 1) a greater density of dactylopore spines, 2) fewer compound dactylo-pore spines, 3) ridged gastrostyles, and 4) exclusively reticulate-granular coenosteum. Furthermore, *E. novaezelandiae* is known only from off South Island to Auckland Island, whereas *E. chathamensis* is known from the Chatham Rise and usually at greater depth. *Errina chathamensis* is also known to occur in a white form.

Errina chathamensis n. sp. (Plates 34, e, f, 35, a–g)

Errina sp. Powell, 1947: 8, fig. 18 (in part: specimen from Chatham Island).

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Chatham Rise; 91–688 m.

DESCRIPTION: Colonies uniplanar and robust, the largest colony (NZOI Stn C618) 14 cm tall and 14 cm broad, with a dense massive basal branch 24 x

30 mm in diameter. Polychaete commensals not present. Branching dichotomous and unequal; distal branches circular in cross section, attenuating to tips approximately 1 mm in diameter; large-diameter basal branches elliptical in cross section. Coenosteum white or red, the branches of the latter usually having a white central core and branch tips. Both colour forms were found at three stations (*see* Types). Coenosteal texture linear- to reticulate-granular, the former common on small-diameter branches, the latter on medium to large-diameter branches. Coenosteal strips 60–80 µm wide, bordered by discontinuous but elongate slits about 13 µm wide. Strips covered with widely spaced, tiny granules, all approximately 4 µm in diameter and up to 5 µm tall, many of which project laterally from the strip edge into the coenosteal slits.

Gastro- and dactylopores uniformly distributed on branch surfaces; however, there are often fewer pores on one face (posterior, by definition) and pores are completely lacking from large-diameter basal branches. Gastropores circular, relatively small (0.19-0.25 mm in diameter), and usually not bordered by a lip; however, occasionally one or more adjacent dactylopore spines may resemble a lower lip and, rarely, a small lip is present on gastropores on distal branches. Gastropore tubes cylindrical and lacks ring palisades. Gastrostyles variable in shape, being conical to elongate-conical and occupying approximately three-quarters length of tube. H : W ratios range from 2 to 6. Gastrostyles covered with elongate, pointed spines up to 26 µm long.

Dactylopore spines dimorphic (adcauline and conical to flush), both forms occurring in approximately equal numbers. Adcauline spines quite tall (up to 0.7 mm) and about 0.25 mm wide, with a dactylotome width of 70-89 µm. Adcauline dactylopore spines often compound, each having 2-6 dactylotomes orientated in various directions. Compound dactylopore spine clusters often form the basis of incipient branchlets. Conical dactylopore spines have a circular pore diameter of 55–75 µm and are flush to only slightly raised above the coenosteal surface.

Female ampullae relatively smooth, regular hemispheres 0.70–*0.82*-0.93 mm in diameter, often clustered on branch faces. Often 1 or 2 dactylopore spines occur on each ampulla. Female efferent pores rarely observed, but when present, 0.18–0.22 mm in diameter. Unequivocal male ampullae not observed, perhaps because efferent pores, an important sexually dimorphic character, are rarely present. Also, because the female ampullar size range is broad, a size sexual dimorphism might be obscured.

TYPES: Holotype: NZOI Stn J55, 1 female col. (white), NZOI H-571. Paratypes: NZOI Stn A910, 15 col. and branches (white), NZOI P-832, 3 col., USNM 60253; Stn C617, numerous branches (white and red), NZOI P-833, 4 branches, USNM 85124; Stn C618, 2 col. (red), NZOI P-834, 1 col. and SEM stubs 588, 599, USNM 85125; Stn D871, 2 branches (white), NZOI P-835; Stn D876, 5 col. and several branches (white and red), NZOI P-836; Stn D878, 4 col. and branches (white), NZOI P-837, SEM stub 589 (USNM); D887, 9 branches (white), NZOI P-838; D889, 2 branches (red), NZOI P-839; Stn D896, 6 col. and branches (white and red), NZOI P-840, 3 col., USNM 85126; Stn E153, 3 col. and 2 branches (white), NZOI P-841; Stn E751, 1 branch (white), NZOI P-842; Stn J55, 7 col. and many branches, NZOI P-843, 4 branches and SEM stubs 577–578, USNM 85127; Stn J59, 3 col. and numerous branches (white), NZOI P-844, 4 branches, USNM 85128; Stn Q38, 6 col. and branches (white), NZOI P-845; *Eltanin* Stn 1847, 1 branch (white), USNM 76519.

TYPE LOCALITY: NZOI Stn J55, 44°05.5'S, 176°12.0'E, Chatham Rise west of Chatham Island; 198 m.

ETYMOLOGY: Named for the island and associated rise from which all the type specimens were collected.

REMARKS: The red form of *E. chathamensis* is similar to *E. novaezelandiae* and is compared to that species in the account of the latter. The white form of *E. chathamensis* is superficially similar to *E. gracilis*, but differs in having fewer, thinner dactylopore spines; no ring palisades; and no polychaete commensals (*see* account of *E. gracilis*). Furthermore, *E. gracilis* appears to be restricted to the Subantarctic region.

Errina laevigata n. sp. (Plate 36, a–g)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: South of Stewart Island; Macquarie Ridge; 113–371 m.

DESCRIPTION: Holotype colony uniplanar and massive, 9.7 cm tall and 6.2 cm broad, with a broad basal branch 9 x 19 mm in diameter. Like *E. novaezelandiae*, basal branches loosely fused, forming an almost solid basal flabellum. Branching dichotomous and unequal; branches taper to blunt tips approximately 2 mm in diameter. Holotype colony bored

internally, resulting in a hollow corallum, but apparently without affecting the normal colony and branch shape. Coenosteum light orange, with white central branch cores and dactylopore spines. Coenosteum composed of slightly convex, parallel, linear strips 70–75 µm wide, bordered by shallow, almost continuous slits about 5 µm wide. Strips smooth on top, giving a shiny, porcellanous aspect to coenosteum. Very small granules present on lateral edges of strips, the granules projecting into the slits.

Gastro- and dactylopores uniformly distributed on small-diameter branches, but virtually absent from basal, large-diameter branches. Gastropores well spaced, circular, and small (0.16-0.19 mm in diameter); gastropores not bordered by lips. Gastropore tubes cylindrical, lacking a ring palisade. Gastrostyles small and elongate-conical, the largest gastrostyle observed 0.31 mm tall. Illustrated gastrostyle (Plate 36, g) 0.20 mm tall and 0.09 mm in diameter (H : W = 2.2); H : W ratios range from 1.6 to 3.4 (N = 10). Gastrostyles prominently and obliquely ridged, at least in the illustrated style; ridges bear simple, elongate, sharp spines up to 32 µm long.

Dactylopore spines of 2 kinds: a tall, thick-walled, primarily adcauline-orientated spine, and a low, only slightly raised, circular dactylopore. Adcauline dactylopore spines up to 0.6 mm tall and about 0.19 mm wide, with a dactylotome width of about 70 µm. Their lateral walls are sharply edged at the dactylotome. Occasionally there are 1 or 2 cylindrical spinules that project upward from either side of the dactylopore spine apex, thus adding to the height of the spine (Plate 36, d). Adcauline dactylopore spines rarely compound. Smaller, conical dactylopore spines are much less abundant, circular (40–50 µm in diameter), and only slightly raised. Dactylopore spines shorter and more slender (about 15 µm wide) than those first described also present, having circular or slit-shaped dactylotomes restricted to their lower portion. Coenosteal spinules of similar size but without a dactylotome also present, most abundantly on branch edges that are closely adjacent to another branch.

Female ampullae unknown. Male ampullae primarily internal, having an internal diameter of 0.4-0.5 mm and accompanied by a superficial mound only about 0.3 mm in diameter. Often a short, cylindrical spinule occurs in the centre of the ampullar mound, but efferent pores were not observed.

TYPES: Holotype: NZOI Stn D145, 1 male col., NZOI H-572, fragments of holotype, SEM stubs 595, 678, USNM 85129. Paratypes: NZOI Stn D9, 1 col., NZOI P-846; *Eltanin* Stn 1411, 1 branch, USNM 60161.

TYPE LOCALITY: NZOI Stn D145, 48°42'S, 167°27'E, between Stewart and Auckland Islands; 366 m.

ETYMOLOGY: The species name *laevigata* (from the Latin *laevigatus*, smooth) refers to the smooth coenosteum of this species.

REMARKS: *Errina laevigata* is most similar to *E. novaezelandiae* ("*cruenta*" form) particularly in colony and dactylopore spine shapes. It differs significantly, however, in coenosteal texture (linear-smooth), male ampullar structure (internal), and in having accessory dactylopore spine spinules. It also appears to have proportionally fewer small circular dactylopore spines, smaller gastropores, and more slender adcauline dactylopore spines. Both species overlap in distribution, but *E. laevigata* appears to have a deeper range.

Errina hicksoni n. sp. (Plate 37, a–g)

[?] *Errina (Eu-Errina) antarctica*: Broch 1951a : 35 (in part: *Discovery* Stn 2215); Boschma & Lowe 1969 : pl. 5, map 1 (in part: record from off Antipodes Island).

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Known only from the Bounty Plateau off Bounty and Antipodes Islands; 40–155–? 210 m.

DESCRIPTION: Colonies uniplanar and broad, the lower part of large colonies being a solid, thick flabellum or a reticulate fan of fused branches. Colonies moderately large, up to 7 cm tall and 10 cm broad (NZOI Stn A743), with massive basal branches up to 2.5 x 1.5 cm in diameter (NZOI Stn A751). Branching dichotomous and unequal; branch anastomosis common. Branches attenuate gradually to blunt tips about 1.5 mm in diameter. No polychaete-induced skeletal modifications seen. Coenosteum a delicate light orange, with white branch cores and ampullae, the latter sometimes producing a mottled appearance. Coenosteum composed of strips 33–52 µm wide arranged in reticulate order, the strips flanked by deep, fairly continuous coenosteal slits approximately 6 µm wide. Tops of strips smooth; however, small granules about 4 µm in diameter project from lateral edges of strips.

Gastro- and dactylopores uniformly distributed

on branches; however, pores of both kinds are more abundant on anterior colony face and less abundant on large-diameter, basal branches. Gastropores numerous: circular in shape and variable in diameter, ranging from 0.12–0.29 mm. Gastropores usually lack lips; however, occasionally some will have a small lower lip and others are rimmed about their entire perimeter. Gastropore tubes cylindrical and straight, the gastrostyle restricted to lower two-thirds of tube. Ring palisade present at level of gastrostyle tip, composed of irregularly shaped, globose elements up to 30 µm in diameter, which are covered with minute granules about 5 µm in diameter. Gastrostyles conical to elongate. Illustrated gastrostyle (Plate 37, f) 0.37 mm tall and 0.12 mm in diameter (H : W = 3.1); however, H : W ratios vary from 2.0 to 5.9 (N = 14, Boschma's unpublished notes deposited at the RMNH), depending on gastropore depth, which in turn is dependent on branch diameter. Gastrostyle longitudinally ridged, the ridges bearing small, multitipped spines.

Dactylopore spines of one type: thick-walled, relatively short, and primarily adcauline-orientated spines, which are never compound. Dactylopore spines only up to 0.21 mm tall and about 0.26 mm wide, with a dactylotome width of 75–80 µm.

Female ampullae smooth hemispheres 0.70–0.75 mm in diameter, most obvious on small-diameter branches. As branches increase in diameter, ampullae are covered with coenosteum and thus become internal, only about 0.50 mm in internal diameter. These internal cavities are easily seen in a fractured branch cross section. Female efferent pores rare, about 0.14 mm in diameter and accompanied by a short efferent tube. Male ampullae unknown.

TYPES: Holotype: NZOI Stn A743, 1 female col., NZOI H-573. Paratypes: NZOI Stn A704, 1 col., NZOI P-847; Stn A705, 6 col. and branches, NZOI P-848; Stn A734, 3 branch fragments, NZOI P-849; Stn A743, 2 col. and branches, NZOI P-850, 2 col., branches and SEM stubs 593–594, USNM 76517; Stn A747, 1 col. and branches, NZOI P-851; Stn A748, 10 col. and many branches, NZOI P-852, 5 col., USNM 76516; Stn A751, 6 col. and many branches, NZOI P-853, 4 col., USNM 76518; Stn I711, 3 branches, NZOI P-854; Stn S80, 4 col., NZOI P-855.

TYPE LOCALITY: NZOI Stn A743, 49°39.8'S, 178°50.2'E, north of Antipodes Island; 40 m.

ETYMOLOGY: Named in memory of Sydney John Hickson for his pioneering work on the genus *Errina*, especially those species first reported from New Zealand (Hickson 1912).

REMARKS: Among the nonlipped, orange *Errina*, *E. hicksoni* is most similar to *E. kerguelensis* Broch, 1942. Although not known from the New Zealand region, *E. kerguelensis* is known from the Subantarctic and Ross Sea areas (Cairns 1983a) and is similar to *E. hicksoni* in having the same coenosteal colour, same sized gastropores, and in having ring palisades, and internal ampullae. *Errina hicksoni* differs in having a more tightly branched, sometimes anastomotic, colony; smaller dactylopore spines; and a smooth, nongranular coenosteum.

Broch's (1951a) report of *E. antarctica* from five *Discovery* stations represents at least four species (*see* Cairns 1983a). Although the specimens from *Discovery* Stn 2215 (Antipodes Island, 163–210 m) are not present at the BM(NH) (Zibrowius, pers. comm.), their location, depth, and general resemblance to *E. antarctica* suggest an identification of *E. hicksoni*.

Errina cooki Hickson, 1912, new rank (Plate 38, a–f)

Errina (Labiopora) novae-zelandiae facies *Cooki* Hickson, 1912 : 884, pl. 95, fig. 5, pl. 96, figs 10–12.
Errina (Eu-Errina) novae-zelandiae: Broch 1942 : 51–53 (in part: facies *Cooki*).
Errina novae-zealandiae [sic]: Ralph 1948 : 110.
Errina novae-zelandiae facies *cooki*: Boschma 1953 : 167.
Errina novae-zelandiae: Boschma 1957 : 56 (in part: facies *cooki*).
Errina novaezealandiae [sic] facies *cooki*: Cairns 1983b : 428.

MATERIAL EXAMINED: NZOI Stn A444, 22 col. and branches, NZOI, 6 col. and SEM stub 582, USNM 60252; Stn A502, 1 col. and 4 branches, NZOI; Stn C60, 2 col., NZOI; Stn C617, 1 col., NZOI.

DISTRIBUTION: Known only from Cook Strait and the western edge of Chatham Rise; 143–380 m.

DESCRIPTION: Colonies uniplanar, broad, and of medium size, the largest colony (a syntype) 5 cm tall and 7 cm broad, the largest basal branch diameter 7.5 mm (NZOI Stn A444). Branching dichotomous, unequal, and relatively sparse; no branch anastomosis. Branches circular to slightly elliptical in cross section, tapering to blunt tips 1.0–1.8 mm in diameter. No polychaete commensals. Coenosteum white and reticulate-granular in texture.

Coenosteal strips 40–60 µm wide, bordered by deep, discontinuous slits about 6 µm wide, and uniformly covered with small granules about 6 µm in diameter and height.

Gastro- and dactylopores occur predominantly on anterior face and lateral branch edges, being much less common on posterior face. Gastropores circular, 0.15–0.22 mm in diameter, and very rarely lipped. Gastropore tubes cylindrical, lacking a ring palisade. Gastrostyles elongate but no tabulae noted; illustrated gastrostyle (Plate 38, e) 0.46 mm tall and 61 µm in diameter (H : W = 7.5). Gastrostyles bear tall, obliquely orientated ridges, which in turn bear tiny spines.

Dactylopore spines short, thick-walled, and primarily adcauline in orientation, rarely compound. Dactylopore spines rarely exceed 0.12 mm in height and 0.24 mm in width, with a dactylotome width of 55–60 µm. Smaller, conical dactylopores, having a pore diameter of only 40–50 µm, occur infrequently on some branches.

Female ampullae are prominent hemispheres 0.65–0.80 mm in diameter; however, efferent pores are never seen. Instead, the tops of many female ampullae are completely ruptured, resulting in concave coenosteal depressions. Planulae may be released through this rupture instead of through a smaller efferent pore. Male ampullae much less conspicuous, being partially submerged in branch coenosteum and about 0.6 mm in diameter. Both male and female ampullae clustered on both faces.

TYPES: At least one syntype (Plate 38, b) is deposited at the Manchester Museum (Boschma #140); another eight syntype branches are deposited at the Zoological Museum, University of Oslo (B886), undoubtedly specimens borrowed and retained by Broch (1942).

TYPE LOCALITY: Cook Strait, depth unknown: "from the cable" (Hickson 1912 : 884).

REMARKS: Although Hickson (1912) made lengthy arguments for considering all four facies of *Errina novaezelandiae* as the same species, and both Broch (1942) and Boschma (1957) accepted his arguments, I disagree with the conspecificity of the four facies (*see* generic Remarks) and herein raise facies *cooki* to the species level.

Among the three other nonlipped, white species of *Errina* (*E. aspera*, *E. atlantica*, and *E. gracilis*), *E. cooki* is remarkably similar to the type-species *E. aspera*, known only from the eastern Atlantic and Mediterranean from 95–236 m (Zibrowius and Cairns, in press). A direct comparison between the two species revealed no significant differences, even at the SEM level; however, because of the great geographic separation of the two populations, they are treated as separate species pending the collection of a larger suite of *E. cooki*.

Errina gracilis Marenzeller, 1903 (Plate 39, a–g)

Errina gracilis Marenzeller, 1903 : 4–7, figs 1-4.
Errina aspera: Boschma & Lowe 1969 : 15, pl. 15, map 2.
Errina (Errina) gracilis: Cairns 1983b : 98–101, figs 11G, 19A–F, 20A–B (synonymy and lectotype designation).

MATERIAL EXAMINED: NZOI Stn C734, 8 col., NZOI, 3 col., USNM; Stn D24, 1 col., NZOI; *Eltanin* Stn 1415, 1 col., USNM 60168; 1416, 1 col., USNM 60166; Stn 1419, 4 col., USNM 60077; Stn 1422, 1 col., USNM 59926; Stn 1691, 7 col., USNM 60150; Stn 1975, 5 col. and SEM stub 681, USNM 60167; specimens cited by Cairns (1983a); 4 paralectotypes, *Belgica* Stn 387, USNM 76874.

DISTRIBUTION: Circum-subantarctic, including southern Macquarie Ridge and Hjort Seamount; 100–1226 m.

DESCRIPTION OF NEW ZEALAND SPECIMENS: Colonies uniplanar and broad, the largest specimen (*Eltanin* Stn 1975) 4.8 cm tall and 5.5 cm broad, with a basal branch diameter of 6.2 mm (Plate 39, a). Branching dichotomous and unequal; branches circular to slightly elliptical in cross section, tapering to tips 1.3–2.5 mm in diameter. Polychaete commensal invariably present, inducing the coral to form flattened tubes along its large-diameter branches. Basal branches often anastomose into a dense, reticulate lamella. Coenosteum white and reticulate-granular in texture. Coenosteal strips 50–80 µm wide and bordered by wide (about 16 µm) but shallow slits. Strips very coarsely granulated, the granules 5–7 µm in diameter and irregular in shape.

Gastro- and dactylopores most abundant on distal branches, very few occurring on large-diameter branches. Gastropores circular, 0.15–0.25 mm in diameter, and very rarely lipped. Gastropore tubes cylindrical, each having a well-developed, annular ring palisade at level of gastrostyle tip, composed of large granular elements 30–35 µm in diameter; tabulae lacking. Gastrostyles elongate-conical (H : W about 4), with a bare basal main shaft and a sparsely ornamented distal section that bears sharp spines up to 26 µm

tall. Gastrostyle tip extends up to and sometimes above coenosteal surface.

Dactylopore spines of medium height (0.3–0.4 mm tall), thick walled, and primarily adcauline in orientation; often compound. Dactylopore spines 0.27–0.30 mm wide, with a dactylotome width of about 0.1 mm. Circular, flush pores 50–70 µm in diameter abundantly scattered over coenosteum, these pores interpreted to be modified dactylopores.

Female ampullae prominent, thin-walled hemispheres 0.8–0.9 mm in diameter; however, efferent pores were not observed. Instead, large circular depressions are common on certain branches, the remnants of ruptured female ampullae. Male ampullae 0.7–0.8 mm in diameter, each bearing 2 or 3 apical efferent pores about 40 µm in diameter.

TYPES: Lectotype and most paralectotypes deposited at the Institut des Sciences Naturelles, Brussels (*see* Cairns 1983a : 100). Paralectotypes are also deposited at the USNM (76874).

TYPE LOCALITY: *Belgica* Stn 387, 71°15'S, 87°39'W, Bellinghausen Sea; 100 m.

REMARKS: Among the 14 nonlipped species of *Errina*, *E. gracilis* is the only species to host a polychaete symbiont. It is further distinguished by having white coenosteum, ring palisades, and being restricted to the Subantarctic region in relatively deep water (360–996 m).

Errina sinuosa n. sp. (Plates 40, a–g, 41, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Known only from the Kermadec Ridge from Raoul Island to south of Esperance Rock; 290–814 m.

DESCRIPTION: Corallum unique in shape, strongly influenced by its obligate commensal polychaete — main branch vertical and sinusoidal, the diameter and amplitude of the sinuous curves decreasing with height. Holotype 37 mm tall and 12.2 mm wide, with a firmly attached base 3.4 mm in diameter; largest specimen (NZOI Stn T256) 5.8 cm tall and 11 x 6 mm in basal branch diameter. Main vertical branch hollow (apically open) and laterally perforate, forming tube for commensal polychaete, which runs entire length of colony. Inner tube diameter approximately 2.6 x 2.0 mm. Within the basal 0–7 mm of the corallum, there is invariably an efferent pore approximately 2 mm in diameter this pore and continuing the length of the main branch is a groove about 1.75 mm in width that is flanked by short, modified branches, which apparently serves as an external path for the polychaete. Short (rarely over 7 mm long), slender branchlets project from lateral edges of main branch, terminating in slender, pointed tips only 0.35 mm in diameter. Coenosteum white: linear-imbricate on branchlets; linear-imbricate to radial-imbricate (Plate 40, e, g) on main branches. Coenosteal strips 60–95 µm wide, sometimes slightly convex, and bordered by short, discontinuous slits about 10 µm wide. Platelets have irregular, but smooth, margins.

Location of gastro- and dactylopores variable — in some specimens (e.g., NZOI Stn K842) gastropores occur only on branch faces and dactylopores are restricted to branch edges; however, in other specimens (e.g., NZOI Stn K844) both gastro- and dactylopores are uniformly distributed on all branch surfaces. Gastropores circular, 0.20–0.25 mm in diameter, and sometimes bordered by a prominent lower lip (e.g., NZOI Stn K842), sometimes not (e.g., NZOI Stn K844). Gastropore tubes cylindrical, lacking a ring palisade. Gastrostyle a massive cone; illustrated style (Plate 40, f) 0.16 mm tall and 84 µm in diameter (H : W = 1.9). Gastrostyles unridged and bear smooth, thick, sharp spines up to 23 µm long.

Dactylopore spines primarily short, thin walled, and exclusively adcauline in orientation, never compound. Dactylopore spines up to 0.10 mm tall and 80 µm wide, with a dactylotome width of 40–60 µm. However, in some specimens the dactylotome slit is not present, the spine being apically perforate with a pore diameter of about 60 µm.

Ampullae unique in construction (Plate 41, a, b), consisting of a squat, irregularly shaped cylinder up to 0.4 mm tall and 0.5 x 0.2 mm in diameter. Its top is flat but recessed about 0.1 mm below its outer edges. The recessed top is very porous and bears several discrete apically perforate cones, one cone invariably in the centre, the others near the edge. Cones about 40 µm tall and 50 µm in basal diameter. Judging from the size of the perforate cones, they are assumed to be male efferent pores.

TYPES: Holotype: NZOI Stn K842, 1 col., NZOI H-574. Paratypes: NZOI Stn C527, 1 col., USNM 85130; Stn K839, 2 col., P-939; Stn K840, 2 col., NZOI P-856; Stn K842, 3 col., NZOI P-857, 2 col. and SEM stubs 596, 685A, USNM 85131; Stn K844, 2 col., NZOI P-858, 1 col. and SEM stub 685B, USNM 85132; Stn K859, 1 col., NZOI P-859; Stn T214, 2 col., NZOI P-860; Stn T256, 2 col., NZOI P-861.

TYPE LOCALITY: NZOI Stn K842, 30°10.2'S, 178°35.9'W, northwest of McCauley Island; 325–370 m.

ETYMOLOGY: The species name *sinuosa* (from the Latin *sinuosus*, curved, sinuous) refers to the sinusoidal shape of the colonies of this species.

REMARKS: Among the 23 Recent species of *Errina*, *E. sinuosa* is easily distinguished by its sinusoidal growth form created by its polychaete commensal, its uniquely shaped ampullae, and its thin-walled dactylopore spines. Its shape is identical to that of *Calyptopora sinuosa*, a species known from the same geographic and bathymetric range.

Errina cheilopora Cairns, 1983
(Plates 41, c–g, 42, a–c)

Errina (Errina) cheilopora Cairns, 1983a : 105–107, figs 22A, 23A–I.
Errina cheilopora: Cairns 1983b : 428.

MATERIAL EXAMINED: NZOI Stn D175, 1 col., NZOI; Stn D176, 8 col., NZOI, 5 col. and SEM stub 682, USNM 85133; Stn D871, 2 branches, NZOI; Stn E803, 7 col., NZOI, 3 col. and SEM stubs 579–580, USNM 85134; Stn E821, 1 col., NZOI; Stn F127, 1 col., NZOI; Stn G937, 1 col., NZOI; Stn H636, 1 col., NZOI; Stn J55, 2 col., NZOI, 2 col., USNM 85135; Stn S25, 1 col., NZOI; Stn S30, 1 col., NZOI, 1 col., USNM 85136; Stn S45, 1 branch, NZOI; Stn T47, 4 col., NZOI. Types, q.v.

DISTRIBUTION: Widespread on continental shelf and slopes south and east of New Zealand, including Macquarie Ridge, Campbell and Bounty Plateaus, and Chatham Rise; 198–1400 m.

DESCRIPTION: Colonies uniplanar and of moderate size, the largest specimen examined (NZOI Stn S30, Plate 41, c) 6.5 cm tall and 6.4 cm broad, with a basal branch diameter of 6.1 x 11.0 mm. Colony branching fairly characteristic, the short basal branch dividing into 2–4 widely divergent major branches near colony base, which in turn give rise to numerous branches of considerably smaller diameter that fill the flabellum but do not anastomose. Branching subsequent to major branches thus may be characterised as dichotomous but unequal. Branches quite dense, each having a solid core. Polychaete commensal lacking. Cross section of basal branch elliptical; that of distal branches, circular. Coenosteum white, on rare occasions a light pink (e.g., *Eltanin* Stns 1411, 1414). Coenosteal texture linear-granular, the strips 50–80 µm wide, bordered by short, discontinuous coenosteal slits and pores 7–15 µm wide. Strips uniformly covered with rounded granules 3–7 µm in diameter.

Gastro- and dactylopores abundant on small-diameter branches but lacking on large-diameter basal branches. Gastropores circular and 0.18–0.33 mm in diameter, each bordered by a prominent, broad, abcauline lip. Gastropore lips up to 3 times gastropore width (e.g., 0.65 mm wide), project as much as 0.5 mm over the gastropore, and usually bear 1–4 dactylopore spines. Gastropore tubes cylindrical and usually bear a poorly-developed, granular ring palisade. Gastrostyles elongate-conical, with a sharp tip. Illustrated gastrostyle (Plate 42, a) 0.29 mm tall and 0.14 mm in diameter (H :W = 2.07); however, H : W ratios range from 1.8 to 8.5 (Cairns 1983a). Upper third of gastrostyle bears large, smooth spines; lower section transversely ridged, the short ridges bearing small spines.

Dactylopore spines of one type — short, thick walled, and exclusively adcauline in orientation, which are uniformly distributed and never compound or laterally fused. Dactylopore spines 0.07–0.15 mm tall and about 0.15 mm wide, with a dactylotome width of about 50 µm.

Female ampullae superficial hemispheres 0.5–0.6 mm in diameter on distal branches, transforming to internal cavities 0.32–0.37 mm in diameter as branch increases in diameter and incorporates the ampullae. Superficial ampullae on large-diameter branches not observed. Efferent pores never seen. Male ampullae also presumed to be internal.

TYPES: The holotype and most paratypes are deposited at the USNM. A paratype from *Eltanin* Stn 1975 is also deposited at the BM(NH) (*see* Cairns 1983a).

TYPE LOCALITY: *Eltanin* Stn 1975, 54°30'S, 150°00'E, off Macquarie Island; 443–549 m.

REMARKS: Among the 23 Recent species of *Errina*, nine have lipped gastropores: *E. cochleata* Pourtalès, 1867; *E. dabneyi* Pourtalès, 1871; *E. macrogastra* Marenzeller, 1904; *E. altispina* Cairns, 1986a; *E. dendyi* Hickson, 1912; *E. cheilopora* Cairns, 1983a; *E. sinuosa* n. sp.; *E. reticulata* n. sp. ; and *E. bicolor* n. sp., the last five of which occur in the New Zealand region. *Errina cheilopora* differs from its New Zealand congeners by having broad, elongate gastropore lips, which often bear 1–4 dactylopore spines; having a delicate growth form; and having a deep-water habit (198–1400 m). It is perhaps most similar to *E. cochleata*, known only from the Straits of Florida

at 194–534 m (Cairns 1983a), but differs in having linear-granular coenosteum (not linear-imbricate) and uniformly distributed gastropores (not restricted to anterior face and branch axils).

Errina bicolor n. sp. (Plates 42, c–g, 43, a–d)

MATERIAL EXAMINED: Types, q.v. NZOI Stn S48, 1 poorly-preserved branch fragment, NZOI.

DISTRIBUTION: Continental shelf surrounding Auckland Island, southeast Campbell Rise, south of South Island, and Macquarie Island; 95-625 m.

DESCRIPTION: Colonies fragile, uniplanar to slightly bushy, and small, one of the largest colonies (NZOI Stn D172) only 32.5 mm tall and 18.5 mm broad, with a basal branch diameter of 2.2 mm; however, basal branch diameters up to 4 mm occur on specimens from NZOI Stn B175. Colonies that remain attached to substrate extremely rare (only 3 among the many specimens examined), but in each case the basal branch was attached to a small bryozoan-encrusted pebble 6–7 mm in diameter. Branching sparse, dichotomous, and equal, often resulting in branching axils of 90°; no branch ansatomosis. Branches slender and delicate, always circular in cross section, and taper to pointed tips 0.75–0.80 mm in diameter. Commensal polychaetes absent; however, many colonies are partially encrusted by bryozoans and serpulids, and some have the attached gastropod *Pedicularia*. Coenosteum light orange or white, both colour forms usually present at each station; coenosteum porcellanous in well-preserved specimens. Light orange coralla usually have white gastropore lips, ampullae, distal branch tips, and branch cores. Coenosteal texture linear-granular, the strips 50-55 μm wide and poorly defined by short coenosteal slits or pores 7-8 μm wide. Rounded granules 3–4 μm in diameter uniformly cover strips.

Gastropores circular and 0.15-0.20 mm in diameter, each bordered by a small but distinct lower lip much like that of *Errina reticulata*. Gastropore tubes cylindrical and straight, lacking a ring palisade. Gastrostyles elongate-conical, the illustrated style (Plate 43, a, b) 0.27 mm tall and 0.10 mm in diameter (H : W = 2.7). Gastrostyles very similar to those of *Errina reticulata* — transversely ridged, the ridges bearing small spines.

Dactylopore spines of one type — thick-walled, short, primarily adcauline-orientated spines, which are sparsely distributed and never compound or laterally fused. Dactylopore spines only up to 0.14 mm tall and about 0.20 mm wide, with a dactylotome width of about 55 μm.

Female ampullae hemispherical, about 0.7 mm in diameter. Male ampullae appear to be partially submerged hemispheres, each about 0.6 mm in diameter. Uneqivocal distinction between male and female ampullae was not possible because the characteristic female efferent pores were never observed.

TYPES: Holotype: NZOI Stn D172, 1 white col., NZOI H-575. Paratypes: NZOI Stn B175, about 30 branches, NZOI P-862, 10 branches and SEM stub 675, USNM 60250; Stn D38, 1 col., and about 20 branches, NZOI P-863, 1 col. and 3 branches, USNM 85137; Stn D72, 1 branch, NZOI P-864; Stn D133, 1 branch, NZOI P-865; Stn D148, 4 branches, NZOI P-866; Stn D172, several hundred branches, NZOI P-867, 27 branches and SEM stubs 590, 676, USNM 60249.

TYPE LOCALITY: NZOI Stn D172, 51°00'S, 166°03'E, south of Auckland Island; 179 m.

ETYMOLOGY: The species name *bicolor* (from the Latin *bicolor*, two colours) refers to the orange and white coenosteal colours of the populations.

REMARKS: *Errina bicolor* is characterised by its sparse, dichotomous, equal branching, which often results in 90° branch axils. No other species of *Errina* has such equal and symmetrical branching. Other distinctive characters are its relatively small gastropore lips and its two coenosteal colour morphs.

Errina reticulata n. sp. (Plates 43, e, f, 44, a–f)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Macquarie Ridge and north of Auckland Island; 79–145 m.

DESCRIPTION: Colonies uniplanar and relatively small, one of the largest colonies (the holotype) only 4.5 cm tall and 5.4 cm broad, with a basal branch diameter of 6.5 mm. Branching dichotomous and unequal, the branches frequently fusing, forming reticulate flabella. Branches circular to elliptical in cross section, gradually attenuating to branch tips about 0.9 mm in diameter. Commensal polychaetes not present. Coenosteum a delicate light orange, with white branch cores, dactylopore spine tips, and ampullae. Coenosteum linear-granular and somewhat porcellanous on distal branches; coenosteum reticulate-granular on larger-diameter branches.

Coenosteal strips 45-60 µm wide, bordered by discontinuous slits about 3 µm wide and uniformly but sparsely covered with small, rounded granules 3-4 µm in diameter. Basal branches often bear tall (up to 80 µm), slender, apically perforate papillae (Plate 44, b), the pores about 13 µm in diameter.

Gastro- and dactylopores most abundant on anterior branch faces and lacking on large-diameter branches. Gastropores circular (0.14-0.20 mm in diameter), each usually bordered by a prominent, broad, lower lip, which is usually broader than the gastropore and extends well above it (Plate 44, d). Gastropore lips best developed on small-diameter distal branches, but may be rudimentary or lacking on large-diameter branches. Gastropore tubes cylindrical and straight, the gastrostyle confined to the lower two-thirds of tube. Each gastropore tube contains a granular ring palisade similar to that described for *Errina hicksoni*. Gastrostyles elongate-conical, the illustrated example (Plate 44, e) 0.35 mm tall and 0.10 mm in diameter (H : W = 3.5). Gastro styles transversely ridged, the ridges bearing small spines, in general, very similar to those of *Errina bicolor*.

Dactylopore spines of one type — thick walled, relatively tall and narrow, and primarily adcauline in orientation; dactylopore spines occasionally compound and laterally fused into short tiers. Dactylopore spines up to 0.36 mm tall and about 0.18 mm wide, with a dactylotome width of approxi-mately 50 µm

Female ampullae hemispherical, 0.60–0.65 mm in external diameter and 0.50-0.55 mm in internal diameter. Female efferent pores about 0.11 mm in diameter, but rarely observed. Male ampullae unknown.

TYPES: Holotype: NZOI Stn D18, 1 female col., NZOI H-576. Paratypes: NZOI Stn D17, several dozen colonies and several hundred branches, NZOI P-868, about 50 branches, USNM 60248; Stn D18, several dozen col. and many branches, NZOI P-869, 23 col. and SEM stubs 591–592, 677, USNM 60247; Stn D20, 5 branches, NZOI P-870; Stn D148, 1 col., NZOI P-871; *Eltanin* Stn 1417, 4 col. and branches, USNM 59908.

TYPE LOCALITY: NZOI Stn D18, 52°31'S, 160°31'E, Macquarie Ridge north of Macquarie Island; 128 m.

ETYMOLOGY: The species name *reticulata* (from the Latin *reticulum*, net, network) refers to the net-like growth form of its colonies, consisting of closely spaced, often anastomosing branches.

REMARKS: *Errina reticulata* is easily distinguished from other species of lipped *Errina* by its reticulate orange corallum; occasionally compound dactylopore spines; and its gastropore-tube ring palisades. It is more easily confused with *Errina hicksoni* (a species without lips), both species having reticulate orange coralla; ring palisades; and a similar depth range. However, in addition to having gastropore lips, *E. reticulata* differs in having a more delicate colony and being geographically isolated from *E. hicksoni* (Macquarie Ridge vs Bounty Plateau).

Errina dendyi Hickson, 1912 new rank
(Frontispiece; Plates 44, g–i, 45, a–f)

Errina (Labiopora) novae-zelandiae facies *Dendyi* Hickson, 1912 : 883, pl. 94, fig. 4.
Errina (Eu-Errina) novae-zelandiae: Broch 1942 : 51–53 (in part: facies *Dendyi*).
Errina (Eu-Errina) rubra Broch, 1942 : 46-48, pl. 4, fig. 13, text-fig. 13.
Errina novae-zelandiae facies *dendyi*: Boschma 1953 : 167.
Errina rubra: Boschma 1953 : 167; 1957 : 57; Cairns 1983b : 428.
Errina novae-zelandiae: Boschma 1957 : 56 (in part: facies *dendyi*).
? *Errina novaezelandiae*: Grange *et al.*, 1981 : fig. 4g; Richardson 1981 : fig. 1.
Errina novaezealandiae [sic] facies *dendeyi* [sic]: Cairns 1983b : 428.

MATERIAL EXAMINED: NZOI Stn E305, 1 frag. (orange), NZOI; Stn E312, 2 branches (orange), NZOI; Stn E337, 1 branch (orange), NZOI; Stn E845, 2 branches (orange), NZOI; Stn E861, 1 col. and 2 branches (orange), NZOI, 1 col., USNM 85138; Stn E865, 1 col. and 1 branch (orange), NZOI; Stn M794, 1 col. (salmon-orange), NZOI, branch fragment and SEM stub 683, USNM 85139; Stn Q741, 1 col. (salmon-orange), NZOI, 1 col., USNM 85140; Long Sound, depth unknown, 1 col. (light pink), NZOI; Hall Arm, Doubtful Sound, 20 m, 2 red colonies, USNM 76300; Gut Passage, between Bauza Island and Secretary Island, mouth of Doubtful Sound, 30 m, 2 pale yellow col., USNM 76301; Wet Jacket Arm between Dusky and Breaksea Sounds, 30 m, 3 pale yellow col. and SEM stubs 587, 680, USNM 76302; *Terra Nova* Stn 90, 1 branch, BM(NH) 1950.3.16.91; fragment of holotype of *E. dendyi*, BM(NH) 1964.9.17.1, SEM stub 684, USNM 85784; syntypes of *E. rubra* from Cape Maria van Diemen, 2 branches, ZMC.

DISTRIBUTION: Throughout Fiordland, South Island (17–30 m) and Three Kings and Norfolk Ridges; 91–318 m.

DESCRIPTION: Colonies uniplanar to bushy, and relatively large, the largest corallum (USNM 76301) 10 cm tall and 8 cm broad, with a basal branch diameter of 5.6 x 5.0 mm. Many colonies from off Fiordland attached to anterior dorsal valve of a living brachiopod by a thin, expansive base; deeper-water northern populations less delicate and often attached to antipatharians. Basal branch short, dividing into 2-4 main branches only millimetres above the base; thereafter branching is dichotomous and unequal; no branch anastomosis. Colony and branches quite fragile, distal branches attenuating to diameters as small as 0.35 mm; however, deeper-water northern populations slightly more robust. Branches round in cross section and dense in structure; no polychaete commensals known. Coenosteum variable in colour, including salmon-orange (e.g., syntypes of *E. dendyi*), light pink, red (e.g., a syntype of *E. rubra*) and pale yellow, the ampullae usually a darker shade of yellow and the dactylopore spines and branch tips a lighter shade of colour. One colony (USNM 76300) is predominantly orange but has one medium-sized white branch. Coenosteal texture linear-granular, the relatively narrow strips 32-45 µm wide and bordered by broad discontinuous slits 8–10 µm wide. Coenosteal granules round, 6-8 µm in diameter, and concentrated near coenosteal slits, resulting in relatively smooth coenosteal strips.

Gastro- and dactylopores concentrated on terminal and subterminal, small-diameter branches; few, if any, pores occur on large-diameter branches. Gastropores circular and small (0.18-0.22 mm in diameter), each bordered by a prominent, straight lower lip that projects well above the gastropore at a 45° angle from the coenosteum. Gastropore lips invariably present on terminal branch gastropores but less common and/or prominent on gastropores on large-diameter branches. Gastropore tubes cylindrical and potentially quite long; no ring palisades. Gastrostyles elongate but no tabulae were noted; illustrated gastrostyle (Plate 45, a) 0.75 mm long and 0.09 mm in diameter (H :W = 8.4), although shorter styles are not uncommon (e.g., H : W of 3–5). Gastrostyles unridged but covered with rather long, individualised spines up to 30 µm long.

Dactylopore spines of only one type — thick-walled, low, exclusively adcauline-orientated spines that are never compound. Dactylopore spines rarely over 0.2 mm tall and 0.13-0.17 mm wide, with a dactylotome wide of 40–50 µm.

Female ampullae hemispherical, 0.62-0.80 mm in diameter, often bearing several dactylopore spines. Female efferent pores rarely observed, 0.10-0.11 mm in diameter and often accompanied by a short efferent tube. Male ampullae also superficial hemispheres 0.50-0.55 mm in diameter, with tiny lateral efferent pores each about 40 µm in diameter. Both types of ampullae abundant on terminal branches, often clustered in groups on both anterior and posterior branch faces.

TYPES: The holotype of *Errina novaezelandiae* facies *dendyi* is presumed to be deposited at the Manchester Museum (Boschma #139). A fragment of the holotype is also deposited at the BM(NH) numbered 1964.9.17.1 and another fragment is at the USNM (SEM stub 684, USNM 85784).

The syntypes of *E. rubra* are deposited at the Zoological Museum of Copenhagen (Plate 44, i).

TYPE LOCALITIES: *Errina dendyi*: Milford Sound, South Island, depth unknown; *E. rubra*: Between Cape Maria van Diemen and Three Kings Islands, 91–119 m.

REMARKS: *Errina dendyi* is quite variable in both coenosteal colour and growth form. The specimens available for analysis show a disjunct bathymetric and geographic distribution of: Fiordland, 17–30 m and the ridges north of North Island, 91–318 m. The shallow-water Fiordland specimens are large and delicate; red, orange, or pale yellow to white in colour; and often attached to brachiopod valves. The deeper-water, northern populations, which include the types of *E. rubra*, are smaller, slightly more robust specimens; orange or red in colour; and often attached to antipatharian axes. All specimens have in common distinct gastropore lips that project at a 45° angle to the coenosteum; relatively slender distal branches; and short, exclusively adcauline-orientated dactylopore spines.

Stylaster Gray, 1831

Gastro- and dactylopores arranged in cyclosystems, which are variable in location, ranging from uniformly distributed on all branch surfaces (Group A) to a strictly sympodial arrangement (Group C), with many intermediate arrangements (Group B). Coenosteal colour and texture variable: the commonest textures reticulate-granular and linear-imbricate. Gastro- and dactylostyles present. Gastrostyles usually ridged and highly spinose; dactylostyles may be quite robust (Group A) or rudimentary (Groups B and C). Well-developed, annular ring palisades usually present; gastropore inner shelf often present in species of Group C. Ampullae

usually superficial with lateral or apical efferent pores, but in some species internal, with efferent pores opening into adjacent gastropore.

TYPE SPECIES: *Madrepora rosea* Pallas, 1766, by subsequent designation (Milne Edwards and Haime 1850b)

REMARKS: *Stylaster* is a highly variable genus composed of 82 valid species, i.e., about one-third of the species in the family. In order to facilitate comparison among species, the genus was divided (Cairns 1983b) into three groups of species based primarily on the location of cyclosystems on the branches, designated as Group A (currently 24 species, "*Allopora*"), Group B (19 species), and Group C (39 species). These group designations have no taxonomic status and are usually (but not always) mutually exclusive for any species. However, an example of a species that does not fit exclusively into any group is *Stylaster brunneus*, specimens of which could be placed in any of the three groups, its growth form and cyclosystem arrangement apparently dependent on degree of water turbulence. Of the four remaining New Zealand species of *Stylaster*, one belongs to Group A and three to Group C.

Characters of value in distinguishing species within the genus are tabularised by Cairns (1986a) and in Table 5. To reiterate, six useful characters are: location of cyclosystems; coenosteal colour (although this is often variable) and texture; gastropore tube shape; presence or absence of a ring palisade; average number of dactylopores per cyclosystem; and cyclosystem diameter.

DISTRIBUTION: Cosmopolitan; 0.5–1485 m (Cairns 1991b).

Stylaster eguchii (Boschma, 1966)
(Plates 46, a–g, 47, a, b)

Allopora bithalamus: Eguchi 1964 : 7–9, pl. 1, figs 1a–d.
Allopora eguchii Boschma, 1966 : 109–112, pl. 1, figs 6–8, text-figs 1–2; Boschma & Lowe, 1969 : 15, pl. 5, map 3; Vervoort & Zibrowius, 1981 : 29–30; Cairns 1983a : 143–146, figs 41C, 46A–G, 47A–C.
Stylaster eguchii: Cairns 1983b : 429.
Calyptopora reticulata: Cairns 1983a : 151 (in part: NZOI Stn A910).

MATERIAL EXAMINED: Southern form: NZOI Stn A734, 3 col., NZOI; Stn A744, 1 col., NZOI; Stn A745, 4 col., USNM 60261; Stn C734, 8 col., NZOI; Stn D6, 1 col., NZOI; Stn D17, over 10 col., NZOI, 2 col., USNM 85141; Stn D18, 1 col., NZOI, SEM stub 603 (USNM); Stn D20, over 10 col., NZOI; Stn D37, 3 col., NZOI; Stn D39, over 50 col., NZOI, 7 col., USNM 85142; Stn D76, 5 col., NZOI, 2 col. and SEM stub 604, USNM 85143; Stn D145, 4 col., NZOI, 1 col., USNM 85144; Stn D149, 1 branch, NZOI; Stn D153, 3 col., NZOI; Stn D176, 12 col., NZOI, 3 col. and SEM stub 601, USNM 85145; Stn E234, 2 branches, NZOI; Stn F132, 1 branch, NZOI; Stn S25, 8 col., NZOI; Stn S29, 3 col., NZOI; Stn S46, 1 col., NZOI; Stn S53, 3 col., NZOI; *Eltanin* Stn 1411, over 30 col., USNM 60096. Northern form: NZOI Stn A846, 2 col., NZOI; Stn A910, over 20 col., NZOI 4 col., USNM 60255; Stn A917, 1 col., NZOI; Stn B487, 12 col., NZOI; Stn B488, 4 col., NZOI, SEM stub 605A (USNM); Stn B489, 10 col., NZOI; Stn B491, 2 col., NZOI; Stn C617, 31 col., NZOI; Stn C618, 7 col., NZOI; Stn C896, 1 col., NZOI; Stn D159, 2 col., NZOI; Stn D877, 1 col., NZOI; Stn D899, 1 col., NZOI; Stn E147, 1 col., NZOI; Stn E804, 12 col., NZOI; Stn E821, 4 col., NZOI; Stn E822, 16 col., NZOI, 4 col. and SEM stubs 602, 605B, USNM 86940; Stn E855, 1 col., NZOI; Stn E861, 1 col., NZOI; Stn I717, 3 col., NZOI; Stn I721, 3 col., NZOI; Stn J55, 20 col., NZOI, 4 col., USNM 86941; Stn J59, 5 col., NZOI; Stn K825, 1 col., NZOI; Stn Q25, 5 col., NZOI; Stn Q38, 1 col., NZOI. Shallow-water form: NZOI Stn M794, 2 col., NZOI; Stn Q749, 2 col., NZOI, 1 col., USNM 86942; Stn Q754, 2 col., NZOI. Other Material Examined: Paralectotype of *A. eguchii* from BANZARE Stn 34, RMNH Coel. 13901.

DISTRIBUTION: Widespread in New Zealand region, particularly off southwest South Island, and the islands and plateaus south and east of South Island, including Macquarie Ridge, Campbell and Bounty Plateaus, and Chatham Rise. Also known from Norfolk and Kermadec Ridges and off continental Antarctica (*see* Cairns 1983a); 15–1485 m.

DESCRIPTION: Colonies variable in shape; however, deep-water specimens invariably uniplanar, shallow-water specimens bushy. Colonies firmly attached to small pebbles and rocks; largest specimen examined (*Eltanin* Stn 1411) 8.5 cm tall and 8.0 cm broad, with a basal branch diameter of 17.1 x 7.5 mm. Branching dichotomous and unequal; branch anastomosis common. Virtually all colonies, except those from shallow water, live in association with a commensal polychaete, which causes the stylasterid to produce large, flattened tubes along its main branches. Worm tubes approximately 3.6 x 2.2 mm in internal diameter; tubes open distally and

proximally as well as along their edges via elongate slits 0.1–0.2 mm wide and 4–5 mm long. Worm tubes restricted to posterior faces (by definition), the coenosteum forming the tubes relatively smooth. Branches circular in cross section unless modified by a polychaete, in which case they are rectangular in cross section. Branches vary in robustness, often in relation to cyclosystem diameter (*see* Remarks on forms). Coenosteum white, dense, and reticulate-granular in texture. Strips 50–80 µm wide, bordered by deep slits about 10 µm wide, and covered with irregularly-shaped granules 3.5–10 µm in diameter.

Whereas cyclosystems on slender distal branches are often sympodial in arrangement, cyclosystems are usually uniformly distributed on anterior and lateral faces of larger-diameter branches. Posterior faces modified by the polychaete tube usually lack cyclosystems. Cyclosystems circular to slightly elliptical in shape and bimodal in size range (*see* Remarks on forms), ranging from 0.8–1.4 mm in diameter. Cyclosystems flush to slightly exsert as much as 1 mm above coenosteum. Based on 31 cyclosystems, the range of dactylopores per cyclosystem was 6–10, average 14.51 (σ = 0.99), and mode 8 (Cairns 1983a). Boschma (1966) reported a range of 5–16 dactylopores per cyclosystem.

Gastropores circular to slightly elliptical and very large: 0.35–0.60 mm in diameter. Gastropore tubes long (as much as 2.4 mm deep) and cylindrical, usually straight but sometimes slightly curved. Gastrostyles occupy lower one-fourth to one-third of gastropore tubes; gastrostyle tips easily visible in intact gastropore tube, facilitated by the lack of a ring palisade and the large gastropore tube. Viewed from above, gastrostyles often appear to be laterally compressed. Gastrostyles variable in shape, ranging from lanceolate to short and squat, with H : W ratios of 1.0–2.5. Style covered with tall, slender, multi-tipped spines, which are laterally fused along meandering ridges. Dactylotomes 0.10-0.16 mm wide and extend only a short distance into gastropore tube. Pseudosepta 1–2 times dactylotome width, with slightly convex upper surfaces; diastemas rare. Dactylostyles conspicuous, composed of a medial, unilinear to bilinear row of tall, blunt, cylindrical elements up to 75 µm tall and 9–14 µm in diameter.

Female ampullae low, superficial mounds approximately 0.7 mm in external diameter and 0.5 mm in internal diameter. Female ampullae invariably located directly adjacent to cyclosystems, their efferent pores leading into the upper cavity of the closest gastropore tube, each tube receiving one or two efferent pores apiece. Female efferent pores large and circular; 0.21–0.24 mm in diameter. The internal female efferent pores explain why Cairns (1983a) overlooked them in his account of this species. Male ampullae small, low, often clustered mounds approximately 0.1 mm high, about 0.35 mm in external diameter, and only about 0.2 mm in internal diameter. Each male ampulla has one apical efferent pore 40–50 µm in diameter.

TYPES: The lectotype and paralectotype, designated by Vervoort and Zibrowius (1981), are deposited at the RMNH: Coel. 13753 and 13901, respectively.

TYPE LOCALITY: BANZARE Stn 34, 66°21'S, 58°50'E, off Cape Boothby, Kemp Coast, Antarctica; 603 m.

REMARKS: In this study, *S. eguchii* was the most frequently collected species, obtained from 51 stations. Three forms of the species, none implying nomenclatural distinction, can be distinguished among the specimens: a southern (robust, typical) form, a northern (delicate) form, and a shallow-water form. Specimens of the southern, or typical, form — described by Boschma (1966), Eguchi (1964), and Cairns (1983a) — are robust, with thick, often anastomosing branches and large cyclosystems 1.2–1.45 mm in diameter. It occurs only south of 49°30'S at depths of 124–1335 m. The northern form has a more delicate colony with more slender, rarely anastomosing branches, and has smaller cyclosystems 0.8–1.15 mm in diameter. It occurs north of 49°30'S at depths of 95–1485 m. The third, shallow-water form is only known from several specimens from the fiords of southeast South Island at depths of 15–42 m. It is similar to the northern form in having small cyclosystems and a delicate growth form, but is characterised by having a bushy corallum, slightly exsert pseudosepta, and in lacking a polychaete commensal.

Although the location of the cyclosystems on distal branches of *S. eguchii* is often sympodial (Group C), cyclosystems are, in general, uniformly distributed on branches. *Stylaster eguchii* is therefore relegated to *Stylaster* Group A. It is distinguished from all other species of *Stylaster* by the unique character of having its female efferent pores opening into adjacent gastropore tubes. It can be further differentiated from the four other New Zealand species in Table 5.

Stylaster brunneus Boschma, 1970
(Cover; Plates 47, c–g, 48, a–g)

Stylaster brunneus Boschma, 1970 : 154–158, pls 1–2, text-figs 1–3; Vervoort & Zibrowius 1981 : 24, 31; Cairns 1983b : 430.

MATERIAL EXAMINED: NZOI Stn I85, 1 male, 1 female col., NZOI, branches and SEM stubs 612-613, USNM 86943; Stn I87, 1 female col., NZOI, SEM stub 600B (USNM); Stn P18, 8 female col. and branches, NZOI, 1 col., USNM 86944; Stn P19, 1 male col., NZOI, 1 col. and SEM stubs 600A, 686, USNM 86945; Stn P23, 1 col., NZOI; Stn P49, 1 col., NZOI; north side of Norfolk Island, 15–20 m, 7 Nov. 1987, 1 male col., WAM 551-87; Norfolk I., 91–108 m, 1 female col., AM G15282; Norfolk I., Crystal Pool, 1 male col., AM G15280; Balls Pyramid, 15 m, 1 male and 1 female col., AM G15281; North Islet of Balls Pyramid, 30 m, 1 male col., AM G15279; 1 frag. of paratype, USNM 76880.

DISTRIBUTION: Off Kuare Island and Noumea, southern New Caledonia; off Norfolk and Philip Islands, Norfolk Ridge; Balls Pyramid, Lord Howe Islands; 15–290 m.

DESCRIPTION: Colonies uniplanar to slightly bushy, robust, and of fairly large size, the largest specimen examined (NZOI Stn I85) 21 cm tall and 24 cm broad, with a basal branch diameter of 23 x 27 mm. Colonies from deeper water (e.g., NZOI Stns I85, I87; 89–290 m) have tall, delicate, uniplanar coralla with exclusively sympodially arranged cyclosystems, whereas shallow-water specimens have shorter, more massive coralla with cyclosystems uniformly distributed on all branch surfaces. Larger-diameter main branches divide dichotomously and equally, often producing 90° axils (Plate 47, c); however, many smaller-diameter branchlets originate from the main branch with regularity. Branches and branchlets relatively straight, not affected by sympodial arrangement of cyclosystems; branch anastomosis absent. Branches bluntly tipped. Coenosteum dense and usually light to dark brown, the darker colonies usually having pale brown to white branch tips, pseudosepta, ampullae, and coenosteal slits (all areas of rapid growth). The deepest-collected colony, however, (NZOI Stn I85, 290 m) has a pure white corallum. Primary coenosteal texture linear-imbricate, the strips 60–70 µm wide and bordered by narrow slits about 5 µm wide. Platelets flat, each one extending across entire strip; leading platelet edges irregular in shape. Secondarily the platelets are covered by a granular stereome, an example of this transition shown in Plate 48, b. No polychaete commensals observed.

There is great variation in the arrangement of cyclosystems. As mentioned before, in some deep-water colonies (e.g., NZOI Stns I85, I87) cyclosystems are exclusively sympodially arranged on lateral branch edges (Group C); in other colonies (e.g., NZOI Stn P18) the arrangement is primarily sympodial but with additional cyclosystems on the branch faces (Group B); and in still other colonies (e.g., NZOI Stn P23) cyclosystems are uniformly arranged on all branch surfaces (Group A). Cyclosystem arrangement thus appears to be determined by the environment and probably strongly influenced by water turbulence. Cyclosystems circular to slightly elliptical and small, ranging from 0.8 to 1.1 mm in greater diameter. Smaller cyclosystems are more common on larger-diameter branches. Cyclosystems usually project perpendicular to coenosteum about 0.3-0.4 mm. Based on 200 cyclosystems, the range of dactylopores per cyclosystem was 9–20, average 14.51, and mode 15 (Boschma 1970).

Gastropores circular to slightly elliptical; 0.24–0.30 mm in diameter. Gastropore tubes long and cylindrical, sometimes slightly curved, and slightly flared at the gastropore; gastropore tubes as much as 1.7 mm deep (Boschma 1970), the gastrostyle occupying only basal one-third to one-quarter of tube. Upper half of gastropore tube covered with linear-imbricate coenosteum, the strips running in a circle within the tube. A discrete, annular ring palisade occurs at two-thirds gastrostyle height, composed of pillow-shaped elements up to 40 µm in diameter and 25 µm tall. Gastrostyles cylindrical to lanceolate, ranging from 0.33 to 0.49 mm tall and from 0.07 to 0.15 mm in diameter, with H : W ratios of 2-4.5; tabulae sometimes present. Lower third of gastrostyles (basal main shaft) coarsely ridged but nonspinose. Upper portion of gastrostyles bears robust, smooth, sharp spines up to 20 µm long. Dactylotomes uniform in width, 65–75 µm; pseudosepta equal to or wider than dactylotomes, 75–150 µm. Diastemas absent. Dactylostyles conspicuous in undamaged cyclosystems, composed of a medial, unilinear series of tall, blunt, cylindrical elements, each approximately 37-40 µm tall and 9–10 µm in diameter.

Female ampullae superficial hemispheres 0.60–0.75 mm in diameter, each mature ampulla having one spongy lateral efferent pore 0.10-0.18 mm in diameter. Male ampullae partially to totally internal (0.3-0.4 mm in diameter), each bearing 1–3 apical efferent pores 25–35 µm in diameter. Both male and female ampullae often clustered on branch faces.

TYPES: Holotype deposited at the ZMA (Coel. 5564). Paratypes deposited at the ZMA and RMNH (*see* Vervoort and Zibrowius 1981); one paratype fragment at USNM (USNM 76880, ex RMNH 6597).

TYPE LOCALITY: Kuare Island, south of New Caledonia (*see* Vervoort and Zibrowius 1981); 35 m.

REMARKS: As stated in the generic remarks, the variation in cyclosystem orientation among specimens of *S. brunneus* allows it to be placed in any of the three groups of *Stylaster* described by Cairns (1983b). Boschma (1970) distinguished this species by its brown coenosteum, which he stated to be unique among the Stylasteridae. This may be true; however, specimens are herein reported that also have white coenosteum, so this character cannot be used exclusively to distinguish the species. Other than colour, *S. brunneus* can be distinguished from the other New Zealand stylasterids by a combination of characters (Table 5) — having large coralla, linear-imbricate coenosteum, and lacking a polychaete commensal.

Stylaster horologium n. sp. (Plates 49, a–g, 50, a-c)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Southern Norfolk Ridge and off Three Kings Islands; 179–1169 m.

DESCRIPTION: Colonies uniplanar to slightly bushy, heavily branched, and relatively small; largest colony (holotype) 44 mm tall and 41 mm broad, with a broken basal branch 5.0 mm in diameter. No polychaete commensal known. Branching dichotomous, unequal, and closely spaced, but rarely anastomosing. Coenosteum white, dense, and reticulate-granular in texture. Coenosteal strips 55-65 µm wide, bordered by deep slits about 10 µm wide. Strips densely covered with tall, slender spines up to 13 µm tall, some projecting laterally into the coenosteal slits, altogether giving the coenosteum a rough texture.

Cyclosystems exclusively sympodially arranged on branch edges, those on the edges of large-diameter branches obsolete and often sealed with coenosteum. Cyclosystems circular, elliptical, or irregular in shape, ranging from 1.0 to 1.4 mm in greater diameter. Based on 50 cyclosystems, the range of dactylopores per cyclosystem was 8–18, average 11.70 (σ = 3.1), and mode 11.

Gastropore tubes complex in structure, but, in general, resembling an hourglass, consisting of three sections. Upper tube a broad, open, infundibuliform chamber approximately 0.50–0.55 mm in upper diameter and narrowing to 0.15-0.22 mm in diameter basally. Upper section about 0.4 mm deep and bears same texture as coenosteum. Below upper chamber is a short intermediate tube 0.15-0.22 mm in diameter and about 0.25 mm long, which basally widens into a roughly spherical lower chamber 0.40–0.45 mm in diameter. The massive gastrostyle base occupies the spherical lower chamber, its apical spine projecting through the intermediate tube and about 0.1 mm into upper infundibuliform chamber, its tip therefore easily visible in an intact cyclosystem. Gastrostyles variable in shape, those from the holotype having a thick basal section about 0.4 mm in diameter and 0.3 mm tall, surmounted by a tall apical spine up to 0.5 mm high and 0.1 mm in basal diameter. Gastrostyles of specimens from other stations more regularly conical, but also have sharp tips that project through the narrow intermediate chamber. Gastrostyles covered with robust, sharp spines up to 25 µm tall. Dactylotomes 75–85 µm wide; pseudosepta 1–2 times dactylotome width; diastemas often present, up to 2-4 times dactylotome width. Dactylostyles robust, composed of 2 or 3 contiguous rows of tall, cylindrical, blunt elements up to 50 µm tall and about 12 µm in diameter.

Female ampullae superficial hemispheres up to 1.1 mm in diameter, each with a lateral efferent pore 0.20–0.25 mm in diameter. Female ampullae bear low reticulate ridges. Male ampullae small, primarily internal, ellipsoidal cavities about 0.36 x 0.21-0.25 mm in diameter, the greater axis of the ellipse perpendicular to coenosteal surface. Upper third of ampulla (about 0.15 mm) rises above coenosteal surface as a small mound, each with 1 apical efferent pore 15–25 µm in diameter. Both male and female ampullae scattered uniformly over branches.

TYPES: Holotype: NZOI Stn E856, 1 female col., NZOI H-577, fragment of holotype and SEM stub 611, USNM 87523. Paratypes: NZOI Stn E845, 1 male col., NZOI P-872, SEM stub 610 (USNM); Stn E846, 4 male and 2 female col., NZOI P-973, 1 male, 1 female col. and SEM stub 688, USNM 87522.

TYPE LOCALITY: NZOI Stn E856, 32°11'S, 168°18'E, southern Norfolk Ridge; 1157–1169 m.

ETYMOLOGY: The species name *horologium* (from the Greek *horologion*, clock, hourglass) is an allusion to the hourglass shape of the gastropore tubes of this species.

REMARKS: *Stylaster horologium* clearly belongs to *Stylaster* (Group C) as defined by Cairns (1983b). It is easily distinguished from other New Zealand *Stylaster* (Table 5) by having a very coarse, reticulate-

granular coenosteal texture, and massive gastrostyle bases each surmounted by a tall apical spine. The hourglass shape of the gastropore tube is also distinctive.

Stylaster imbricatus n. sp. (Plate 51, a–h)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Southern Norfolk Ridge; Three Kings Ridge; off northeast North Island; 128–665 m.

DESCRIPTION: Colonies uniplanar, sparsely branched, and relatively small, the largest corallum (NZOI Stn E845) 45 mm tall with a basal branch diameter of 6.2 mm; holotype 33 mm tall and 18 mm broad, with a basal branch diameter of 5.5 mm. Colony shape strongly influenced by commensal polychaetes, which, in every corallum examined, induced the coral to form a large, flattened, sometimes branched gall. Polychaete tubes thick walled, up to 5.6 x 2.0 mm in internal diameter, constituting most of posterior face (by definition) of colony; tube open apically and along lateral edges via slender, elongate slits about 0.1 mm wide and up to 5 mm long. Colonies usually composed of only 1 or 2 main branches from which relatively short branchlets diverge; branch anastomosis absent. Coenosteum dense, smooth, and white or light orange in colour, colonies of the latter usually having white branch tips and colony bases. Based on the limited specimens available, populations appear to exist as white or orange forms, or as mixed populations. Coenosteum originally linear to reticulate-imbricate, the platelet structure secondarily obscured by a relatively smooth coenosteum covered with very low, smooth granules, resulting in a porcellanous texture. Coenosteal strips 50–80 µm wide, separated by narrow slits 3–4 µm wide. Platelets continuous across a strip; polarity of platelets changes periodically.

Cyclosystems exclusively sympodially arranged on short terminal branches, but less regularly on larger-diameter, polychaete-modified branches. Cyclosystems well defined, circular to irregularly shaped, and moderately exsert; 0.9–1.3 mm in diameter. Based on 100 cyclosystems, the range of dactylopores per cyclosystem was 7–20, average 13.0, and mode 13.

Gastropores circular, 0.35–0.41 mm in diameter. Gastropore tubes long (as deep as 2.0 mm), straight, and cylindrical, each bearing a well-developed, annular ring palisade low in tube at approximately two-thirds gastrostyle height. Ring palisade effectively reduces diameter of gastropore tube by 0.1 mm by creating a solid, circumferential ledge about 50 µm wide surrounding gastrostyle tip. Elements of ring palisade closely spaced, irregularly shaped spheres 40–50 µm in diameter. Gastrostyles conical, occupying only lower one-fifth of gastropore tube, their tips projecting through and above the ring palisade about 0.1 mm. Illustrated gastrostyle (Plate 50, g) 0.40 mm tall and 0.23 mm in basal diameter (H : W = 1.74), and covered with tall, slender, sharp spines up to 45 µm long. Dactylotomes 0.09–0.13 mm wide; pseudosepta 1–2 times dactylotome width; narrow adcauline diastemas about 3 times dactylotome width rare. Dactylostyles conspicuous, composed of a unilinear series of tall, blunt pillars up to 40 µm tall and 10 µm in diameter.

Female ampullae low, superficial bulges (rarely hemispheres) up to 1.1 mm in diameter, each having a lateral efferent pore 0.15–0.27 mm in diameter. Because of the low profile of female ampullae, their efferent pores are often orientated obliquely (upward) instead of perpendicular to surface. Concave depressions 0.8–0.9 mm in diameter resulting from ruptured female ampullae are sometimes present. Female ampullae scattered over branch faces and worm tube. Male ampullae primarily internal, but easily seen in a transverse fracture of a cyclosystem as a circumferential ring of 7–9 ampullae surrounding a gastropore tube 0.8–1.0 mm below gastropore. Male ampullae also occur within polychaete tube coenosteum and uniformly on branch coenosteum. Occasionally small superficial bulges correspond to the internal ampullae but efferent pores were not observed.

TYPES: Holotype: NZOI Stn E861, 1 female col. (orange), NZOI H-578, SEM stub 609 (USNM). Paratypes: NZOI Stn C814, 1 female col. (white), NZOI P-874; Stn E720, 2 col., (white) NZOI P-875, 2 col. (white) USNM 87524; Stn E845, 1 male col. (orange), 1 female col. (white), NZOI P-876, SEM stub 614 (USNM); Stn E846, 1 male col. (orange), NZOI P-877; Stn F928, 2 female col. (white), NZOI P-878; Stn G941, 1 female col., NZOI P-879, 1 female col. and SEM stub 615, USNM 87525; Stn J691, 1 female col. (white), NZOI P-880; Stn S571, 8 male and 5 female col. (orange and white), NZOI P-881, 2 male, 2 female col., and SEM stubs 608A, 687, USNM 87526; Stn S572, 4 female and 2 male col. (white), NZOI P-882, 1 male, 1 female col., and SEM stub 608B (white), USNM 87527; *Eltanin* Stn 1716, 1 female col. (white), USNM 76697; unknown *Eltanin* station, 1 female col. (white), USNM 76719.

TYPE LOCALITY: NZOI Stn E86, 32°25'S, 167°35'E, southern Norfolk Ridge; 318–383 m.

ETYMOLOGY: The species name *imbricatus* (from the Latin *imbricatus*, placed like tiles) refers to the distinctive primary imbricate coenosteal texture of the species.

REMARKS: *Stylaster imbricatus* clearly belongs to *Stylaster* (Group C) as defined by Cairns (1983b). It is distinguished from the other New Zealand congeners by its smooth to linear-imbricate coenosteum, which is often light orange in colour (Table 5). Other diagnostic characters are its commensal polychaete association and the tendency for its male ampullae to be partially internal and to surround gastropores.

? *Stylaster gracilis* Milne Edwards & Haime, 1850 (Plate 52, a–g)

Stylaster gracilis Milne Edwards & Haime, 1850a : 98, pl. 3, fig. 4; Moseley 1881 : 81 (*Challenger* Stn 170); Broch 1936 : 26–29, pl. 1, fig. 4; Boschma 1957 : 11–12 (synonymy); Eguchi 1968 : 21–23, pl. 13, figs 1–10 (synonymy).

MATERIAL EXAMINED: *Challenger* Stn 170, 1 specimen, BM(NH) 1880.11.25.190 and SEM stub 707 (USNM); NZOI Stn U594, 4 col.

DISTRIBUTION: Kermadec and Three Kings Ridges; 406–951 m.

DESCRIPTION OF KERMADEC ISLANDS SPECIMEN (*CHALLENGER* STN 170): Colony fragment bushy, 45 mm tall and 24 mm broad. Polychaete commensal not present but several *Pedicularia* deposits were present. Branching dichotomous, unequal, and non-anastomosing. Branches straight (not zigzag), circular in cross section, attenuating to slender tips 0.65–0.75 mm in diameter. Coenosteum a light orange-pink, with white branch tips and inner cores. Coenosteal strips 35–60 µm wide, frequently bifurcating and joining with adjacent strips in a meshwork pattern. Slits bordering strips composed of elongate pores about 9 µm wide and up to 35 µm long. Strips covered with small, rectangular, imbricate platelets ranging from 3–14 µm wide, 4–10 adjacent platelets required to cross the width of a strip.

Cyclosystems closely spaced and exclusively sympodially arranged on branch edges. Cyclosystems circular, elliptical, or irregular in shape, a typical cyclosystem being 0.85 x 0.55 mm in diameter. Based on 15 cyclosystems, the range of dactylopores per cyclosystem was 12–16, average 13.93 (σ = 1.22), and mode 13.

Gastropore tubes cylindrical, each bearing a well-developed, annular ring palisade adjacent to upper third of gastrostyle. Ring-palisade elements distinctive in shape, resembling vertically aligned platelets: up to 36 µm in vertical (parallel to gastropore tube) dimension, only about 8 µm wide, and up to 30 µm tall (Plate 52, c). Gastrostyles cylindrical and highly ridged, the ridges bearing tall, sharp spines up to 22 µm tall. Illustrated style (Plate 52, c) 0.41 mm tall and 0.10 mm in diameter (H : W = 4.1). Both dactylotomes and pseudosepta 60–70 µm wide; diastemas often present for part of adcauline cyclosystem perimeter. Dactylostyles rudimentary, composed of a single row of blunt, cylindrical elements 22–25 µm tall and about 9 µm in diameter.

Male ampullae common on branch faces, consisting of small mounds 0.45–0.50 mm in diameter, each with one apical efferent pore about 20 µm in diameter.

TYPES: Type assumed to be lost — not present at the Muséum National d'Histoire Naturelle, Paris or the BM(NH), (pers. comm. H. Zibrowius).

TYPE LOCALITY: Australia; depth unknown.

REMARKS: *Stylaster gracilis* has been reported from throughout the western Pacific from Australia to off Japan at depths of 18–951 m (*see* Boschma 1957 and Eguchi 1968 for records). It is unlikely that all of these specimens are conspecific. In the absence of the type specimens and other comparative specimens, it is with considerable doubt that Moseley's (1881) identification of *S. gracilis* from the Kermadec Islands is correct.

Calyptopora Boschma, 1968

Gastro- and dactylopores arranged in cyclosystems, which are usually unilinearly arranged along median anterior branch faces. Coenosteum white and reticulate-granular in texture; nematopores common. Broad abcauline cyclosystem lids usually present, but sometimes reduced to abcauline lips. Gastro- and dactylostyles present; gastrostyles unridged; annular ring palisade present. Both male and female ampullae superficial.

TYPE SPECIES: *Calyptopora reticulata* Boschma, 1968a, by original designation.

TABLE 5. Characteristics of the five New Zealand species of *Stylaster* (r.p. = ring palisade, e.p. = efferent pores)

Characters	*S. eguchii* (Boschma, 1966)	*S. brunneus* Boschma, 1970	*S. horologium* n. sp.	*S. imbricatus* n. sp.	?*S. gracilis* Milne Edwards & Haime, 1850
Colony size	Moderate to large	Large	Moderate	Small	Moderate
Polychaete commensal	Present (polynoid)	Absent	Absent	Present (eunicid)	Absent
Coenosteal colour and texture	White, reticulategranular	Usually brown (may be white), linear-imbricate or reticulate-granular	White, reticulate-granular (rough)	Orange or white, linear- to reticulate-imbricate, porcellanous	Light orange, linear-imbricate
Cyclosystem location and group designation	Uniform distribution (Group A)	Variable distribution (Groups A–C)	Lateral edges (Group C)	Primarily on lateral edges (Group C)	Primarily on lateral edges (Group C)
Range and average number of dactylopores/cyclosystem	6–10, x = 14.5	9–20, x = 14.5	8–18, x = 11.7	7–20, x = 13.0	12–16, x = 13.9
Gastropore tube shape and presence of r.p.	Cylindrical, deep; no r.p.	Cylindrical, deep; r.p. present	Constricted; no r.p. but a narrow intermediate tube	Cylindrical, deep; r.p. present	Cylindrical, deep; distinctive r.p.
Gastrostyle	Variable in shape: lanceolate to squat, H:W = 1.0–2.5	Lanceolate, H:W = 2–4	Massive base and tall apical spine	Conical, H:W = 1.74–2.0	Cylindrical, ridged, H:W= 4.1
Dactylostyle	Conspicuous: tall, unilinear elements	Conspicuous: tall, unilinear elements	Robust: 2 or 3 rows of tall elements	Conspicuous: tall, unilinear elements	Rudimentary: unilinear elements
Female ampullae	Low bulges; internal e.p. open into gastropore tube	Hemispherical; small external e.p.	Hemispherical; external e.p.	Low superficial bulges or hemispheres; external e.p.	Unknown
Distribution	Widespread in New Zealand region; 15–1485 m	Norfolk Island and New Caledonia; 15–290 m	Southern Norfolk Ridge and Three Kings Island; 179–1169 m	Off north and northeastern North Island; 128–665 m	?Indo-West Pacific; 18–951 m

REMARKS: As discussed by Cairns (1983b), *Calyptopora* is very similar to *Stylaster* (Group C), differing primarily in having unilinear, anterior-facing cyclosystems; ridged gastrostyles; and cyclosystem lids. These characters are consistently and well exemplified by the type and nontype specimens of *C. reticulata* reported by Boschma (1968a); however, now that many more specimens of this species are available, it is clear that these characters are quite variable. Although specimens usually have anteriorly facing cyclosystems, the cyclosystems on some branches are anterolateral, and on still others sympodially arranged on branch edges, all three arrangements sometimes occurring on the same corallum. Furthermore, the expression of the cyclosystem lid or lip may also be variable within one colony, ranging from prominent to almost absent. Nonetheless, *Calyptopora* is maintained as a genus distinct from *Stylaster* based on its tendency to have anteriorly facing cyclosystems and cyclosystem lids.

Calyptopora contains only two species, both known from the New Zealand region. Two other species previously assigned to the genus have been subsequently reassigned : *C. pachypoma* (Hickson & England, 1905) was designated the type species of *Pseudocrypthelia* Cairns, 1983c; and *C. complanata* (Pourtalès, 1867) was considered to be a species of *Stylaster* (Group C) by Cairns (1986a).

DISTRIBUTION: New Zealand region; 216–2100 m.

Calyptopora reticulata Boschma, 1968
(Plates 53, a–g, 54, a–h)

Calyptopora reticulata Boschma, 1968a : 102–108, pls 1–3, text-figs 1–2; 1968d : 315–320; Vervoort & Zibrowius 1981 : 30; Cairns 1983a : 150–151, figs 41E, 49A–H, 50A–E (but not NZOI Stn A910); 1983b : 430, 484–486, figs 19A–I.
Calyptropora [sic] *reticulata*: Dawson 1979 : 24.

MATERIAL EXAMINED: NZOI Stn A744, 2 branches, NZOI; Stn A846, 2 col., NZOI; Stn C618, 1 branch, NZOI; Stn C781, 1 branch, NZOI; Stn D6, 1 col., NZOI; Stn D39, 5 col., NZOI; Stn D169, 1 col., NZOI; Stn D176, 13 col., NZOI, 3 col., USNM 87528; Stn E800, 2 col., NZOI; Stn E821, 4 col., NZOI, 2 col., USNM 87529; Stn E822, 4 col., NZOI, 2 col., USNM 87530; Stn E861, 1 col., NZOI, SEM stub 618 (USNM); Stn F123, 2 col., NZOI, 2 col., USNM 87531; Stn F127, 1 col., NZOI; Stn F132, 10 fragments (paratypes) and SEM stub 653, USNM 76878; Stn G3, 1 col., NZOI, SEM stub 617B (USNM); Stn G927, 9 col., NZOI, 1 col., USNM 87532; Stn I721, 1 col., NZOI; Stn P46, 2 col., NZOI, 3 col., USNM 87533; Stn S22, 1 col., NZOI; Stn S29, 4 col., NZOI; Stn S30, 3 col., NZOI; Stn S45, 2 col., NZOI, 1 col., USNM 87534; Stn S46, 3 col., NZOI; Stn S53, 1 col., NZOI; Stn S70, 1 col., NZOI; Stn T39, 5 col., NZOI; Stn U599, 7 branches, NZOI; specimens reported by Cairns (1983a), USNM.

DISTRIBUTION: Very common in deep water south and east of South Island, including Macquarie Ridge to Macquarie Island, Campbell and Bounty Plateaus, Chatham Rise, and off South Island; Norfolk and Three Kings Ridges; 216–2100 m.

DESCRIPTION: Colonies large, forming broad, uniplanar, reticulate fans composed of frequently anastomosing branches. Tallest colony (holotype) 17 cm high, broadest colony (*Eltanin* Stn 1851) 20 cm wide; basal branches of large colonies are massive, dense structures up to 2.3 x 1.9 cm in diameter. Branching dichotomous but quite unequal, with very slender, delicate branches originating directly from thick main branches. Branches often straight and long, extending for 5 or 6 cyclosystems without branching. Branches circular to elliptical in cross section, the posterior sides of some branches (e.g., the types) prominently ridged. Colony shape influenced by the invariable presence of commensal polychaetes (i.e., *Malmgreniella dicirra* Hartman), which induce the coral to produce large (e.g., 4.2 x 1.8 mm internal diameter), flattened gall-tubes that run along and between main branches. Polychaete galls occur with equal frequency on both anterior and posterior faces, undoubtedly several polychaetes occurring on large colonies. Edges of polychaete galls porous, bearing elongate coarse slits up to 1.5 mm wide. Coenosteum white and reticulate-granular in texture. Coenosteal slits 50–90 µm wide, bordered by deep, thin slits 4–5 µm wide, and covered with rounded granules 6–8 µm in diameter. Occasionally small papillae (nematopores) occur on large-diameter branches, each 0.14–0.20 mm in diameter and about 50 µm tall.

Cyclosystems usually unilinearly arranged on midline of anterior branch faces; however, occasionally cyclosystems slightly staggered off-centre of midline, and, in extreme cases, cyclosystems occur sympodially on branch edges. All degrees of arrangement may occur on the same colony. Cyclosystems large (0.9–1.6 mm in greater diameter) and variable in shape, ranging from circular to elliptical, to quite irregular. Most cyclosystems (e.g., those of the type specimens) bear a prominent, broad abcauline lid, which

extends high above and slightly over the cyclosystem. A smaller adcauline lip is often present as well. In the extreme case, the distal edges of the lid and lip fuse over the gastropore, dividing the cyclosystem in half (Plate 53, d). However, there is great variation in the degree of development of cyclosystem lids, sometimes being expressed as only one or two highly exsert and slightly broader abcauline pseudosepta. Occasionally there are no lips or lids. Based on 100 cyclosystems, Boschma (1968a) found a range of 7–13 dactylopores per cyclosystem, an average of 10.31, and a mode of 10; based on 16 cyclosystems Cairns (1983a) found a range of 3–17 and an average of 11.30 ($\sigma = 2.27$).

Gastropores take the shape of the cyclosystem perimeter and are about 0.4 mm in diameter. Gastropore tube a somewhat inflated elongate cavity, which tapers abruptly to a narrow diameter of about 0.25 mm at the ring palisade. A well-developed, annular ring palisade occurs at about two-thirds gastrostyle height, composed of tall, irregularly-shaped elements up to 50 µm long. Gastrostyle restricted to lower part of gastropore chamber, its tip projecting just above level of ring palisade. Gastrostyles spindle shaped, the illustrated style (Plate 54, d) 0.52 mm tall and 0.21 mm in diameter (H : W = 2.5), the range of H : W ratios being 1.3–2.9. Gastrostyles with coarse, sharp spines up to 25 µm tall, clustered in tufts on gastrostyle. Dactylotomes 70–120 µm wide; pseudosepta of approximately same width, broader if modified into lips or lids. Diastemas usually absent. Dactylostyles well developed, composed of 2 or 3 contiguous rows of blunt pillars, each element up to 38 µm tall and 16 µm in diameter.

Female ampullae superficial hemispheres 0.70–1.05 mm in diameter, sometimes with a lateral efferent tube that terminates in an efferent pore about 0.2 mm in diameter. Male ampullae superficial, irregularly-shaped mounds 0.50–0.61 mm in diameter, often clustered in groups of two or more. Male efferent pore apical, approximately 25 µm in diameter. Both male and female ampullae uniformly distributed over coenosteum, including cyclosystem lids, but most common on coenosteum forming worm tubes.

TYPES: Holotype (H-48) and most paratypes (P-100) deposited at the NZOI. Two paratypes are also deposited at the RMNH (Coel. 13754 A, B) and several paratype branches are at the USNM (76878) (*see* Vervoort and Zibrowius 1981; Dawson 1979).

TYPE LOCALITY: NZOI Stn F132, 49°59'S, 177°30'E, off Antipodes Islands; 1335 m.

Calyptopora sinuosa n. sp. (Plate 55, a–g)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Colville and Kermadec Ridges; 260–814 m.

DESCRIPTION: Colonies sinuous in shape, resembling a vertical, low-amplitude sine wave, with only short branchlets originating from the single main vertical branch. Largest colony (NZOI Stn T256) 6.7 cm tall and 8 mm in basal branch diameter; holotype 5.4 cm tall and 2.6 cm broad, with a basal branch diameter of 6.5 mm. Colony shape determined by its commensal polychaete, the main branch in reality a hollow worm tube with an internal diameter of 2.8–3.6 mm. In general, walls of worm tube near colony base solid and thick, penetrated only by elongate lateral slits about 0.2 mm wide; distally, where tubes are being formed, they are thinner and more porous. In well-preserved basal coralla, there is invariably an elliptical pore 1.6– 1.8 mm in diameter confluent with the main poly-chaete tube, which allows the polychaete to escape the central tube at the base. Anterior to this pore and extending 2.0–2.5 cm up the corallum is a shallow groove or semi-enclosed tube about 2.5 mm in width that rejoins the main tube higher on the corallum. This "external" tube thus completes a basal loop for the polychaete. Tubes within dead coralla are often inhabited by ophiuroids. The main, vertical branch may bifurcate once or twice, but branching of any kind is minimal. Coenosteal strips reticulate-imbricate, 60–100 µm wide, and covered by irregularly shaped granules. Short, low coenosteal ridges are also common.

Cyclosystems primarily unifacial but occasionally occurring in an antero-lateral arrangement, the influence of the commensal polychaete producing a disruptive effect on branching and cyclosystem location. Cyclosystems often quite irregular in shape and about 1.2 mm in diameter. Abcauline and occasionally adcauline pseudosepta enlarged into, small lips, in the extreme case their distal edges fusing over the gastropore (Plate 55, b); however, very often gastropore lips are not present at all. The small size of the pseudosepta and the often slightly damaged condition of the specimens make it difficult to accurately count dactylopores; however, based on 25 cyclosystems the range of dactylopores per cyclosystem was 9–16, average 12.36 ($\sigma = 1.73$), and mode 12.

Upper gastropore tube large, open, and chaliciform, about 0.7 mm in diameter and depth. Openness of gastropore tube accentuated by the

extremely short pseudosepta. Base of upper tube horizontal (shelf-like), made so by a robust annular ring palisade consisting of large (up to 40 µm tall), irregularly shaped elements. Below ring palisade a much smaller, roughly spherical lower chamber about 0.32 mm in diameter contains the gastrostyle. Gastrostyles short and squat, the illustrated style (Plate 55, g) only 0.21 mm tall and 0.17 mm in diameter (H : W = 1.23), its blunt apex terminating at or below level of ring palisade. Gastrostyles covered with numerous simple, smooth spines up to 28 µm tall. Dactylotomes uniformly 60–70 µm wide but pseudosepta quite variable in width, ranging from 70 µm to 0.2 mm, especially those modified into lips. Abcauline pseudosepta often quite exsert and flared, whereas diastemas are not uncommon on the adcauline side. Dactylostyles composed of 2 or 3 contiguous rows of blunt pillars, each element up to 30 µm tall and 7 µm in diameter.

Female ampullae unknown. Male ampullae primarily internal ellipsoidal cavities 0.3–0.4 mm in diameter, sometimes rising slightly above coenosteal surface. Apical efferent pores small, about 30 µm in diameter. Male ampullae tend to concentrate in worm-tube coenosteum and in circles around gastropore tubes.

TYPES: Holotype: NZOI Stn K840, 1 male col., NZOI H-579. Paratypes: NZOI Stn K800, 18 col., NZOI P-938; NZOI Stn K827, 15 col., NZOI P-883, 3 col., USNM 87535; Stn K840, 1 col. and SEM stub 690, USNM 87536; Stn P947, 13 col., NZOI P-884, 4 col. and SEM stub 689, USNM 87537; Stn T217, 5 col., NZOI P-885, 2 col., USNM 87538; Stn T256, 1 dead col., NZOI P-886.

TYPE LOCALITY: NZOI Stn K840, 30°17'S, 178°25'W, off McCauley Island, Kermadec Islands; 398–412 m.

ETYMOLOGY: The species name *sinuosa* (from the Latin *sinuosus*, curved, sinuous) refers to the sinusoidal shape of the colonies of this species.

REMARKS: *Calyptopora sinuosa* is distinguished from *C. reticulata* by its distinctive sinusoidal growth form, its paucity of branching, its internal ampullae, and its short gastrostyles. In growth form it is identical to *Errina sinuosa*, a species known from the same geographic area.

Stenohelia Kent, 1870

Gastro- and dactylopores arranged in cyclosystems which occur exclusively on anterior branch faces. Cyclosystems lack lids and lips. Coenosteum usually white, either linear- or reticulate-imbricate in texture. Gastropore tubes elongate and usually curved; gastrostyles present, usually encircled by a robust ring palisade. Dactylostyles usually well developed. Ampullae superficial, often clustered around base of cyclosystems. Ampullar efferent pores of both sexes usually well distinguished.

TYPE SPECIES: *Allopora maderensis* Johnson, 1862, by subsequent designation (Broch 1936).

REMARKS: Ten valid species are recognised in this genus, most of them listed by Cairns (1983b : 430–431); however, subsequently one species has been described (*S. paucisepta* Cairns, 1986a) and one synonymised (*S. robusta* Boschma, 1964 as *S. concinna* Boschma, 1964, *see* Cairns 1991a), resulting in the same number of valid species. An eleventh, undescribed species is known from west of New Caledonia (NZOI Stn I741), which has pale orange coenosteum. Characters of diagnostic value include coenosteal texture, cyclosystem diameter, nature of ampullae, number of dactylopores per cyclosystem, and presence or absence of ring palisades.

Moseley (1879, 1881) reported and illustrated a specimen of *Stenohelia profunda* Moseley, 1881 from the Kermadec Ridge north of Raoul Island (1097 m). This specimen (BM(NH) 1880.11.25.183), designated a paralectotype by Cairns (1986a), is indistinguishable from typical western Atlantic specimens, having 13 unifacial cyclosystems (Plate 57, d) about 1.4 mm in diameter, 16–18 dactylopores per cyclosystem, clustered female ampullae about 0.82 mm in diameter, and concave pseudosepta. But as Zibrowius and Cairns (1982) and Cairns (1986a) suggested, it is unlikely for a stylasterid to have such a widespread and disjunct distribution, implying that a station error might be responsible for the unusual distribution. For instance, in reporting this specimen, Moseley (1881) listed it from *Challenger* Stn 191 from 197°50'W, meaning instead to write Stn 171 from 177°50'W. Given previous station errors among the *Challenger* material and the lack of any additional records of this species in the Pacific, the presence of *S. profunda* in the New Zealand region is considered questionable.

DISTRIBUTION: Atlantic and Pacific Oceans; 91–2021 m.

Stenohelia conferta Boschma, 1968

(Plates 56, a–h, 57, a–c)

Stenohelia conferta Boschma, 1968e : 435-438, text-fig. 1, pl. 1, figs 1–9; Dawson 1979 : 25; Vervoort & Zibrowius 1981 : 31; Cairns 1983b : 430.

MATERIAL EXAMINED: Types (NZOI).

DISTRIBUTION: Known only from the type locality off the Antipodes Islands; 1335 m.

REDESCRIPTION OF TYPE SPECIMENS: Colonies uniplanar, the largest specimen (holotype) 34 mm tall and 21.2 mm broad, with a basal branch diameter of 2.5 mm. Branching dichotomous and unequal; branch anastomosis rare. Commensal polychaetes absent. Branches straight, circular in cross section, and narrow to the diameter of a terminal cyclosystem. Coenosteum white and reticulate-imbricate in texture. Coenosteal strips 55–75 µm wide, bordered by deep, discontinuous slits about 12 µm wide. Platelets quite narrow (4–5 µm wide) and irregularly shaped, arranged in a rather disorganised fashion, which obscures the imbricate arrangement.

Cyclosystems circular to slightly elliptical and closely spaced, occurring only on anterior face but sometimes staggered along branch. Cyclosystems 0.8–1.2 mm in diameter, the greater diameter of an elliptical cyclosystem perpendicular to branch axis. Based on 100 cyclosystems, the range of dactylopores per cyclosystem was 7–13, average 10.42, and mode 11 (Boschma 1968e).

As is typical for the genus, gastropore tubes are cuved about 90°. Lower gastropore tube roughly spherical (about 0.35 mm in diameter), opening to an upper infundibuliform tube through a circular aperture about 0.25 mm in diameter. Ring palisades absent. Upper gastropore tube widens to about 0.55 mm in diameter at level of dactylotomes. Gastrostyles cylindrical and robust, the illustrated style (Plate 57, a–c) 0.47 mm tall and 0.13 mm in diameter at mid-height (H : W = 3.6), standing on a more massive base about 0.20 mm in diameter. Upper third of gastrostyle projects through aperture separating upper and lower gastropore tubes. Gastrostyles densely covered with clusters of small spines, each spine only about 6 µm tall and 2 µm in basal diameter. Dactylotomes uniformly 61–65 mm wide; pseudosepts 2–3 times dactylotome width; diastemas absent. Dactylostyles robust and easily seen in an intact cyclosystem, each composed of 1 or 2 rows of tall, cylindrical to clavate elements up to 41 µm tall and 18 µm in distal diameter.

Female ampullae unknown. Male ampullae primarily internal, clustered near cyclosystems and on posterior branch faces. Internal diameter of ampullae 0.35-0.45 mm. A small conical spine overlays each ampulla, probably containing the efferent pores.

TYPES: The holotype (H-53 as illustrated in Plate 56, a) and most paratypes (P-102–107) of *S. conferta* are deposited at NZOI; one paratype is also at the RMNH (*see* Vervoort and Zibrowius 1981) and one SEM stub (#706) is at the USNM.

TYPE LOCALITY: NZOI Stn F132, 49°59'S, 177°32'E, off Antipodes Island; 1335 m.

REMARKS: *Stenohelia conferta* is the only described species in its genus known from the southern hemisphere and can be distinguished from most congeners by its low number of dactylopores per cyclosystem (average 10.42); robust, clavate dactylostyle elements; reticulate-imbricate coenosteal texture; and in lacking ring palisades. It is most similar to *S. paucisepta* Cairns, 1986a (Lesser Antilles, 300–514 m), both species having a low number of dactylopores per cyclosystem and similar coenosteal texture, but *S. conferta* differs in having larger cyclosystems, a lower gastrostyle H : W ratio, and in lacking ring palisades. Only one other species, *S. concinna* Boschma, 1964 (Galápagos, 549–704 m) is known to lack ring palisades, but is otherwise distinguished by having linear-imbricate coenosteum, polychaete commensals, a higher number of dactylopores per cyclosystem (average 15.54), and large, porous ampullae.

Conopora Moseley, 1879

Gastro-and dactylopores arranged in cyclosystems, which are: sympodially arranged on branch edges (Group A *sensu* Cairns 1983b), uniformly distributed on all branch surfaces (Group B *sensu* Cairns 1983b), arranged tetraserially, or uniserially. Colonies usually uniplanar and firmly attached; however, one species (*C. adeta* Cairns 1987a) is free living. Corallum shape often strongly influenced by commensal polynoid. Coenosteum linear-imbricate (Group A) or linear-granular (Group B) and invariably white. Gastropore tubes double-chambered, the chambers usually separated by a gastropore ring constriction. Gastro- and dactylostyles absent. Gastrozooid tentacles absent. Ampullae superficial or internal (usually the latter); efferent pores apical or open within gastropore tube (usually the latter).

TYPE SPECIES: *Conopora tenuis* Moseley, 1879 (= *C. laevis* (Studer, 1878)), by monotypy.

REMARKS: Cairns (1983b) divided *Conopora* into two groups, A and B, the former having species with sympodially arranged cyclosystems and imbricate coenosteal texture, the latter having species with uniformly distributed cyclosystems and granular coenosteum. The genus diagnosis must now be amended to accommodate *C. tetrastichopora* and *C. unifacialis*, colonies of which have tetraserial rows of cyclosystems or a single anterior row of cyclosystems, respectively and therefore do not fit within either of the two groups. It is interesting to note that in the analogous case of *Stylaster* (*see* Cairns 1983b : 489), species with unifacially orientated cyclosystems are placed in a different genus, *Stenohelia*. Another amendment of the generic diagnosis must be made to accommodate variation in gastropore shape: *C. tetrastichopora* and *C. gigantea* do not have a typical double-chambered gastropore tube separated by a gastropore ring constriction, and *C. unifacialis* also lacks a gastropore ring constriction but does have a homologous intermediate cylindrical gastropore tube.

Eight or nine Recent species of *Conopora* are recognised. In addition to the six species that occur in the New Zealand region, there remain *C. major* Hickson and England, 1905 (=? *C. verrucosa*) (Indonesia); *C. dura* Hickson and England, 1909 (Providence Island, west Indian Ocean); and *C. adeta* Cairns, 1987a (off Queensland, Australia). Characters of value in discriminating species are listed in Table 6.

DISTRIBUTION: Indo-West Pacific, Antarctic, and Subantarctic; 110–2355 m (*see* Cairns 1991b).

Conopora verrucosa (Studer, 1878)
(Plates 57, e–g, 58, a–d)

Stylaster verrucosus Studer, 1878 : 635, fig. 6 a–b; Moseley 1881 : 87; Boschma 1953 : 166; 1957 : 17.
Stylaster laevis (?): Moseley 1881 : 81.
Stylaster erubescens: Moseley 1881 : 81; Boschma 1953 : 169.
[?]*Conopora major* Hickson & England, 1905 : 25–26, pl. 3, figs 33–35.
Conopora pauciseptata Broch, 1951a : 41–44, pl. 4, figs 1–2; Boschma 1957 : 39; 1966 : 113-116, 117, pl. 1, figs 1–5, 9–11; Boschma & Lowe 1969 : 15, pl. 15, map 3; Cairns 1983a : 128–130, figs 31C–D, 36A–G.
Conopora verrucosa: Zibrowius 1981 : 275; Cairns 1983b : 490, figs 21E–H.

MATERIAL EXAMINED: NZOI Stn A745, 6 branches, NZOI; Stn C618, 2 col., NZOI; Stn D6, 2 col., NZOI; Stn D39, 10 col., NZOI, 6 col. and SEM stub 628, USNM 87539; Stn D149, 3 col., NZOI, 2 col., USNM 87540; Stn D150, 2 col., NZOI, SEM stub (USNM); Stn D159, 11 col., NZOI, 4 col., USNM 87541; Stn D169, 1 col., NZOI; Stn D176, 7 col., NZOI, 3 col., USNM 87542; Stn D216, 4 branches, NZOI; Stn E305, 4 branches, NZOI; Stn E337, 1 branch, NZOI; Stn E731, 1 col., NZOI; Stn E800, 2 col., NZOI; Stn E821, 2 col., NZOI; Stn E822, 15 col., NZOI, 2 col., USNM 87543; Stn E846, 1 col., NZOI, 1 col., USNM 87544; Stn E850, 1 col., NZOI; Stn F81, 1 col., NZOI; Stn F928, 1 branch, NZOI; Stn G937, 6 col., NZOI; Stn G941, 4 col., NZOI; Stn I96, 1 col., NZOI, 1 col., USNM 87545; Stn I97, 2 col., NZOI; Stn J55, 1 col., NZOI; Stn P9, 4 col., NZOI; Stn P57, 1 col., NZOI; Stn P552, 4 col., NZOI; Stn P947, 5 col., NZOI; Stn P948, 1 col., NZOI; Stn S27, 1 col., NZOI; Stn S28, 1 col., NZOI; Stn S571, 2 col., NZOI; Stn S572, 10 col., NZOI; Stn T243, 3 col., NZOI; *Stylaster erubescens* of Moseley (1881), *Challenger* Stn 170, BM(NH) 1880.11.25.178; *Stylaster laevis* of Moseley (1881), *Challenger* Stn 171, BM(NH) 1880.11.25.177; specimens reported by Cairns (1983a); holotype of *S. verrucosus*.

DISTRIBUTION: Widespread in the New Zealand region from the Kermadec Ridge to Macquarie Island; also known from the Subantarctic and parts of Antarctica (*see* Cairns 1983a); 198–2355 m.

DESCRIPTION: Colonies primarily uniplanar, robust, and relatively large, the largest colonies having frequently anastomosing branches that form a reticulate fan. Largest colony (*Eltanin* Stn 1414) 12 cm tall and 5.5 cm broad, with a massive basal branch diameter of 1.5 cm. Holotype only 15.6 mm tall and 18.8 mm broad. All colonies live in association with commensal polychaetes, which induce the coral to produce large, flattened tubes that parallel the major branches. Polychaete gall-tubes occur on both anterior and posterior faces. Branching dichotomous and unequal. Cross section of terminal branches rectangular, the greater width in plane of colony; intermediate-sized branches square in cross section; large-diameter branches again rectangular in cross section, but with their greater width perpendicular to plane of colony. Coenosteum white and linear-imbricate in texture. Coenosteal strips 70–130 µm wide, separated by narrow slits about 7 µm wide. Platelets usually continuous across a strip; polarity of platelets changes frequently. Nematopores common on all specimens, occurring abundantly on branch coenosteum, pseudosepta, and polychaete tube coenosteum. Nematopore mounds circular to irreg-

ular in outline, 40–55 µm in diameter and up to 25 µm tall.

Cyclosystems exclusively sympodial in arrangement, slightly exsert on distal branches, but flush to slightly recessed into branch coenosteum on larger-diameter branches, resulting in two rows of closely spaced cyclosystems, one on each branch edge. Cyclosystems circular to slightly irregular in shape and 0.8–2.0 mm in diameter. Broch (1951) reported a range of 3–11 dactylopores per cyclosystem for the type of *C. pausiseptata*, an average of 6.59, and a mode of 8. Based on 192 cyclosystems, Boschma (1966) reported a range of 2–11 dactylopores per cyclosystem and averages of 7.07 and 7.13 for two populations (mode = 8). Cairns (1983a), based on 29 nondiastemate cyclosystems, reported a range of 8–15 dactylopores per cyclosystem, an average of 10.41 (σ = 1.50), and modes of 10 and 11. The higher range of Cairns' counts were undoubtedly caused by his restriction of counting only those cyclosystems in the terminal and penultimate position on branches, before diastemas had reduced the number originally present.

Gastropores circular, about 0.4 mm in diameter. Gastropore tubes divided into three sections. Upper section cylindrical, 0.9–1.0 mm deep, and bordered by dactylotomes and inner pseudoseptal edges. Directly beneath dactylotomes is a roughly hemispherical upper chamber about 0.55–0.60 mm in diameter. Upper chamber contiguous with the slightly compressed lower chamber (about same diameter but slightly less deep) through a constricted aperture — the gastropore ring constriction — which is variable in size. Total depth of gastropores 1.5– 2.0 mm. Texture of gastropore tube walls of upper section and upper chamber is that of coenosteum; texture of lower chamber smooth. Dactylotomes about 80 µm wide and extend deeply into gastropore tube; pseudosepta wide and coarse, 1–3 times dactylotome width. Diastemas common, becoming progressively wider (at the expense of dactylopores) with increased distance from branch tip.

Female ampullae internal ellipsoidal cavities 0.6–0.75 mm in greater diameter, usually two occurring distal to each cyclosystem (Plate 58, c). Female efferent pores located in diastema region, or on a pseudoseptum, or within a dactylotome in upper distal gastropore chamber; efferent pores 0.10–0.18 mm in diameter. Male ampullae also internal ellipsoidal cavities 0.50–0.55 mm in greater diameter, often 3 or 4 occurring distal to a cyclosystem. Male efferent pores located in same position as female but usually smaller in size — 50–80 µm in diameter. Ampullae never found in polychaete tube coenosteum.

TYPES: The holotype of *Stylaster verrucosus* is deposited at the ZMB (#1764, illustrated in Plate 57, e).

The location of the holotype of *Conopora pauciseptata*, collected at *Discovery* Stn 2493, is unknown.

TYPE LOCALITY: *Gazelle* Stn 60/44 (*see* Zibrowius 1981), 35°2'S, 175°40'E, off northeast North Island; 1092 m.

REMARKS: Based on the description and illustrations of *Conopora major* Hickson and England, 1905 (Indonesia, 204–1901 m), it is likely to be a junior synonym of *C. verrucosa*. Points of similarity include primarily internal ampullae that have efferent pore openings into the upper gastropore chamber, abundant coenosteal nematopores, polychaete commensals, and robust growth form.

Comparisons of *C. verrucosa* to the morphologically similar *C. laevis* are made in the account of the latter species and in Table 6.

Conopora laevis (Studer, 1878)
(Plates 58, e–g, 59, a–g)

Stylaster laevis Studer, 1878 : 635, pl. 2, fig. 5a–b; *non* Moseley 1881 : 81 (= *C. verrucosa*); Boschma 1953 : 166; 1957 : 12.

Stylaster obliquus Studer, 1878 : 635–636, pl. 2, fig. 7a–d; Moseley 1881 : 88; Boschma 1953 : 166.

Conopora tenuis Moseley, 1879 : 503; 1881 : 82, 88, pl. 12, figs 5–6; *non* Hickson & England 1905 : 25; 1909 : 351; [?] Broch 1936 : 88–89, pl. 13, fig. 37, text-fig. 29a–c; Boschma 1953 : 167; 1957 : 39; 1966 : 115–116.

Stylaster sp.? Moseley 1881 : 81 (in part: BM(NH) 1880.11.25.179b, other specimen is *Crypthelia* sp.).

Stenohelia obliqua: Boschma 1957 : 32.

Conopora laevis: Zibrowius 1981 : 274–277, pl. 3, figs 8–11, pl. 4, figs 1–5; Cairns 1983b : 490–492, figs 21A–D.

MATERIAL EXAMINED: NZOI Stn A910, 10 col., NZOI, 7 col. and SEM stub 629B–C, USNM 60254 ; Stn C814, 1 col., NZOI, 1 col., USNM 87546; Stn D90, 1 col., NZOI; Stn E305, 1 branch, NZOI; Stn E306, 1 branch, NZOI; Stn E720, 1 col., NZOI; Stn E731, 1 col., NZOI, 2 col. USNM 87547; Stn E840, 2 col., NZOI; Stn E845, 1 col., NZOI; Stn E861, 4 col., NZOI, SEM stub 629A (USNM); Stn E862, 1 col., NZOI; Stn E875, 4 col., NZOI, 3 col., USNM 87548; Stn E885, 2 col., NZOI; Stn G941, 2 col., NZOI, 1

col., USNM 87549; Stn J59, 1 col., NZOI; Stn J657, 1 col., NZOI; Stn J659, 1 col., NZOI; Stn J691, 1 col., NZOI; Stn J711, 1 col., NZOI; Stn K828, 5 col., NZOI; Stn K860, 1 col., USNM 87550; Stn P8, 1 col., NZOI; Stn P15, 1 col., NZOI; Stn P35, 2 col., NZOI; Stn S53, 1 col., NZOI; Stn T226, 3 col., NZOI, 2 col., USNM 87551; Stn T235, 2 col., NZOI; Stn T243, 3 col., NZOI; *Stylaster* sp. of Moseley (1881), *Challenger* Stn 214, BM(NH) 1880.11.25.179b; *Conopora tenuis* of Hickson and England (1909), Stn D7, 1 col., BM(NH) 1923.2.15.207A; *Terra Nova* Stn 90, 2 col., BM(NH) 1950.1.11.7; holotypes of *Stylaster laevis*, *S. obliquus*, and *C. tenuis*. Reference Specimens: *Conopora tenuis* of Hickson and England (1905), *Siboga* Stn 156, 1 col., ZMA.

DISTRIBUTION: New Zealand region: Norfolk Ridge, north of North Island, Kermadec Ridge, Chatham Rise, and one record on Campbell Plateau southeast of Campbell Island; also reported from throughout the Indo-West Pacific (*see* Zibrowius 1981); ?110–130–1035 m.

DESCRIPTION: Colonies uniplanar, delicate, and relatively small. Largest colony examined (*Terra Nova* Stn 90) 8.5 cm tall and 9.0 cm broad, with a basal branch diameter of 1 cm, but most colonies examined rarely exceed 3 cm in height. Colonies firmly attached by a broad base to small pebbles and other corals. Colony shape strongly influenced by commensal polychaetes, which begin their association with the stylasterid early in the coral's ontogeny. The colony is essentially one vertical, thick-walled polychaete tube, from which few, relatively straight branchlets diverge, although larger colonies (e.g., *Terra Nova* Stn 90) may have several main branches and host several polychaetes. Branchlets circular in cross section and usually not secondarily thickened, as in *C. verrucosa*. Coenosteum white and linear-imbricate in texture. Coenosteal strips 62–115 µm wide, bordered by narrow slits about 7 µm wide. Platelets continuous across a strip; change of polarity rare. Nematopores usually absent, which results in a relatively smooth coenosteal surface, but nematopores occur on worm-tube coenosteum of some specimens.

Cyclosystems exclusively sympodially arranged, remaining exsert from the coenosteum even on large-diameter branches. Cyclosystems circular to slightly elliptical, 0.8–1.2 mm in diameter, and slightly flared. Based on 50 cyclosystems from NZOI Stn A910, the range of dactylopores per cyclosystem was 10 to 16, average 12.58 (σ = 1.43), and mode 12.

Gastropores circular, 0.4-0.5 mm in diameter. Gastropore tube shape as described for *C. verrucosa*. Dactylotomes about 0.1 mm wide; pseudosepta thin, ranging from about 0.75 to 1.5 times dactylotome width. Upper edges of pseudosepta sometimes concave. Diastemas rare; when present, about 2 times dactylotome width.

Female ampullae superficial hemispheres up to 0.8 mm in diameter on distal branches, gradually becoming immersed in coenosteum with age until they are largely internal or even concave on worm-tube coenosteum. Female efferent pores lateral, about 0.2 mm in diameter. Male ampullae low superficial mounds 0.60-0.65 mm in diameter, with lateral efferent pores 75–80 µm in diameter. Both male and female ampullae occur on branches and are especially common within the thick coenosteum forming the exterior of worm tubes, where they are commonly seen in cross section if part of the tube is broken. Occasionally efferent pores appear to exist on the inner side (coenosteum facing polychaete) of worm tube.

TYPES: The holotypes of *Stylaster laevis* (Plate 58, g) and *S. obliquus* (Plate 58, e) are deposited at the ZMB (#1776, 1778, respectively). Both were collected at *Gazelle* Stn 58/42.

The syntypes of *Conopora tenuis* are deposited at the BM(NH) (1880.11.25.184, *see* Plate 59, c, e). A small SEM preparation of one is at the USNM (SEM stub 135B).

TYPE LOCALITIES: The type locality of *S. laevis* and *S. obliquus* is *Gazelle* Stn 58/42, 34°09.9'S, 172°35.8'E, east of Three Kings Islands; 165 m. The type locality of *C. tenuis* is *Challenger* Stn 170, 29°55'S, 178°14'W, north of McCauley Island; 95 m.

REMARKS: *Conopora laevis* and *C. verrucosa* are similar in morphology and overlap in geographic and bathymetric ranges, although they were rarely collected at the same station. *Conopora laevis* is most easily differentiated by having scattered ampullae with external efferent pores, *C. verrucosa* having ampullae adjacent to gastropores and efferent pores opening into the gastropore tube. However, if colonies are sexually immature, other characters must be used to distinguish them. For instance, *C. laevis* usually lacks nematopores and thus has smooth coenosteum; *C. verrucosa* invariably has large, prominent nematopores and a warty coenosteum. Both species were named for this characteristic of their coenosteal texture; however, occasionally *C. laevis* does have some nematopores. Other differences are that *C. laevis*: 1) has a smaller,

more delicate colony with circular, nonreinforced branches, 2) rarely has diastemas, 3) has thinner, occasionally concave pseudosepta, 4) has thick, ampulla-bearing worm-tube coenosteum, and 5) has a greater average number of dactylopores per cyclosystem, even though its cyclosystems are generally smaller.

Conopora candelabrum n. sp. (Plates 60, a–f, 61, a-e)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Norfolk Ridge, Three Kings Ridge, and Campbell Plateau; 403–1170 m.

DESCRIPTION: Colonies uniplanar, fragile (branch tips invariably broken when collected), and of moderate size, the largest specimen (holotype) 4.0 cm tall and 7.8 cm broad, with a basal branch diameter of 4.1 mm. Branching pattern characteristically pinnate, the presumed idealised development represented by the holotype and described thusly. Basal branch vertical, 5.0–6.5 mm in diameter, and 12–15 mm tall, whereupon it splits equally into two secondary branches, the axil between then usually 90°–120°. In one specimen, however, (NZOI Stn P8) the secondary branches are parallel and almost vertical, with an axil of 0°. The two secondary branches each generate a series of long, straight, relatively closely spaced branchlets that alternate in position on lower and upper secondary branch edges. Branchlets on lower edge usually short (presumably limited by contact with substrate), whereas branchlets on upper edge often quite long and unbranched for as much as the length of 22–25 cyclosystems. Branchlets grow in parallel fashion but occasionally a branchlet will bifurcate, the resultant branchlets soon fusing with closely adjacent branchlets, and contributing to a loose reticulum. No commensal polychaetes known. Coenosteum white and linear-imbricate in texture, the coenosteal strips 40–45 mm wide and bordered by thin, elongate slits about 3 mm wide. Platelets thick, continuous across a strip, and minutely longitudinally ridged. In some specimens (e.g., NZOI Stn S572) secondary calcification obscures platelet structure, resulting in a very smooth, dense, porcellanous texture. Nematopores common, 17–20 mm in pore diameter, but variable in expression: in some colonies (e.g., the holotype) they are almost flush with coenosteum and thus inconspicuous, whereas in other specimens (e.g., NZOI Stn U599) they are elevated and quite conspicuous.

Cyclosystems closely spaced and exclusively symmpodially arranged primarily on branchlet edges; no cyclosystems occur on basal branch and very few occur on secondary branches. Cyclosystems slightly exsert and inclined slightly anteriorly, not perpendicular to branch edge. Cyclosystems circular, 0.8–0.9 mm in diameter on holotype, 0.55–0.72 mm in diameter on other typical paratypes. Because number of dactylopores per cyclosystem is related to cyclosystem diameter and the cyclosystems of the holotype are consistently larger than those from other specimens, two counts were made, and a third for the variety (see Remarks). Based on 32 cyclosystems of the holotype, there was a narrow range of 9 to 12 dactylopores per cyclosystem, an average of 10.50 (s = 0.98), and mode of 11. Based on 50 cyclosystems, the typical smaller-diameter paratypes had a range of 3 to 11 dactylopores per cyclosystem, average 7.86 (s = 1.54) and mode of 8.

Upper dactylotome-enclosed portion of gastropore tubes cylindrical and about 0.5 mm deep. Beneath this section is a roughly spherical upper chamber about 0.5 mm in diameter. A gastropore ring constriction of about 0.3 mm diameter separates upper chamber from lower, the latter shaped like an inverted hemisphere, about 0.35 mm in diameter and 0.20 mm deep. Inner surfaces of upper section and upper chamber textured as branch coenosteum; surface of lower chamber smooth. Dactylotomes 65–85 mm wide; pseudosepta robust and thick, 1–2 times dactylotome width, with blunt inner edges. Diastemas not present on cyclosystems of holotype, but narrow diastemas about 3 times dactylotome width sometimes present on cyclosystems of paratypes, especially the variety.

Female ampullae primarily internal but also apparent as massive superficial swellings up to 1.7 mm in diameter, occurring infrequently on branch faces adjacent to cyclosystems. Female efferent pores (about 0.12 mm in diameter) open into upper distal gastropore chamber and are not visible in an intact cyclosystem. Even in a longitudinal section (Plate 60, f) the female efferent pore is obscured by small finger-like projections. Male ampullae also primarily internal but often accompanied by low superficial swellings. Male ampullae ellipsoidal cavities 0.5 x 0.3 mm in internal diameter, 1 or 2 occurring distal to each mature cyclosystem. Male efferent pores about 25–40 mm in diameter and also open into upper distal gastropore tube, either through a pseudoseptum or a dactylotome.

TYPES: Holotype: NZOI Stn E859, 1 female col., NZOI H-580, SEM stubs 623, 691A (USNM). Paratypes: NZOI Stn G3, 11 branches, NZOI P-887; Stn G937, 1

branch, P-888; Stn P8, 1 col., NZOI P-889; Stn P552, 1 branch, NZOI P-890; Stn S571, 2 branches, NZOI P-891, SEM stub 691A (USNM); Stn S572, 9 col., NZOI P-892, 3 col. (variety) and SEM stub 693, USNM 87553, 2 col. and SEM stubs 622, 692 (typical), USNM 87552; Stn S573, 4 col., NZOI P-893, 2 col., USNM 87554; Stn U567, 2 col., P-935; Stn U581, 2 col., P-931; Stn U591, 12 col., P-936; Stn U594, 27 col., NZOI P-894; Stn U599, 10 branches, NZOI P-895, 7 branches, USNM 87555; Stn U600, 2 col., NZOI P-928.

TYPE LOCALITY: NZOI Stn E859, 32°01'S, 168°03'W, southern Norfolk Ridge; 500 m.

ETYMOLOGY: The species name *candelabrum* (from the Latin *candelabrum*, branched candlestick) refers to the characteristic candelabrum-like growth form of the species.

REMARKS: Eight of the 14 colonies from NZOI Stn S572 and two specimens from NZOI Stn U594 differ from typical *C. candelabrum* in several consistent characters and are distinguished as a variety herein. The variety is similar in colony shape, coenosteal texture, and gastropore tube shape but diminutive in colony size (Plate 60, b), having correspondingly smaller cyclosystems (Plate 61, e), gastropore chambers, and a lesser number of dactylopores per cyclosystem. Cyclosystems range from 0.45 to 0.55 mm in diameter, and, based on 50 cyclosystems from NZOI Stn S572, have only 4–7 dactylopores per cyclosystem, an average of 5.58 (σ = 0.86), and a mode of 6. The cyclosystems are not exsert, being almost flush with the branch coenosteum, and orientated perpendicular to branch edges. Furthermore, broad diastemas are not uncommon, sometimes as wide as half the cyclosystem perimeter.

Conopora candelabrum is distinguished from the other species of *Conopora* by its characteristic growth form (pinnate branching) and its very small cyclosystems (*see* Table 6).

Conopora tetrastichopora n. sp.
(Plates 61, f–h, 62, a–f)

[?] *Conopora pauciseptata* Broch, 1951a : 41–44, pl. 4, figs 1–2, text-figs 8–11.

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Three Kings Ridge; 282–710 m.

DESCRIPTION: Colonies primarily uniplanar or slightly bushy, the latter caused by branching in two planes. Colonies robust and firmly attached by a broad base; largest corallum (holotype) 8.5 cm tall and 5.6 cm broad, with a basal branch diameter of 10.4 mm. No polychaete commensals observed. Branching sparse, dichotomous, and equal; branches anastomose occasionally. Branches circular to square in cross section, the latter shape characteristic of some small-diameter branches, which have rows of cyclosystems at each corner of the square branch perimeter. Branches blunt, gradually tapering to tips about 3 mm in diameter. Coenosteum white; presumed tissue is brown. Coenosteal texture linear-granular, sometimes reticulate-granular around cyclosystems and within upper gastropore tubes. Linear strips narrow (20–40 µm wide), often bifurcating and rejoining one another or simply terminating after a short distance. Coenosteal slits very narrow: about 1 µm wide. Strips covered with very low, rounded granules 3–4 µm in diameter, which produce a relatively smooth texture.

Cyclosystems closely spaced and arranged in 4 (sometimes 5) discrete rows on small-diameter, terminal branches, but often arranged in only 3 rows on large-diameter branches, the fourth ("posterior") row missing. Cyclosystems flush to only slightly exsert and orientated perpendicular to branch surface. Cyclosystems circular to slightly irregular in shape, the latter shape caused by a large diastema; cyclosystems 0.9–1.25 mm in diameter. Based on 50 cyclosystems from specimens from NZOI Stn E846, the range of dactylopores per cyclosystem was only 2–6, average 4.44 (σ = 0.86), and mode 5. Cyclosystems with relatively few dactylopores are common on large-diameter branches, whereas cyclosystems on terminal branches invariably have 4–6 dactylopores.

Upper section of gastropore tube cylindrical, about 0.7–0.8 mm deep, and bordered for its entire length by dactylotomes and inner pseudoseptal edges. There is no upper chamber as found in *C. verrucosa* and *C. laevis*; instead, the upper section leads directly to a larger (about 0.7 mm in diameter) spherical lower chamber via an aperture (gastropore ring constriction) about 0.4 mm in diameter. Interior of upper gastropore textured as coenosteum, whereas lower chamber is smooth. Dactylotomes broad, about 0.14 mm wide; pseudosepta robust, with concave upper edges, 1–2 times dactylotome width. Diastemas always present, even on newly formed cyclosystems, often constituting half of cyclosystem perimeter.

Female ampullae internal ellipsoidal cavities up to 0.9 mm in greater diameter and 0.7 mm in lesser diameter, opening into upper distal gastropore

chamber (usually just beneath the diastema) via an efferent pore 0.15–0.20 mm in diameter. In sexually mature female colonies, 1 or 2 ampullae are associated with each cyclosystem. Male ampullae also internal ellipsoidal cavities up to 0.7 mm in greater diameter and 0.5 mm in lesser diameter, and also opening into gastropore tube in same position as female efferent pores. Up to 3 male ampullae may occur adjacent to a male cyclosystem, each efferent pore about 0.1 mm in diameter. Efferent pores of both sexes easily seen in undamaged, mature cyclosystems. There is no superficial relief of either male or female ampullae.

TYPES: Holotype: NZOI Stn E846, 1 female col., NZOI H-581. Paratypes: NZOI Stn E305, 1 female branch, NZOI P-896; Stn E846, 5 col., and branches, NZOI P-897, 3 col. and SEM stubs 624–625, USNM 87556; Stn P-543, 2 male branches, NZOI P-898, 1 branch, USNM 87557; Stn S572, 1 male col., NZOI P-899; Stn U599, 1 branch, NZOI P-900.

TYPE LOCALITY: NZOI Stn E846, 34°07.5'S, 171°57.5'E, west of Three Kings Island; 343–417 m.

ETYMOLOGY: The species name *tetrastichopora* (from the Greek *tetra*, four + *stichos*, row + *poros*, orifice) refers to the tetraserial rows of cyclosystems common to most branches.

REMARKS: *Conopora tetrastichopora* is easily distinguished from all other species of *Conopora* by its tetraserial arrangement of cyclosystems and its linear-granular coenosteal texture (Table 6). It also has a very low range and average number of dactylopores per cyclosystem (average 4.44) and the consistent presence of a broad diastema. It is, however, remarkably similar to the description of *Conopora pauciseptata* Broch, 1951. The description of *C. pauciseptata*, collected at Discovery Seamount (42°03.9'S, 0°03.5'E, 472 m), was based on a single worn basal fragment, which unfortunately cannot now be located. Intriguing points of similarity include its apparent three rows of cyclosystems on its larger diameter branches, broad cyclosystem diastemas, internal ampullae, "finger-print" coenosteal texture, and lack of polychaete commensals. It differs in having a higher average number of dactylopores per cyclosystem (range, 3–11; average, 6.59), unequal branching, and a rectangular branch cross section. However, if the type or topotypic specimens are discovered, they should be compared to *C. tetrastichopora*.

Conopora unifacialis n. sp. (Plates 63, a–f, 64, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Known only from type locality: Colville Ridge; 547–646 m.

DESCRIPTION: Of the 3 colonies examined, 2 were uniplanar and 1 had flabella orientated in 3 planes. Colonies relatively small — largest colony 27.4 mm tall and 27.7 mm broad, with a basal branch diameter of 3.8 mm; holotype an incomplete colony 21.8 mm tall and 18.0 mm broad. Branching dichotomous and equal; branch anastomosis occurred once in the limited material at hand. Distal branches circular in cross section and relatively slender, the cyclosystems often greater in diameter than the branches bearing them. No polychaete commensals observed. Coenosteum white and linear-imbricate in texture. Coenosteal strips large and coarse, 0.13–0.28 mm wide, and convex to ridged. Strips sometimes swirl obliquely along branches, often interconnecting with adjacent strips through wide (0.16–0.20 mm thick) bridges. Strips bordered by shallow grooves up to 70 µm wide, the bridging of which creates large, elliptical coenosteal pores up to 90 µm in greater diameter and about 70 µm in lesser diameter. Illustrated platelet structure (Plate 63, e) obscure due to worn condition of specimens.

Cyclosystems occur exclusively on midline of anterior branch faces, with a very slight distal inclination. Cyclosystems large (up to 1.6 x 1.3 mm in diameter) and elliptical in shape, their greater axis transverse to branch axis. Based on 34 cyclosystems (all that were available to count), the range of dactylopores per cyclosystem was 14–21, average 18.41 (σ = 1.42), and mode 18.

Gastropore tubes unique in structure. Upper section composed of a broad, shallow, infundibuliform chamber about 0.5 mm deep and encircled by dactylotomes and pseudosepta only for its upper half. This broad upper section leads to a circular intermediate tube 0.28–0.33 mm in diameter and about 0.25 mm long, which is an apparent homologue to the gastropore ring constriction. Intermediate tube opens into a flattened lower chamber about 0.15 mm tall and 0.55 mm in diameter, which is highly porous. Dactylotomes broad and 0.09– 0.16 mm wide; pseudosepta quite slender (20–30 µm wide), usually only one-fourth to one-third dactylotome width. Diastemas absent.

Female and male ampullae occur as large internal continuous masses that create irregular swellings

on posterior branch faces. Individual ampullae not observed. Although the ampullar masses are on the posterior branch faces, the female efferent pores open to anterior face and are 0.19–0.20 mm in diameter. Male efferent pores apical and thus open onto posterior branch face, each efferent pore about 0.14 mm in diameter. Male efferent pores differentiated from coenosteal pores by their slightly larger size and more regular, circular shape.

TYPES: Holotype: NZOI Stn P947, 1 male col., NZOI H-582. Paratypes: NZOI Stn P-947, 1 male col., NZOI P-901, 1 female col. and SEM stub 621, USNM 87558.

TYPE LOCALITY: NZOI Stn P947, 25°13.7'S, 179°04.1'W, Colville Ridge; 547–646 m.

ETYMOLOGY: The species name *unifacialis* (from the Latin *unus*, one + *facies*, face) refers to the unifacial arrangement of cyclosystems of this species.

REMARKS: *Conopora unifacialis* differs from all other species of *Conopora* in having: unifacially arranged cyclosystems; a very high range and average number of dactylopores per cyclosystem (average, 18.4); a uniquely shaped gastropore tube; very slender pseudosepta; and large coenosteal pores (Table 6).

Conopora gigantea n. sp. (Plates 64, c–f, 65, a–d)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Known only from type locality: southern Norfolk Ridge; 356 m.

DESCRIPTION OF HOLOTYPE: Colony uniplanar and robust, 7.1 cm tall and 6.5 cm broad, with a basal branch diameter of 9.2 mm and a broad, encrusting base. Branching dichotomous, equal, and sparse — only 7 branch axils present on holotype. Branches circular in cross section and thick, tapering to blunt tips as much as 6–7 mm in diameter. No polychaete commensals present. Coenosteum white and linear-granular in texture. Coenosteal strips 80–100 µm wide and slightly convex, separated by shallow grooves 45–50 µm wide. Grooves periodically pierced by circular pores 35–45 µm in diameter. Strips densely covered with small (up to 15 µm tall), triangular, pointed granules. No nematopores.

Cyclosystems uniformly distributed on all branch faces, orientated perpendicular to branch face and only slightly exsert. Cyclosystems circular to slightly elliptical and large — up to 2.6 mm in greater diameter. Based on 50 cyclosystems, the range of dactylopores per cyclosystem was 8–13, average 9.66 (σ = 1.00), and mode 9.

Gastropore tubes unique in structure. Upper 0.60–0.65 mm of tube cylindrical and encircled by dactylotomes and inner pseudoseptal edges. Just beneath lower edges of dactylotomes the tube expands slightly in diameter (to about 1.5 mm) and continues as a cylinder to the rounded base, a distance of about 1.75 mm. No gastropore ring constriction present or any other differentiation of the tube shape (Plates 64, e, 65, a, d). Dactylotomes wide and 0.27–0.38 mm across; pseudosepta wedge shaped, sometimes as wide as an adjacent dactylotome, but narrowing to a very slender, sharp inner edge approximately 20 µm wide. Upper edges of pseudosepta loculated, composed of a network of large pores 0.13–0.15 mm mm in diameter. Diastemas absent.

Female ampullae enormous internal tubes up to 1.8 mm in internal diameter and of great length (often over 5 mm). Efferent pores common on holotype, consisting initially of small nonperforate mounds about 0.3 mm tall and 0.5–0.6 mm in diameter. Eventually coenosteum at top of mound becomes porous and finally is resorbed, revealing a large circular efferent pore about 0.45 mm in diameter. Male ampullae unknown.

TYPE: Holotype: NZOI Stn I96, 1 female col., NZOI H-583, SEM stub 620 (USNM).

TYPE LOCALITY: NZOI Stn I96, 32°10.8'S, 167°21.2'E, southern Norfolk Ridge; 356 m.

ETYMOLOGY: The species name *gigantea* (from the Latin *giganteus*, giant) refers to the large colony size and robust branches of this species.

REMARKS: *Conopora gigantea* belongs to *Conopora* (Group B), as defined by Cairns (1983b), consisting of only one other Recent species with uniformly distributed cyclosystems and granular coenosteum — *C. dura* Hickson and England, 1909, known only from two specimens collected off Providence Island, western Indian Ocean at 229 m. Although superficially similar, *C. gigantea* is distinguished by having considerably larger cyclosystems, a lower average number of dactylopores per cyclosystem, lacking nematopores, and having non-differentiated upper and lower gastropore chambers.

TABLE 6. Characteristics of the six New Zealand species of *Conopora*
(gprc = gastropore ring constriction, e.p. = efferent pores, amp = ampullae, pss = pseudosepta)

Character	*C. verrucosa* (Studer, 1878)	*C. laevis* (Studer, 1878)	*C. candelabrum* n.sp.	*C. tetrastichopora* n.sp.	*C. unifacialis* n.sp.	*C. gigantea* n.sp.
Colony size and shape	Moderate size, robust, uniplanar, often reticulate	Small, delicate, uniplanar, no branch anastomosis	Large, fragile, uniplanar, pinnately branched (candelabrum-shaped)	Large, robust, primarily uniplanar, sparsely branched	Small, delicate, primarily uniplanar, equal branching	Large, robust, uniplanar, equal sparse branching
Polychaete commensal	Present	Present	Absent	Absent	Absent	Absent
Coenosteal texture	Linear-imbricate	Linear-imbricate	Linear-imbricate to linear-smooth	Linear-granular	Linear-imbricate, coenosteal pores coarse	Linear-granular, pointed
Arrangement of cyclosystems (Group designation)	Exclusively sympodially (Group A)	Exclusively sympodially (Group A)	Exclusively sympodially (Group A)	Four discrete rows (quadriserially), no group designation	Unifacial medial row, no group designation	Uniformly distributed (Group B)
Cyclosystem diameter	0.8–2.0 mm	0.8–1.2 mm	0.45-0.90 mm	0.9–1.25 mm	Up to 1.3 x 1.6 mm	Up to 2.6 mm
Range and average no. of dactylopores/cyclosystem	8–15, x = 10.4	10-16, x = 12.6	typical: 3–12, x = 9.2 variety: 4–7, x = 5.6	2–6, x = 4.44	14–21, x = 18.4	8–13, x = 9.7
Gastropore tube shape	Double-chambered, gprc present	Double-chambered, gprc present	Double-chambered, gprc present	No discrete upper chamber or gprc	Unique: intermediate tube instead of gprc	Unique: cylindrical, no gprc
Ratio of width of dactylostomes to pseudosepta; diastema presence	1 : 1–3; diastemas often present	1 : 0.75–1.5; diastemas rare	1 : 1–2; diastemas always present	1 : 1–2; wide diastemas always present	1 : 0.25–0.33; diastemas absent	1 : 1 (pss loculated and inner edges quite thin); diastemas absent
Female ampullae; e.p. location	Internal; e.p. open into gastropore tube	Superficial; e.p. lateral	Massive, superficial; e.p. open into gastropore tube	Internal; e.p. open into gastropore tube	Massed on posterior face; e.p. on anterior face	Enormous internal tubes; e.p. apical
Male ampullae; e.p. location	Internal; e.p. open into gastropore tube	Superficial; e.p. lateral	Primarily internal; e.p. open into gastropore tube	Internal; e.p. open into gastropore tube	Massed on posterior face; e.p. apical	Unknown
Distribution	Widespread in New Zealand region, Subantarctic, and Antarctic; 198–2355 m	Northern New Zealand region, ?Indo-West Pacific; 130–1035 m	Norfolk and Three Kings Ridges, Campbell Plateau; 403–1170 m	Three Kings Ridge; 282–710 m	Colville Ridge; 547-646 m	Norfolk Ridge; 356 m

Incertae Sedis

"Conopora" anthohelia n. sp.
(Plates 65, e–g, 66, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Colville Ridge and Three Kings Ridge; 547–1170 m.

DESCRIPTION OF HOLOTYPE: Colony uniplanar, 20.3 mm tall and 18.6 mm broad, with a basal branch diameter of 3.4 x 4.2 mm. Branching dichotomous and equal, only two generations of branching present, resulting in 3 axils and 4 branch tips. Branches flattened in plane of colony; distal branches blunt, 2.9–3.5 mm in diameter. Coenosteum white, with a linear-granular, porcellanous texture. Strips 0.12–0.32 mm wide, but coenosteal slits obscure. Mid-line of coenosteal strips often carinate, each ridge as high as 60 µm; if strip not carinate, there is often a series of pointed granules of equivalent height along mid-line. Nematopores absent.

Cyclosystems primarily unifacial, the holotype having 11 cyclosystems on its anterior face (Plate 65, f) and 3 (1 near the ends of 3 of the 4 branches) on the posterior face. Anterior-facing cyclosystems closely spaced, often directly adjacent to one another, and occur from colony base to near branch tips; however, cyclosystems do not occur at branch tips, but always slightly subdistally. Cyclosystems circular to slightly elliptical and nonexsert, up to 2.6 mm in greater cyclosystem diameter. Based on 14 cyclosystems (all available for analysis) the range of dactylopores per cyclosystem was 17–20, average 18.42 (σ = 0.77), and mode 18. Cyclosystems lack lids and lips but most have a short proximal diastema occupying 20°–30° of its circumference.

Gastropore tubes unique in structure. Upper chamber broad and extremely shallow, the pseudoseptal inner edges extending far below dactylotomes. Nonetheless, a smooth, nonseptate portion of upper chamber exists just above gastropore ring constriction. Gastropore ring constriction circular and quite large: 0.7–0.8 mm in diameter. Short (up to 75 µm), lamellar septa (Plate 66, b) project from the edge of the gastropore ring constriction and continue along the lateral and lower, outer edges of lower gastropore chamber. These lamellae occur in equal numbers to pseudosepta and are interpreted as disrupted continuations of the pseudosepta within the lower gastropore chamber. Lower chamber also relatively shallow (only 0.10–0.11 mm deep) and bears a large, low mound (Plate 66, a, b) centrally. The mound is analogous in position to a gastrostyle but is only about 0.05 mm high and 0.45 mm in basal diameter (H : W ratio = 0.11), appearing as little more than a slight, but distinct convexity in lower chamber. Mound sparsely covered with pointed granules up to 40 µm tall.

No ampullae were apparent; however, it appeared as though large subcoenosteal cavities exist on much of the posterior face, similar to the internal ampullar masses of *Conopora unifacialis*.

TYPES: Holotype: NZOI Stn P947, 1 col., NZOI H-584. Paratype: NZOI Stn U581, 1 col., NZOI P-933.

TYPE LOCALITY: NZOI Stn P947, 25°13.7'S, 179°04.1'W, Colville Ridge; 547–646 m.

ETYMOLOGY: The species name *anthohelia* (from the Greek *anthos*, flower + *helios*, sun) the latter being a common suffix used in stylasterid names, in this case pertaining to the cyclosystems), alludes to the sunflower-like nature of the cyclosystems of this species.

REMARKS: Among the stylasterid genera, *"Conopora" anthohelia* is most similar to *Conopora*, specifically *C. unifacialis*. Points of similarity include unifacial, nonexsert cyclosystems; broad, shallow gastropore upper chambers; an almost identical average number of dactylopores per cyclosystem; dichotomous, equal branching; and co-occurrence at the same station. However, there are striking differences that distinguish *"Conopora" anthohelia* from *C. unifacialis* as well as the other species in the genus — *"C." anthohelia* has a rudimentary gastrostyle; larger, subterminal, diastemate cyclosystems; thick, flattened branches; an enormous gastropore ring constriction with pseudosepta occurring in and below it; and a carinate, porcellanous coenosteal texture.

"Conopora" anthohelia also resembles the genus *Pseudocrypthelia* in having double-chambered gastropore tubes, unifacial cyclosystems, and a rudimentary gastrostyle. It differs in lacking a cyclosystem lid, having linear-granular coenosteum (not linear imbricate), lacking nematopores, and in having very shallow gastropore tubes with pseudoseptal ridges extending into the lower chamber.

Because of the limited material available, a new genus is not suggested for this species.

Astya Stechow, 1921

Gastro- and dactylopores arranged in cyclosystems, which occur exclusively on anterior branch faces;

cyclosystems may or may not be covered with a lid. Colonies uniplanar and very delicate. Coenosteum white and linear-imbricate in texture; nematopores common, especially on ampullae. Gastropores double-chambered; no gastro- or dactylostyles. Gastropore ring constriction may have an additional blunt pillar that projects into gastropore tube. Ampullae superficial, occurring in proximal cyclosystem wall or encircling the cyclosystems.

TYPE SPECIES: *Astylus subviridis* Moseley, 1879, by monotypy.

REMARKS: Aside from the newly described species reported herein, only one other Recent species is known in this genus — the type-species, *A. subviridis* (Moseley 1879). No additional specimens have been collected of *A. subviridis* and the type specimen has disintegrated, but was well described and figured by Moseley (1879, 1881). It is with some hesitation that *A. aspidopora* n. sp. is included in *Astya* because it differs from the type species in two significant ways. First, it has well-developed, fixed cyclosystem lids. Second, it has a curved gastropore tube with a typical gastropore ring constriction (no protruding pillar) and an accessory upper gastropore chamber "shelf" unlike any structure known in other stylasterids. Other less significant differences are that *A. aspidopora* has fewer dactylopores per cyclosystem (10–18, average 14.36 vs 17–19 for *A. subviridis*) and has discrete ampullae not arranged in rings around the cyclosystems.

DISTRIBUTION: Philippines; Three Kings Ridge; 590–914 m.

Astya aspidopora n. sp. (Plates 66, c–f, 67, a–g)

Material examined: Types, q.v.

DISTRIBUTION: Known only from the type locality — Three Kings Ridge; 590–640 m.

DESCRIPTION: Colonies uniplanar and quite delicate, the species thus far known only from branch fragments, the largest fragment 10.4 mm tall and 8.7 mm broad, consisting of 13 cyclosystems; holotype fragment 8.2 mm broad, consisting of 8 cyclosystems. Branching appears to be dichotomous and equal, with no branch anastomosis. Branches circular in cross section and very slender; branches that support distal cyclosystems only 0.35–0.40 mm in diameter. Linear-imbricate coenosteum composed of convex strips 45–75 μm wide, bordered by slits 4–5 μm wide. Platelets continuous across a strip, exposing distalmost 10 μm. Mound-shaped to conical nematopores common on branch coenosteum; on outer, upper pseudoseptal edges; on ampullae; and even on the spurs that overhang the male efferent pores. Nematopore mounds up to 50 μm tall and 75 μm in basal diameter, with a circular apical pit 22–30 μm in diameter.

Cyclosystems circular to elliptical in shape, ranging from 1.0–1.35 mm in greater diameter. Cyclosystems orientated perpendicularly to branch and slightly flared. Based on 50 cyclosystems, the range of dactylopores per cyclosystem was 10–18, average 14.36 (σ= 2.13), and mode 14. Cyclosystem lids broadly based (attached to one-quarter to one-third of cyclosystem circumference), slightly inclined distally, and rectangular in shape, covering 50–60% of cyclosystem. Distal edge of cyclosystem lid thin; proximal portion usually greatly swollen with ampullae.

Gastropore tube quite unusual in shape — double-chambered, as in *Conopora* and *Crypthelia*, but curved 90°, as in *Crypthelia curvata*, such that lower portion of upper gastropore chamber and all of lower chamber run parallel to branch axis. Upper chamber roughly spherical, 0.50–0.55 mm in diameter, and bordered by inner edges of pseudosepta and dactylotomes; however, near base of upper chamber, at the point of tube inflection, is a thin, vertical shelf-like extension that projects from the proximal (beneath cyclosystem lid) one-third of the gastropore circumference. Shelf-like extension 18–20 μm thick, its distal edge broadly notched, often in a semi-circular (Plate 67, d, g) or V-shaped notch, which results in two rounded or triangular lateral projections. Just around the bend of the upper gastropore tube and literally on the lower side of the shelf is a well-developed gastropore ring constriction, which leads into a roughly spherical, slightly smaller lower gastropore chamber. Lower chamber and gastropore ring constriction not visible in an intact cyclosystem, but must be viewed from an excavation of the posterior face. Dactylotomes 75–80 μm wide; pseudosepta broad (1–2 times dactylotome width at outer margins) and wedge shaped, with slightly concave upper edges.

Female ampullae massive swellings 0.9–1.2 mm in diameter (often larger than the cyclosystems), one occurring in the combined space of the proximal cyclosystem wall and cyclosystem lid. Female efferent pores 0.12–0.15 mm in diameter, opening into roof of lower gastropore chamber, which is hidden behind the gastropore shelf. Male ampullae also massive hemispheres 0.8–1.0 mm in

diameter, 1–3 occurring in each cyclosystem near proximal cyclosystem wall, lateral to cyclosystem wall, or even on the posterior branch face opposite a cyclosystem. Male efferent pores apical, 80–90 µm in diameter, and invariably protected by an overhanging spur, which may be up to 0.11 mm tall and 0.18 mm long (Plate 67, e).

TYPES: Holotype: NZOI Stn U599, 1 female branch, NZOI H-585. Paratypes: NZOI Stn U599, 30 branches, NZOI P-902, 10 branches, SEM stubs 645–646, 686–687, USNM 87559.

TYPE LOCALITY: NZOI Stn U599, 30°43'S, 173°16.9'E, Three Kings Ridge; 590–640 m.

ETYMOLOGY: The species name *aspidopora* (from the Greek *aspis*, shield + poros, orifice) referes to the curious shelf-like projection of the upper gastropore tube, which tends to shield the lower gastropore chamger, and to the spurs that overhang and appear to protect the male efferent pores.

REMARKS: *See* Remarks on the genus.

Crypthelia Milne Edwards & Haime, 1849

Gastro- and dactylopores arranged in cyclosystems, which occur exclusively on anterior branch faces with only one exception (*C. trophostega*), in which they are bifacial. Colonies invariably uniplanar with slender branches. Coenosteum white and linear-imbricate in texture. Nematopores common, especially on cyclosystem lids, pseudosepta, and ampullae. Cyclosystems covered partially or entirely by one or more fixed lids. Gastropore tubes double-chambered, separated by a gastropore ring constriction; no gastro- or dactylostyles. Ampullae usually superficial and large, occurring in a variety of positions on the branch and with a variety of efferent-pore locations; female ampullae usually occur singly within cyclosystem lid and proximal cyclosystem wall; male ampullae usually clustered in compartmentalised rings encircling cyclosystems or in cyclosystem lid or proximal cyclosystem wall.

TYPE SPECIES: *Crypthelia pudica* Milne Edwards and Haime, 1849, by monotypy.

REMARKS: *Crypthelia* is one of the most highly derived stylasterid genera (Cairns 1984), having a world-wide, predominantly deep-water radiation of 30 recognised species. Twenty-five species were listed by Cairns (1986b); *C. micropoma* Cairns was added in 1985; and four new species are added herein. In an effort to subdivide the genus to facilitate comparisons, all species have been categorised (Cairns 1986b) based on the position of their male and female ampullae and efferent pores. Since there are three basic types of female arrangements and eight types of male arrangements, a total of 24 female/male combinations are theoretically possible, only nine (not 12, as I reported in 1986b) of which have been found. The following combinations (called ampullar formulae) and number of species having that combination are: A–A1 (3), A–A2 (2), A–C4 (2), B–B (2), B–C1 (9), B–C2 (1), B–C3 (1), B–C4 (1), C–D (1). Data for the remaining eight species are incomplete: A–? (1), ?–A1 (1), B–? (2), ?–C1 (1), ?–C3 (1), ?–? (2). The formula B–C1 (female ampullae in proximal cyclosystem wall and male ampullae encircling the cyclosystem and having apical efferent pores) is the most common combination and is found in four of the six New Zealand species. Other characters of value in discriminating species of *Crypthelia* are listed in Table 7, and include cyclosystem diameter; lid shape, size, and orientation; pseudoseptal width, length, and degree of concavity; range of dactylopores per cyclosystem; and gastropore shape.

DISTRIBUTION: Cosmopolitan; 140–2789 m, including the deepest living stylasterid (Cairns 1991b).

Crypthelia studeri n. sp. (Plates 68, a–f, 69, a-c)

Cryptohelia pudica: Studer 1878 : 633–634.

MATERIAL EXAMINED: Types, q.v.; *C. pudica* of Studer (1878), *Gazelle* Stn 60/44, ZMB 1779, 1 branch. Reference Material: Syntypes of *C. balia*, ZMA 7396.

DISTRIBUTION: Throughout the New Zealand region from Campbell Plateau, Macquarie Ridge, Bounty Plateau, Kermadec Ridge, and Three Kings Ridge; 343–1940 m.

DESCRIPTION: Colonies of moderate size; holotype a colony fragment 30.5 mm tall and 22.7 mm broad; however, other paratypes from same station are slightly larger. Branches highly anastomotising, forming reticulate, uniplanar flabella. Reticulation of colony reinforced by commensal polychaete galltubes, which often bridge adjacent branches, and were present in all colonies examined, occurring exclusively on posterior branch faces. Coenosteum linear-imbricate, the strips 55–90 µm wide and

sometimes highly convex, separated by discontinuous slits about 10 μm wide. Platelets continuous across strip and corrugated; however, the platelet structure of most specimens is obscure, being replaced with a rough granular coenosteum. Nematopores occur on branch coenosteum, pseudosepta, ampullae, and cyclosystem lids; nematopores usually small (about 50 μm in diameter) and only slightly elevated, but on some coralla (e.g., NZOI Stn T243) nematopores form large (0.14 mm diameter) concave pits.

Cyclosystems unifacial, strongly flared, and elliptical to irregular in shape; up to 2.3 x 1.8 mm in diameter. Based on 50 cyclosystems, the range of dactylopores per cyclosystem was 11–22, average 16.16 (σ = 1.92), and mode 17. Cyclosystem lids relatively small, covering only 30–40% of cyclosystem, and slightly inclined upward, providing a clear view of the underlying cyclosystem; lids usually longer than broad, with a rounded distal edge that is often broken. Base of cyclosystem lid relatively narrow, less than or equal to one-quarter circumference of cyclosystem; upper edge of lid slightly concave.

Upper section of gastropore tube broad and infundibuliform, sloping gradually into the upper chamber, which is roughly spherical (diameter about 0.62 mm). Upper and lower portions of upper chamber truncate (toroidal in shape), such that its depth is less than half its width. Gastropore ring constriction well developed, about 0.5 mm in diameter. Lower chamber an inverted hemisphere (or flattened chamber) about 0.6 mm in diameter and only about 0.2 mm deep. Dactylotomes broad, 0.14–0.16 mm wide; pseudosepta thin, only about two-thirds dactylotome width at outer edges. Upper edges of pseudosepta highly concave.

Female ampullae massive swellings up to 1.5 mm in internal diameter, usually occurring in or adjacent to proximal cyclosystem wall. Occasionally, in colonies strongly modified by polychaetes, female ampullae also occur within the distal cyclosystem wall. Efferent pores circular and 0.25–0.30 mm in diameter, opening into upper gastropore chamber just beneath dactylotome level. Male ampullae form a discontinuous band encircling each cyclosystem, composed of 5 or 6 individual mounds, each mound 0.6–0.7 mm in diameter. Efferent pores apical and 33–35 μm in diameter, sometimes occurring in shallow apical depressions up to 0.16 mm in diameter. These depressions sometimes surrounded by a ring of small nematopores, the nematopores only slightly larger in diameter than the efferent pore (Plate 69, c).

TYPES: Holotype: NZOI Stn D39, 1 male col. (typical form), NZOI H-586, SEM stub 638 (USNM). Paratypes: Typical form — NZOI Stn D6, 1 male col., NZOI P-903; Stn D39, 2 male col., NZOI P-904, 2 female and 1 male col., USNM 87560; Stn D159, 2 female, 1 male col., NZOI P-905; Stn D176, 2 male col., NZOI P-906; Stn S45, 1 male col., NZOI P-907; Stn T226, 1 female, 1 male col., NZOI P-908; Stn T256, 1 female col., NZOI P-909; *Eltanin* Stn 1991, 1 female col. and SEM 639, USNM 60265. Delicate form — NZOI Stn A744, 1 female, 2 male col., NZOI P-910; Stn A745, 1 branch, NZOI P-911; Stn E821, 1 female, 1 male col., NZOI P-912; Stn E822, 1 col., NZOI P-913; Stn S53, 2 col., NZOI P-914, 3 col., USNM87561; Stn T243, 1 male col., NZOI P-915; Stn U599, 1 col., NZOI P-916; *Eltanin* Stn 1851, 26 col. and SEM stubs 640–641, USNM 60094.

TYPE LOCALITY: NZOI Stn D39, 50°58'S, 165°45'E, southwest of Auckland Island; 465–549 m.

ETYMOLOGY: This species is named in memory of Theophil Studer, who reported the first stylasterids from the New Zealand region (Studer 1878), including a specimen of *C. studeri* that he indentified as *C. pudica*.

REMARKS: Specimens from several lots (see Types, delicate form) differ from typical *C. studeri* as defined by the holotype and preceding description, by having a smaller, more delicate corallum. The slender branches of this form, herein called the "delicate form", appear to be embedded in polychaete tube coenosteum. The colonies are slightly bushy and sparsely branched, consisting of nonbifurcating branches all of which originate from the polychaete tube coenosteum. Their cyclosystems are often slightly smaller (1.5–1.8 mm in diameter), more widely separated, and not exclusively unifacially arranged — instead, alternating between unifacial and sympodial on the same corallum. The cyclosystem lids of the delicate form are smaller or absent, often consisting only of an enlarged, exsert pseudoseptum 1–2 times the width of a typical pseudoseptum. Their gastropore ring constrictions appear to be more highly developed resulting in a smaller aperture. Although this may seem to constitute enough differences to warrant description as a separate species, it is noted that most of the characters of the delicate form grade imperceptibly with those of the typical form. Furthermore, no geographic or bathymetric differences were found between the forms. It was a specimen of the delicate form that Studer (1878) identified as *C. pudica*.

In the New Zealand region, *C. studeri* is most

similar narrow, distally inclined cyclosystem lids; a similar number of dactylopores per cyclosystem; fragile coralla; and the same ampullar formula — B–C1 (Table 7). *Crypthelia studeri* differs from *C. fragilis* and all other New Zealand species by always having a commensal polychaete relationship, which causes a high degree of branch anastomosis. Furthermore, it has narrower pseudosepta and typically larger cyclosystems than *C. fragilis*.

Outside the New Zealand region, *C. studeri* is similar to *C. balia* Hickson and England, 1905 (Indonesia, 1300–1633 m), both species having commensal polychaetes, delicate coralla, and relatively small cyclosystem lids. *Crypthelia studeri* appears to differ by having larger cyclosystems and considerably smaller nematopores. More specimens of *Crypthelia* from the Indonesian region however, are needed to better characterise the four or five species reported by Hickson and England (1905).

Crypthelia robusta n. sp. (Plates 69, d–g, 70, a–g)

MATERIAL EXAMINED: Types, q.v. *Terra Nova* Stn 91, 1 female col., BM(NH) 1950.1.11.6; *Terra Nova* Stn 96, 1 poorly preserved col., BM(NH) 1950.1.11.8.

DISTRIBUTION: Southern Norfolk Ridge; South Three Kings Ridge; 128–757 m.

DESCRIPTION: Colonies broad, uniplanar, and relatively small, the largest colony (holotype) only 41.3 mm tall and 47.3 mm broad, with a basal stem diameter of 5.1 mm. All colonies firmly attached through a massive, vertical basal branch 10–14 mm tall and 4–6 mm in diameter, above which branching is dichotomous, equal, and sometimes symmetrical, as in the holotype; branch anastomosis occurs infrequently. Distal branches slender and of lesser diameter than cyclosystems. Commensal polychaetes may or may not be present. Coenosteum linear-imbricate, the strips 60–110 µm wide and bordered by elongate slits about 10 µm wide. Platelets usually continuous across a strip but highly corrugated, each bearing 4–6 low, rounded longitudinal ridges. Nematopores low and inconspicuous, 30-40 µm in diameter, most frequently occurring on cyclosystem lids, outer cyclosystem lips, and on ampullae.

Cyclosystems predominantly unifacial, but on those colonies hosting polychaete commensals (e.g., *Terra Nova* specimens), cyclosystems are bifacial. Cyclosystems elliptical in shape and bimodal in size — 5 of the 11 colonies examined (two from NZOI Stn I97, one from Stn P9, and both from *Terra Nova* stations) have quite large cyclosystems 3.5–4.5 x 3.1–3.5 mm in diameter, whereas the remaining 6 colonies, including the holotype, have smaller cyclosystems 2.5–2.8 x 2.1–2.2 mm in diameter. Cyclosystems highly exsert and flared distally, many cyclosystems having a broad, nonseptate lip up to 0.6 mm wide encircling the distal half (cyclosystem perimeter opposite that of lid) of cyclosystem. Cyclosystem lids quite large: broader than long, up to 3.0 mm wide in larger cyclosystems and 1.8–1.9 mm wide in smaller cyclosystems, and covering 80–90% of the cyclosystem. Lids horizontal and quite low, allowing only limited access to gastropore chamber. Those colonies having large cyclosystems have a range of 19–23 dactylopores per cyclosystem, average 21.71 ($N = 11$, $\sigma = 1.10$), and mode of 22; colonies with small cyclosystems have a range of 9–17 dactylopores per cyclosystem, an average of 13.76 ($N = 50$, $\sigma = 1.89$), and mode of 15. Upper, cylindrical section of gastropore tube about 0.9– 1.0 mm deep and relatively narrow, encircled by dactylotomes and highly exsert pseudosepta. The intermediate (upper) gastropore chamber is roughly spherical with a diameter of 1.1–1.25 mm, bordered above by the lower recurved edges of the pseudosepta and below by the circular gastropore ring constriction, which is 0.65–0.75 mm in diameter. Lower chamber quite compressed, slightly wider than upper chamber, but only 0.10-0.20 mm deep (Plate 70, a, f). Dactylotomes fairly uniform in width, 0.10–0.12 mm. Pseudosepta quite slender, only about half the dactylotome width at their outer edges and having very slender, knife-like inner edges only 20–25 µm thick. Upper pseudoseptal edges smooth and solid; lower edges recurve inward to join gastropore tube wall (Plate 70, a). Pseudosepta unequal in length, some projecting far into tube, others only one-quarter to three-quarters as far. There seems to be no pattern to the relative lengths of the pseudosepta within a cyclosystem.

Female ampullae massive swellings up to 2.2 mm in diameter, occurring in proximal cyclosystem lid or within cyclosystem wall on either side of lid. Efferent pores not observed. Male ampullae form continuous bands or occur as individual ampulla surrounding each cyclosystem and also occur on proximal cyclosystem lid. Individual ampullae about 1.5 mm in diameter. Efferent pores apical and circular (50–60 µm in diameter), sometimes recessed in a circular apical depression 0.3–0.6 mm in diameter.

TYPES: Holotype: NZOI Stn I97, 1 female col., NZOI H-587. Paratypes: NZOI Stn I97, 2 female col., 2 male col., NZOI P-917, 1 male col., 1 female col., and SEM stubs 635–636, USNM 87562; Stn P8, 1 male col., NZOI P-918; Stn P9, 1 male col., NZOI P-919, SEM stub 637 (USNM).

TYPE LOCALITY: NZOI Stn I97, 32°22.9'S, 167°28.2'E, southern Norfolk Ridge; 540–544 m.

ETYMOLOGY: The species name *robusta* (from the Latin *robustus*, solid, strong) refers to the robust basal stem of each colony and the very large cyclosystems of this species.

REMARKS: *Crypthelia robusta* is the most distinctive species of *Crypthelia* in the New Zealand region, having very large cyclosystems (and a correspondingly high number of dactylopores per cyclosystem); very thin, knife-like pseudosepta of unequal lengths; large, low cyclosystem lids; and broad, nonseptate cyclosystem lips (Table 7).

Although cyclosystem diameter is believed to be fairly consistent among the specimens of various species of *Crypthelia* and has therefore been used to help discriminate species (Cairns 1986a, b, herein), in *C. robusta* and *C. polypoma* there are colonies having significantly different cyclosystem diameters. The character of having pseudosepta of unequal lengths is relatively rare among the species of *Crypthelia*, shared with only two other species — *C. dactylopoma* Cairns, 1986b and *C. curvata*, n. sp. Both *C. robusta* and *C. dactylopoma* have relatively large cyclosystems with a correspondingly high number of dactylopores per cyclosystem and the same ampullar formula, *C. robusta* differing in having much wider lids, cyclosystem lips, and much thinner pseudosepta.

Crypthelia polypoma n. sp. (Plates 71, a–g, 72, a, b)

MATERIAL EXAMINED: Types, q.v.

DISTRIBUTION: Norfolk, Three Kings, and Kermadec Ridges; 590–814 m.

DESCRIPTION: Colonies broad and uniplanar, but variable in size and robustness; the holotype (largest specimen) 50.4 mm tall and 58.2 mm broad, with a basal branch diameter of 5.7 mm and relatively robust distal branches up to 1.1 mm in diameter. A paratype from NZOI Stn G3, however, is quite delicate, with cyclosystems half the diameter as those of the holotype and slender distal branches only 0.5 mm in diameter. Branching dichotomous and equal; no polychaete commensals known. Linear-imbricate coenosteum composed of well-defined, slightly convex strips 80–110 µm wide, bordered by elongate slits 11–12 µm wide. All specimens slightly worn and thus details of platelet structure obscure, but platelets appear to be continuous across a coenosteal strip and longitudinally ridged. Circular nematopores about 60 µm in diameter common on branch coenosteum and cyclosystem lids.

Cyclosystems primarily unifacial, most occurring on anterior face (by definition), but cyclosystems on some branches also occur on opposite (posterior) branch face. Cyclosystems elliptical to "rectangular with rounded edges" in shape. Cyclosystems of holotype large, 2.0–2.2 x 1.3–1.5 mm in diameter; those of specimens from NZOI Stn U599 are much smaller, only 1.3–1.4 mm in greater cyclosystem diameter; and those from NZOI Stn G3 smaller still with greater cyclosystem diameters of only 1.1–1.3 mm. Cyclosystems exsert and slightly flared. Based on 41 cyclosystems (all that were available for analysis), there was a range of 12–27 dactylopores per cyclosystem, average of 14.54 ($\sigma = 0.98$), and mode of 15. Number of dactylopores per cyclosystem did not vary in a statistically significant way among the differently sized cyclosystems. Cyclosystem lids broad and low, each arching about three-quarters distance across a cyclosystem. Invariably (with no exceptions in the material examined) a smaller secondary (adcauline) lid originates from the opposite cyclosystem wall and fuses with the larger lid, bisecting the cyclo-system. Often a third (Plate 71, b, f) and even fourth small lid originate from the lateral edges of a cyclosystems, also fusing with the primary abcauline lid, forming a massive canopy covering most of the cyclosystem.

Upper gastropore tube cylindrical, up to 0.6 mm deep, and flanked by dactylotomes and highly exsert pseudoseptal inner edges. Upper gastropore chamber an ellipsoidal cavity about 0.8 mm broad and 0.5 mm deep. Gastropore ring constriction about 0.42 mm in diameter, leading into a flattened lower chamber only about 0.18 mm deep and of slightly greater diameter than upper chamber. Dactylotomes 83–90 µm wide. Pseudosepta wedge shaped and 1.5–3.0 times dactylotome width at their outer edges, with flat to concave upper edges. Inner edges of pseudosepta vertical, extending to upper part of upper gastropore chamber. Dimensions of gastropore tubes, dactylotomes, and pseudosepta given above pertain to holotype; dimensions of same features of smaller cyclosystems

from two other stations correspondingly smaller.

Female ampullae unknown. Male ampullae discrete mounds 0.4–0.5 mm in diameter, 6–8 of which encircle a mature male cyclosystem. Mounds bear 5 or 6 low, radiating ridges, between which are shallow depressions. In each depression is an efferent pore 25–30 µm in diameter.

TYPES: Holotype: NZOI Stn T256, 1 male col., NZOI H-588, SEM stub 648 (USNM). Paratypes: NZOI Stn G3, 1 male col., NZOI P-920, 1 fragment and SEM stub 695, USNM 87563; Stn U599, 2 male frag-ments, SEM stub 647, USNM 87564.

TYPELOCALITY: NZOI Stn T256, 30°31'S, 178°39'W, off Curtis Island, Kermadec Islands; 710–814 m.

ETYMOLOGY: The species name *polypoma* (from the Greek *polys*, many + *poros*, orifice) refers to the multiple cyclosystem lids characteristic of this species.

REMARKS: *Crypthelia polypoma* differs from other congeners in having consistently multilidded cyclosystems. Colonies of some other species occasionally have cyclosystems with an additional lid (e.g., *C. dactylopoma* Cairns, 1986a : fig. 25B), but no other species has such consistently well-developed multiple lids. *Crypthelia polypoma* is also distinctive in having ridged male ampullae and very broad pseudosepta (Table 7).

Crypthelia fragilis Cairns, 1983
(Plates 72, c–f, 73, a–f)

Crypthelia fragilis Cairns, 1983a : 130–133, figs 31F, 37A–G, 38A–C; 1983b : 431.

MATERIAL EXAMINED: Types; NZOI Stn F127, 1 col., NZOI; Stn F132, 1 col., NZOI .

DISTRIBUTION: Pacific-Antarctic Ridge, Subantarctic Slope, Macquarie Ridge, off Antipodes Islands; 952– 2329 m.

DESCRIPTION: Colonies uniplanar and extremely delicate, the largest colony (*Eltanin* Stn 1852) only 27 mm tall and 25 mm broad, with a basal branch diameter of 1.7 mm. Branching dichotomous and equal; branch anastomosis occurs occasionally; no polychaete commensals known. Branches circular in cross section and quite slender, much smaller in diameter than cyclosystems they support, branches supporting terminal cyclosystems as little as 0.45 mm in diameter. Linear-imbricate coenosteum composed of discrete, convex strips 50–100 µm wide, bordered by discontinuous slits 6–9 µm wide. Platelets 10– 11 µm wide, several (4–11) occurring across width of a coenosteal strip. Circular nematopores 40–50 µm in diameter occur on the branch coenosteum, cyclosystem lids, ampullae, and with regularity on the upper, outer edges of each pseudoseptum.

Cyclosystems exclusively unifacial, circular to slightly elliptical in shape, and 1.0–1.8 mm in diameter. Cyclosystems exsert and slightly flared. Based on 31 cyclosystems, the range of dactylopores per cyclosystem was 13–18, average 15.71 (σ = 1.13), and mode 15 (Cairns 1983a). Cyclosystem lids usually rather slender (e.g., only twice pseudoseptal width), slightly inclined upward, and concave above, covering only 10–20% of the cyclo-system; however, in some cyclosystems, the lid is broader, covering as much as 75% of the cyclo-system.

Upper gastropore tube cylindrical, flanked by vertical inner edges of the pseudosepta and deeply incised dactylotomes. Below this section is a well-defined, smooth-walled, spherical upper chamber, which is about 0.56 mm in diameter. A gastropore ring constriction approximately 0.35 mm in diameter leads to a broad, flattened lower chamber, which is only about 40 µm deep but envelopes entire lower half of upper chamber. Dactylotomes 75–90 µm wide and extend deep into upper gastro-pore tube. Pseudosepta wedge shaped, 1.5–2.0 times dactylotome width at their outer margins, and have concave upper edges. Inner edges of pseudosepta vertical and slightly concave.

Female ampullae massive swellings about 1.4 mm in diameter, lodged within proximal cyclo-system wall and proximal cyclosystem lid. Female efferent pores circular and about 0.27 mm in diameter, opening beneath cyclosystem lid into upper gastro-pore tube above the spherical upper chamber (Plate 72, f). Male ampullae consist of hemispherical mounds 0.8–0.9 mm in diameter, 2 or 3 of which normally encircle a cyclosystem. A mature ampulla bears an apical depression 0.25–0.30 mm in diameter, which is penetrated by an irregularly-shaped efferent pore 40–50 µm in diameter.

TYPES: The holotype and most paratypes are deposited at the USNM. Additional paratypes are also deposited at the RMNH and the BM(NH) (*see* Cairns 1983a).

TYPE LOCALITY: *Eltanin* Stn 17-5, 52°10'S, 142°10'W, seamount on Pacific-Antarctic Ridge; 2305–2329 m.

REMARKS: Only two additional specimens of *C. fragilis* are reported in this account. Therefore, the preceding description was based primarily on a re-examination of the type specimens and thus reiterates the original description but adds to the interpretation of the dimorphic ampullae.

Crypthelia fragilis is distinctive among the *Crypthelia* from the New Zealand region in having a very delicate corallum with very small cyclosystems; narrow coenosteal platelets; and nematopores that regularly occur on the outer pseudoseptal edges (Table 7). It is restricted to relatively deep water and known only from the Subantarctic region. Comparisons to *C. studeri* are made in the account of that sepcies.

Crypthelia curvata n. sp. (Plates 73, g, h, 74, a–f)

MATERIAL EXAMINED: Types, q.v.; NZOI Stn P552, 2 poorly preserved fragments, NZOI.

DISTRIBUTION: Southern Norfolk Ridge; Three Kings Ridge, including off Three Kings Islands; 282–1258 m.

DESCRIPTION: Colonies uniplanar and delicate, the largest specimen examined (holotype) 35.5 mm tall and 20.6 mm broad, with a broken basal branch diameter of 2.2 mm. Branching dichotomous and equal; no polychaete commensals known. Branches circular in cross section and slender, branches supporting terminal cyclosystems about 0.6 mm in diameter. Linear-imbricate coenosteum composed of discrete, convex strips 40–60 µm wide bordered by elongate strips about 7 µm wide. Platelets continuous across a strip but longitudinally ridged. Circular nematopores 40–50 µm in diameter occur on branch coenosteum, cyclosystem lids, and often on the outer, upper edges of pseudosepta.

Cyclosystems unifacial and elliptical to irregular in shape, 1.3–1.8 mm in greater diameter. Cyclosystems exsert and slightly flared. Based on 29 cyclosystems (all that were available for analysis), there are 15–21 dactylopores per cyclosystem, average 17.79 ($\sigma = 1.40$), and mode 19. Cyclosystem lids usually rather small (e.g., 0.6 mm wide), longer than wide, slightly inclined upward, and cover only 10–20% of the cyclosystem; however, some cyclosystems have broader lids (e.g., up to 1.1 mm wide), covering a much larger percentage of the cyclosystem.

Upper gastropore tube cylindrical and elongate (Plate 74, a, c) (up to 1.2 mm deep), flanked by dactylotomes and the gradually attenuating inner edges of the pseudosepta, which extend far below the dactylotomes. Upper gastropore chamber essentially a continuation of upper gastropore section but without pseudoseptal ridges. Upper chamber cylindrical and elongate (up to 1 mm deep and about 0.7 mm in diameter), and curved as much as 90° such that its lowest point parallels the branch axis. Gastropore ring constriction about 0.45 mm in diameter; lower chamber large and spherical, 0.55–0.70 mm in diameter, and enveloping the gastropore ring constriction (Plate 74, d). Because of the great depth and curvature of the gastropore tube, the gastropore ring constriction and lower gastropore chamber usually cannot be seen in an intact cyclosystem. Dactylotomes 85–100 µm wide. Pseudosepta unequal in length — most pseudosepta within a cyclosystem are identical in length but 3 or 4 usually project less deeply into the gastropore tube, some only half the length of a typical pseudoseptum. Pseudosepta wedge shaped, 1.5–2.0 times dactylotome width at their outer edges, with flat to slightly concave upper edges; inner pseudoseptal edges vertical.

Female ampullae unknown. Male ampullae discrete hemispherical bulges 0.7 mm in diameter, several of which encircle a cyclosystem. Male efferent pores appear to be irregularly shaped, 45–50 µm in diameter, occurring on the inner, upper edges of the pseudosepta.

TYPES: Holotype: NZOI Stn E860, 1 col., NZOI H-589. Paratypes: NZOI Stn E305, 1 male col., NZOI P-923, 2 male branches and SEM stub 650, USNM 87565; Stn S568, 1 col., NZOI P-921, SEM stub 649 (USNM); Stn U599, 2 male cyclosystems, NZOI P-922, 2 male cyclosystems, USNM 87566.

TYPE LOCALITY: NZOI Stn E860, 32°21'S, 167°41'E, southern Norfolk Ridge; 1246–1258 m.

ETYMOLOGY: The species name *curvata* (from the Latin *curvatus*, curved, bent) refers to the curved gastropore tubes characteristic of this species.

REMARKS: Only one other species of *Crypthelia* has male efferent pores that open through the upper pseudosepta (C3 designation of Cairns,1986b), *C. cymas*, a species also known from the New Zealand region at similar depths. *Crypthelia curvata* is distinguished from *C. cymas* by having an elongate, curved gastropore tube; somewhat smaller cyclosystems; thinner cyclosystem lids; and thicker pseudosepta (Table 7).

Disregarding ampullar formula, *C. curvata* is most similar to *C. fragilis*, both species having delicate

uniplanar colonies and similarly sized and shaped cyclosystems, pseudosepta, and cyclosystem lids. *Crypthelia curvata* differs in having curved gastropore tubes, differently positioned male efferent pores, slightly more robust colonies, and much broader coenosteal platelets. Furthermore, although both species occur in relatively deep water, *C. fragilis* is known only from the Subantarctic region south of New Zealand, and *C. curvata* only from the ridges north of New Zealand.

Crypthelia cymas Cairns, 1986
(Plates 75, a–f, 76, a–d)

Cryptohelia [sic] sp. cf. *C. pudica*: Moseley 1876 : 548, 557 (in part: specimens off Raoul Island).
Cryptohelia [sic] *pudica*: Moseley 1881 : 82–83 (in part: *Challenger* Stn 171).
Crypthelia cymas Cairns, 1986b : 33–36, figs 22A–I, 23A–C, 27H.

MATERIAL EXAMINED: NZOI Stn E306, 1 female col., NZOI; Stn E861, 10 col. and branches, NZOI, 4 col. and SEM stubs 630–632, 694, USNM 87569; Stn P8, 1 male col., NZOI; Stn P46, 2 male col., NZOI; *C. pudica* of Moseley (1881), *Challenger* Stn 171, 6 col., BM(NH) 1880.11.25.186.

DISTRIBUTION: Norfolk Ridge, Three Kings Ridge, Kermadec Ridge (Moseley 1881), 263–757 m; Galápagos Islands; 166-806 m.

DESCRIPTION OF NEW ZEALAND SPECIMENS: Colonies uniplanar and large; the largest colony examined (NZOI Stn E861) 9.8 cm tall and 5.3 cm broad, with a basal branch diameter of 6.3 mm; however, a basal fragment (also from NZOI Stn E861) 10.5 mm in diameter attests to much larger coralla. Branches occasionally anastomose. Distal branches slender, of lesser diameter than the cyclosystems they bear. Polychaete commensals present on main basal branches of some, but not all, colonies. Linear-imbricate coenosteal strips 40-50 µm wide, bordered by thin, often obscure, slits about 5 µm wide. Platelets usually continuous across strip but corrugated, producing a rough microtexture (Plate 75, d). Relatively low (10–13 µm tall), circular to elliptical nematopores occur abundantly on branch coenosteum, as well as on cyclosystem lids (especially the edges), under the lids, and on pseudosepta, where as many as 4 may occur per cyclosystem.

Cyclosystems exclusively unifacial and elliptical in outline, up to 2.3 x 1.8 mm in diameter. Cyclosystems stand exsert from branch coenosteum as much as 1 mm, female cyclosystems being slightly flared. Mature male cyclosystems girdled with ampullae resulting in a rotund, nonflared shape. Cyclosystems toward base of colony obsolete and often filled with coenosteum. There is no sexual dimorphism regarding number of dactylopores per cyclosystem — based on 25 female cyclosystems, the range was 15–18, average 16.24 (σ = 1.20), and mode 16; based on 25 male cyclosystems, the range was 13–19, average also 16.24 (σ = 1.33), and mode 17. Cyclosystem lids longer than broad and tongue shaped to rectangular, with rounded distal edges. Cyclosystems lids horizontal and 0.65–1.0 mm wide, covering 50–70% of the cyclosystem (80–90% in gravid female cyclosystems). Proximal section of lid swollen with ampullae in sexually mature cyclosystems of both sexes.

Upper cylindrical section of gastropore tube encircled by dactylotomes and pseudosepta to a depth of about 1 mm. Intermediate (upper gastropore chamber) tube roughly spherical (about 0.6 mm in diameter), with both upper and lower edges truncate (toroidal), such that it is only about 0.3 mm deep. The lower truncate border of the upper gastropore tube is the gastropore ring constriction, which is about 0.33 mm in diameter. Lower chamber also roughly spherical and of greater diameter (e.g., 0.8 mm), its upper edges enveloping the gastropore ring constriction (Plate 76, a) and continuous with the dactylopores. Dactylotomes of fairly uniform width, 0.12–0.14 mm. Outer edges of pseudosepta equal to dactylotome width, but narrowing to very slender inner edges bordering the gastropore. Upper edges of pseudosepta slightly concave and inclined downward toward gastropore.

Female ampullae massive swellings in proximal cyclosystem lid and wall, up to 4 occurring per cyclosystem. Female efferent pores rarely seen in study material, but when present, open on underside of lid and are about 0.25 mm in diameter. Multiple male ampullae form a continuous cavity encircling each cyclosystem and produce the characteristic swollen aspect. Male efferent pores exit through upper edges of pseudosepta, the pores being 70–100 µm in diameter and irregular in outline. Male efferent pores occur in same position and are about same size as pseudoseptal nematopores, but are distinguished by the complete perforation of the pseudoseptum and their irregular outline (Plate 76, c). Numerous male efferent pores occur within each cyclosystem.

TYPES: The holotype and most paratypes are deposited at the USNM (72106, 72107, respectively); one colony is also at the BM(NH)(1984.9.28.10).

TABLE 7. Characteristics of the six New Zealand species of *Crypthelia*
(cs = cyclosystem, dt = dactylotomes, gcsd = greater cyclosystem diameter, e.p. = efferent pores)

Character	*C. studeri* n.sp.	*C. robusta* n.sp.	*C. polypoma* n.sp.	*C. fragilis*. Cairns, 1983	*C. curvata* n.sp.	*C. cymas* Cairns, 1986
Cyclosystem diameter	Up to 2.3 x 1.8 mm	Bimodal; 2.5/4.5 mm in gcsd	Variable: 1.1–2.2 mm in gcsd	1.0–1.8 mm in gcsd	1.3–1.8 mm in gcsd	Up to 2.3 x 1.8 mm
Cyclosystem lid: shape; cover; orientation	Elongate; 30–40%; slightly inclined upward	Broad; 80–90%; horizontal and low	Broad; 80–90%; horizontal (arched), 1–3 accessory lids fused with primary lid	Elongate and slender; 10–20%; inclined upward	Elongate; 10–20%; slightly inclined upward	Elongate, tongue-shaped; 50–90%; horizontal
Pseudosepta: width relative to dactylotome; relative lengths; upper edge	Thinner than dt; equal; concave	Much tinner; unequal; smooth and solid	Broader (1.5–3.0 x dt width); equal; concave	Broader (1.5–2.0 x dt width); equal; concave	Broader (1.5–2.0 x dt width); slightly unequal; concave	Equal in width to dt; equal; slightly concave
Range and average no. of dactylopores/cs	11–22, x = 16.16	Large css: 19–23, x = 21.72 Small css: 9–17, x = 13.76	12–17, x = 15.71	13–18, x = 15.71	15–21, x = 17.79	13–19, x = 16.24
Ampullar formula	B–C1	B–C1	?–C1, male ampullae ridged	B-C1	?–C3	B-C3
Other distinguishing characteristics	Polychaete tubes always present; branches highly anastomosing	Broad, nonseptate cs lips present		Coenosteal platelets narrow; nematopores occur regularly	Gastropore tube elongate and curved	Colonies large; polychaete tubes present; 1–4 nematopores per ps
Distribution	Throughout New Zealand region; 343–1940 m	Southern Norfolk and Three Kings Ridges; 128–757 m	Ridges north of New Zealand; 590–814 m	Subantarctic islands and seamounts; 952–2329 m	Ridges north of New Zealand; 282–1258 m	Ridges north of New Zealand, Galápagos; 263–757 m

TYPE LOCALITY: *Albatross* Stn 2818, 0°29'S, 89°54.5'W, northeast of Santa Cruz, Galápagos; 717 m.

REMARKS: Four male colonies from NZOI Stn E861 display a pattern of variation that deserves special mention. In an otherwise homogeneous lot of specimens that do not have polychaete commensals, these four specimens do have polychaete worm tubes. Correlated with this difference is that its cyclosystems are smaller (about 1.4 mm in diameter), but have extensively flared outer lips (Plate 75, e, f) and broader cyclosystem lids. Since all other characters are the same, these differences are assumed to have been caused by the polychaete commensal and therefore fall within the range of variation of *C. cymas*.

The New Zealand specimens of *C. cymas* were carefully compared to the type series of *C. cymas* from the Galápagos Islands, and, although some slight differences were noted, all specimens are considered to be conspecific. The differences are that the Galápagan specimens do not have upper pseudoseptal edge nematopores, and they have a slightly higher average number of dactylopores per cyclosystem. Thus, although it is unusual for a stylasterid to have such a broad distribution, I cannot justify the description of a new species based on these grounds.

Only one other species of *Crypthelia* has male efferent pores that open through the upper pseudosepta — *C. curvata*. Comparisons to that species are made in the account of that species as well as in Table 7.

Pseudocrypthelia Cairns, 1983

Gastro- and dactylopores arranged in cyclosystems, which occur exclusively on anterior face of colony; fixed lids cover cyclosystems. Colonies small, delicate, and primarily uniplanar. Coenosteum white and linear-imbricate in texture. Nematopores large and mound shaped, occurring on pseudosepta, ampullae, branch coenosteum, and even within upper gastropore tube. Gastropore tube double chambered. Small, rudimentary gastrostyles present; dactylostyles absent. Male ampullae contained in cyclosystem lids.

TYPE SPECIES: *Cryptohelia pachypoma* Hickson and England, 1905, by original designation (Cairns 1983c).

REMARKS: *Pseudocrypthelia* is a monotypic genus, recently discussed and illustrated by Boschma (1968d) and Cairns (1983c).

DISTRIBUTION: Norfolk Ridge; Sulu Sea (*Albatross* Stn 5569); Jilolo Passage, east of Halmahera, Indonesia; 555–1069 m.

Pseudocrypthelia pachypoma (Hickson & England, 1905) (Plates 76, e–h, 77, a–d)

Cryptohelia pachypoma Hickson & England, 1905 : 22–23, pl. 3, figs 24–25; England 1926 : 281.

Crypthelia pachypoma: Boschma 1953 : 167; 1956 : F100, fig. 82,1b; 1957 : 35–36 (part: not *Albatross* Stn 2818, = *Crypthelia lacunosa*).

Calyptopora pachypoma: Boschma 1968a : 107; 1968d : 315–320, pl. 1, figs 1–5, text-figs 1–2; Cairns 1983b : 430.

Pseudocrypthelia pachypoma: Cairns 1983c : 31–32, pls 1–3.

MATERIAL EXAMINED: NZOI Stn G3, 1 male col., NZOI, 1 fragment and SEM stub 651, USNM 87567; types.

DISTRIBUTION: Norfolk Ridge; Jilolo Passage, east of Halmahera; 505–1069 m.

DESCRIPTION OF NEW ZEALAND SPECIMEN (NZOI STN G3): Colony uniplanar and quite delicate, 16.5 mm tall and 14.7 mm broad, with a basal branch diameter of 1.6 mm. Colony composed of 2 main branches from which short, smaller-diameter branches originate in seriatim, some of the lateral branchlets limited to only 1 cyclosystem; branches not anastomosing. Branches circular in cross section and very slender, branches supporting terminal cyclosystems only about 0.3 mm in diameter. Linear-imbricate coenosteum composed of slender, slightly convex strips 22–52 µm wide, bordered by thin, elongate slits about 4 µm wide. Platelets continuous across strip, low in relief, and regular in arrangement, each platelet revealing 12–15 µm of its leading edge. Large, mound-shaped nematopores common on branch coenosteum, cyclosystem lids, upper and inner pseudoseptal edges, and within gastropore tube. Nematopore mounds up to 30 µm tall and 40 µm in basal diameter, each with a circular apical pit about 13 µm in diameter.

Cyclosystems circular to slightly elliptical, 0.71–0.75 mm in diameter. Based on 23 cyclosystems (all cyclosystems available for analysis), the range of dactylopores per cyclosystem is consistently 12–14, average 13.04 (σ = 0.64), and mode 13. Cyclosystem lids have a relatively narrow base but broaden to cover the entire cyclosystem, in many cases even extending beyond cyclosystem edges.

Lids horizontal and longitudinally creased above, occasionally fusing to distal cyclosystem edge.

Upper gastropore tube broad and shallow, the upper 0.2 mm flanked by dactylotomes and pseudosepta, the lower 0.15 mm (upper gastropore chamber) continuing in an infundibuliform shape to the gastropore ring constriction. Upper chamber linear-imbricate in texture bearing numerous mounded nematopores (Plate 77, d). Gastropore ring constriction about 0.20 mm in diameter; lower chamber fairly shallow, about 0.15 mm deep, containing the centrally placed gastrostyle. Gastrostyle conical (Plate 77, c, d), about 0.13 mm tall and 0.14 mm in basal diameter (H : W = 0.93), its pointed tip extending almost to gastropore ring constriction. Gastrostyle irregular in surface topography, bearing granules or small, pointed spines. Dactylotomes quite narrow (only about 20 µm wide), reduced in width by adjacent overreaching pseudoseptal edges. Pseudosepta quite broad, up to 6 times dactylotome width and having slightly concave upper edges.

Female ampullae unknown. Male ampullae small mounds about 0.5 mm in diameter occurring within cyclosystem lids.

TYPES: Lectotype and three paralectotypes are deposited at the ZMA (Coel. 7394).

TYPE LOCALITY: *Siboga* Stn 150, 0°06'N, 129°07.7'E, Jilolo Passage, east of Halmahera, Indonesia; 1089 m.

REMARKS: The specimen reported herein is the only additional specimen reported subsequent to its original description. The New Zealand specimen differs from the type specimens in having a more delicate corallum with smaller cyclosystems (0.71 mm vs 1.2 mm in the lectotype) and correspondingly fewer dactylopores per cyclosystem (12–14, average of 13.04 vs 13–19, average of 16.1 for the lectotype). Otherwise the two specimens are identical. Another specimen in this genus but not identified as *P. pachypoma* (*Albatross* Stn 5569, USNM 87568) from the Sulu Sea, has larger cyclosystems than the lectotype, up to 1.6 mm in diameter, and contains up to 21 dactylopores per cyclosystem.

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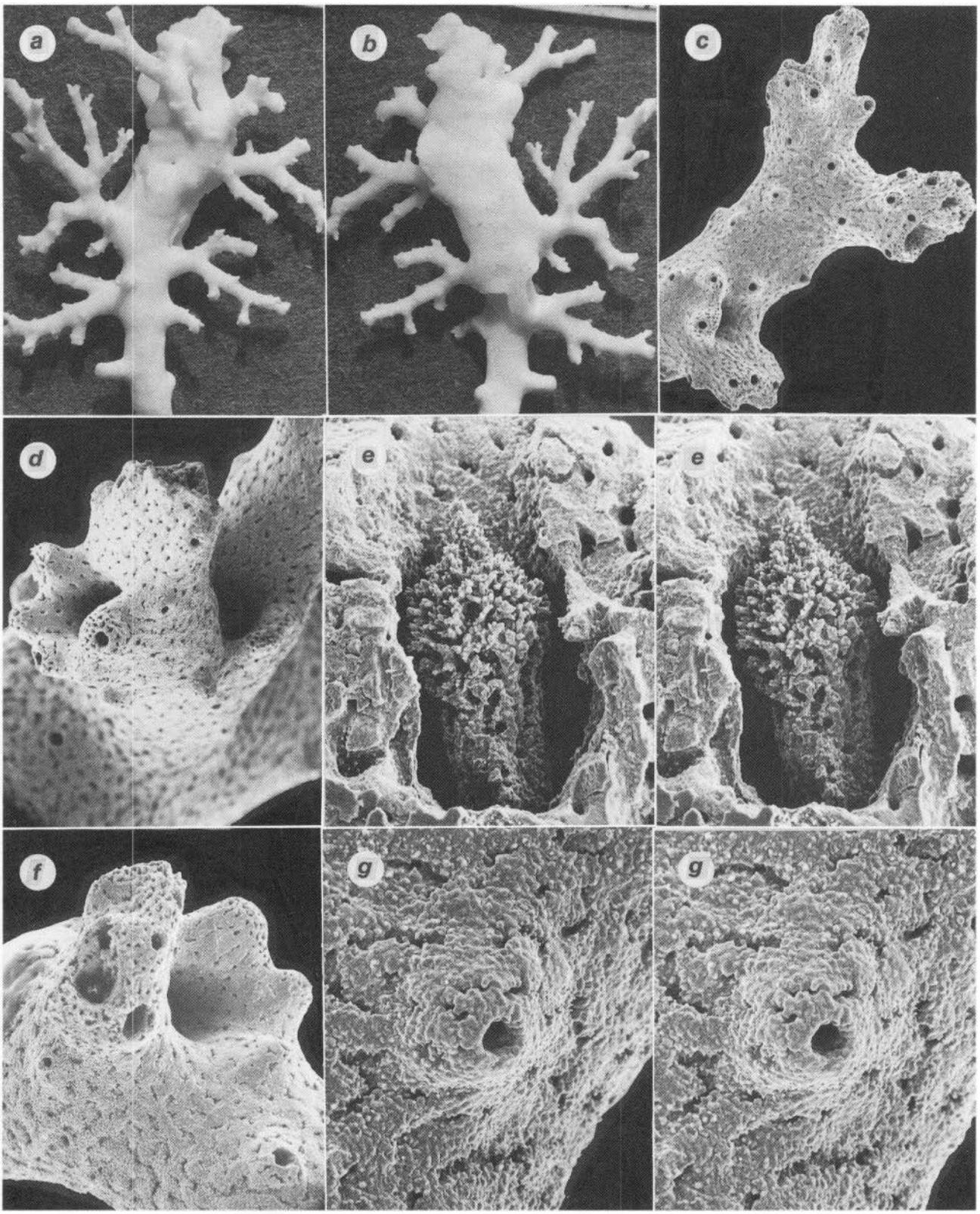

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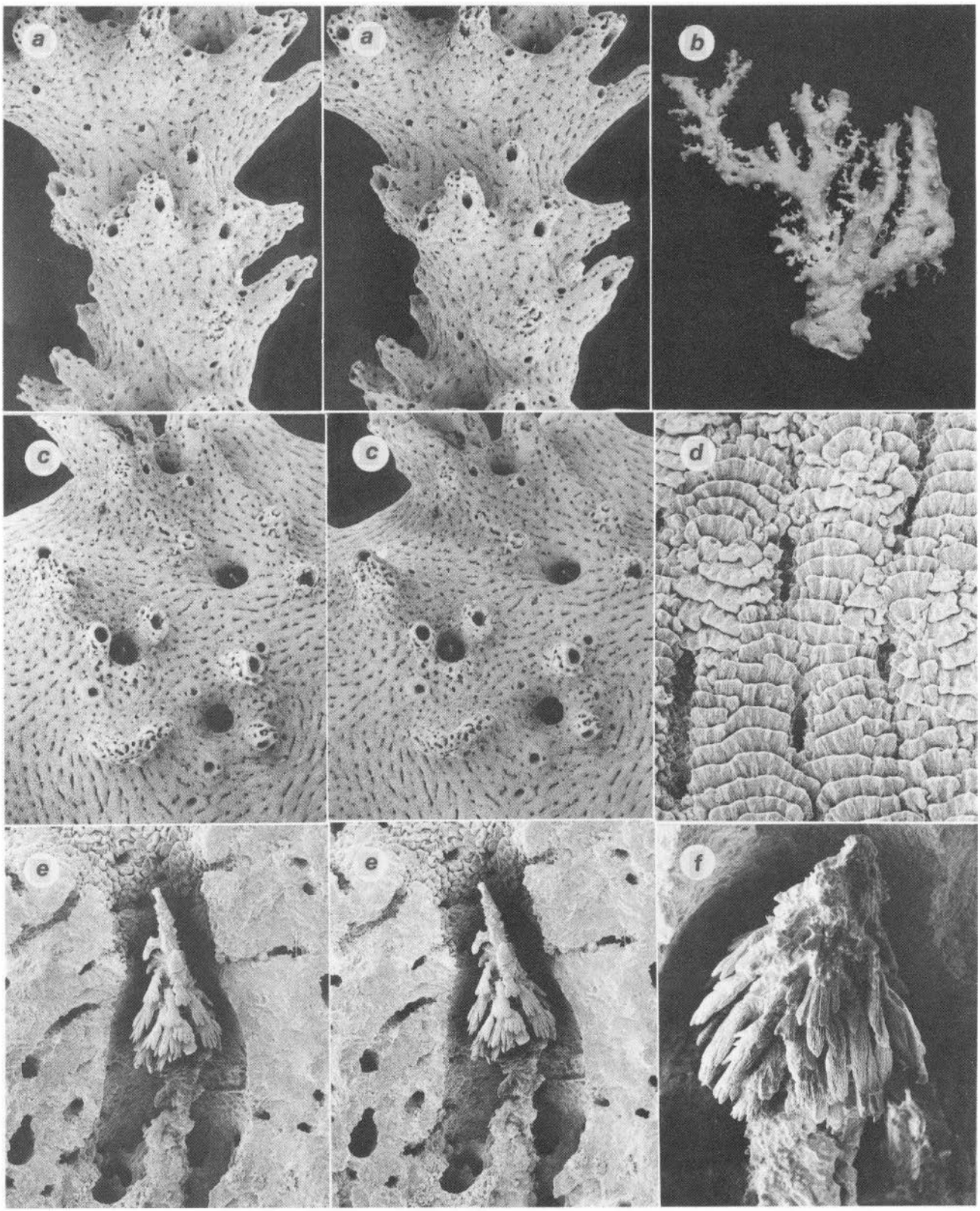

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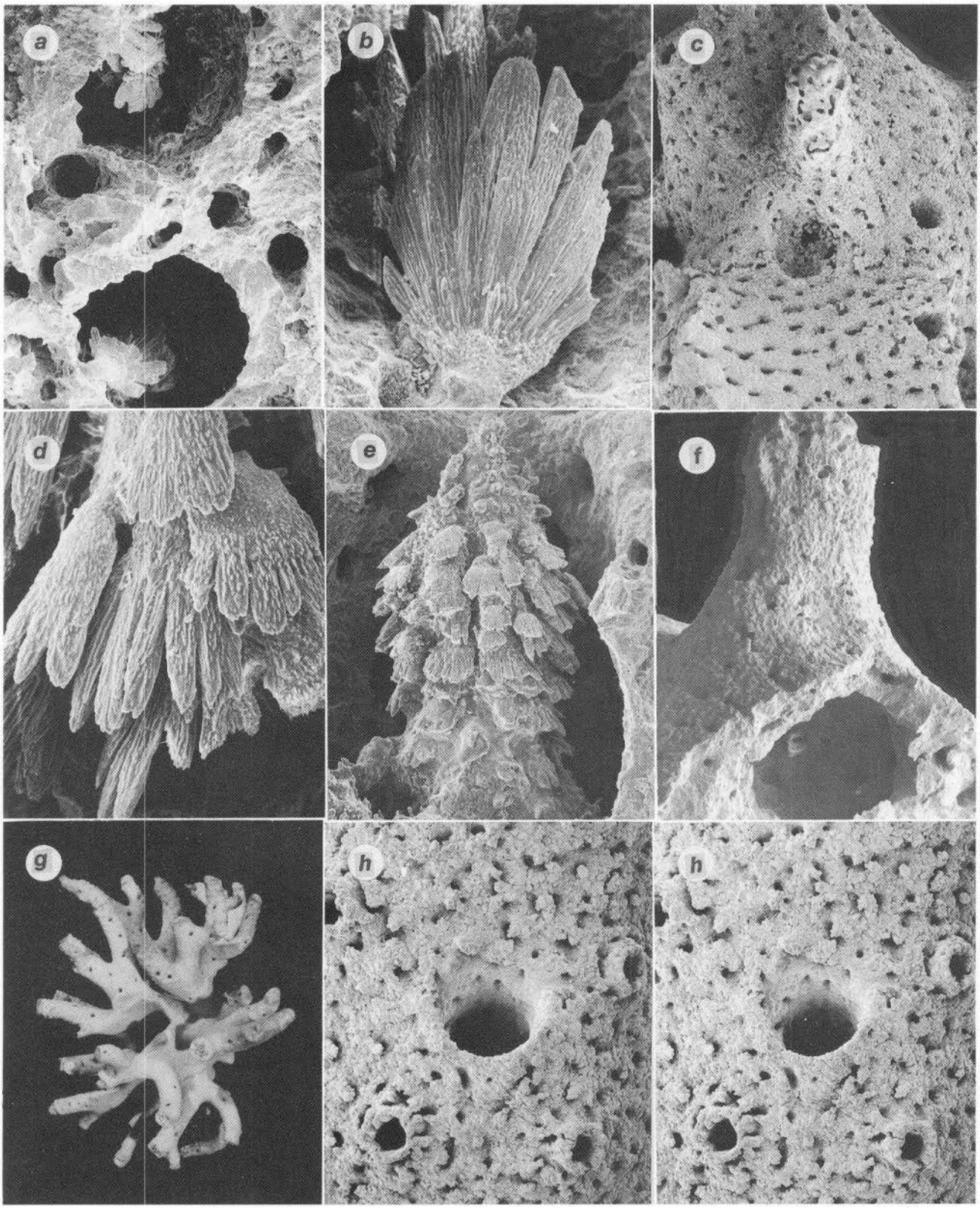

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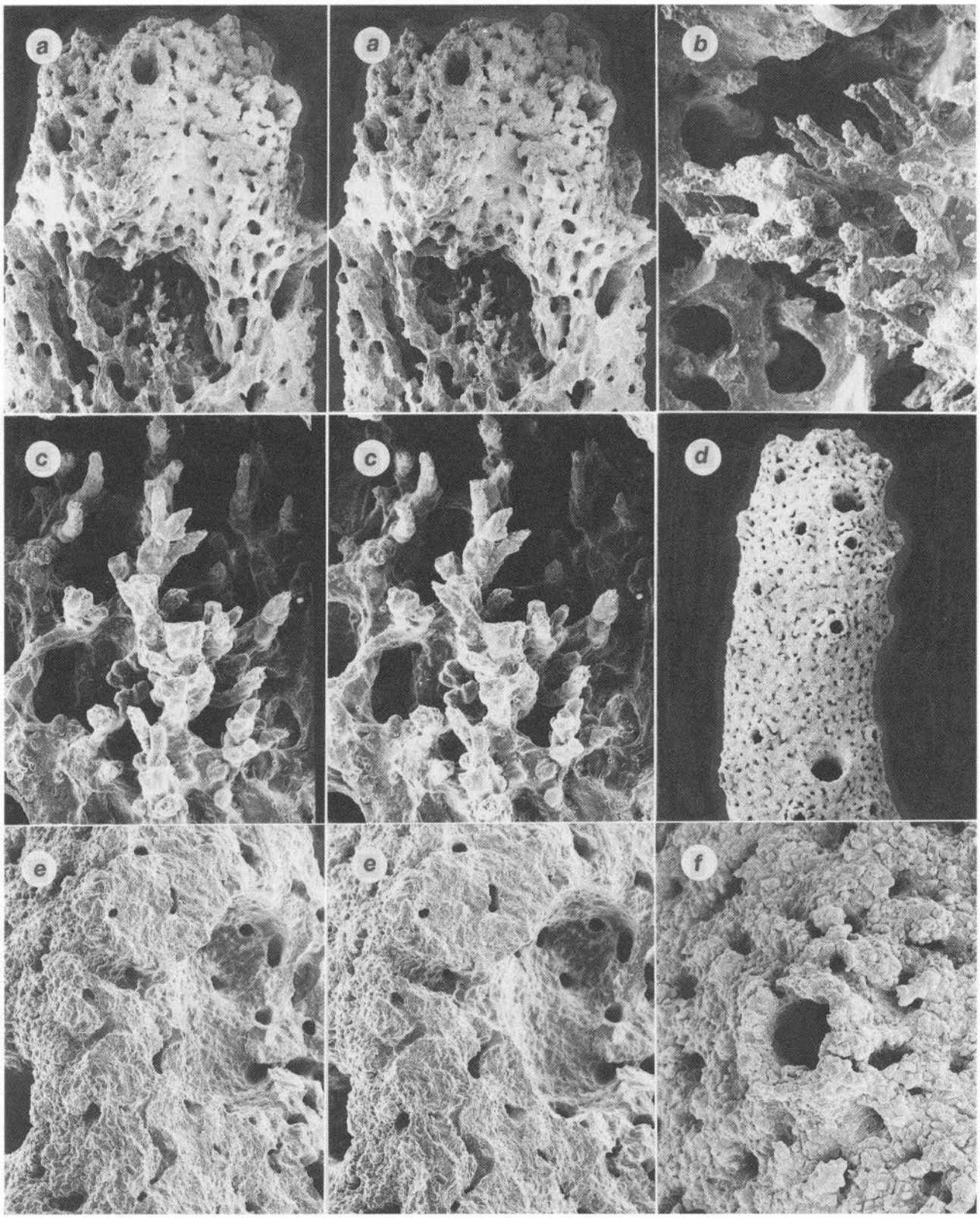

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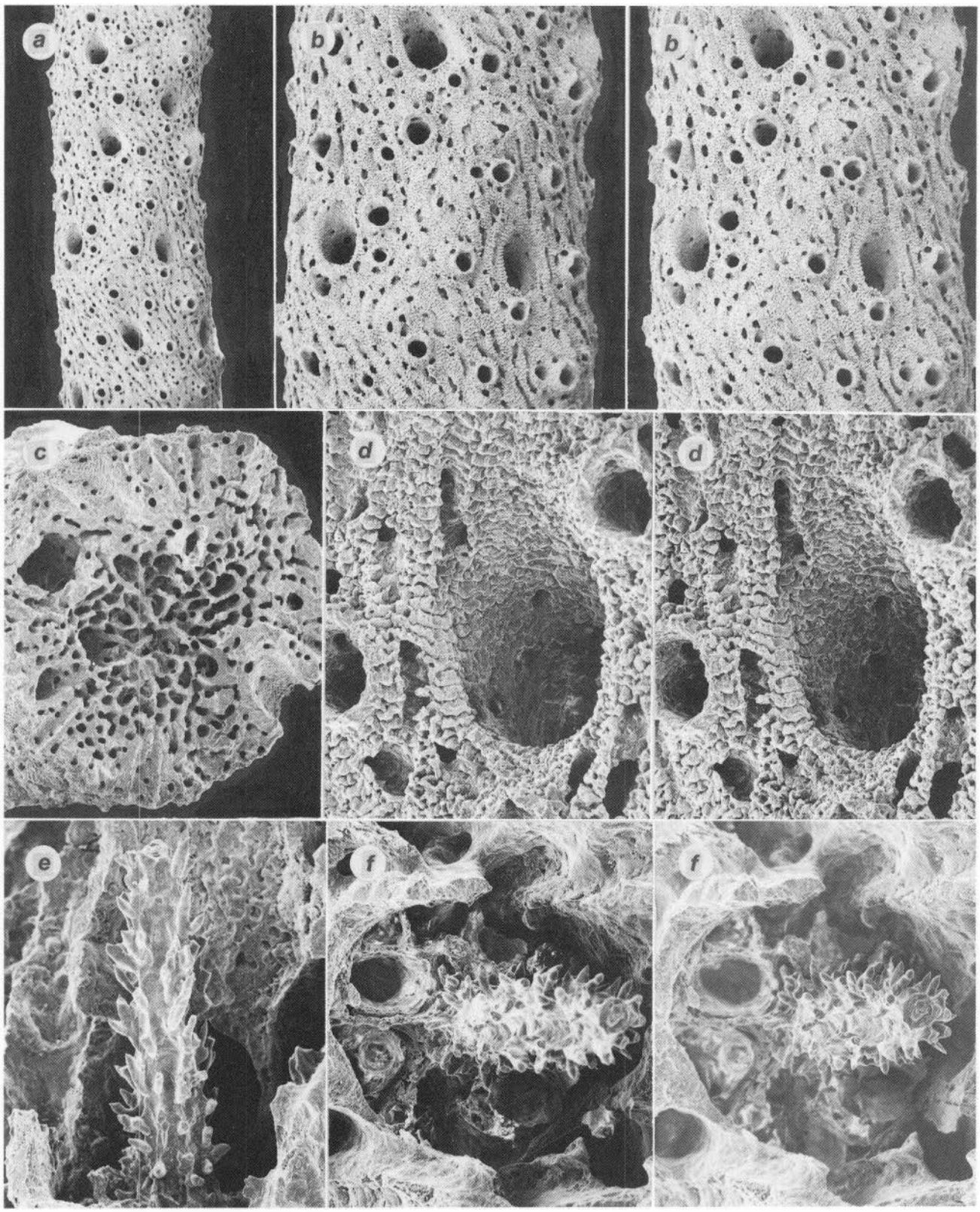

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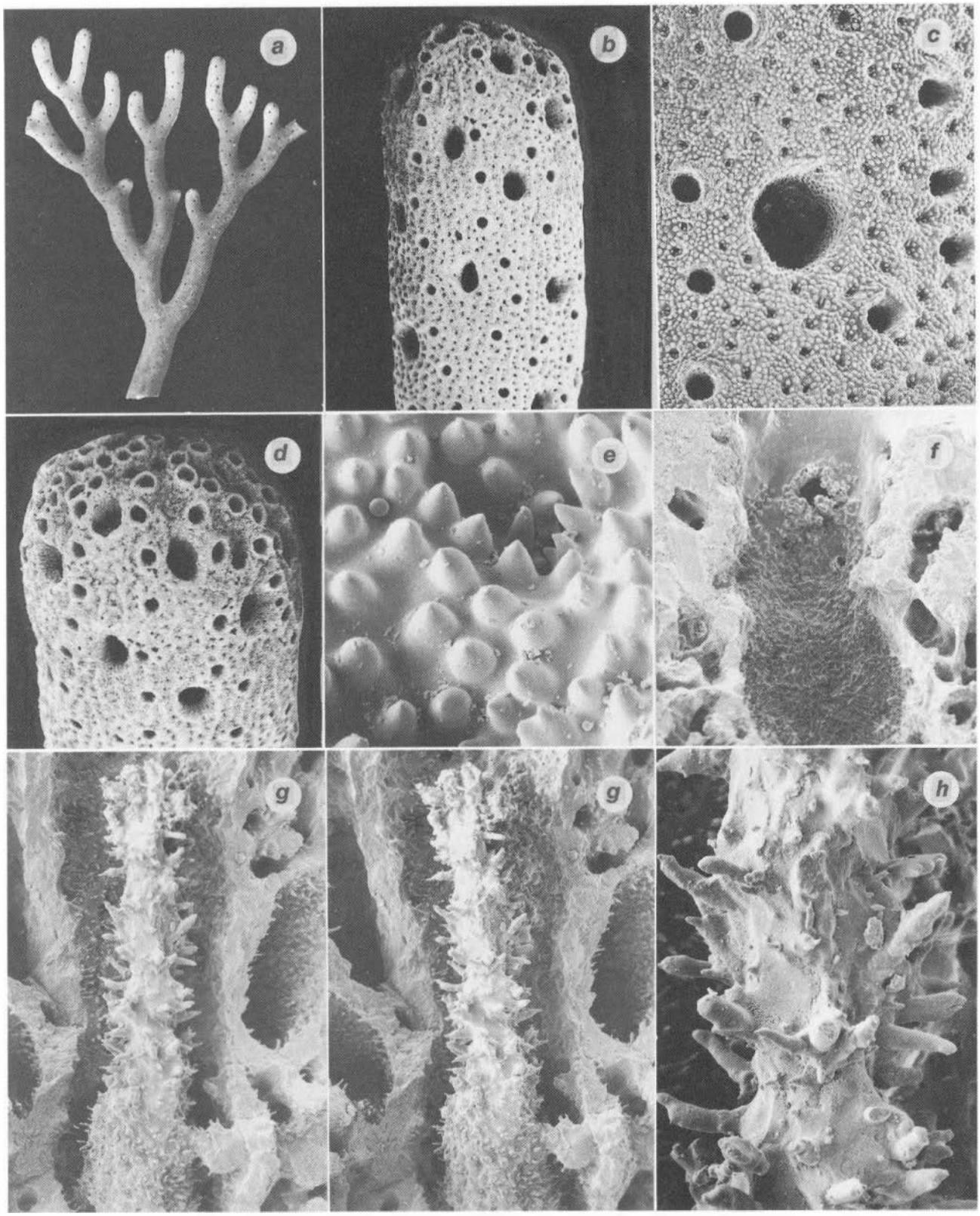

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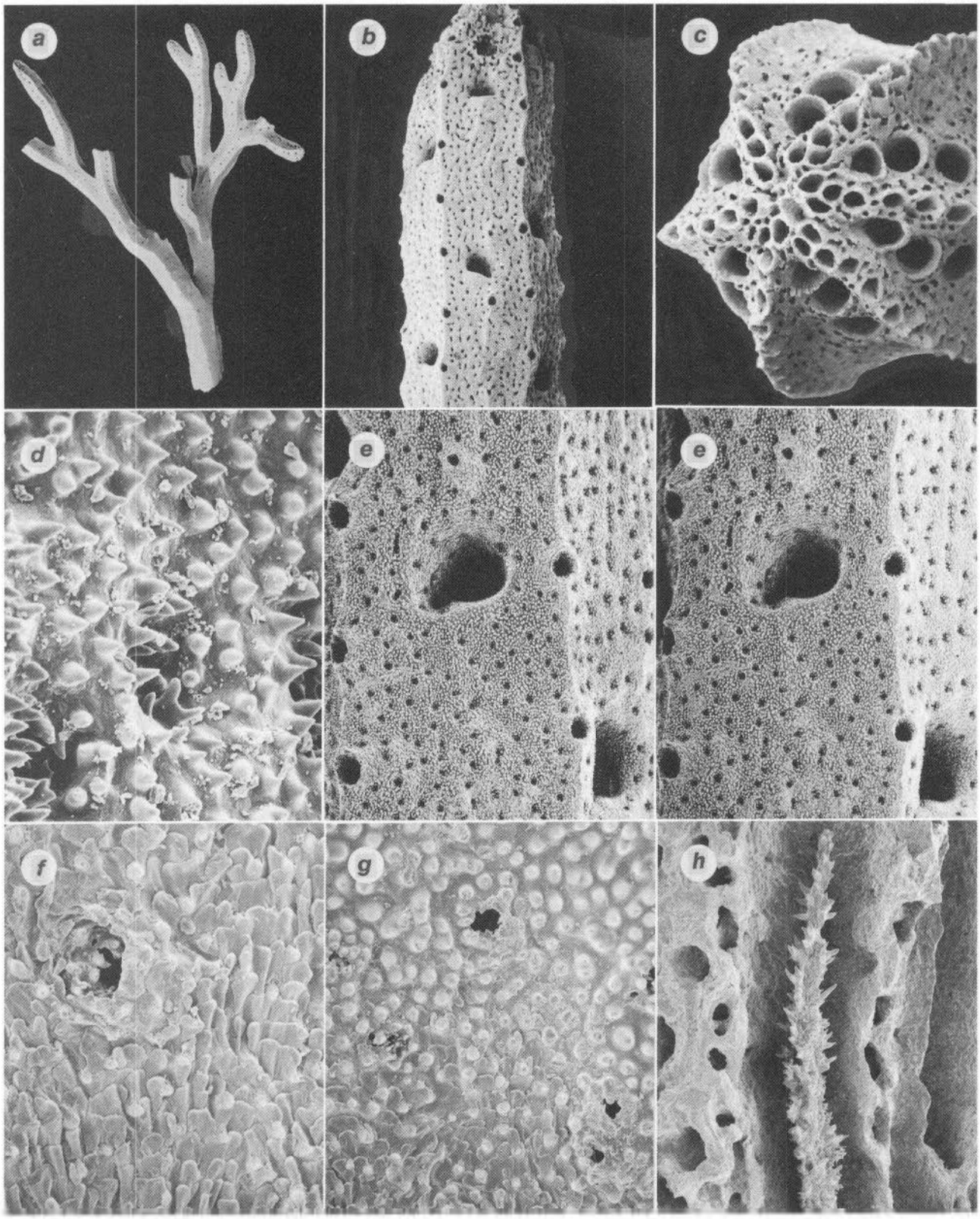

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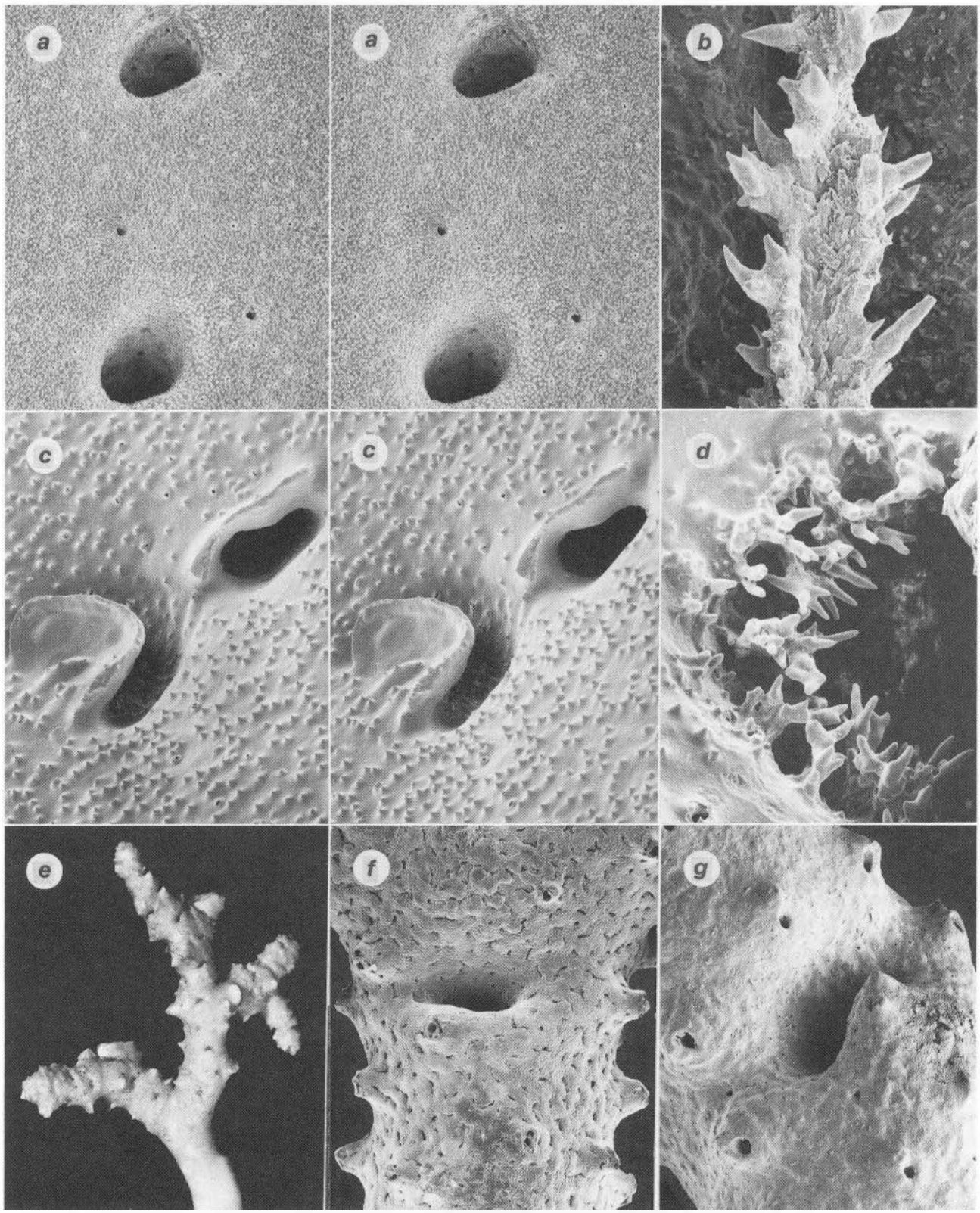

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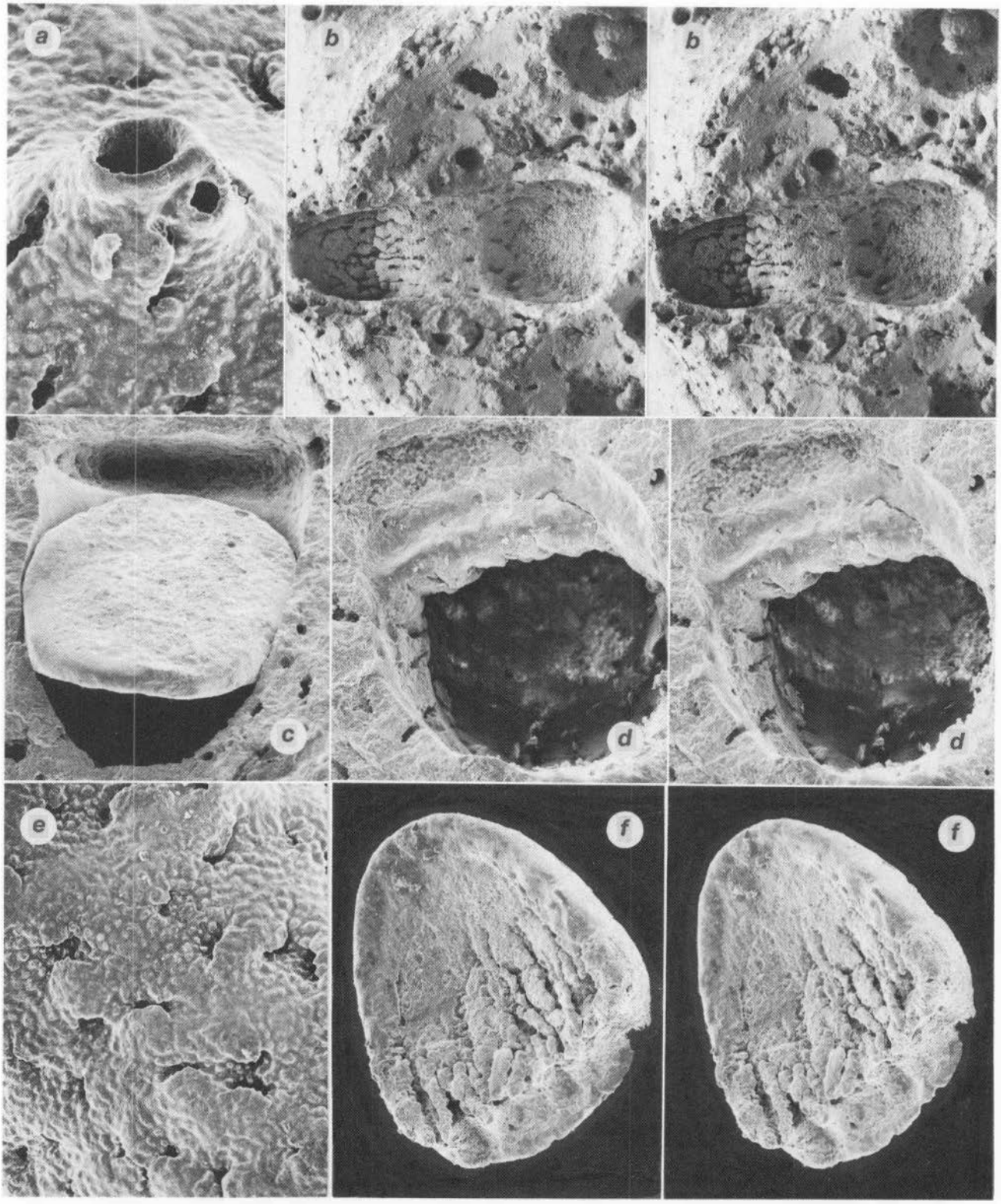

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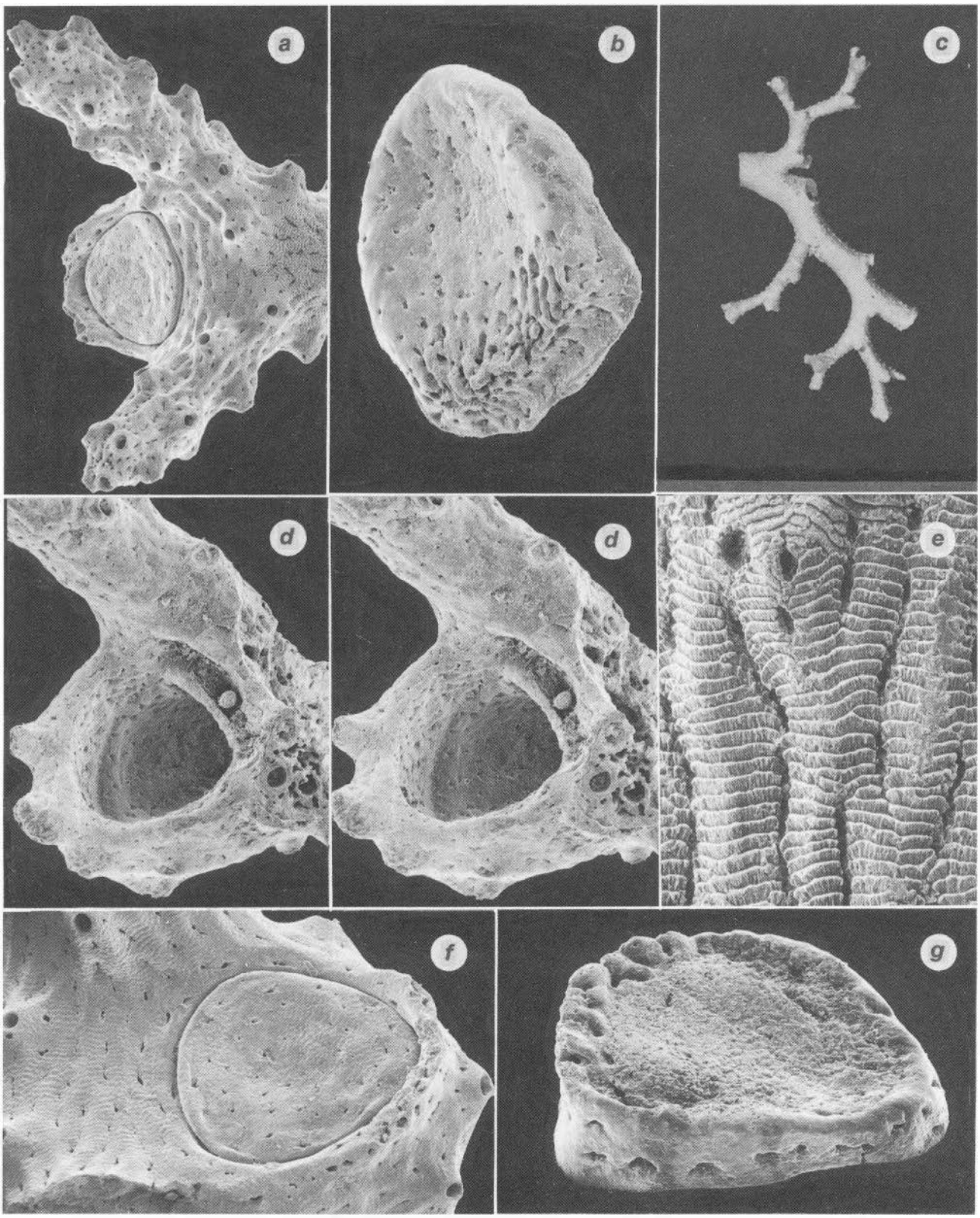

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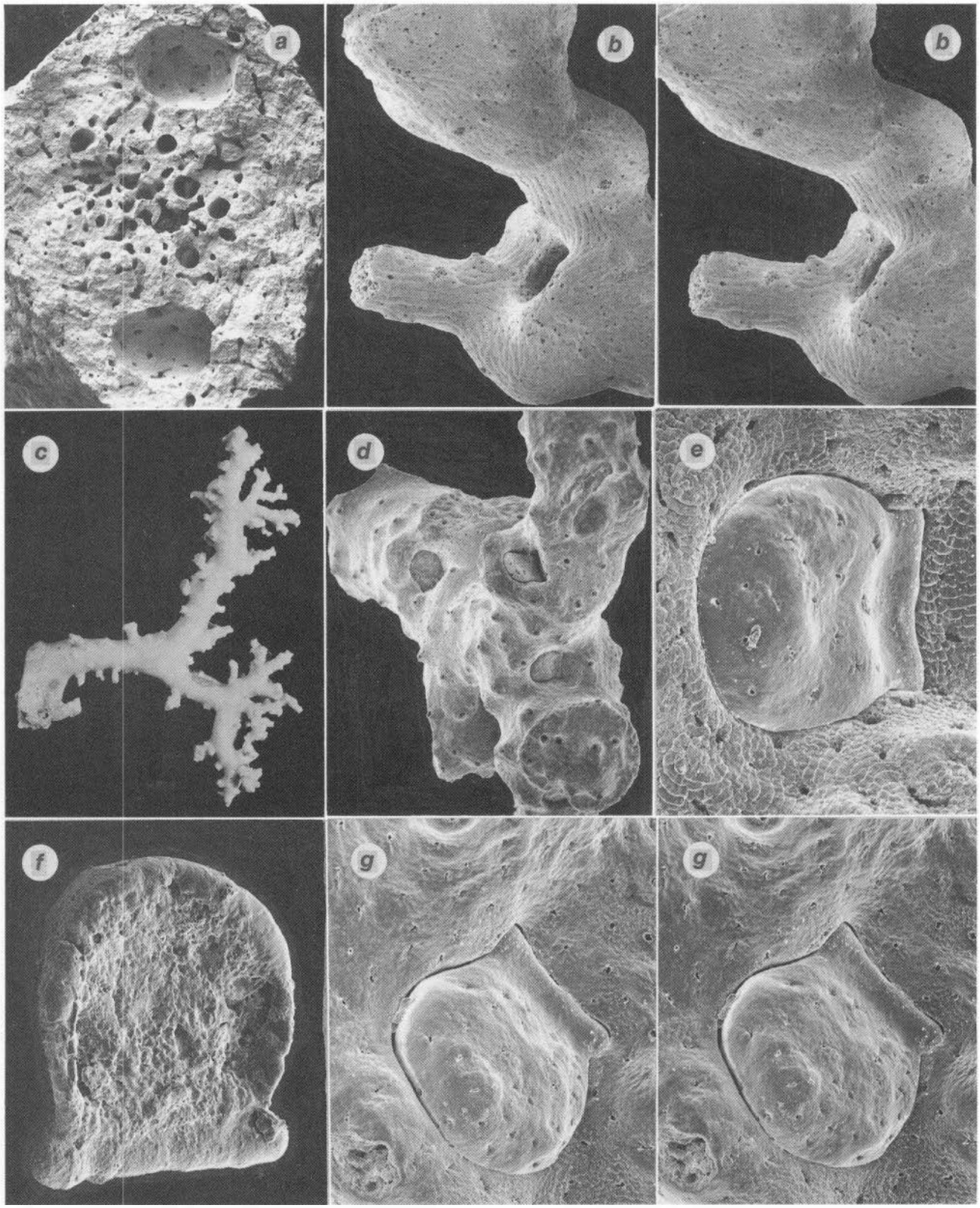

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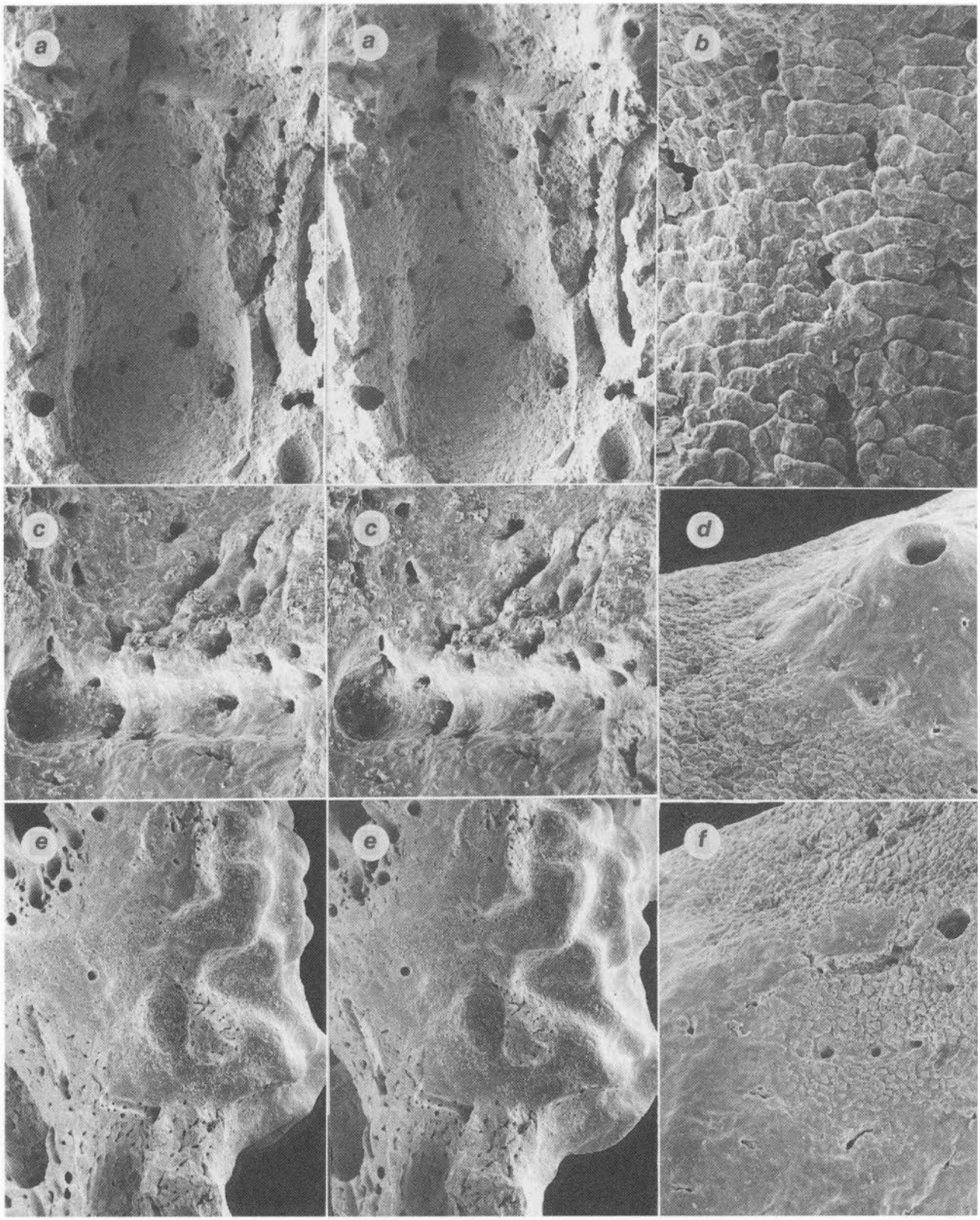

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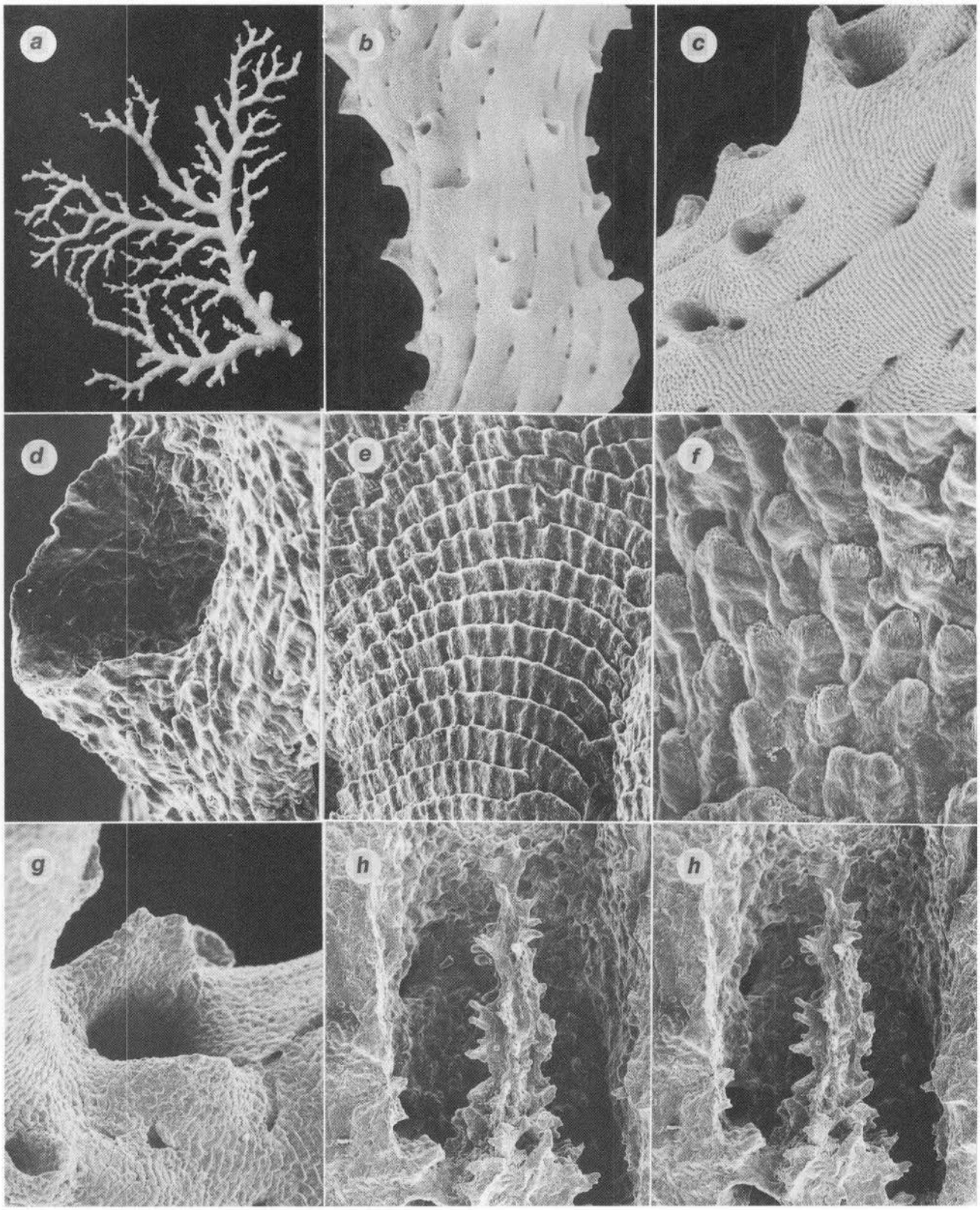

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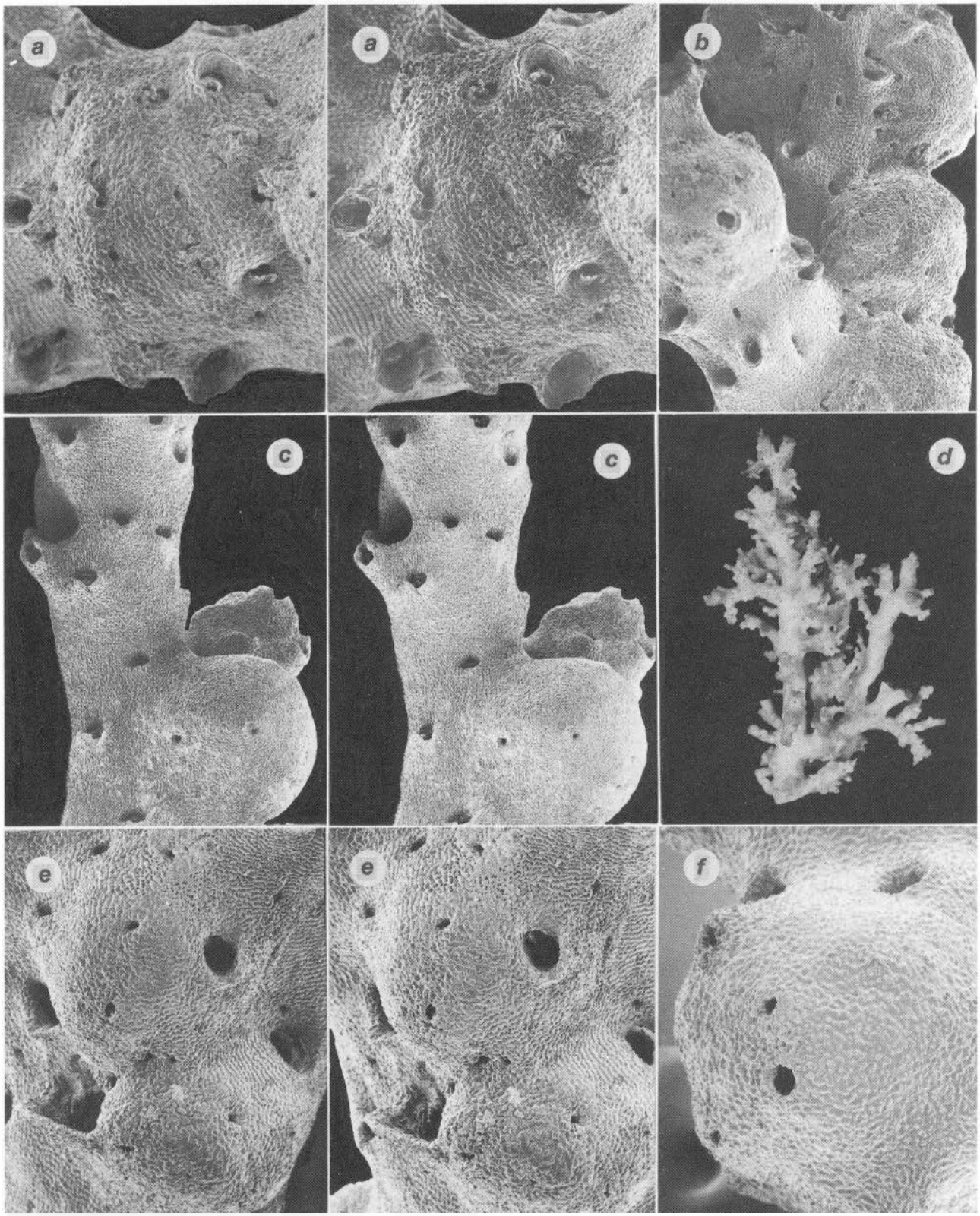

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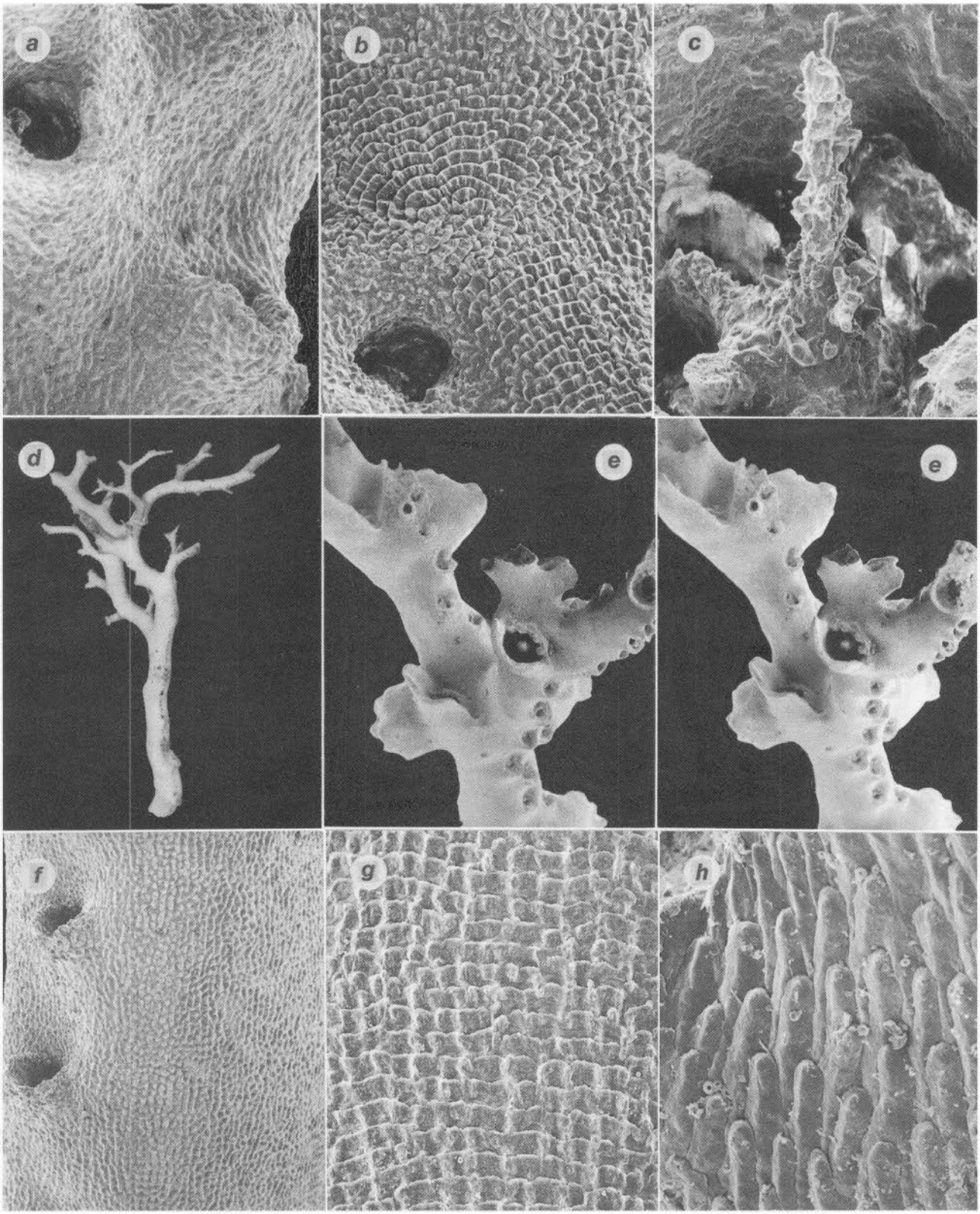

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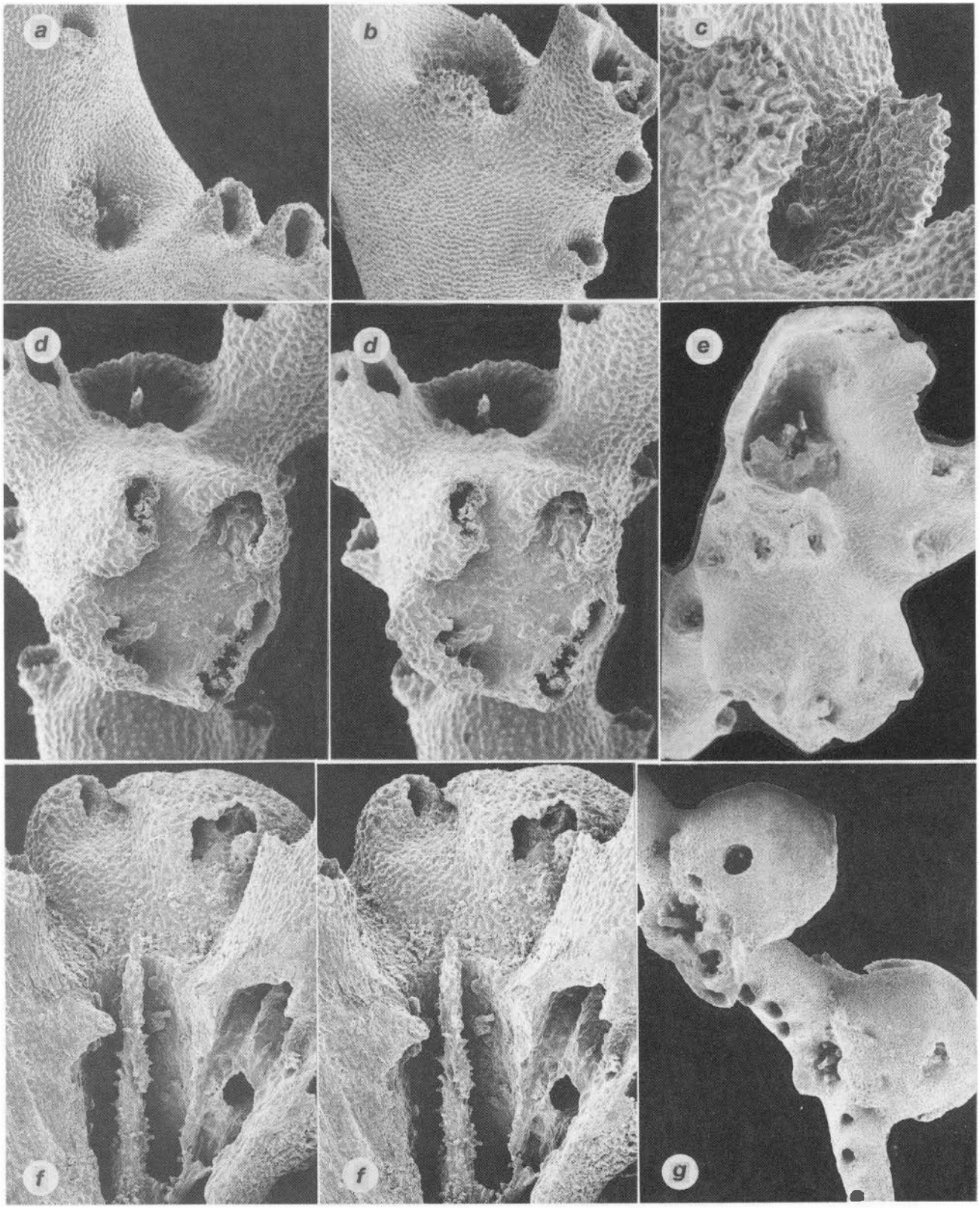

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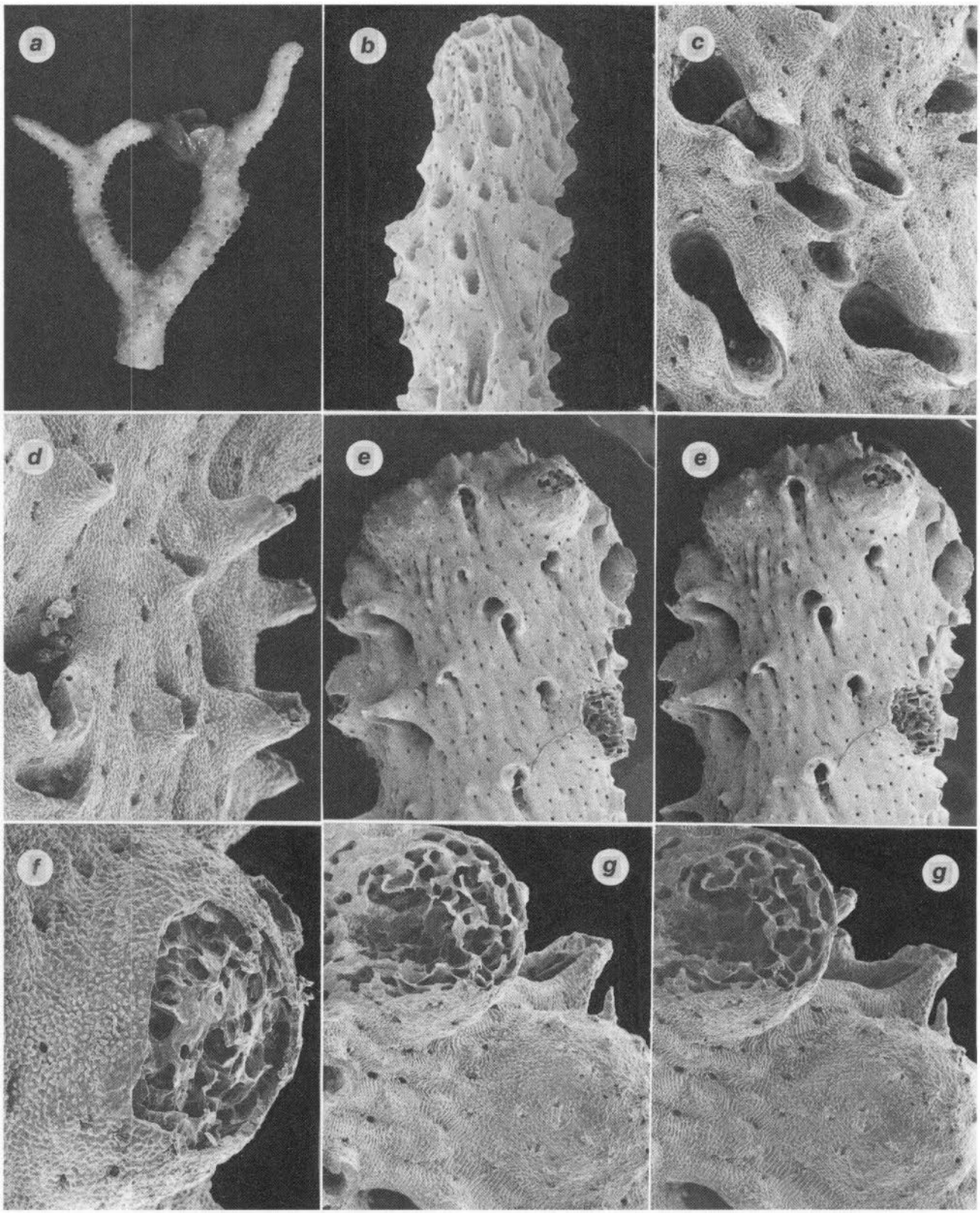

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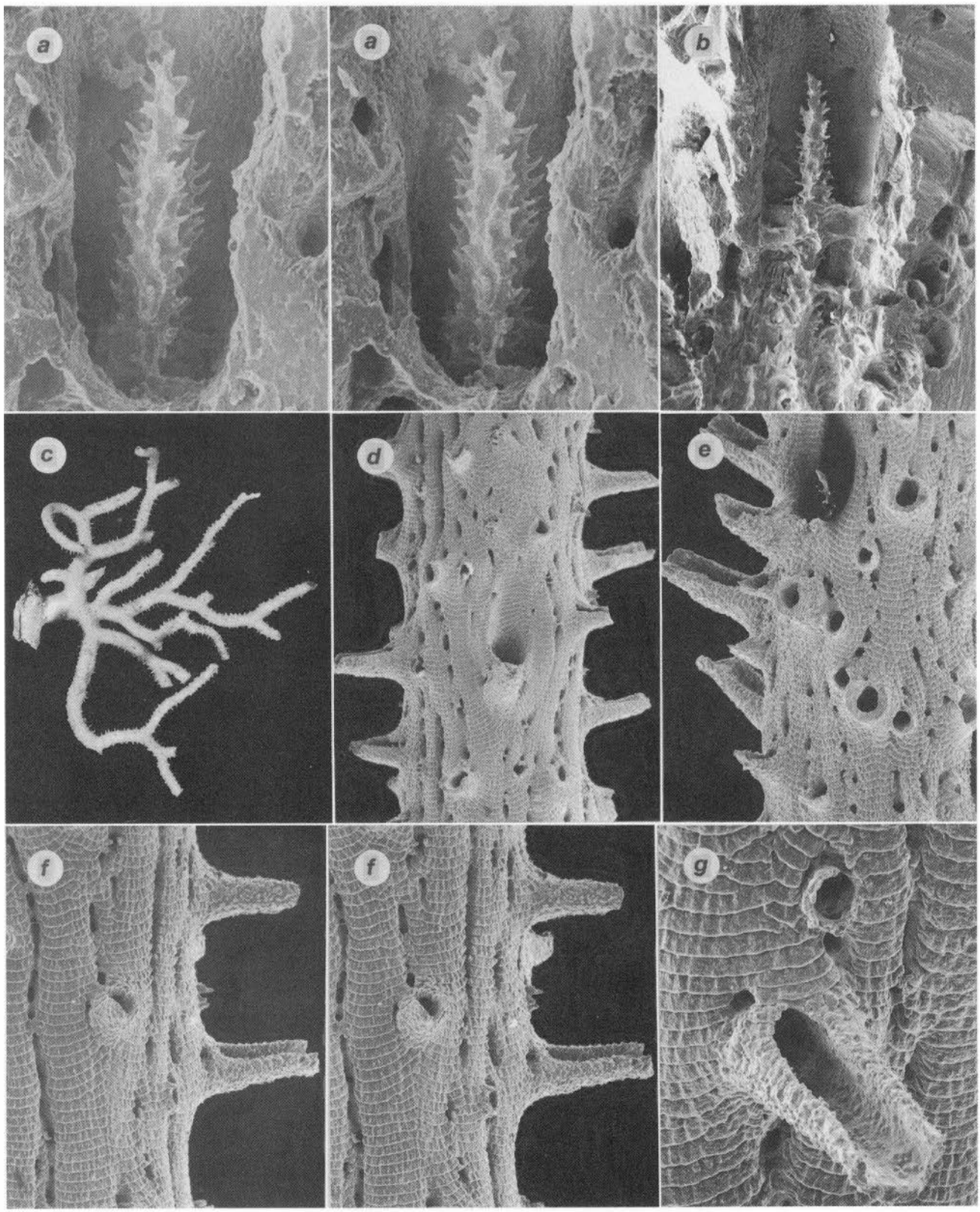

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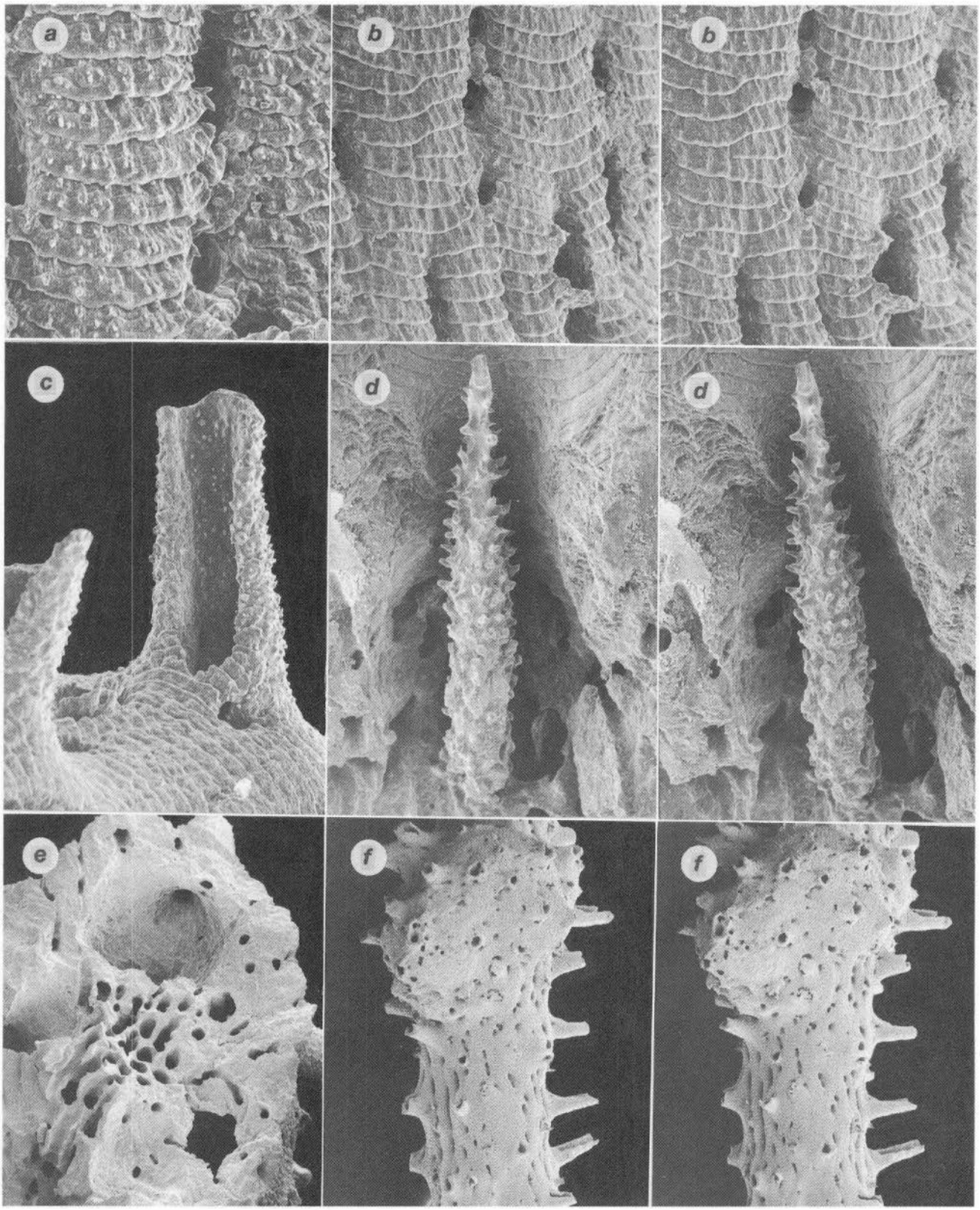

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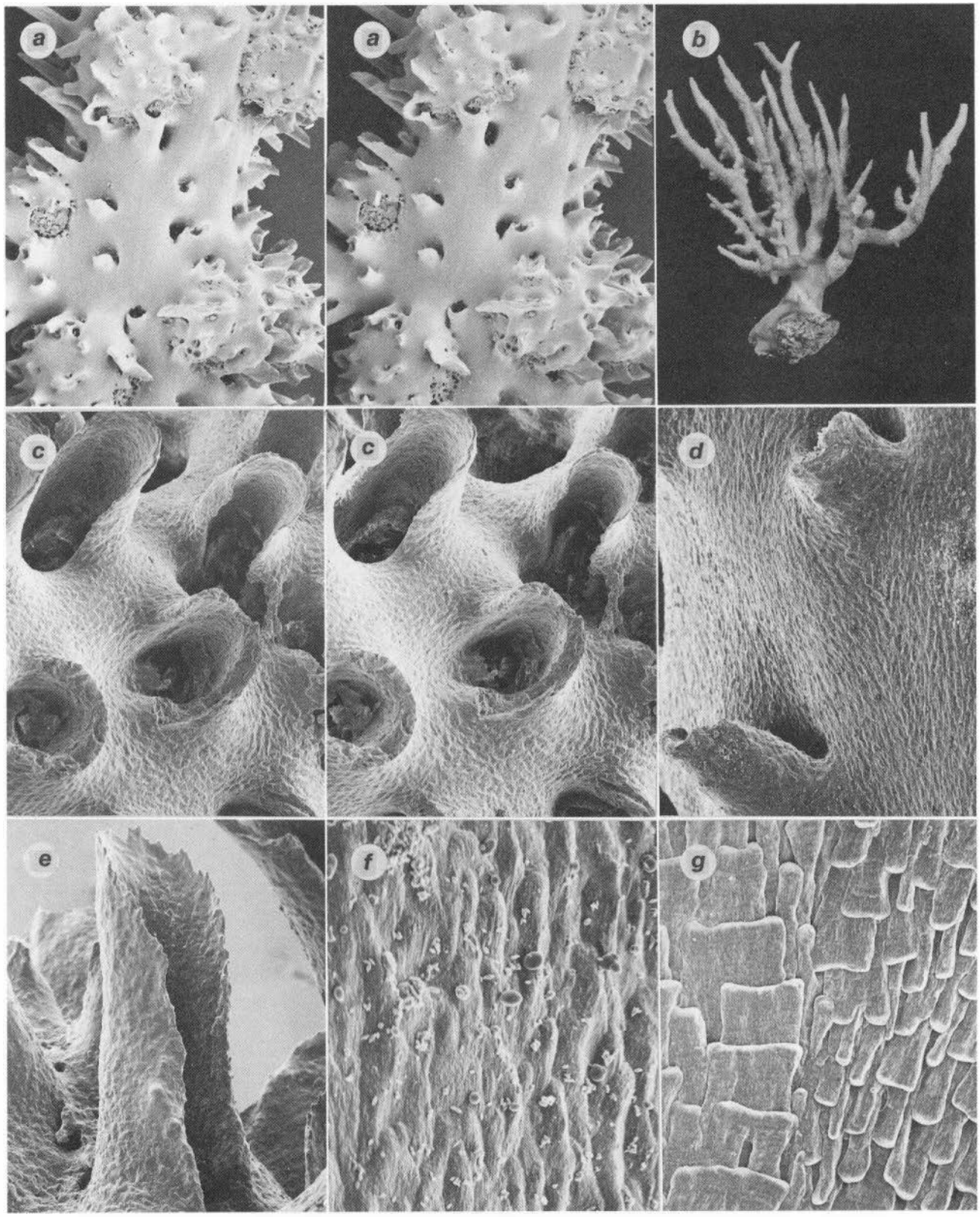

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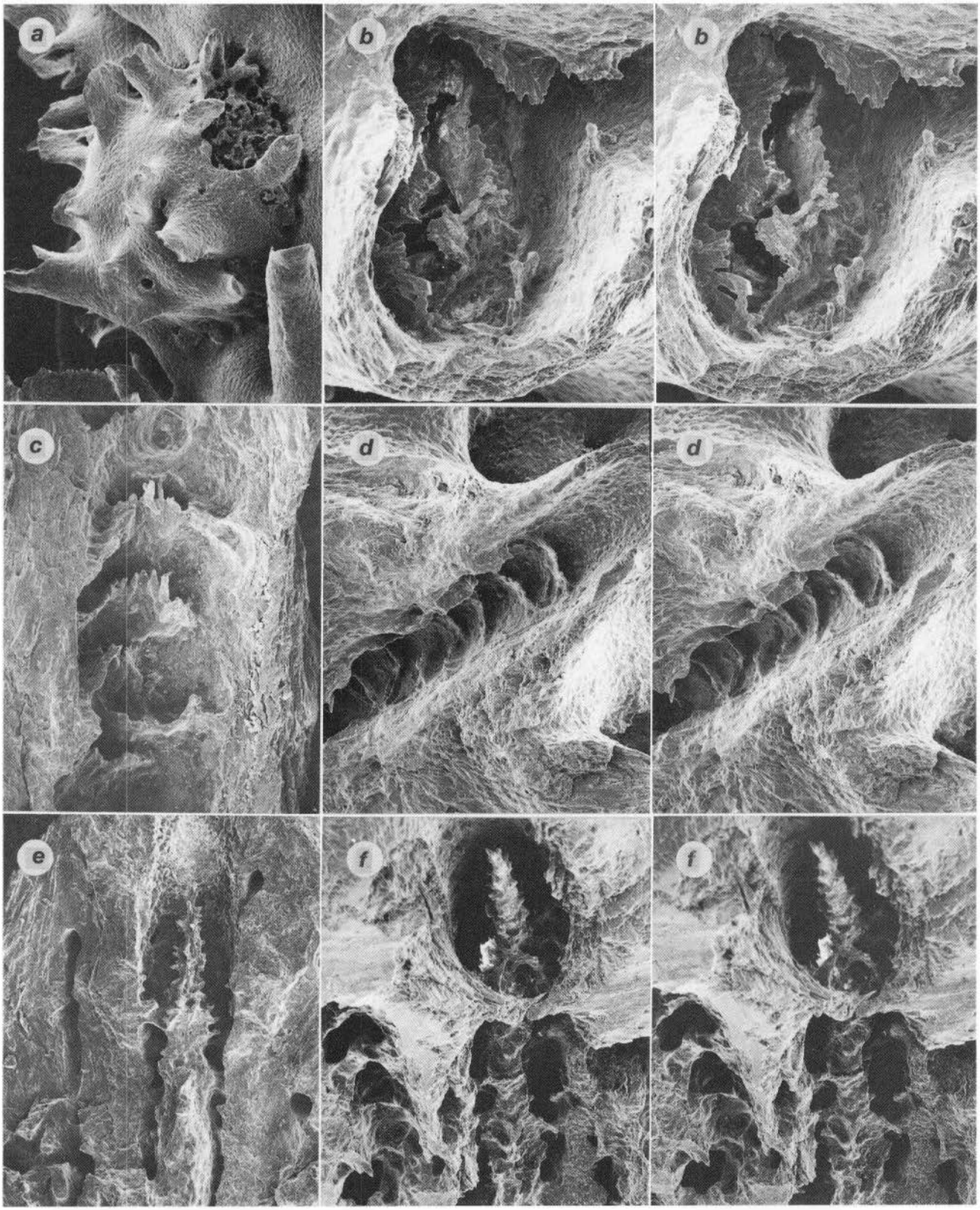

PLATE 21. *Lepidotheca robusta* (a–f, holotype, I96): a, female ampulla and efferent pore, x 40; b, apical view of dactylopore pseudotabulae in a sheared dactylopore spine, x 220, stereo pair; c, d, dactylopore pseudotabulae in longitudinal section of a dactylopore tube, x 205, x 94, respectively (d is a stereo pair); e, f, gastrostyle and tabula, x 65, x 80, respectively (f is a stereo pair).

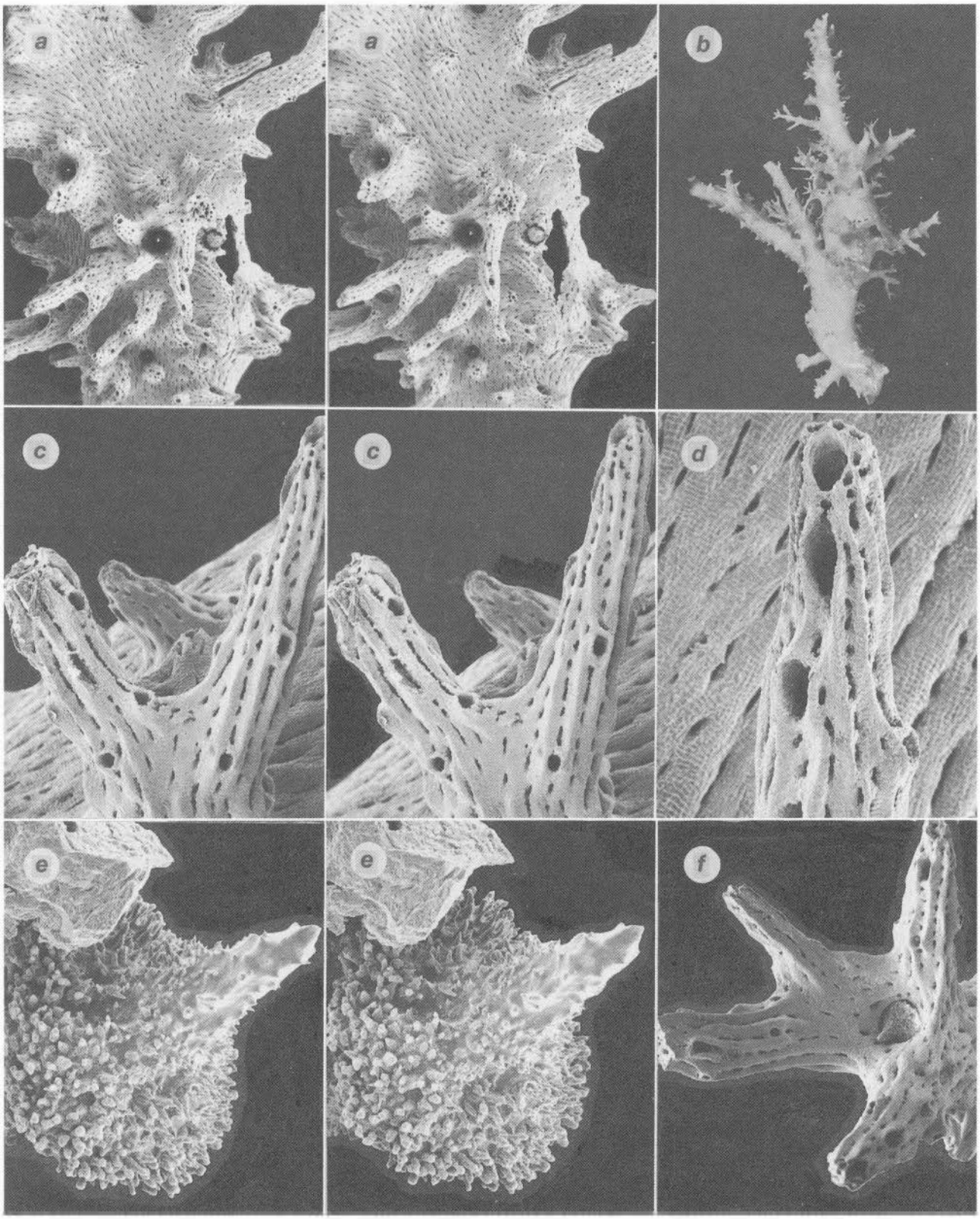

PLATE 22. *Stephanohelia praecipua* (a–f, E861, 85108): a, colony segment illustrating branching pattern, x 15, stereo pair; b, holotype colony, x 2.0, NZOI; c, d, terminal branchlets illustrating aligned dactylopores, x 61, x 112, respectively (c is a stereo pair); e, gastrostyle, x 290, stereo pair; f, characteristic branching pattern with an axial gastropore, x 48.

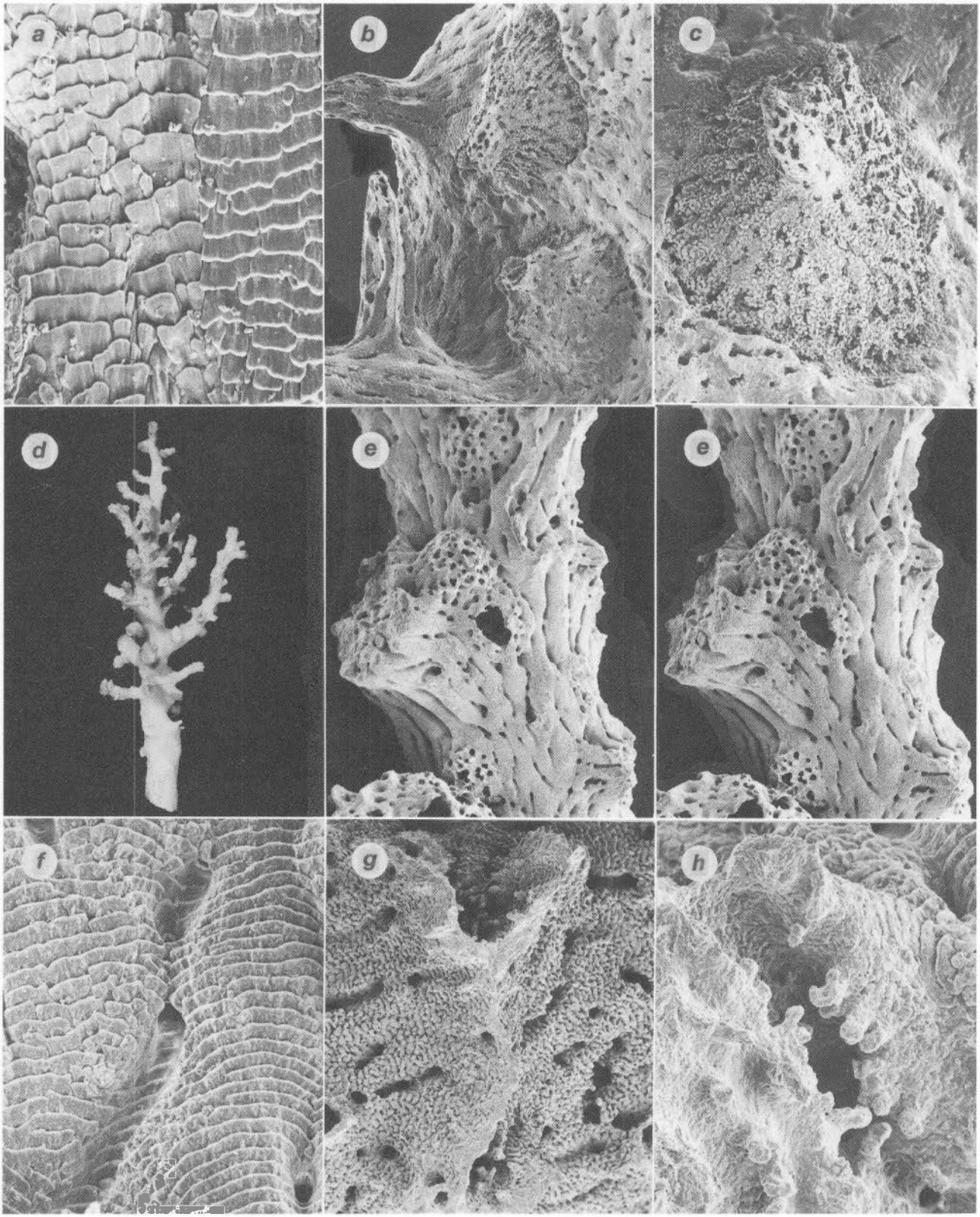

PLATE 23. *Stephanohelia praecipua* (a, E861, USNM 85108; b, c, E859, USNM 85107): a, alternating coenosteal polarity, x 420; b, c, male (?) ampullae, x 50, x 95, respectively. *Inferiolabiata labiata* (d–f, h, F127, NZOI; g, *Eltanin* 2143, USNM 60007): d, colony, x 1.3; e, branch segment illustrating coenosteal texture and spongy male (?) ampullae, x 17, stereo pair; f, linear-imbricate coenosteal texture with broad coenosteal slit, x 128; g, h, dactylopore spine with lateral dactylostyles, x 55, x 135, respectively.

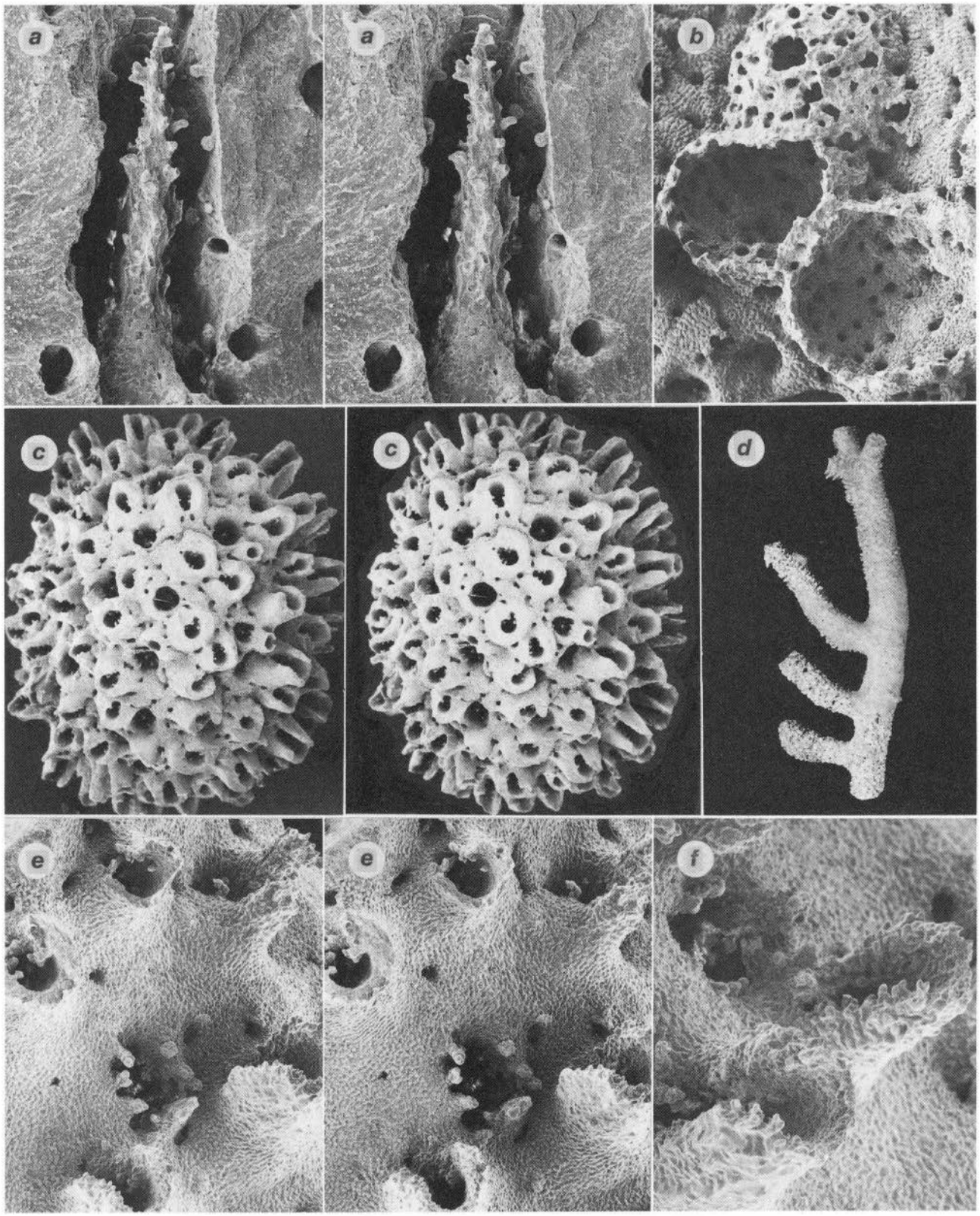

PLATE 24. *Inferiolabiata labiata* (a, F127, USNM 85109; b, *Eltanin* 2143, USNM 60007): a, gastrostyle and diffuse ring palisade, x 90, stereo pair; b, clustered ampullae, x 37. *Inferiolabiata spinosa* (c, e, f, E861, USNM 85112; d, holotype, E861): c, apical view of branch tip illustrating numerous lateral dactylostyles, x 21, stereo pair; d, holotype colony, x 1.4; e, branch coenosteum with one gastropore and several dactylopore spines, x 58, stereo pair; f, dactylopore spines with serrate edges, x 107.

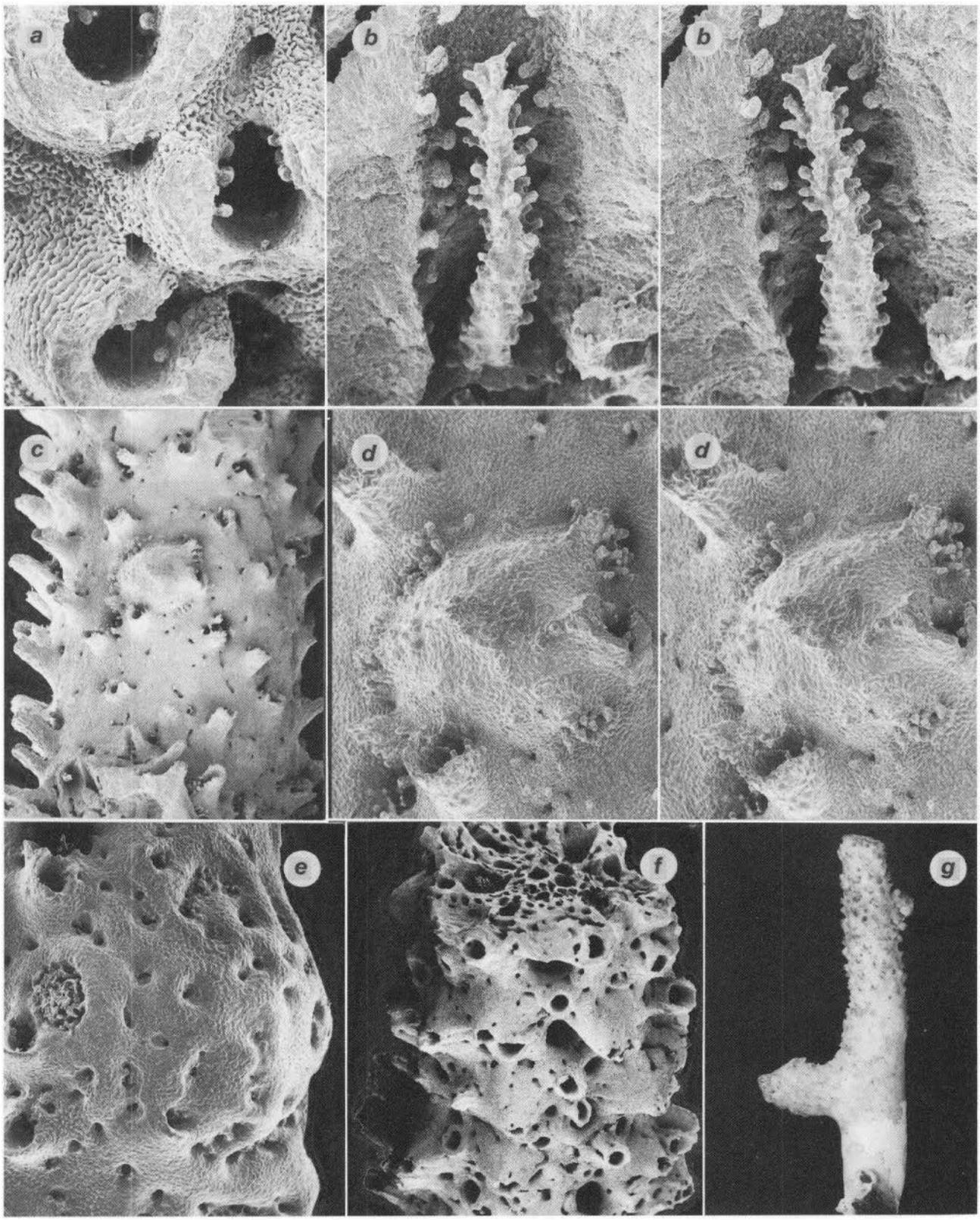

PLATE 25. *Inferiolabiata spinosa* (a–d, E861, USNM 85112; e, I372, NZOI): a, apical view of dactylopore spines illustrating lateral dactylostyles, x 125; b, gastrostyle and diffuse ring palisade, x 135, stereo pair; c, branch segment with tall dactylopore spines and one male ampulla, x 17; d, male ampulla and efferent pore, x 55, stereo pair; e, female ampulla and efferent pore, x 39. *Inferiolabiata lowei* (f, E305, NZOI; g, P541, NZOI): f, branch segment illustrating dactylopore spines, x 17; g, colony, x 3.0.

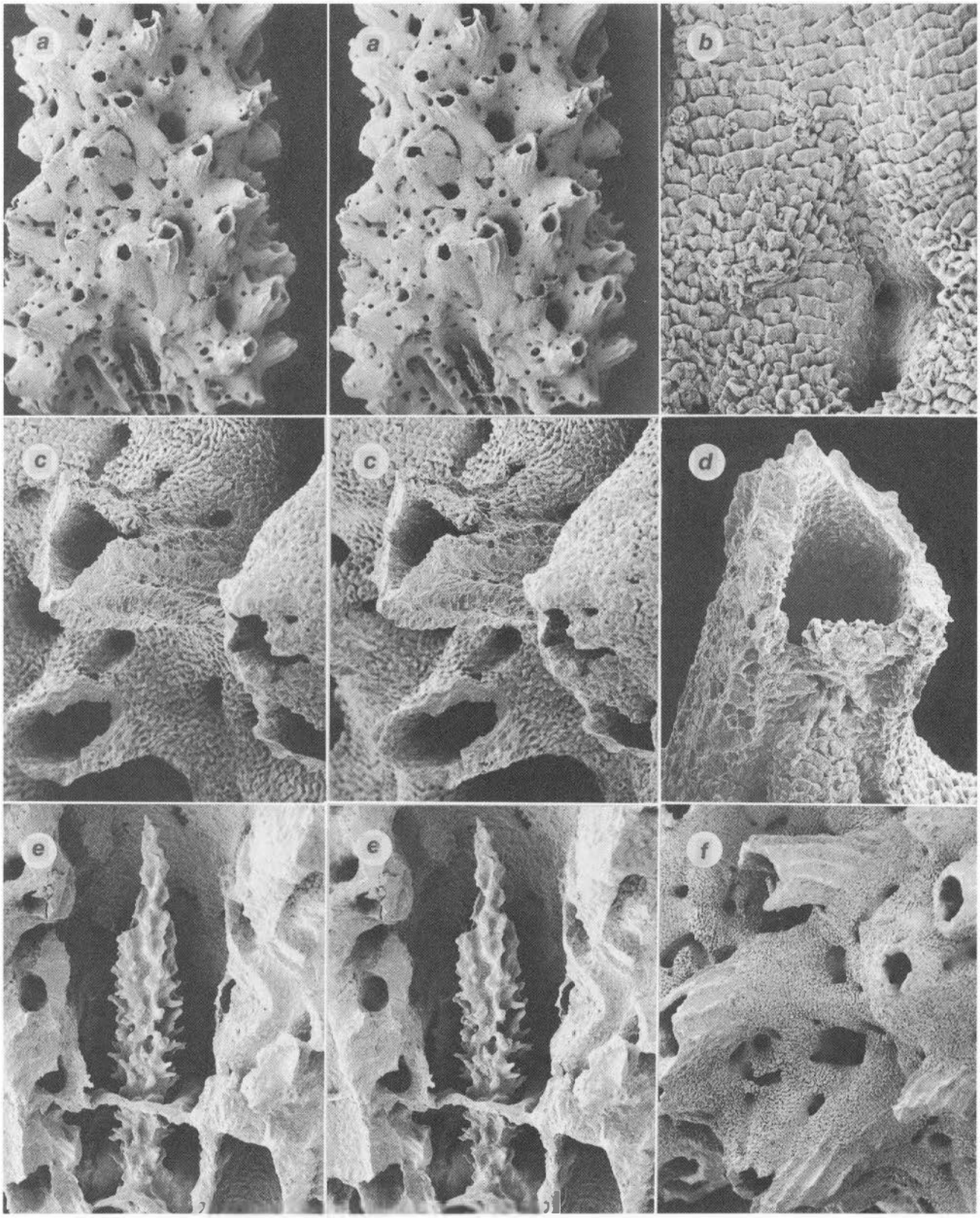

PLATE 26. *Inferiolabiata lowei* (a–f, E305, NZOI): a, branch segment illustrating gastrostyle, ridged dactylopore spines, mammiform male ampullae, and gastropores, x 15, stereo pair; b, imbricate coenosteal texture, x 150; c, d, sheared dactylopore spines illustrating adcauline platelet, x 83, x 130, respectively (c is a stereo pair); e, gastrostyle stabilised by two tabulae, x 70, stereo pair; f, ridged dactylopore spines, x 39.

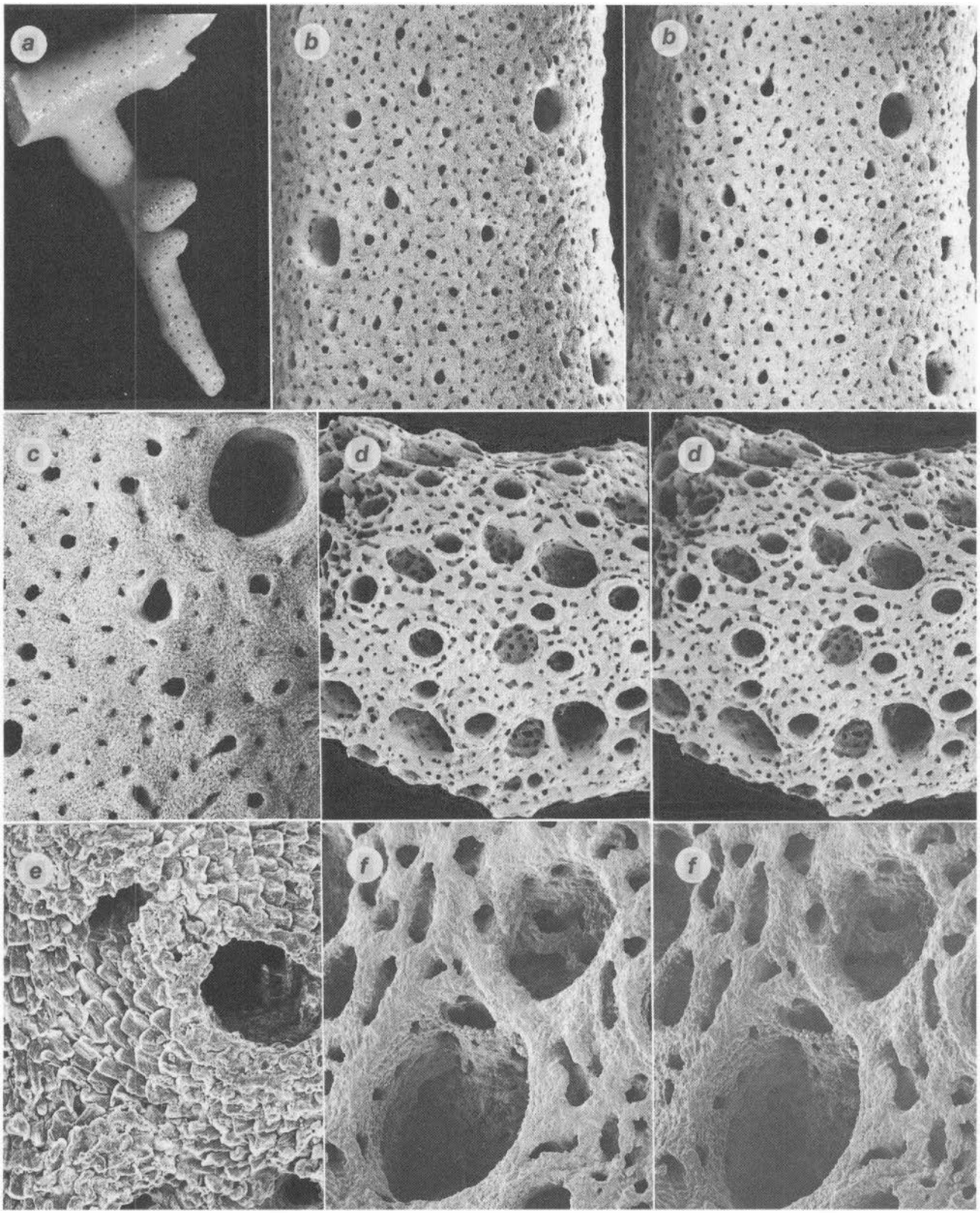

PLATE 27. *Sporadopora mortenseni* (a, syntype, ZMC; b, c, e, E305, USNM 85113; d, f, P472, NZOI): a, syntype colony, x 2.1; b, c, branch coenosteum illustrating large, circular gastropores, smaller elliptical dactylopores, and very small coenosteal pores, x 20, x 47, respectively (b is a stereo pair); d, branch segment illustrating gastropores, dactylopores, and several shallow pits overlying male ampullae, x 26, stereo pair; e, imbricate coenosteal texture, x 240; f, enlargement of spongy pit overlying internal male ampulla and its efferent pore opening into adjacent gastropore tube, x 82, stereo pair.

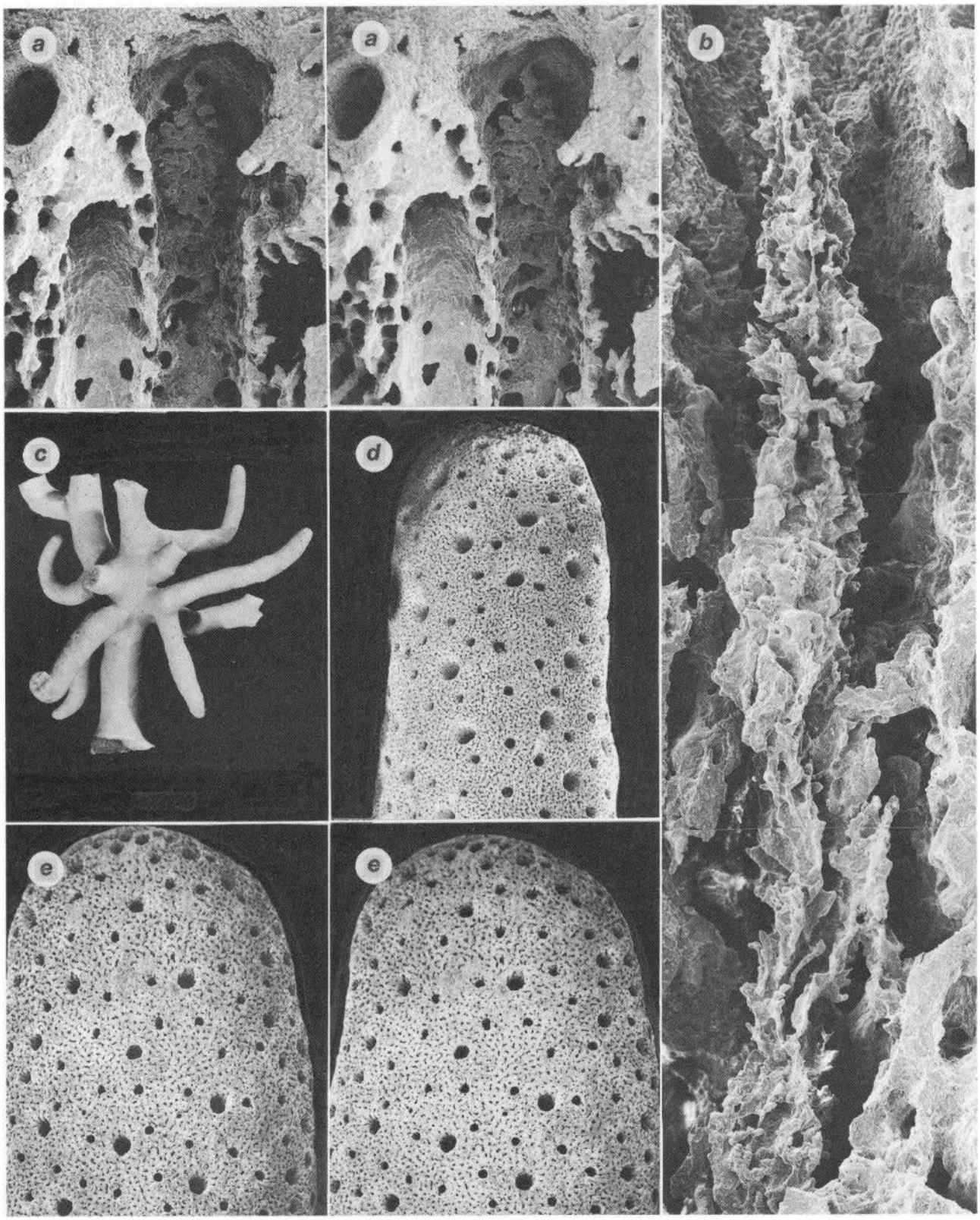

PLATE 28. *Sporadopora mortenseni* (a, P472, NZOI; b, E305, USNM 85113): a, longitudinal section of a gastropore tube illustrating presumed male efferent pore, x 65, stereo pair; b, elongate gastrostyle, x 160. *Sporadopora micropora* (c, holotype, D39; d, e, D39, USNM 85114): c, holotype colony, x 1.2; d, e, blunt branch tips illustrating gastropores (larger pores) and dactylopores, x 12.8, x 15.4, respectively (e is a stereo pair).

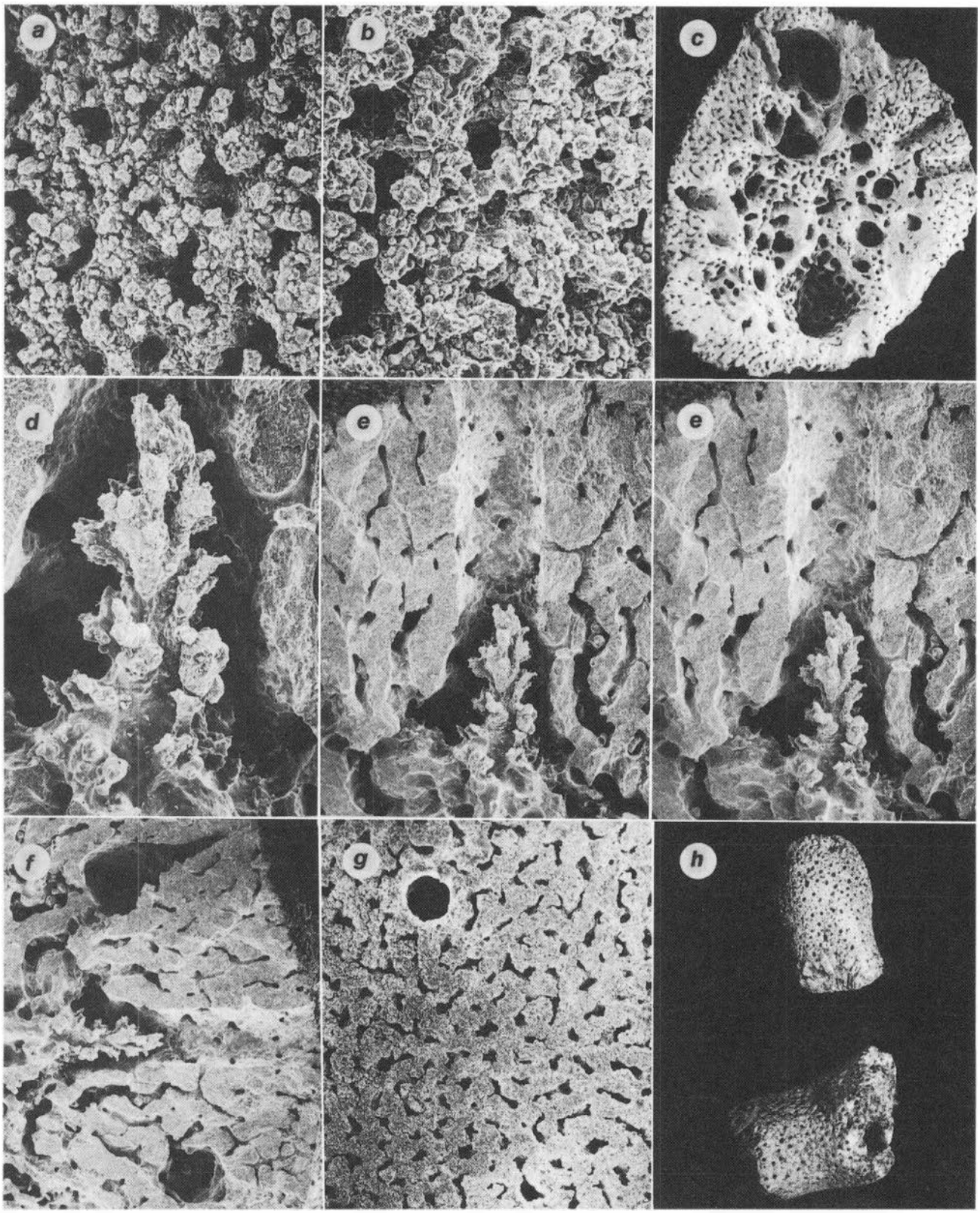

PLATE 29. *Sporadopora micropora* (a–g, D39, USNM 85114): a, b, g, coenosteal texture, x 160, x 285, x 61, respectively; c, branch cross section illustrating internal female ampullae and porous branch core, x 2.05; d, e, gastrostyle, x 150, x 67, respectively (e is a stereo pair); f, longitudinal section of gastropore tube flanked by two internal male ampullae, x 44. *Sporadopora margirata* (h, 2 syntypes from NZGS): x 2.2.

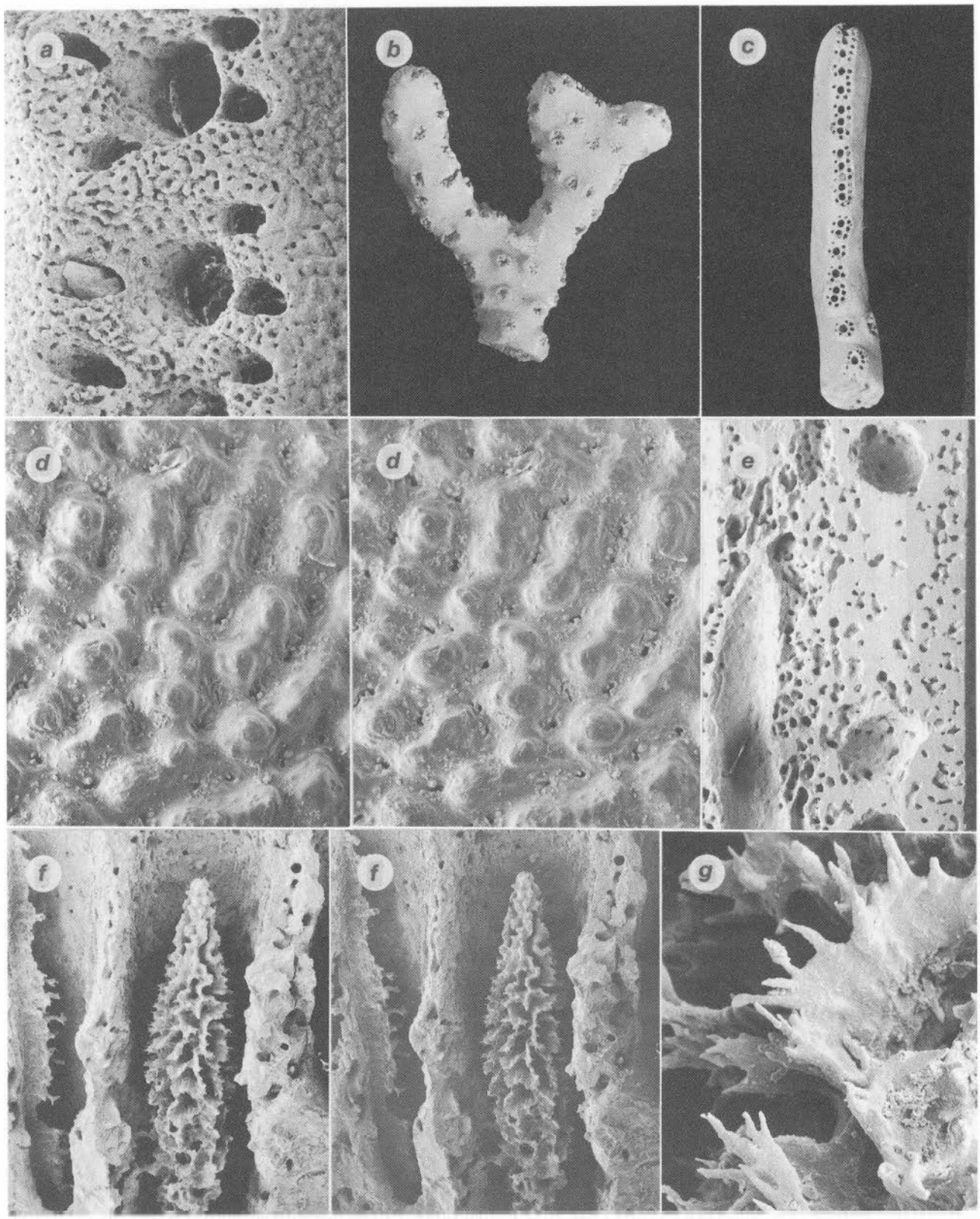

PLATE 30. *Distichopora dispar* (a, b, f, g, D159, USNM 85116; c, holotype, D159; d, e, D39, NZOI): a, pore row, x 32.5; b, colony with pseudocyclosystemate arrangement of pore types, x 2.2; c, colony with typical pore-row arrangement of pore types, x 3.0; d, tuberculate coenosteal texture, x 135, stereo pair; e, longitudinal section of branch illustrating two internal male ampullae (branch surface to right), x 30.5; f, gastrostyle with dactyloridge to left, x 54, stereo pair; g, spination of gastrostyle ridge, x 545.

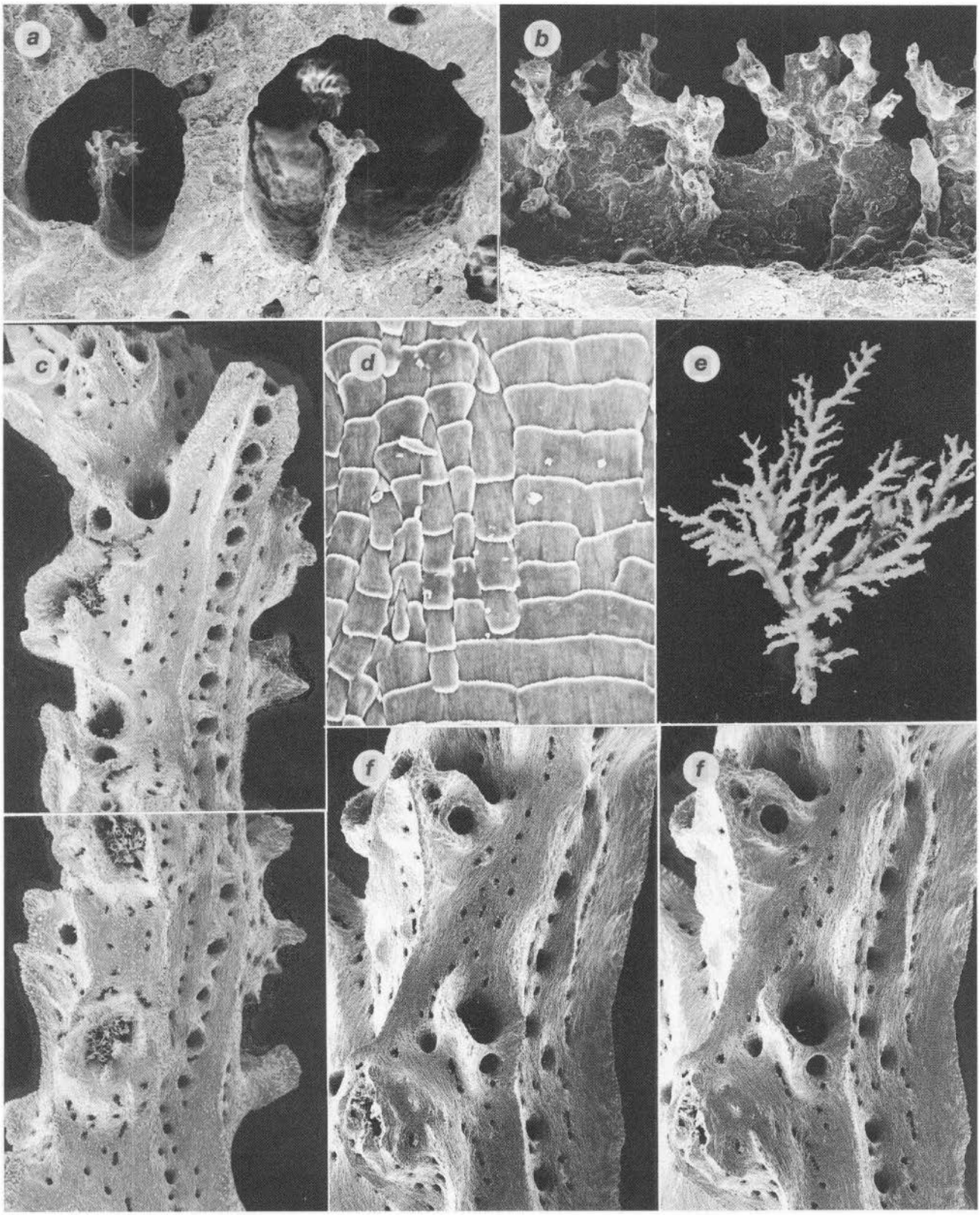

PLATE 31. *Distichopora dispar* (a, D159, USNM 85116; b, D39, NZOI): a, axial view of two dactyloridges, x 150; b, lateral view of a dactyloridge, x 265. *Systemapora ornata* (c, d, f, P46, USNM 85117; e, holotype, P46, NZOI): c, f, branch segment illustrating aligned dactylopores, lipped gastropores, and several male ampullae, x 30.5, x 38, respectively (f is a stereo pair); d, imbricate coenosteal texture with alternating polarity, x 600; e, holotype colony, x 0.7.

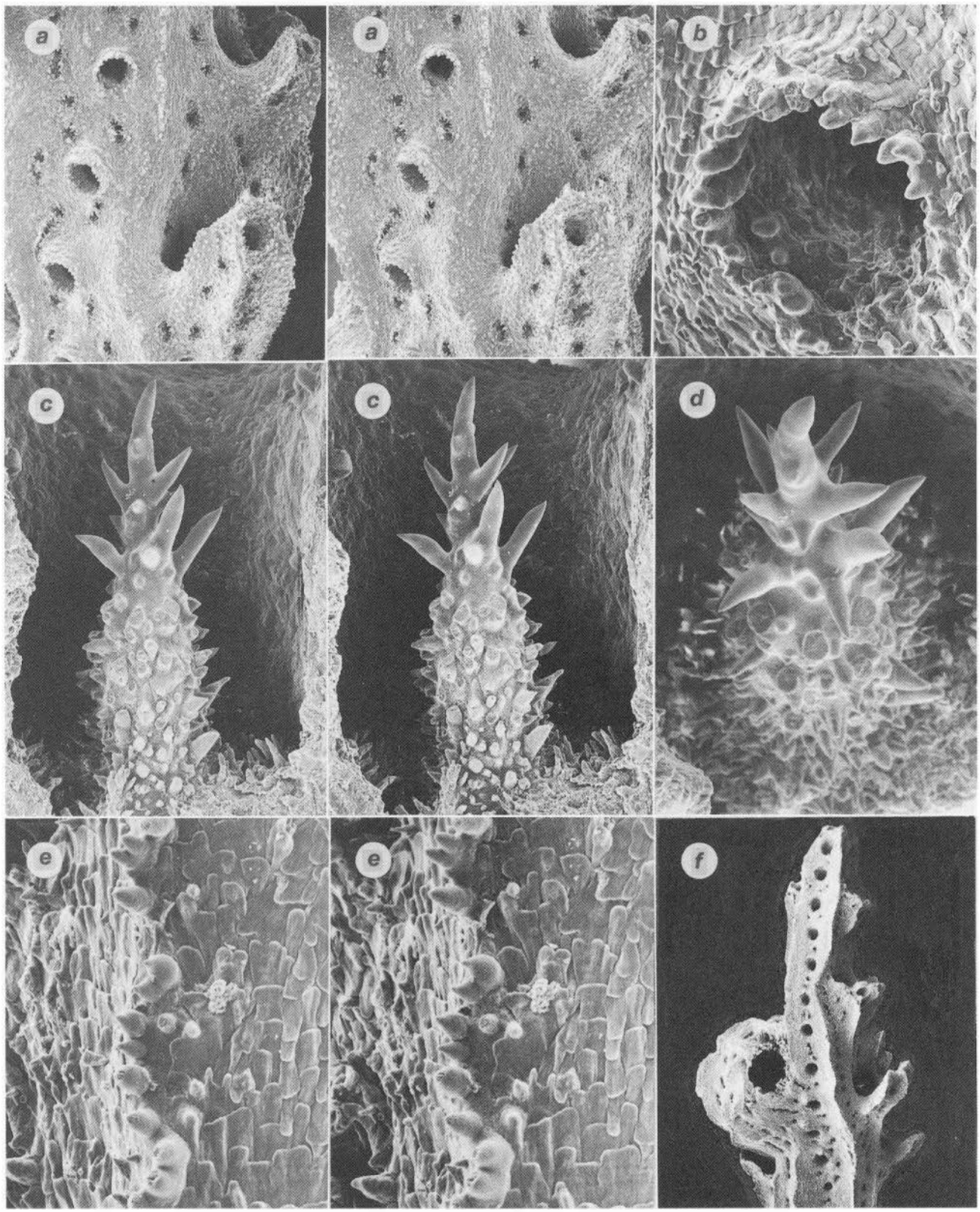

PLATE 32. *Systemapora ornata* (a–f, P46, USNM 85117): a, aligned dactylopores and two lipped gastropores, x 50, stereo pair; c, dactylopore spine, x 320; c, d, gastrostyle, x 240, x 405, respectively (c is a stereo pair); e, aligned coenosteal spines separating lateral branch edge from branch face, x 455, stereo pair; f, branch tip bearing a female ampulla with efferent pore, x 18.1.

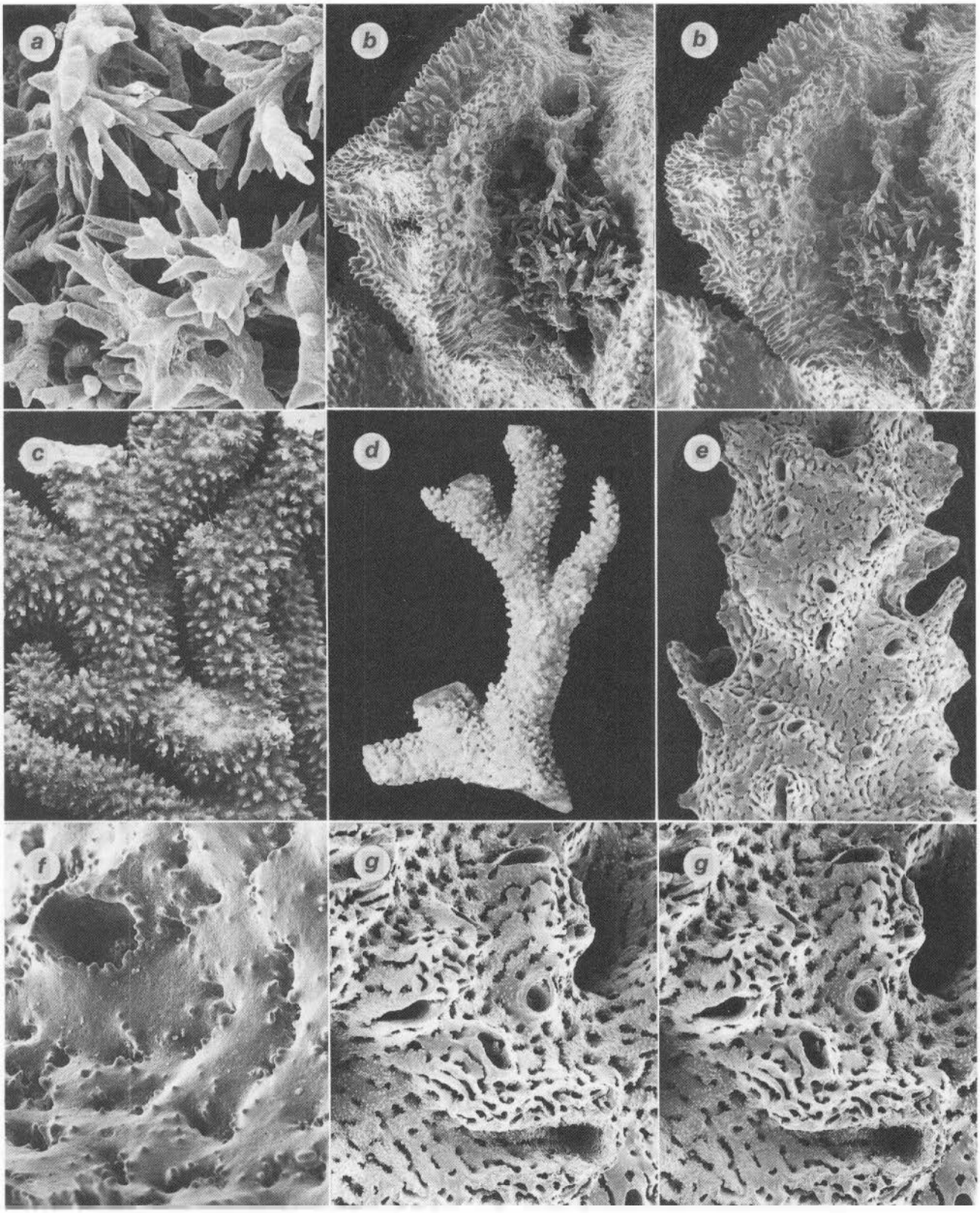

PLATE 33. *Systemapora ornata* (a, b, P46, USNM 85117): a, cluster of spines protecting male efferent pore, x 475; b, male ampulla, x 110, stereo pair. *Errina novaezelandiae* (c, syntype of *E. n.* forma *benhami*, Manchester Museum, Boschma #138; d, syntype of *E. n.* forma *ramosa*, BM(NH) 1950.1.11.83; e, Q741, USNM 85121; f, Q748, USNM 85122; g, paratype of *E. cruenta*, D156, USNM 76879): c, d, branches with dactylopore spines, x 3.8, x 2.7, respectively; e, branch segment with dactylopore spines and lipped gastropores, x 40; f, reticulate-granular coenosteal texture and one conical dactylopore spine, x 235; g, tall, horseshoe-shaped and small, mound-shaped dactylopores, x 68.5, stereo pair.

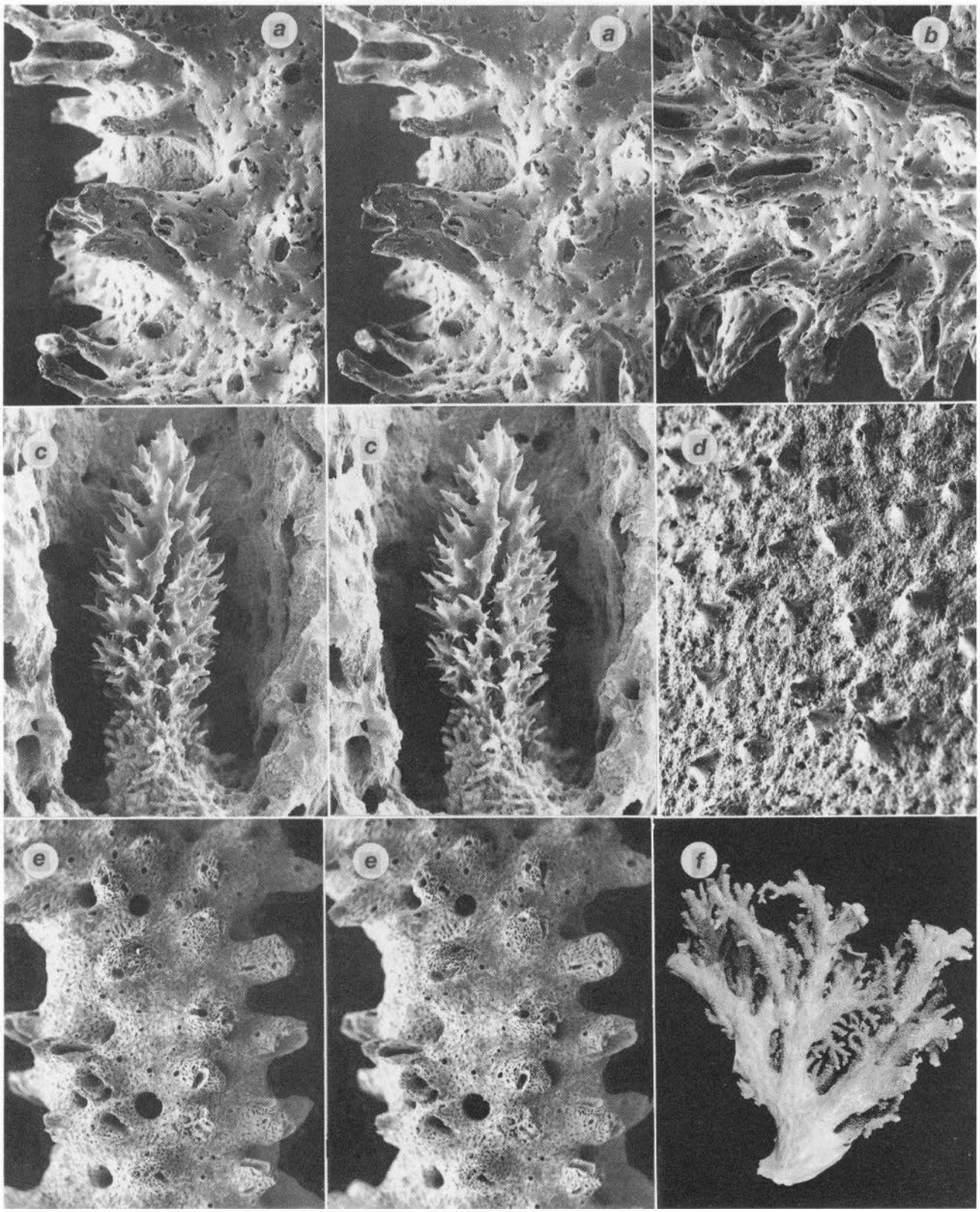

PLATE 34. *Errina novaezelandiae* (a, b, d, Q748, USNM 85122; c, paratype of *Errina cruenta*, D156, USNM 76879): a, b, dactylopore spines, x 61, x 48, respectively (a is a stereo pair); c, gastrostyle, x 160, stereo pair; d, coenosteal papillae, x 55.5. *Errina chathamensis* (e, f, C618, USNM 85125): e, branch segment with compound dactylopore spines, x 18.5, stereo pair; f, red colony, x 0.45.

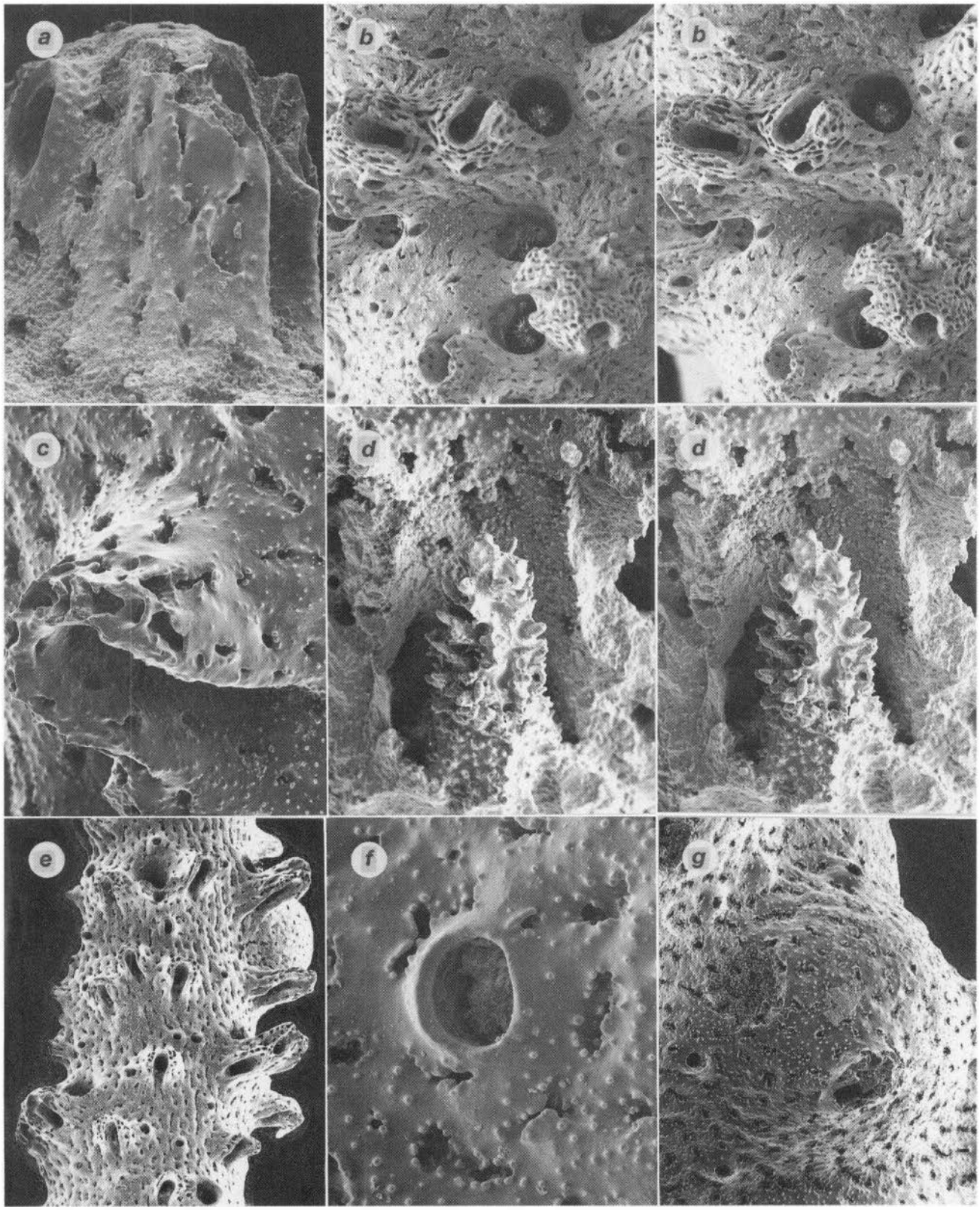

PLATE 35. *Errina chathamensis* (a, c, e, g, J55 [red form]; b, d, f, D878 [white form]: a, b, compound and small conical dactylopore spines, x 160, x 42.5, respectively; c, simple dactylopore spine, x 150; d, gastrostyle, x 160, stereo pair; e, female branch segment with both types of dactylopore spines, x 23; f, small conical dactylopore spine, x 240; g, female ampulla, x 53.

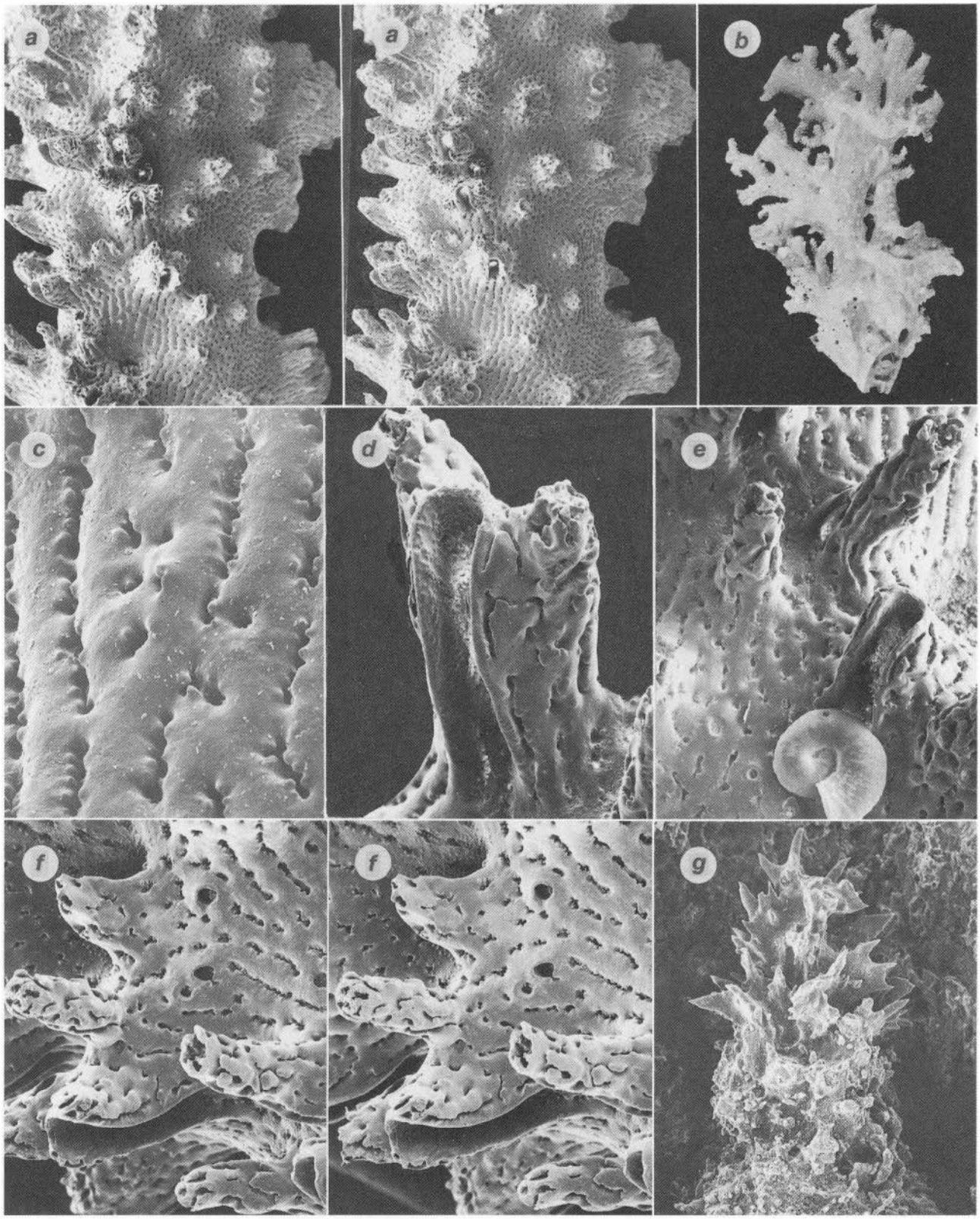

PLATE 36. *Errina laevigata* (a–g, holotype, D145): a, branch segment with dactylopore spines, x 20, stereo pair; b, holotype colony, x 0.73; c, smooth coenosteal texture, x 210; d, dactylopore spines with accessory spinules, x 105; e, f, dactylopore spines and spinules, x 72.5, x 68.5, respectively (f is a stereo pair); g, gastrostyle, x 310.

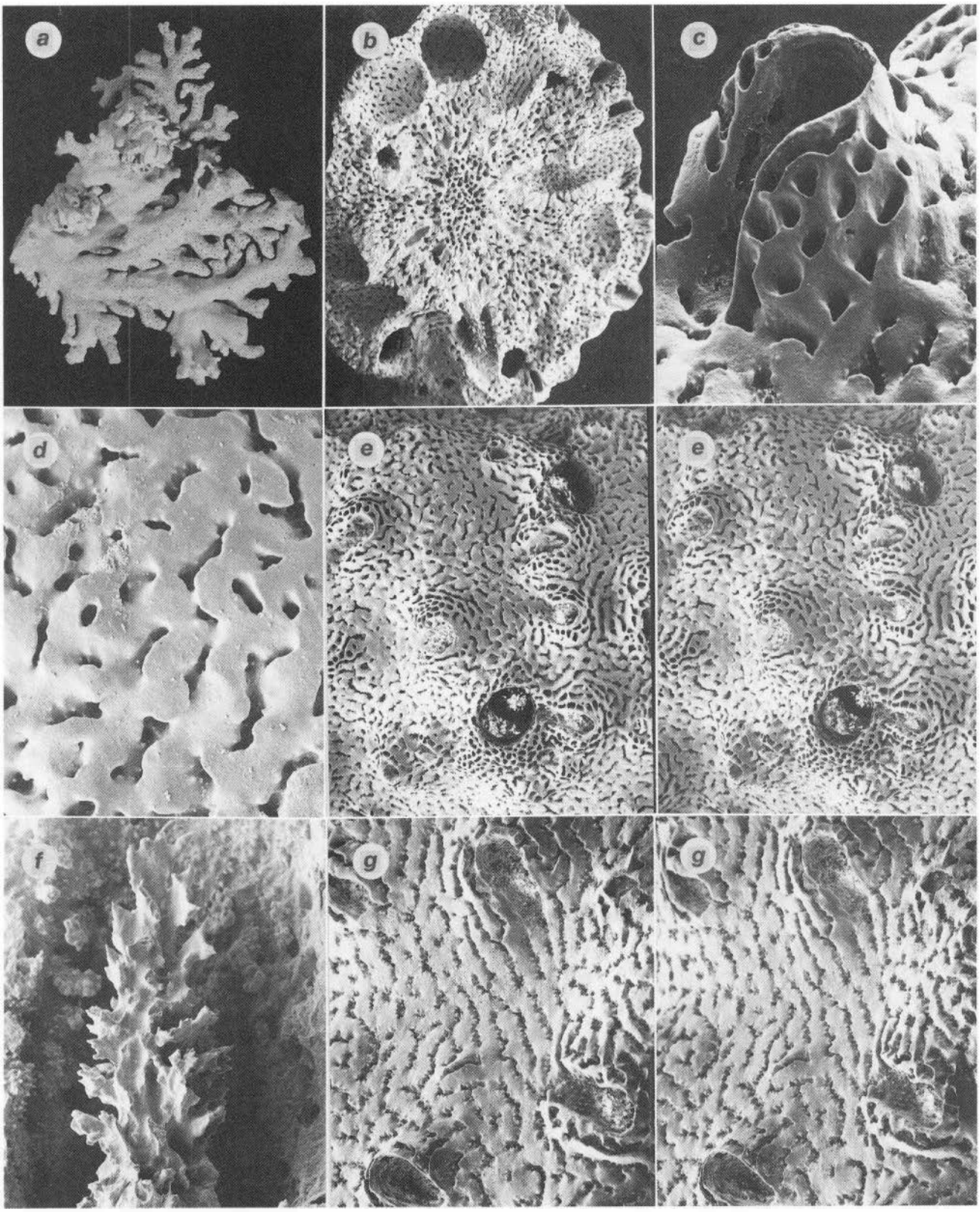

PLATE 37. *Errina hicksoni* (a–g, A743, USNM 76517): a, holotype colony, x 0.85, NZOI; b, branch cross section illustrating a gastrostyle and several ampullae, x 23.5; c, imbricate dactylopore spine, x 180; d, smooth coenosteal texture, x 180; e, g, coenosteum bearing dactylopore spines, x 39, x 87, respectively (both are stereo pairs); f, gastrostyle and ring palisade, x 200.

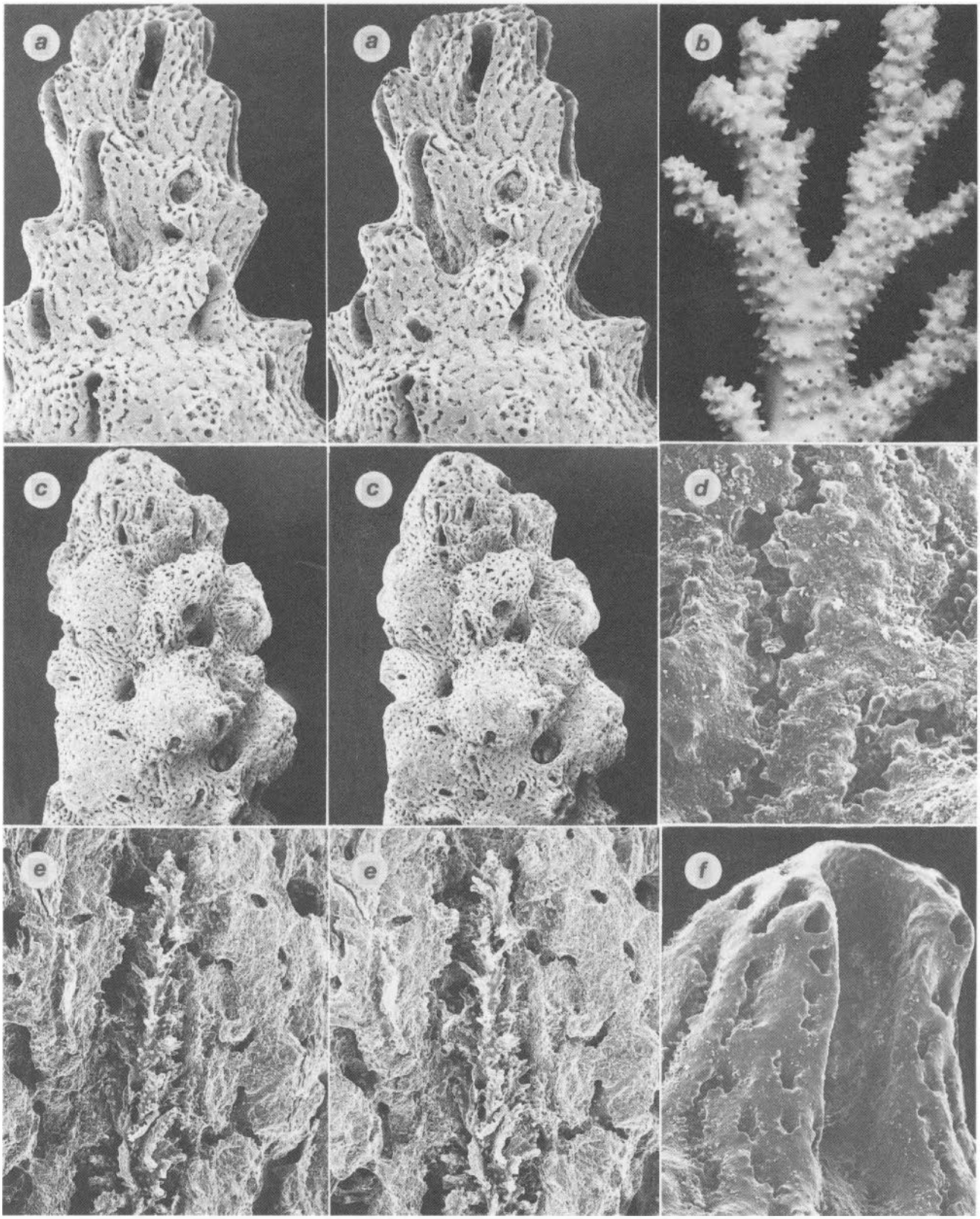

PLATE 38. *Errina cooki* (a, c–f, A444, USNM 60252; b, syntype, Manchester Museum, Boschma #140): a, branch tip illustrating dactylopore spines and lipped gastropore, x 50, stereo pair; b, branch of syntype, x 3.5; c, branch tip illustrating dactylopore spines, gastropores, and female ampullae, x 20, stereo pair; d, reticulate-granular coenosteal texture, x 510; e, gastrostyle, x 135, stereo pair; f, dactylopore spine, x 195.

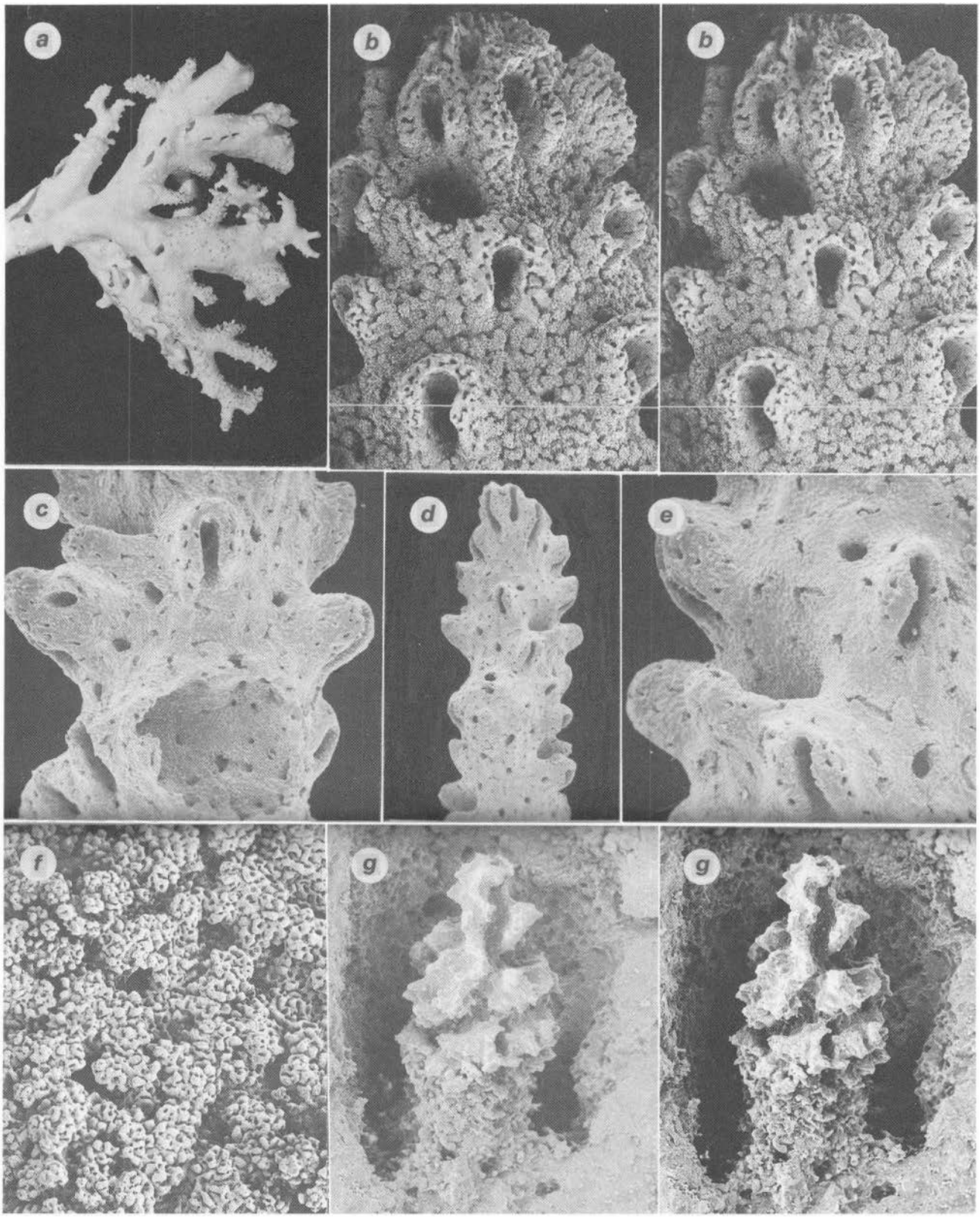

PLATE 39. *Errina gracilis* (a, b, f, g, *Eltanin* 1975, USNM 60167; c–e, lectotype, *Belgica* 387, USNM 78874): a, large colony, x 1.2; b, branch tip illustrating dactylopore spines, gastropore, and coenosteal texture, x 39, stereo pair; c–e, branch segments illustrating dactylopore spines, lipped gastropore, and ampullae, x 47, x 19, x 65, respectively; f, reticulate-granular coenosteal texture, x 140; g, gastrostyle, x 175, stereo pair.

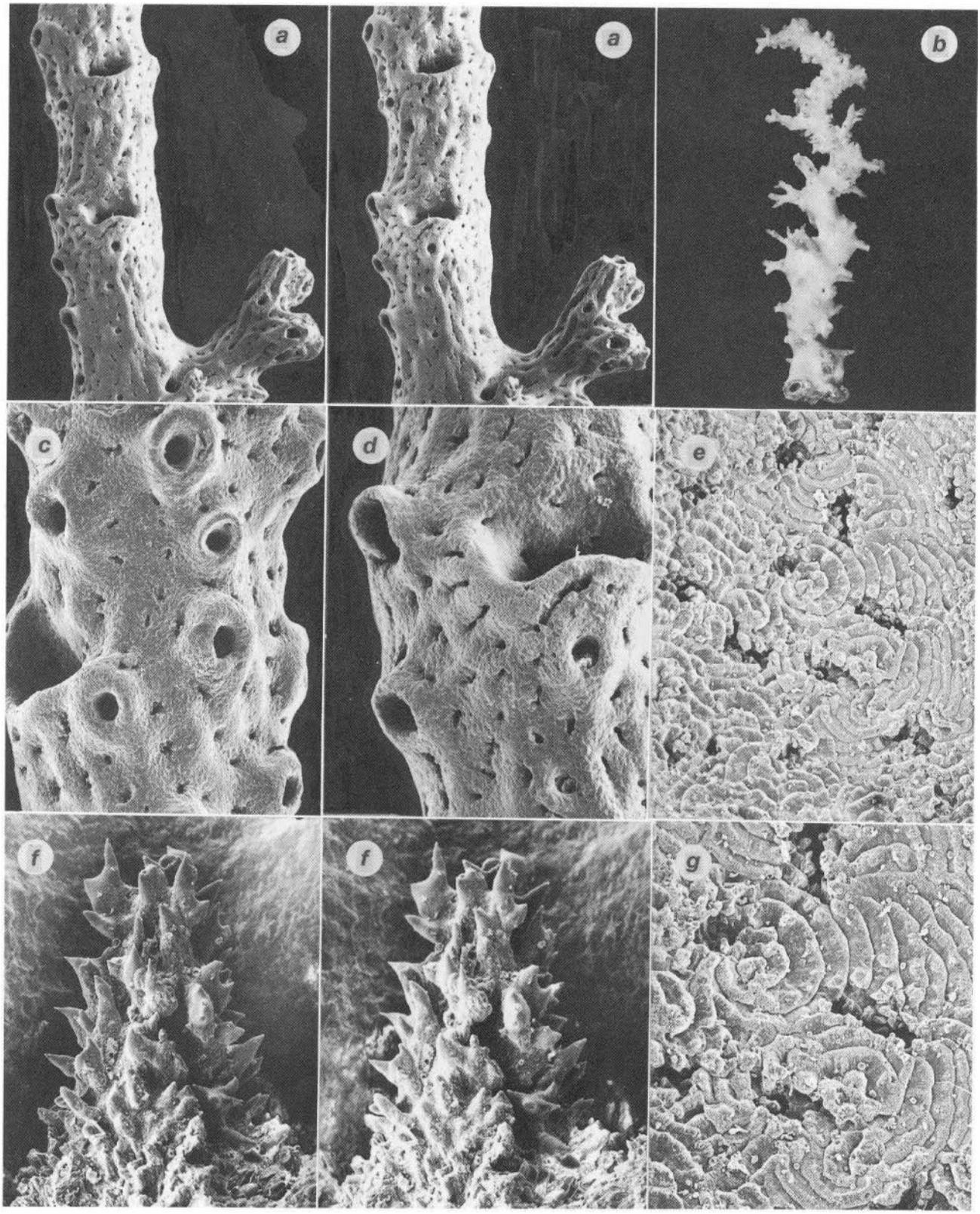

PLATE 40. *Errina sinuosa* (a, d–g, K842, USNM 85132; b, holotype, K842): a, c, d, branch segments illustrating aligned dactylopore spines and lipped gastropores, x 28, x 77, x 90, respectively (a is a stereo pair); b, holotype colony, x 1.8; e, g, radial-imbricate coenosteal texture, x 190, x 310, respectively; f, gastrostyle, x 430, stereo pair.

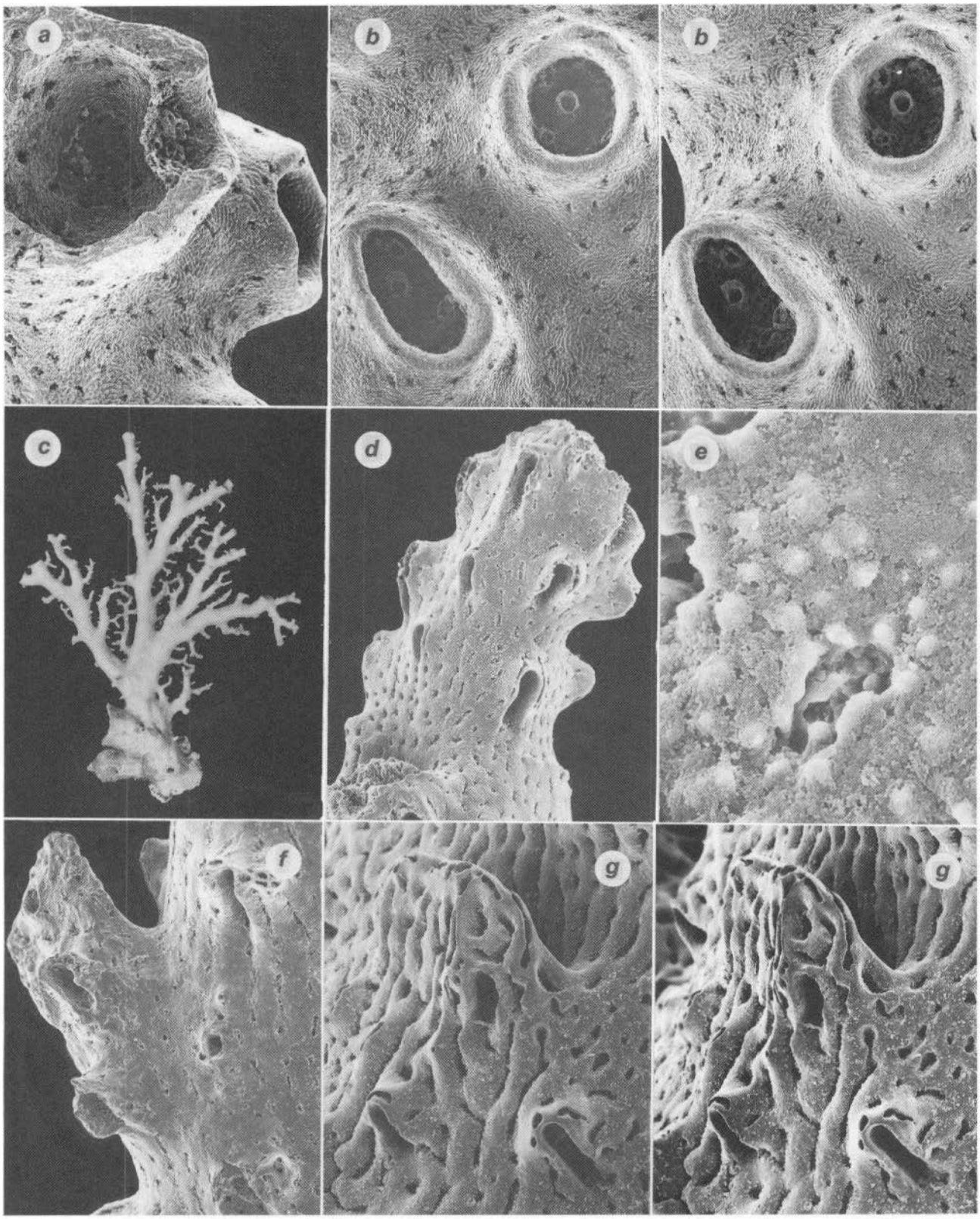

PLATE 41. *Errina sinuosa* (a, b, K842, USNM 85131): a, b, longitudinal section and apical view of male (?) ampullae, x 66, x 63.5 (b is a stereo pair). *Errina cheilopora* (c, S30, NZOI; d, e, *Eltanin* 1975, USNM 60076; f, E803, USNM 85134; g, D176, USNM 85133): c, large colony, x 0.83; d, branch tip bearing dactylopore spines, x 60; e, reticulate-granular coenosteal texture, x 800; f, g, broad gastropore lip bearing dactylopore spines, x 67, x 90, respectively (g is a stereo pair).

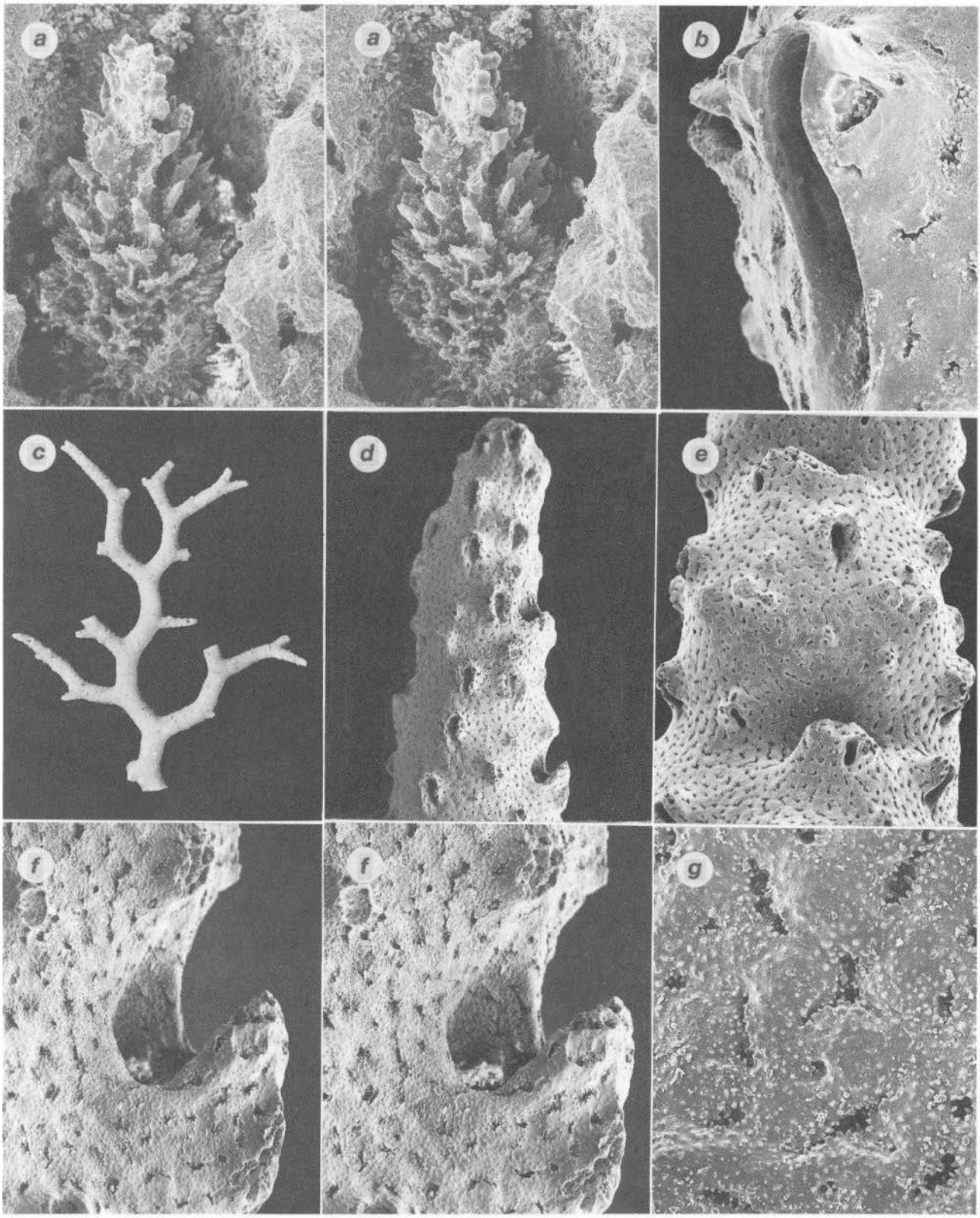

PLATE 42. *Errina cheilopora* (a, D176, USNM 85133; b, E803, USNM 85134): a, gastrostyle, x 215, stereo pair; b, dactylopore spine, x 185. *Errina bicolor* (c, holotype, D172; d–f, D172, NZOI; g, B175, USNM 60250): c, holotype colony, x 2.0; d, branch tip, x 21; e, branch segment illustrating dactylopore spines and lipped gastropore, x 39; f, gastropore lip, x 94, stereo pair; g, reticulate-granular coenosteal texture, x 265.

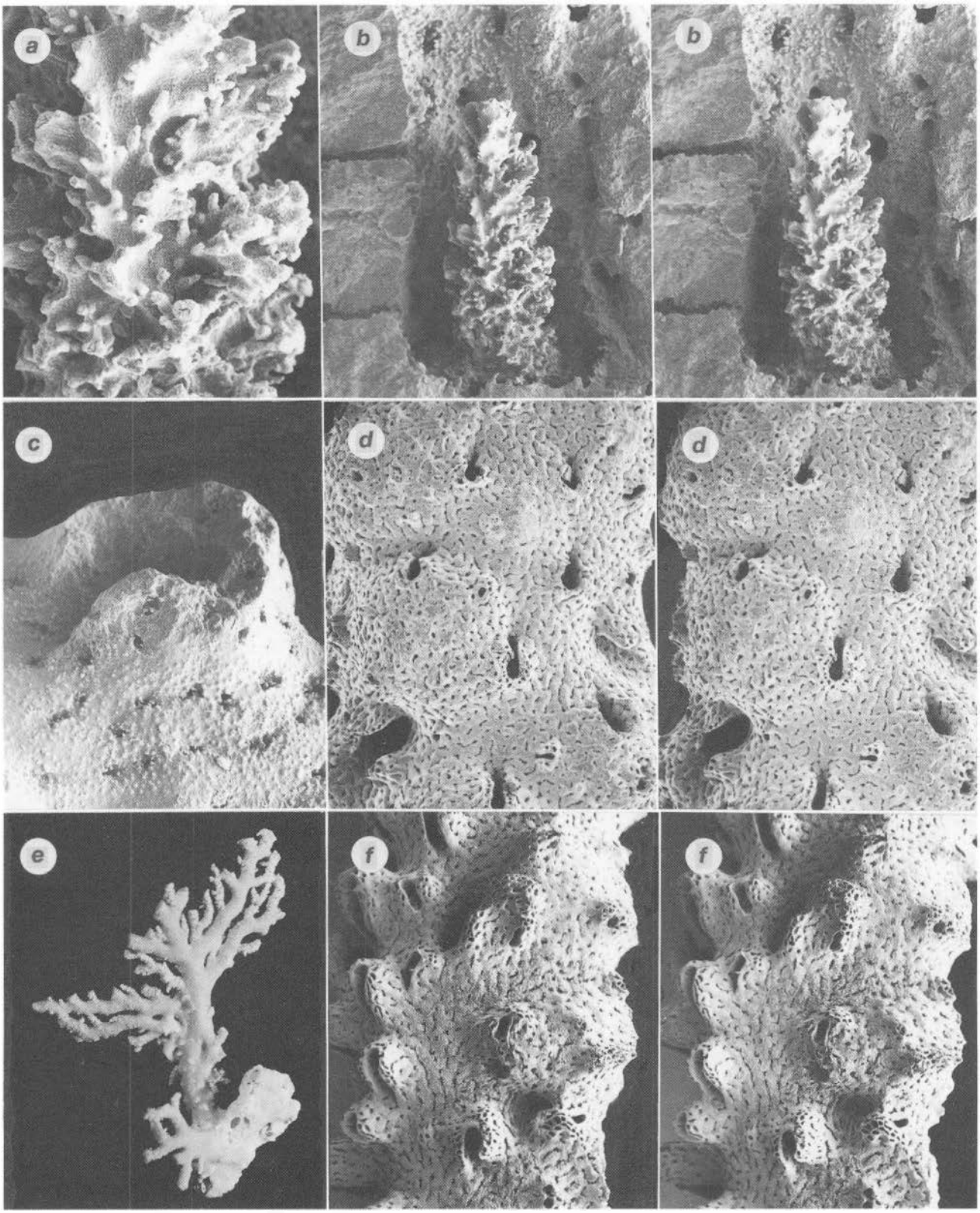

PLATE 43. *Errina bicolor* (a–c, D172, USNM 60249; d, B175, USNM 60250): a, b, gastrostyle, x 525, x 185, respectively (b is a stereo pair); c, dactylopore spine, x 175; d, branch segment illustrating dactylopore spines and female ampullae, x 33, stereo pair. *Errina reticulata* (e, f, D18): e, holotype colony, x 0.95, NZOI; f, branch segment illustrating dactylopore spines, USNM 60247, x 40.5, stereo pair.

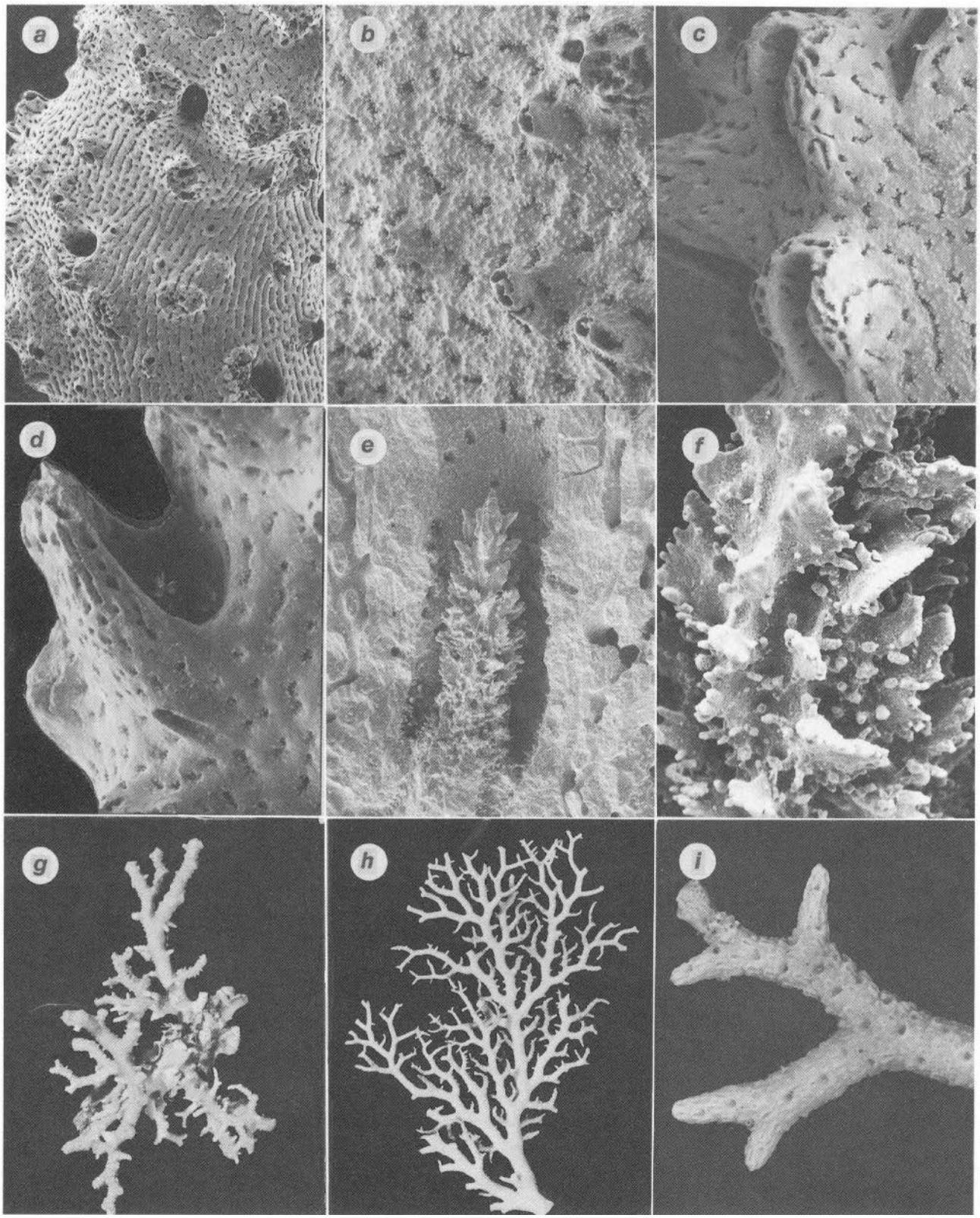

PLATE 44. *Errina reticulata* (a–f, D18, USNM 60247): a, branch segment illustrating coenosteal texture, gastropores, and dactylopore spines, x 29.5; b, coenosteal papillae, x 135; c, dactylopore spines, x 115; d, gastropore lip, x 110; e, f, gastrostyle, x 135, x 510, respectively. *Errina dendyi* (g, E865, NZOI; h, Gut Passage, USNM 76301; syntype of *E. rubra,* ZMC): g, orange colony, x 0.88; h, pale yellow colony, x 0.71; i, red colony, x 5.0.

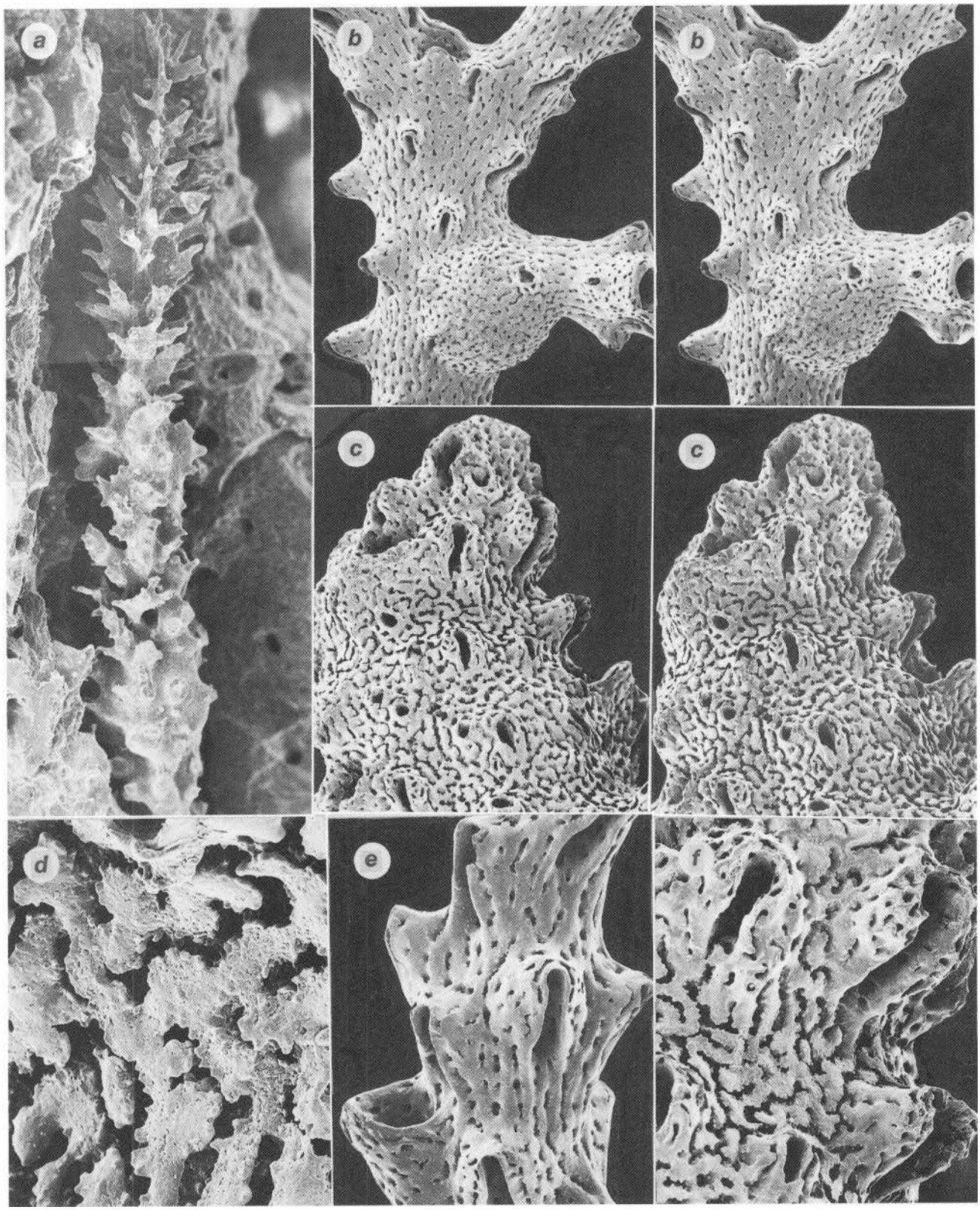

PLATE 45. *Errina dendyi* (a, b, e, Wet Jacket Arm, USNM 76302; c, d, f, Milford Sound, holotype, USNM 85784): a, gastrostyle, x 205; b, branch segment illustrating dactylopore spines and a female ampulla, x 32; c, branch tip, x 40.5; d, coenosteal texture, x 240; e, f, branch segment illustrating a lipped gastropore, dactylopore spines, and coenosteal texture, x 66, x 83, respectively.

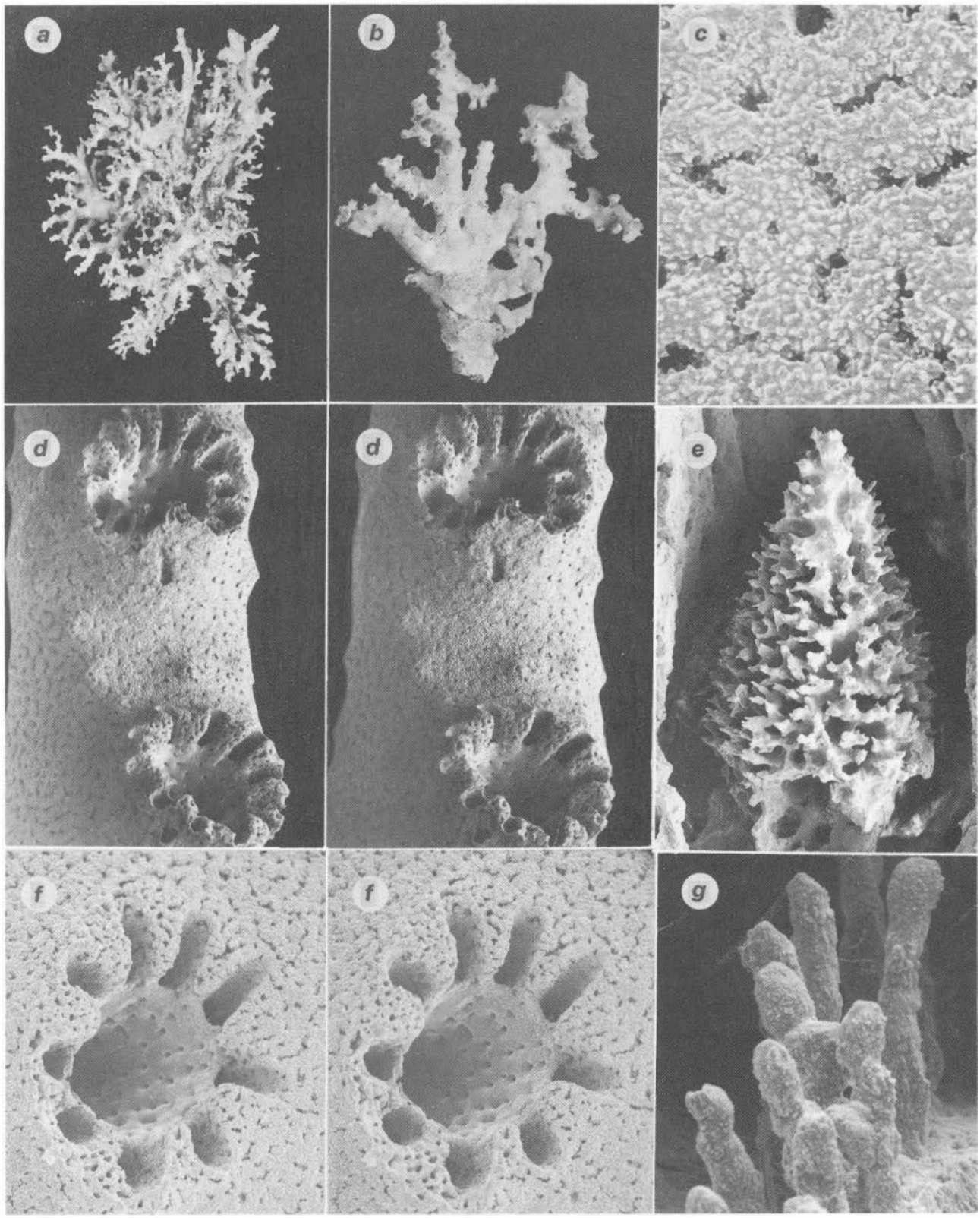

PLATE 46. *Stylaster eguchii* (a, Q749, USNM 86942; b, D39, NZOI; c, f, *Eltanin* 1411, USNM 60096; d, E822, USNM 86940; e, g, D18, NZOI): a, shallow-water bushy form. x 0.8; b, southern flabellate form, x 1.0; c, reticulate-granular coenosteal texture, x 190; d, branch segment illustrating two cyclosystems and several small conical male efferent pores, x 25, stereo pair; e, gastrostyle, x 125; f, cyclosystem, x 42, stereo pair; g, dactylostyle, x 175.

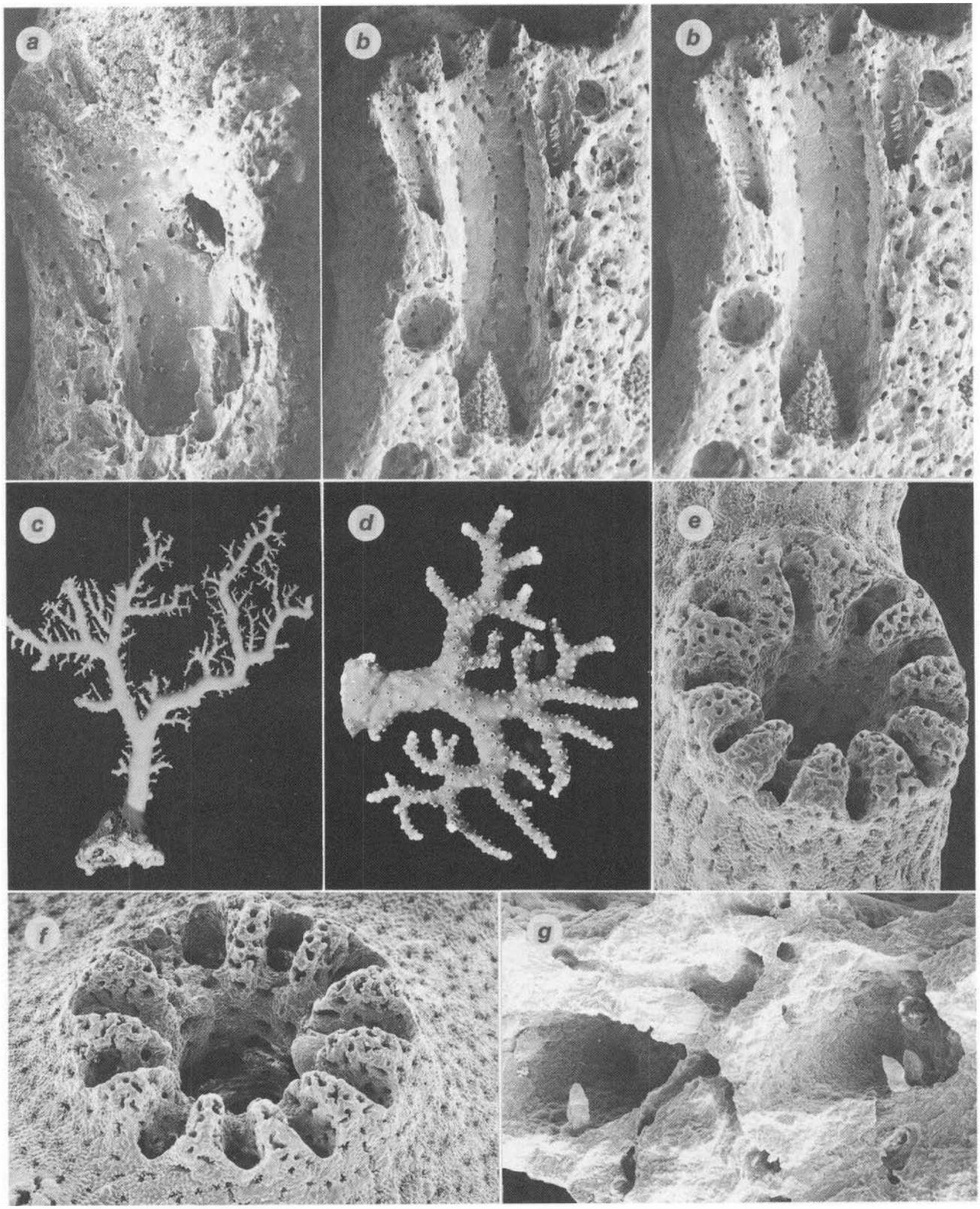

PLATE 47. *Stylaster eguchii* (a, B488, NZOI; b, D76, USNM 85143): a, longitudinal section of a gastropore tube illustrating female efferent pore in upper chamber, x 47; b, longitudinal section of a gastropore tube illustrating gastrostyle, dactylostyles, and internal male ampullae, x 30, stereo pair. *Stylaster brunneus* (c, I87, NZOI; d, Norfolk Island, WAM 551--87; e, f, P19, USNM 86945; g, I85, USNM 86943): c, large colony with sympodially arranged cyclosystems, x 0.38; d, colony with uniformly arranged cyclosystems, x 1.0; e, f, cyclosystems, x 64, x 80, respectively; g, rudimentary dactylostyles of deep-water specimen, x 260.

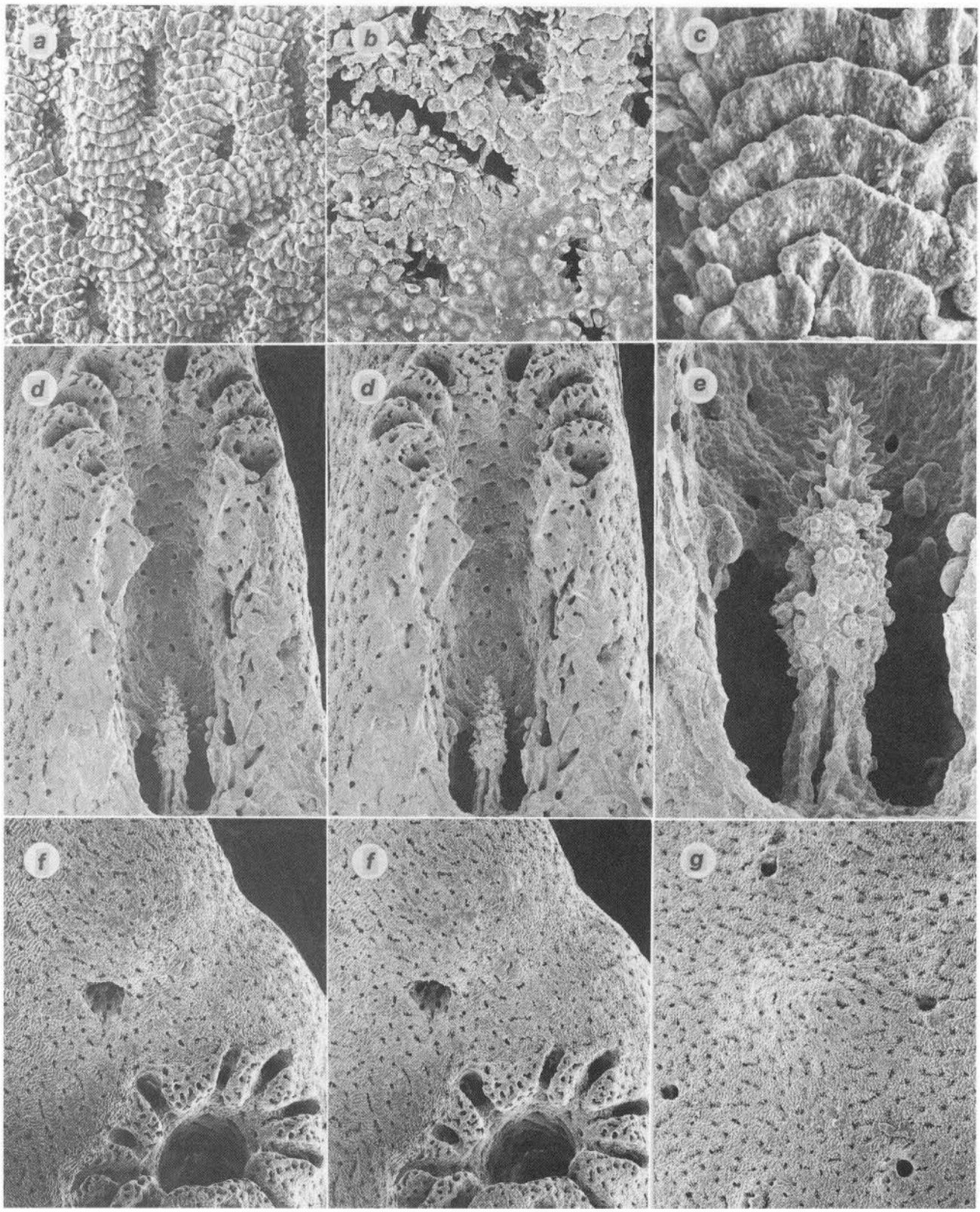

PLATE 48. *Stylaster brunneus* (a, c, I85, USNM 86943; b, d, e, g, P19, USNM 86945; f, I87, NZOI): a, c, linear-imbricate coenosteal texture, x 205, x 825, respectively; b, transition between linear-imbricate and reticulate-granular coenosteal texture, x 315; d, e, longitudinal section of a gastropore tube illustrating gastrostyle and ring palisade, x 53.5, x 173, respectively (d is a stereo pair); f, cyclosystem and female ampulla with efferent pore, x 52.5, stereo pair; g, male efferent pores, x 52.5.

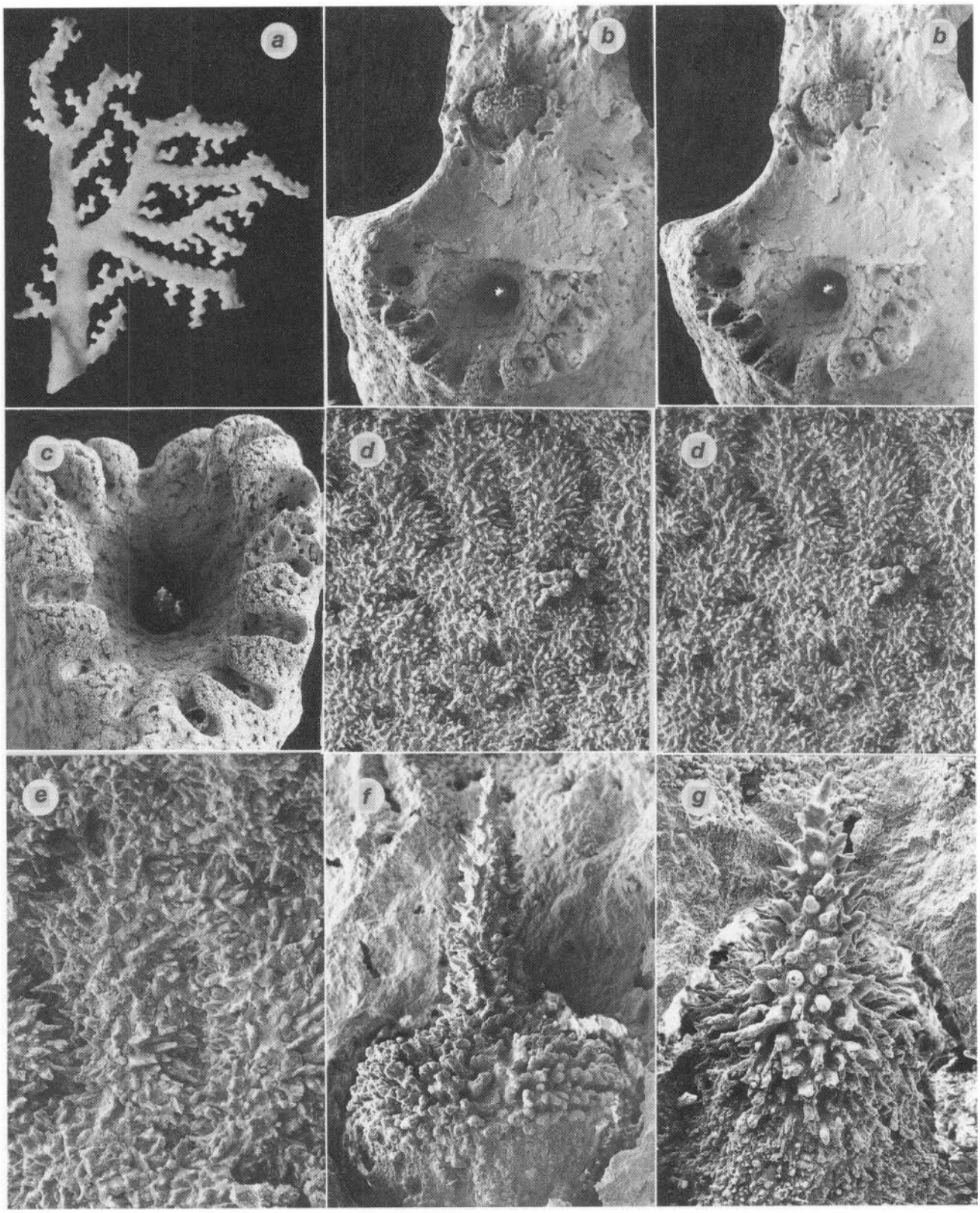

PLATE 49. *Stylaster horologium* (a-c, f, holotype, E 856; d, e, g, E845, NZOI): a, holotype colony, x 1.3; b, apical view of one cyclosystem with dactylostyles visible and lateral view of adjacent gastrostyle, x 33, stereo pair; c, cyclosystem, x 59; d, e, reticulate-granular coenosteal texture, x 180, x 360, respectively (d is a stereo pair): f, g, gastrostyles, x 130, x 210, respectively.

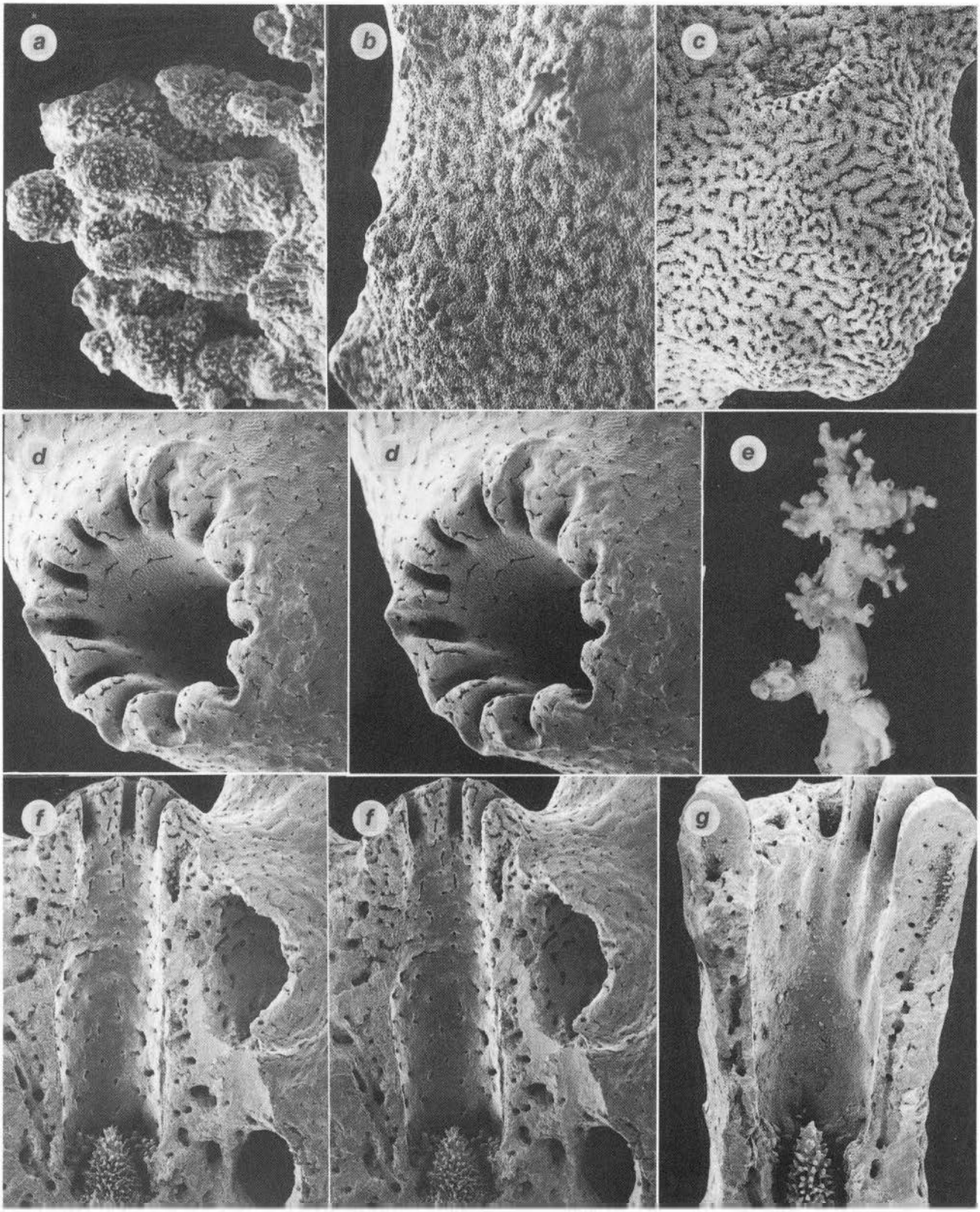

PLATE 50. *Stylaster horologium* (a, E856, USNM 87523; b, E845, NZOI; c, E846, USNM 87522): a, dactylostyle, x 840; b, male efferent pores, x 66; c, female ampulla with efferent pore, x 60. *Stylaster imbricatus* (d, S571, USNM 87526; e, f, E861, holotype; g, G941, USNM 87525): d, cyclosystem, x 41.5, stereo pair; e, holotype colony, x 1.55; f, longitudinal section of a gastropore tube illustrating gastrostyle, ring palisade, and a fractured female ampullae, x 37, stereo pair; g, longitudinal section of a gastropore tube illustrating gastrostyle, ring palisade, and dactylostyle, x 44.

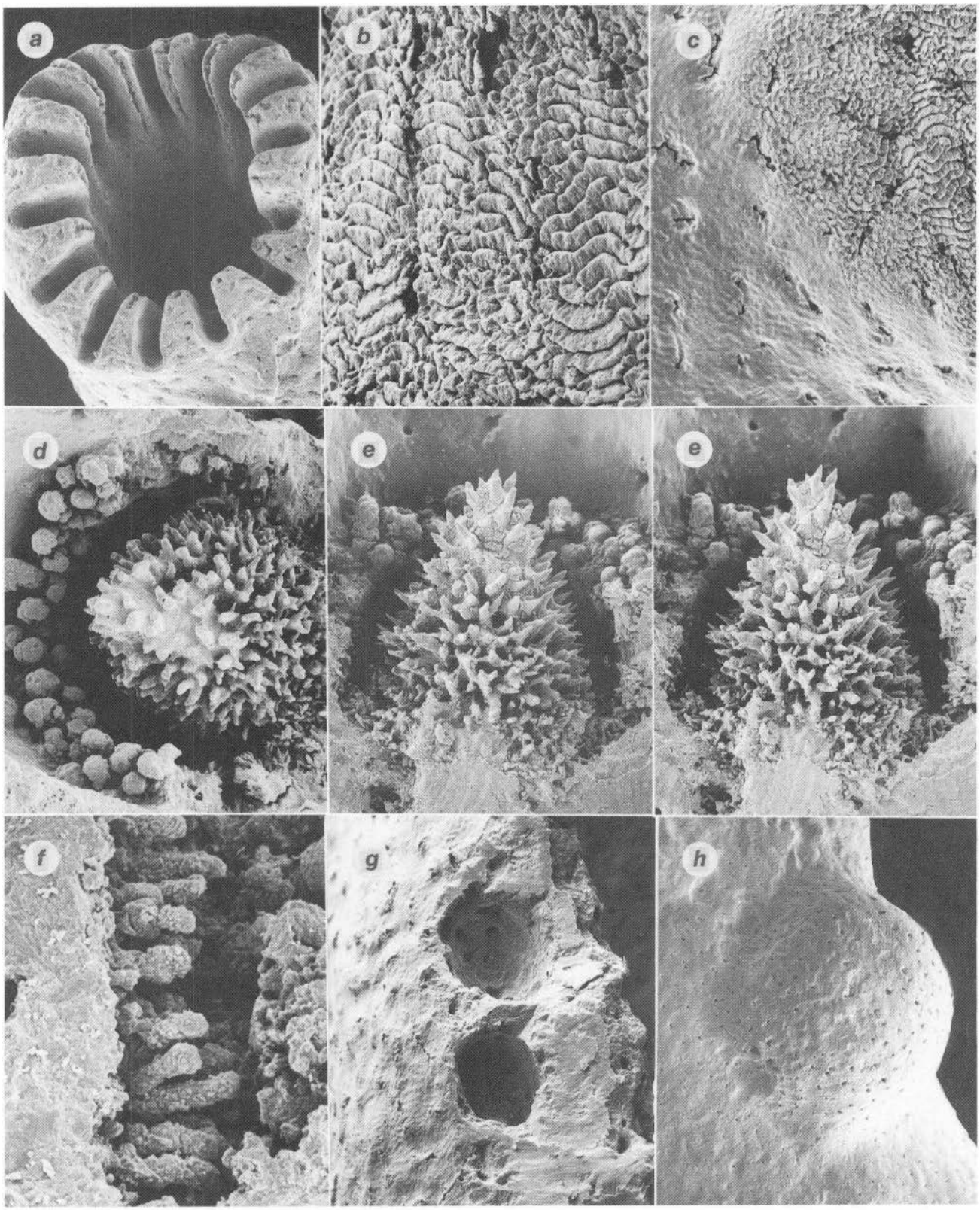

PLATE 51. *Stylaster imbricatus* (a, G941, USNM 87525; b, c, S571, USNM 87526; d–f, E861, holotype; g, h, S572, USNM 87527): a, cyclosystem, x 45; b, imbricate coenosteal texture, x 240; c, transition between imbricate and granular coenosteal textures, x 120; d, e, gastrostyle and annular ring palisade, both x 125 (e is a stereo pair); f, dactylostyle, x 465; g, cross section of internal male ampullae that occur in worm tube coenosteum (surface to left), x 77.5; h, female ampulla and efferent pore, x 39.

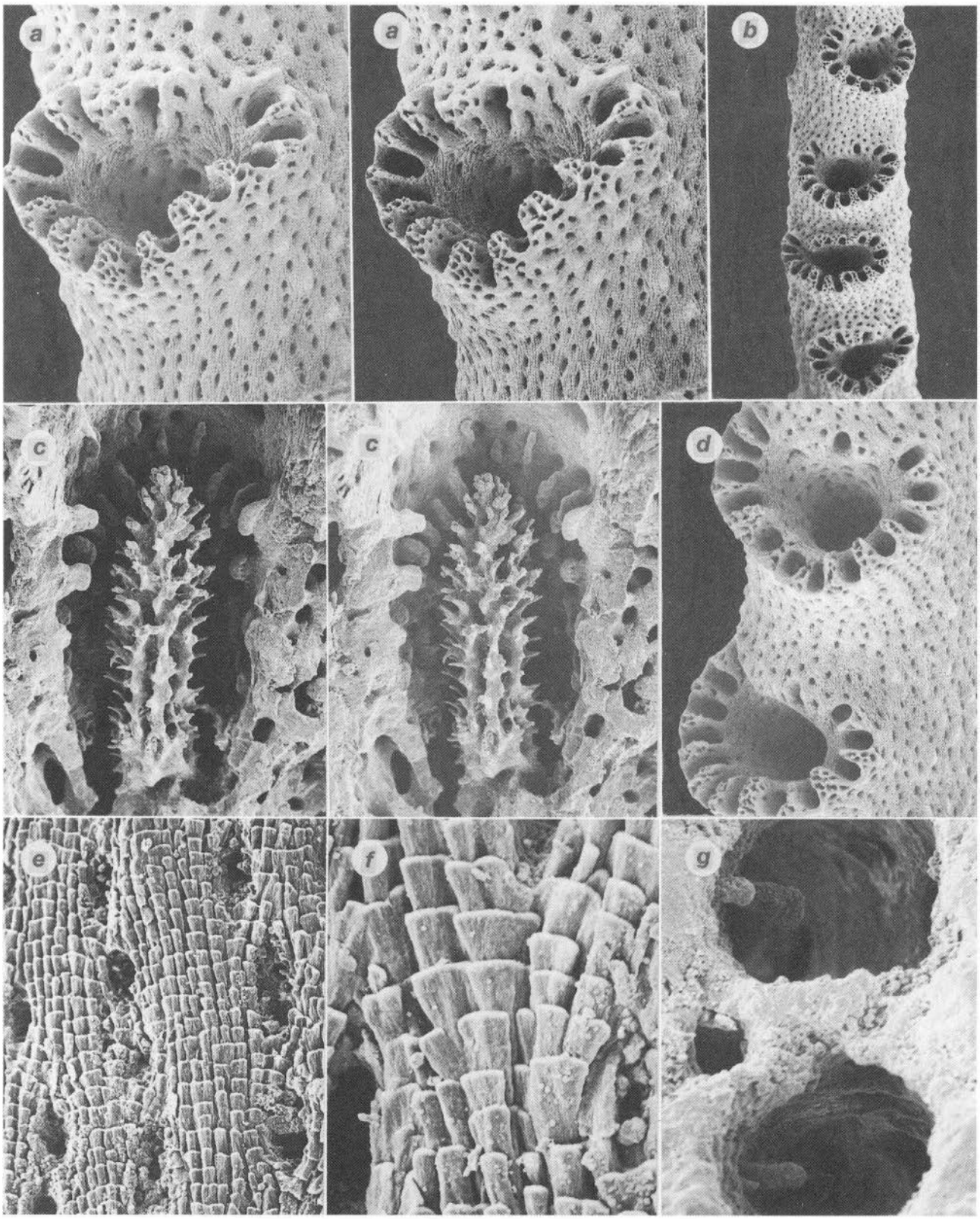

PLATE 52. *Stylaster gracilis* (a–g, *Challenger* 170, BM(NH) 1880.11.25.190, male): a, b, d, cyclosystems, x 65, x 22.5, x 53, respectively (b is a stereo pair); c, gastrostyle and ring palisade, x 143; e, f, imbricate coenosteal texture, x 340, x 960, respectively; g, two dactylostyles, x 510.

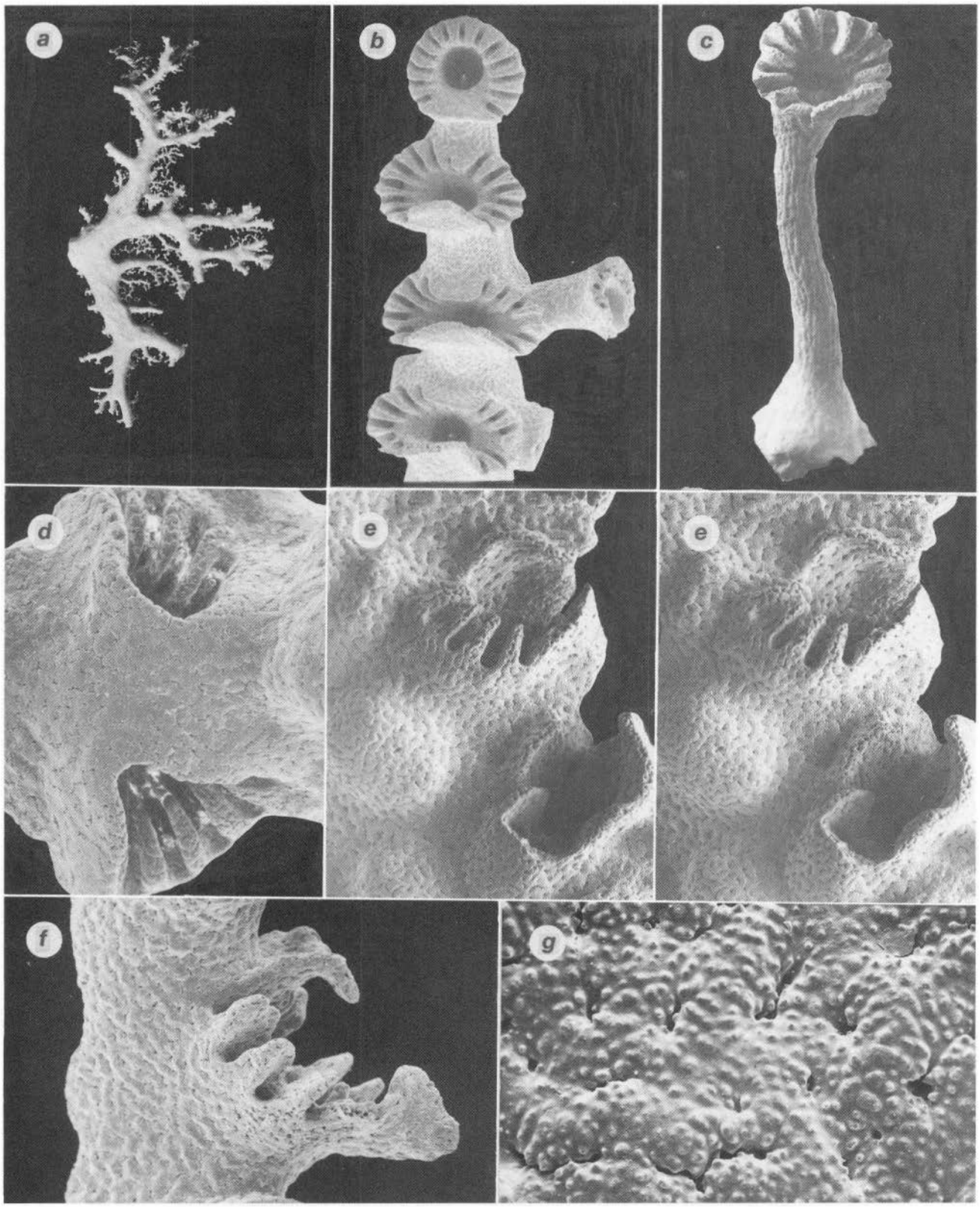

PLATE 53. *Calyptopora reticulata* (a, d, *Eltanin* 1851, USNM 60008; b, *Eltanin* 1991, USNM 60010; c, G3, NZOI; e, g, F132, USNM 76878; f, *Eltanin* 2143, USNM 60009): a, large colony, x 0.35; b, unifacial cyclosystems having progressively more developed lids, x 16; c, founder cyclosystem, x 23.5; d, cyclosystem with fused opposing lids, x 45.5; e, two cyclosystems and male ampullae, x 28, stereo pair; f, lateral view of a cyclosystem with well-developed opposing lids, x 33.5; g, reticulate-granular coenosteal texture, x 220.

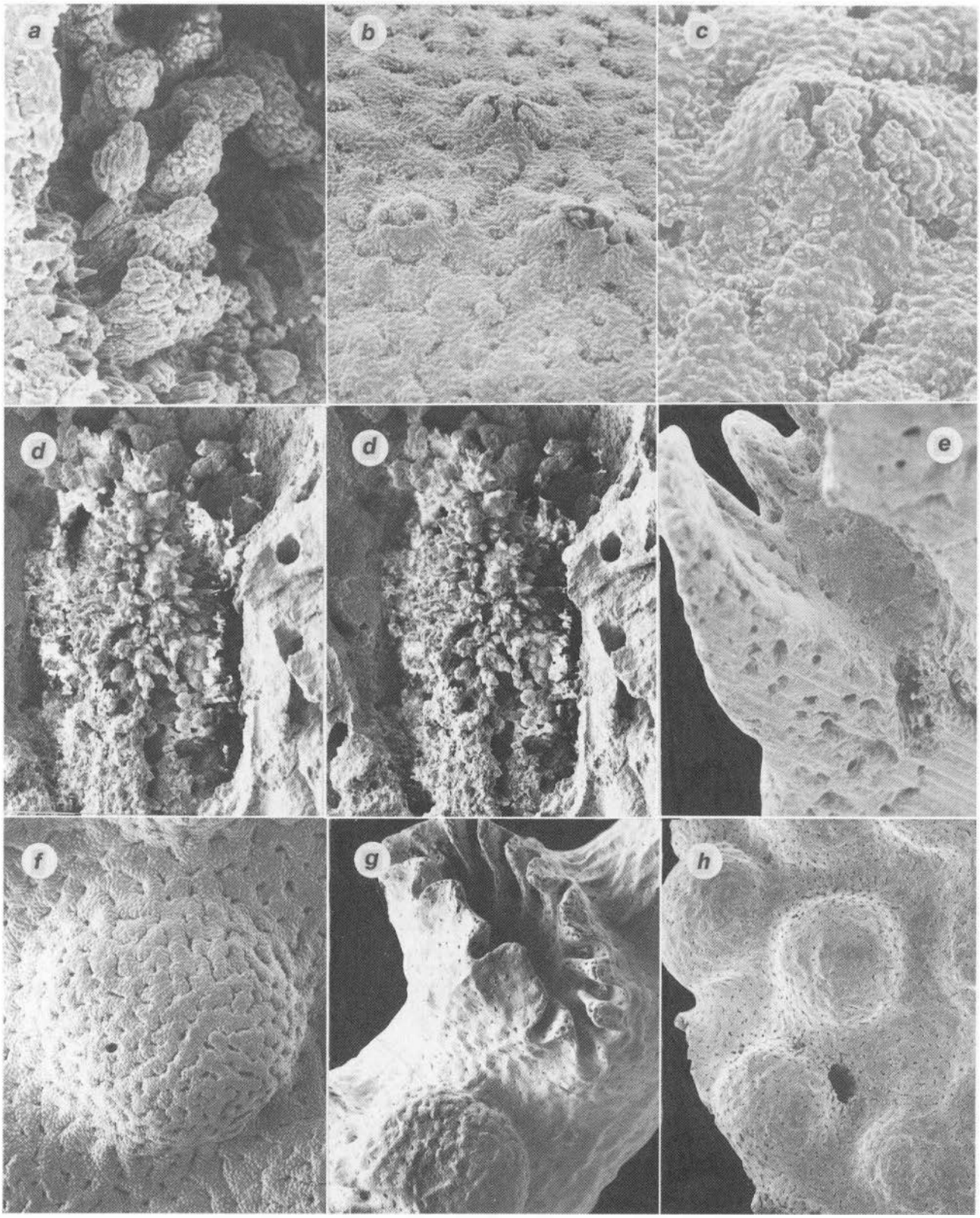

PLATE 54. *Calyptopora reticulata* (a, d, f, F132, USNM 76878; b, c, e, *Eltanin* 1991, USNM 60010; g, h, E861, NZOI): a, dactylostyle, x 800; b, c, coenosteal papillae, x 88, x 240, respectively; d, gastrostyle and ring palisade, x 122, stereo pair; e, longitudinal section of a gastropore tube illustrating gastrostyle, ring palisade, and commodious upper gastropore chamber, x 53; f, male ampulla, x 58; g, cyclosystem and female ampullae, x 41; h, female ampullae, one with an efferent pore, x 30.5.

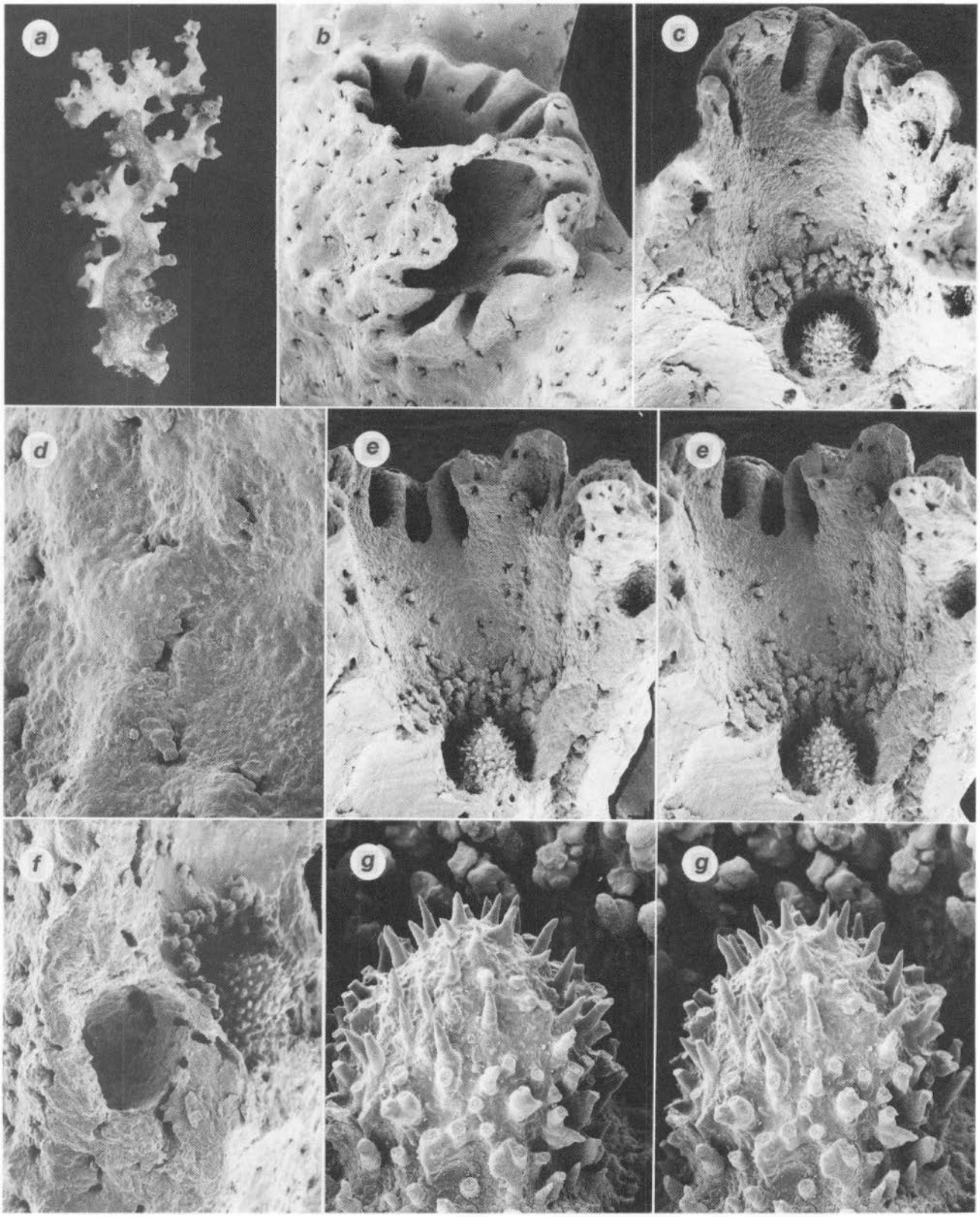

PLATE 55. *Calyptopora sinuosa* (a, f, g, K840, holotype; b-e, P947, USNM 87537): a, holotype colony, x 1.2; b, cyclosystem with fused opposing lids, x 42; c, e, longitudinal section of a gastropore tube illustrating gastrostyle and ring palisade, both x 51 (e is a stereo pair); d, reticulate-granular coenosteal texture, x 145; f, gastrostyle, ring palisade, and cross section of an internal male ampulla, x 78; g, gastrostyle and ring palisade, x 250, stereo pair.

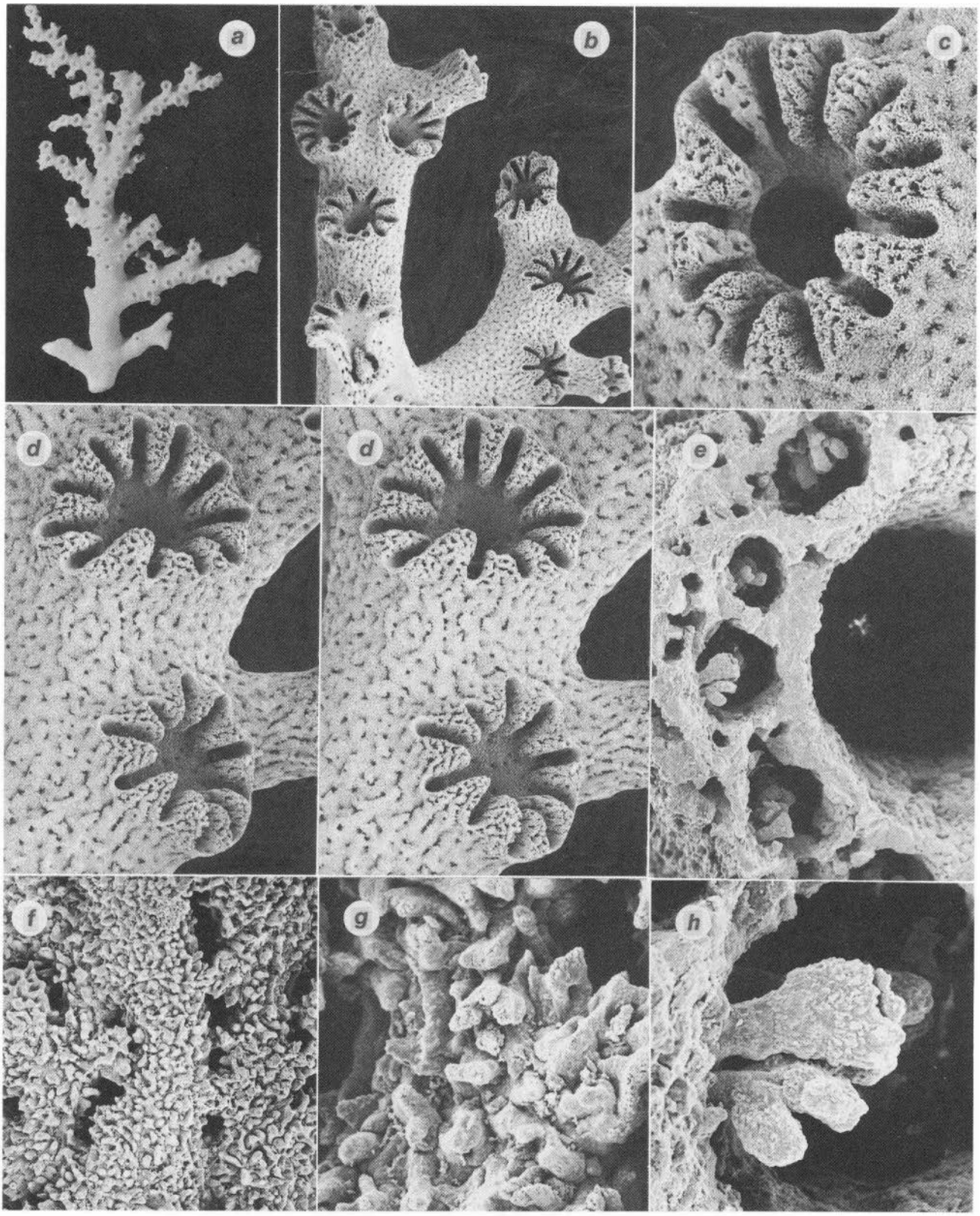

PLATE 56. *Stenohelia conferta* (a, holotype, F132; b–h, paratype, F132): a, holotype colony, x 2.0; b, d, branch segment illustrating unifacial cyclosystems, x 13.8, x 37, respectively; c, cyclosystem, x 67; e, four dactylostyles surrounding a gastropore tube, x 180; f, g, coenosteal texture, x 240, x 810, respectively; h, dactylostyle, x 720.

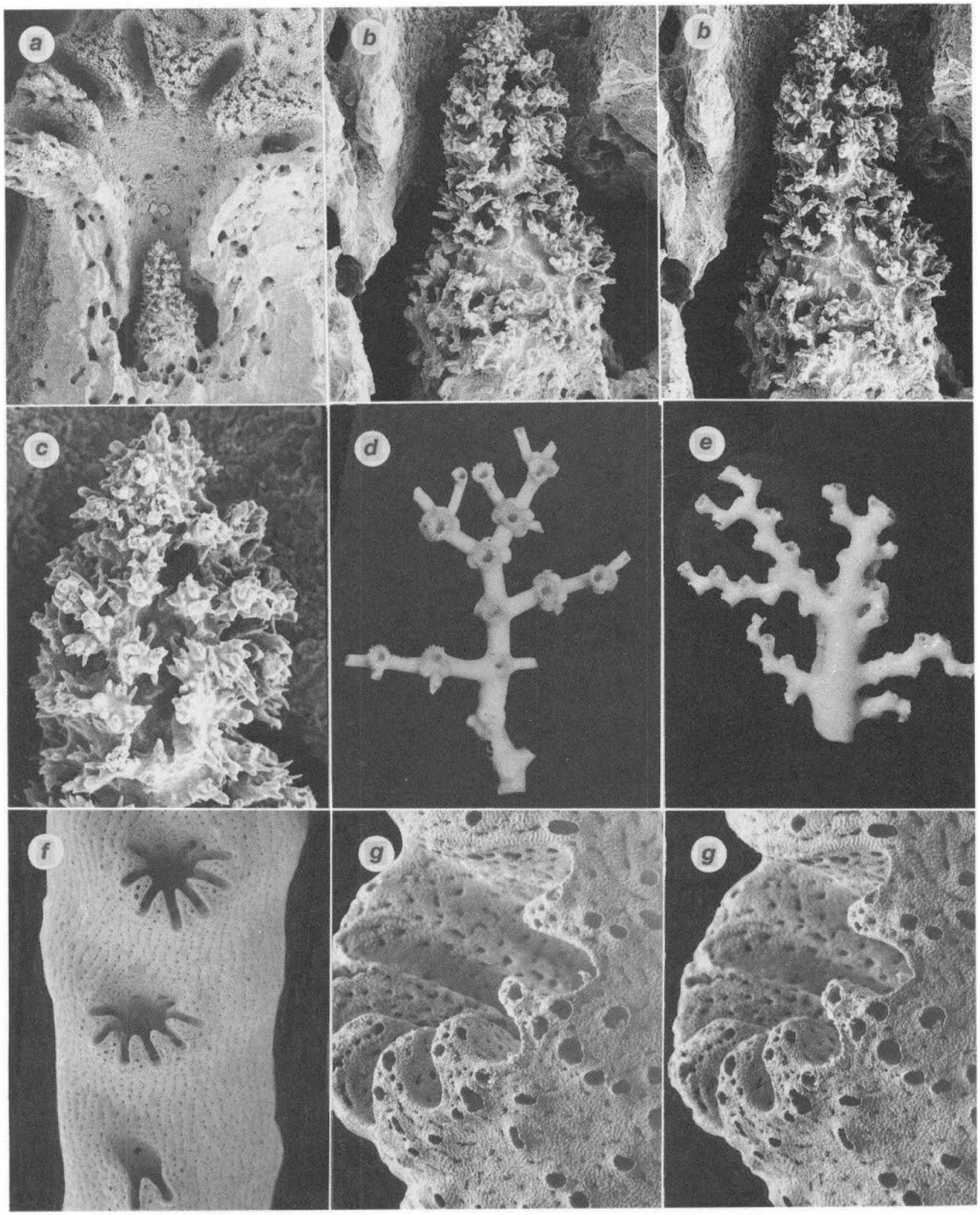

PLATE 57. *Stenohelia conferta* (a–c, F132, paratype): a–c, gastrostyle, x 50, x 163, x 340, respectively (b is a stereo pair). *Stenohelia* sp. cf. *S. profunda* (d, *Challenger* 170, BM(NH) 1880.11.25.183, paralectotype of *S. profunda*): d, colony, x 2.7. *Conopora verrucosa* (e, holotype of *Stylaster verrucosus*, ZMB 1764; f, *Edisto* 14–2, USNM 52617; g, D39, USNM 87539): e, holotype colony, x 3.0; f, cyclosystems, x 17; g, cyclosystem with numerous nemato-pores, x 64, stereo pair.

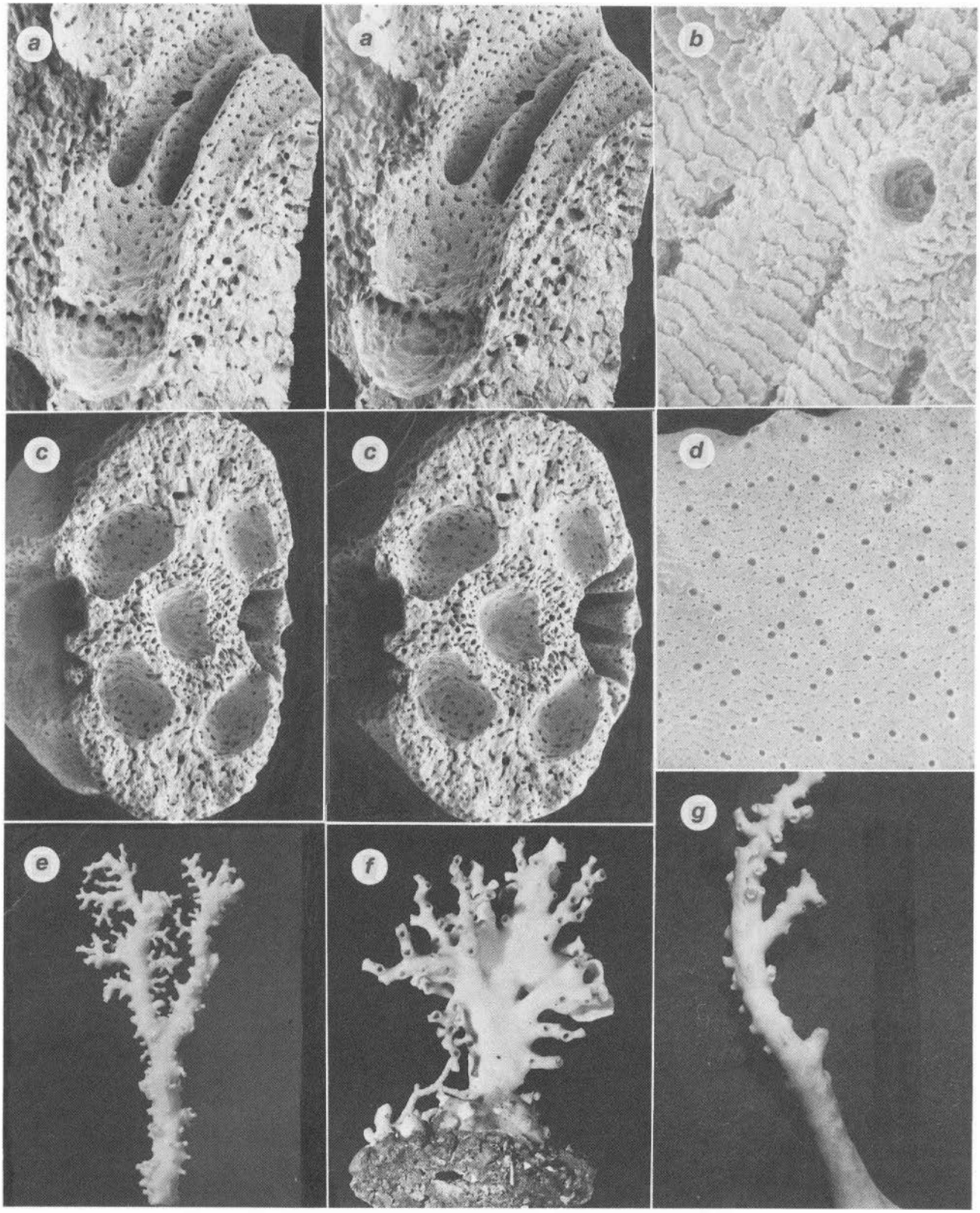

PLATE 58. *Conopora verrucosa* (a, D39, USNM 87539; b, *Vema* 17-61, USNM 60052; c, D150, NZOI; d, *Eltanin* 1089, USNM 52619): a, longitudinal section of a gastropore tube illustrating double chambers and a male efferent pore in upper dactylotome, x 37, stereo pair; b, linear-imbricate coenosteal texture and a nematopore, x 240; c, branch cross section revealing four female ampullae (corners) and base of a gastropore chamber (centre), x 23, stereo pair; d, coenosteum with numerous nematopores, x 19. *Conopora laevis* (e, holotype of *Stylaster obliquus*, ZMB 1778; f, K860, NZOI; g, holotype of *Stylaster laevis* ZMB 1776): e–g, colonies, x 1.0, x 1.5, x 2.0, respectively.

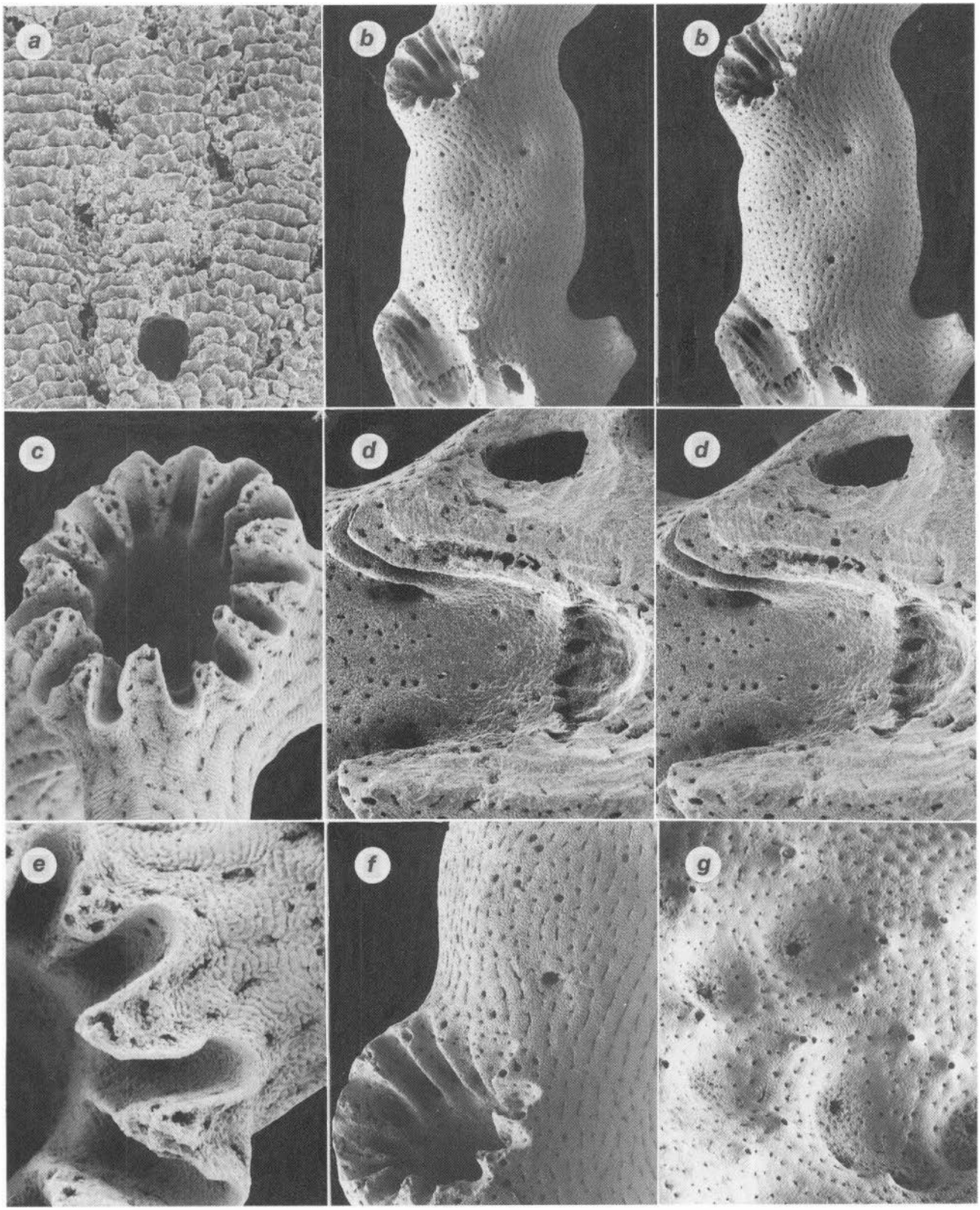

PLATE 59. *Conopora laevis* (a, b, d, f, g, A910, USNM 60254; c, e, holotype of *C. tenuis*, *Challenger* 170, BM(NH) 1880. 11.25.184): a, linear-imbricate coenosteal texture, x 250; b, branch segment having two cyclosystems and several male ampullae with efferent pores, x 17.5, stereo pair; c, e, cyclosystem with concave pseudosepta, x 50, x 96, respectively; d, rotated longitudinal section of a gastropore tube illustrating double chambers and fractured male ampulla, x 48, stereo pair; f, cyclosystem and male ampulla with efferent pore, x 37; g, female ampullae (broad concavities) within worm tube coenosteum, nematopores interspaced, x 53.

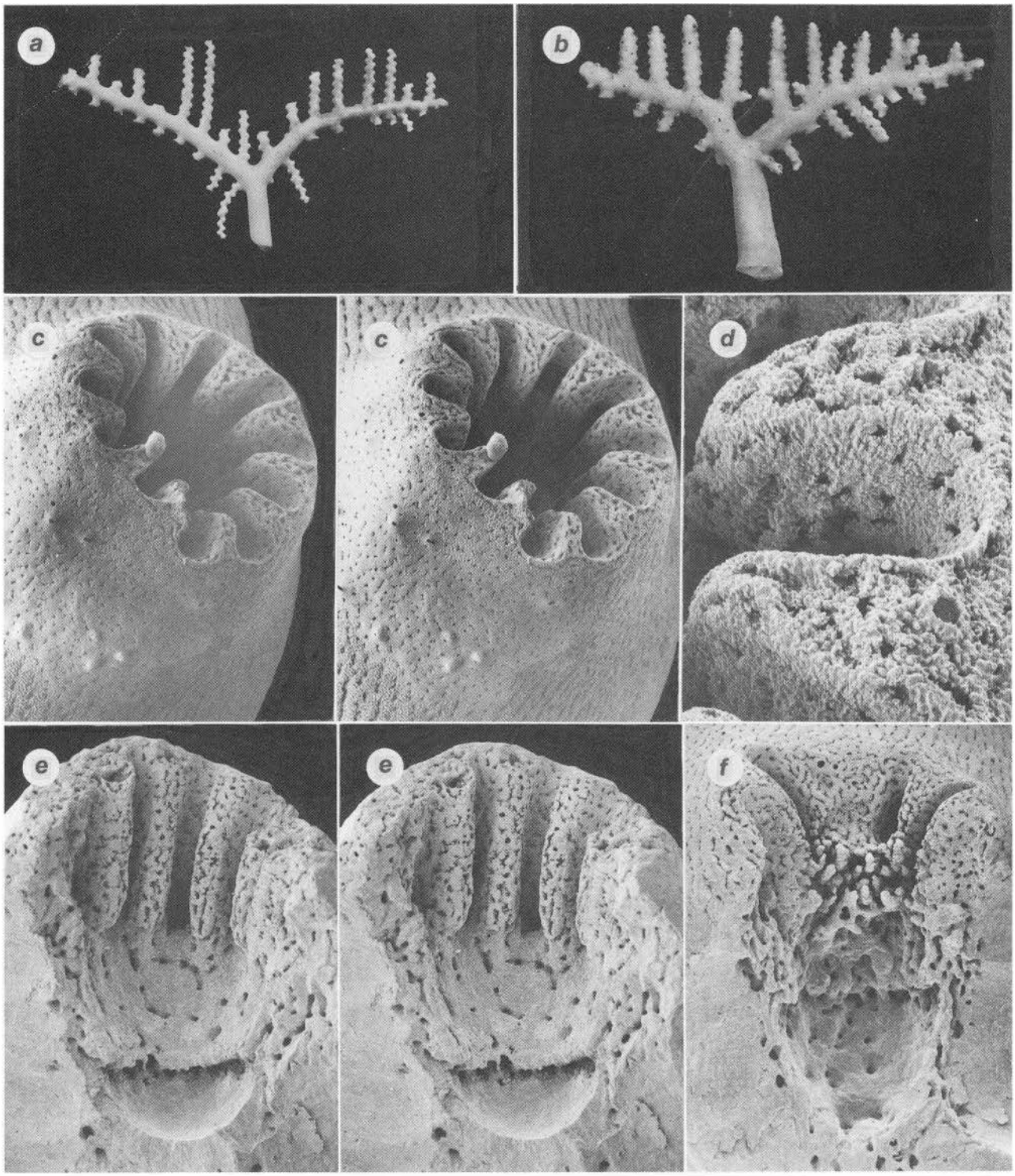

PLATE 60. *Conopora candelabrum* (a, c, d, holotype, E859; b, e, S572, NZOI; f, E859, paratype, NZOI): a, holotype colony, x 0.85; b, colony of variety, x 1.7; c, cyclosystem with bulging female ampulla, x 60, stereo pair; d, pseudosepta, x 225; e, longitudinal section of a gastropore tube illustrating double chambers, x 65, stereo pair; f, longitudinal section of a gastropore tube illustrating female efferent pore in upper chamber, x 53.

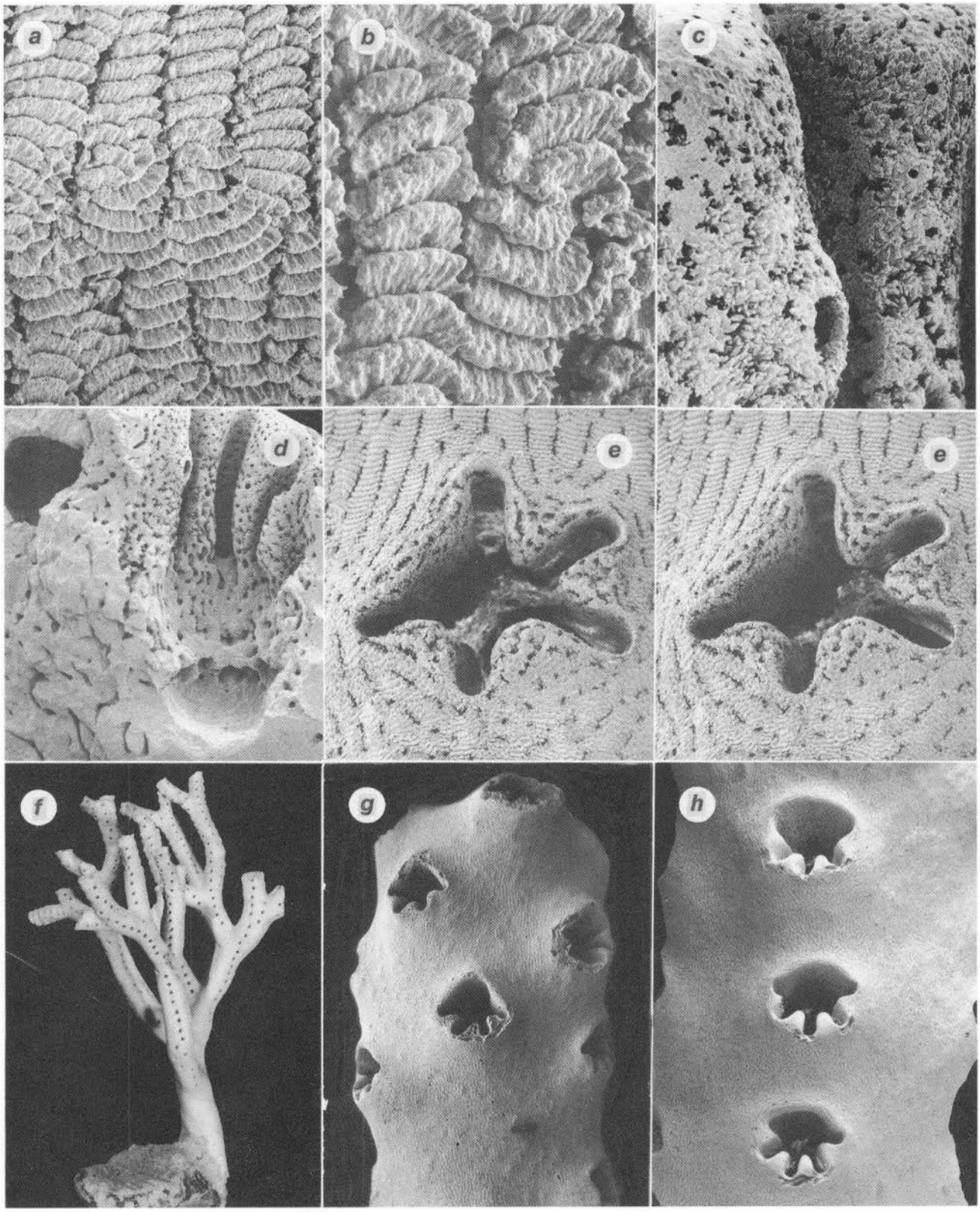

PLATE 61. *Conopora candelabrum* (a, e, S572, USNM 87553, variety; b, E859, holotype, NZOI; c, d, S572, USNM 87552, typical): a, b, linear-imbricate coenosteal texture, x 305, x 690, respectively; c, male efferent pore on a pseudoseptum, x 215; d, longitudinal section of a gastropore tube and male ampulla illustrating an efferent pore on pseudoseptum (*see* preceeding figure), x 53; e, cyclosystem of variety, x 110, stereo pair. *Conopora tetrastichopora* (f, holotype, E846, NZOI; g, h, paratypes, E846, USNM 87556): f, holotype colony, x 0.92; g, h, branch segment illustrating linearly arranged cyclosystems, x 13.1, x 17, respectively.

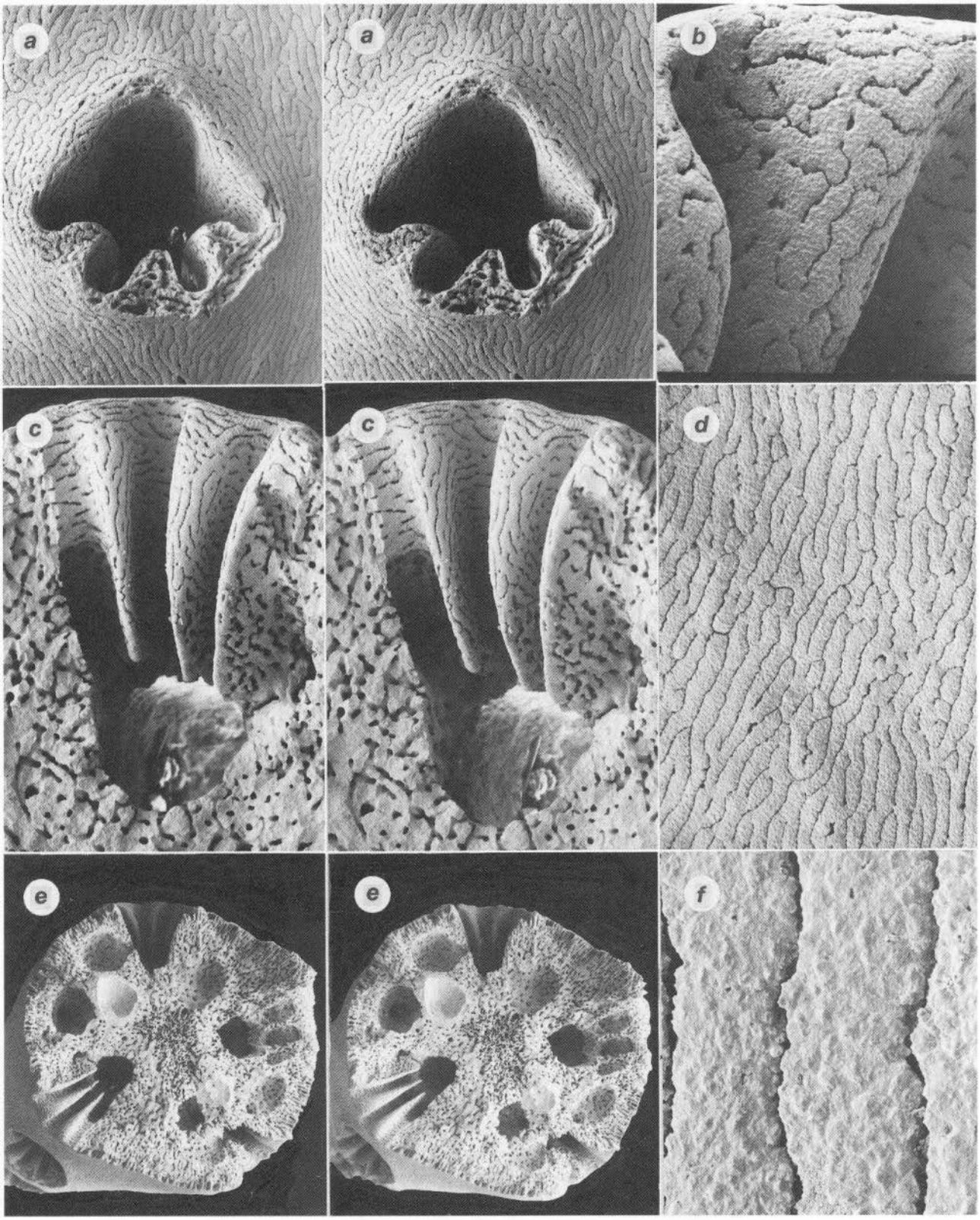

PLATE 62. *Conopora tetrastichopora* (a–f, E846, USNM 87556): a, cyclosystem and coenosteal texture, x 46, stereo pair; b, thick pseudoseptum, x 150; c, fractured cyclosystem revealing several pseudosepta and gastropore ring constriction, x 55, stereo pair; d, f, linear-granular coenosteal texture, x 81, x 580, respectively; e, branch cross section revealing spongy core, three gastropore tubes, and adjacent internal male ampullae, some of the latter revealing efferent pores to gastropore chamber (upper left), x 13.8, stereo pair.

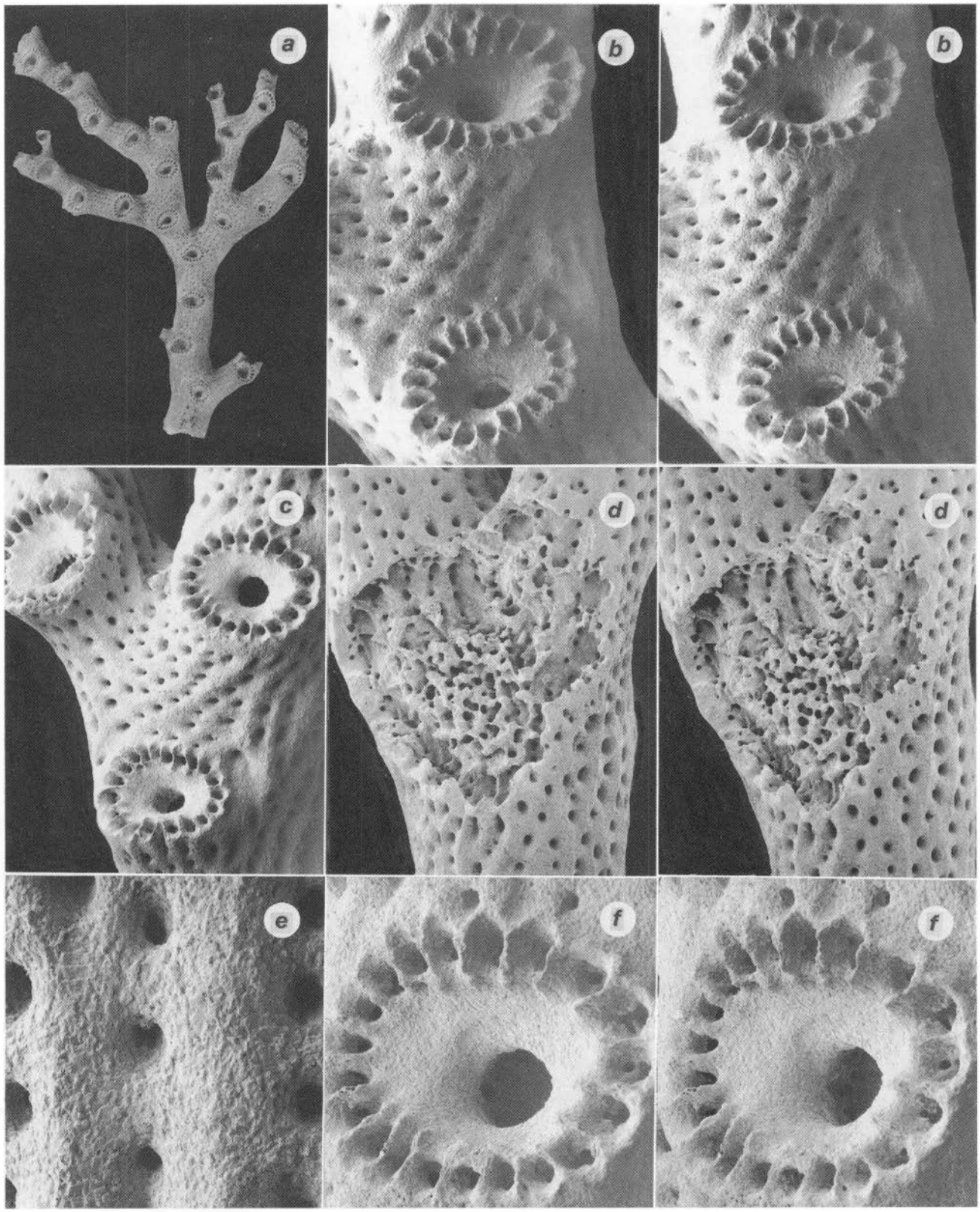

PLATE 63. *Conopora unifacialis* (a, P947; b–f, paratype, P947, USNM 87558): a, holotype colony, x 2.9; b, c, branch segments bearing unifacial cyclosystems, x 20, x 15.5, respectively (b is a stereo pair); d, fractured coenosteum covering massed male ampullae on posterior branch face, x 16.2, stereo pair; e, coenosteal texture, x 82; f, cyclosystem, x 41, stereo pair.

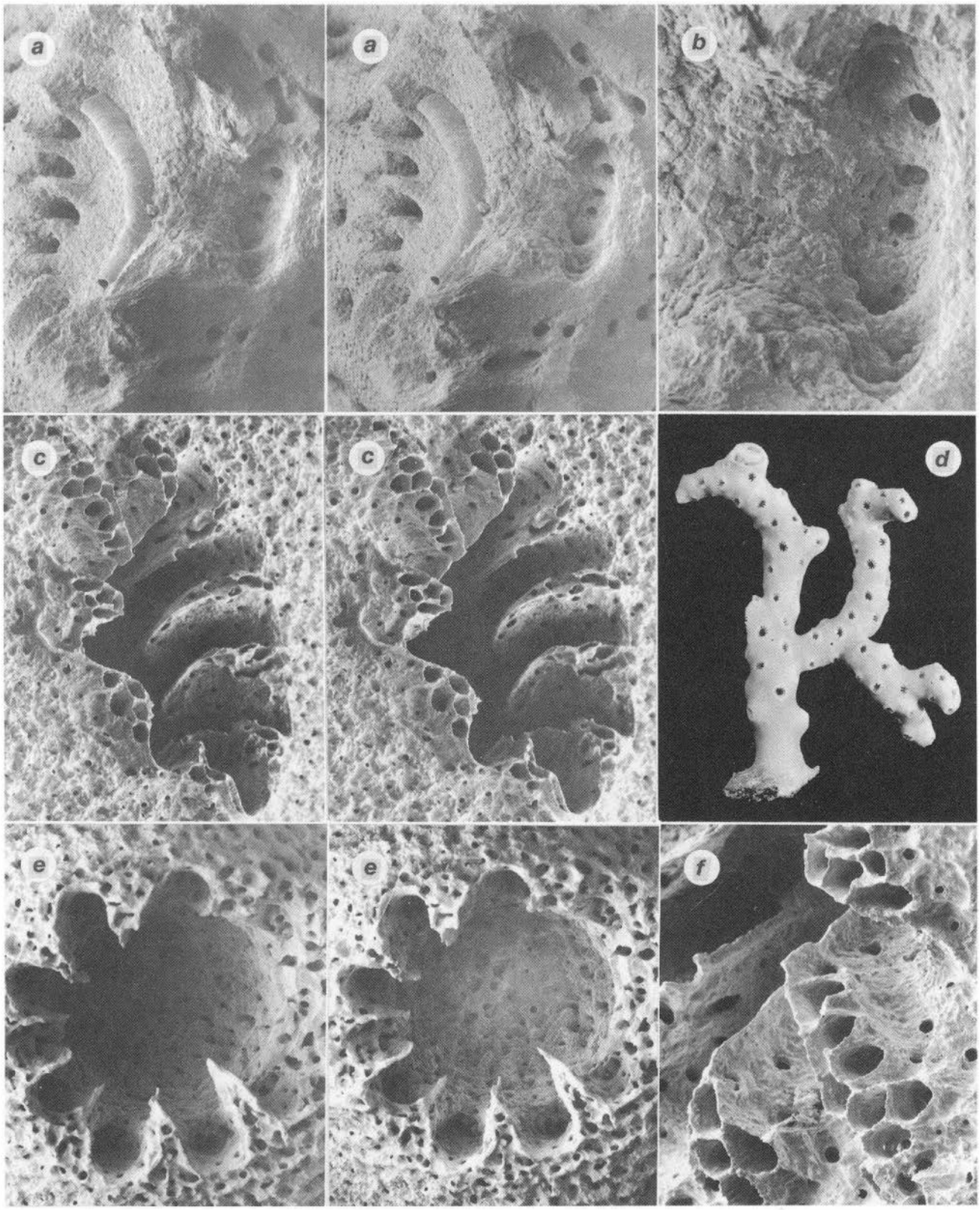

PLATE 64. *Conopora unifacialis* (a, b, P947, USNM 87558): a, b, rotated view of longitudinal section of a gastropore tube illustrating gastropore ring constriction and flattened lower chamber, x 49, x 120, respectively (b is a stereo pair). *Conopora gigantea* (c–f, holotype, I96, NZOI): c, oblique view of a cyclosystem, x 26, stereo pair; d, holotype colony, x 0.9; e, oral view of a cyclosystem, x 26, stereo pair; f, loculated pseudosepta, x 54.

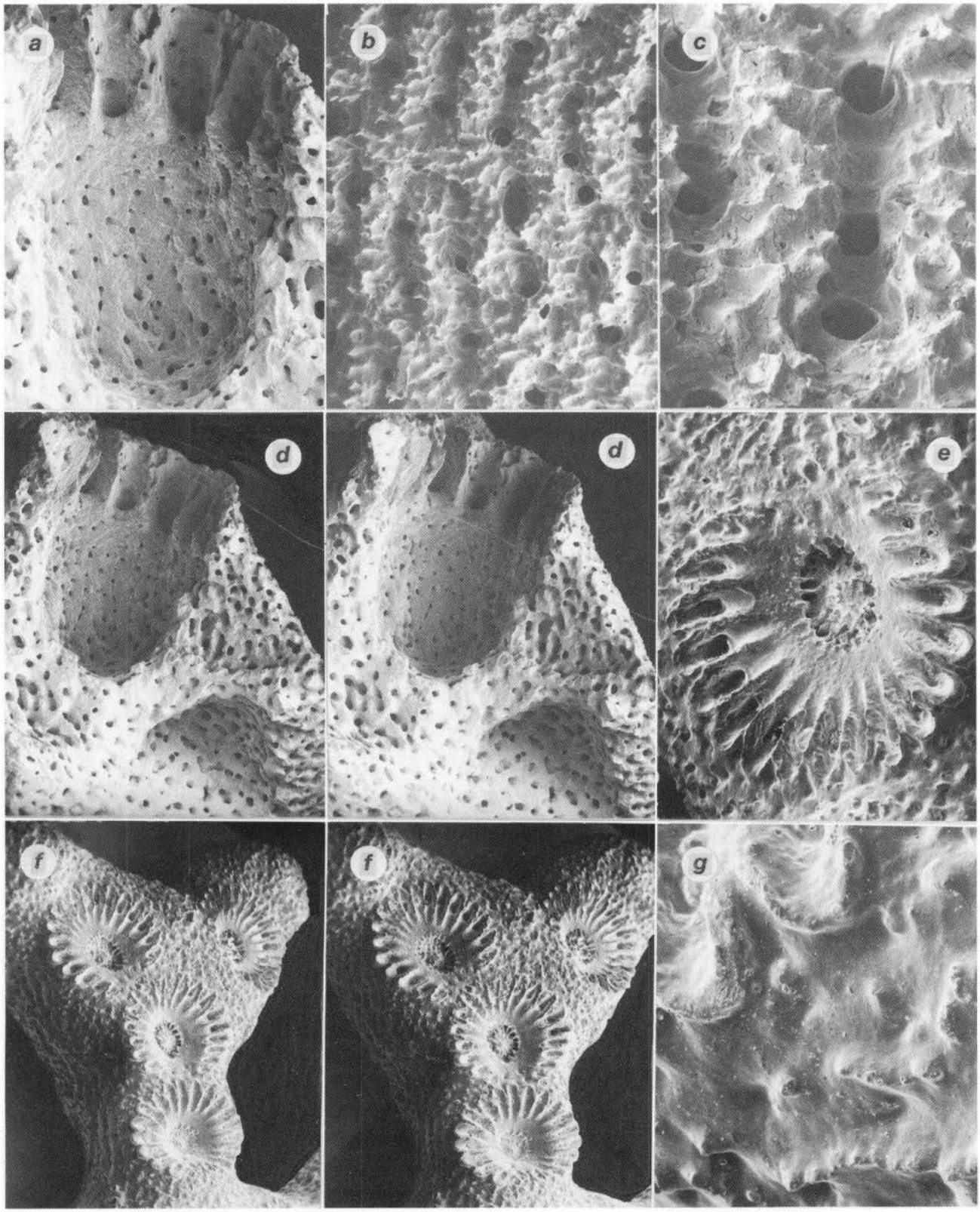

PLATE 65. *Conopora gigantea* (a–d, holotype, I96, NZOI): a, longitudinal section of a gastropore tube illustrating the lack of a gastropore ring constriction, x 28; b, c, coenosteal texture, x 72, x 195, respectively; d, longitudinal section of a gastropore tube and part of a female (?) ampulla (lower right), x 17.3, stereo pair. *"Conopora" anthohelia* (e–g, holotype, P947, NZOI): e, cyclosystem with a "gastrostyle" mound, x 21.5; f, branch tip illustrating closely adjacent, unilinear cyclosystems, x 8.0, stereo pair; g, edges of pseudosepta (upper left) and coenosteal texture, x 82.

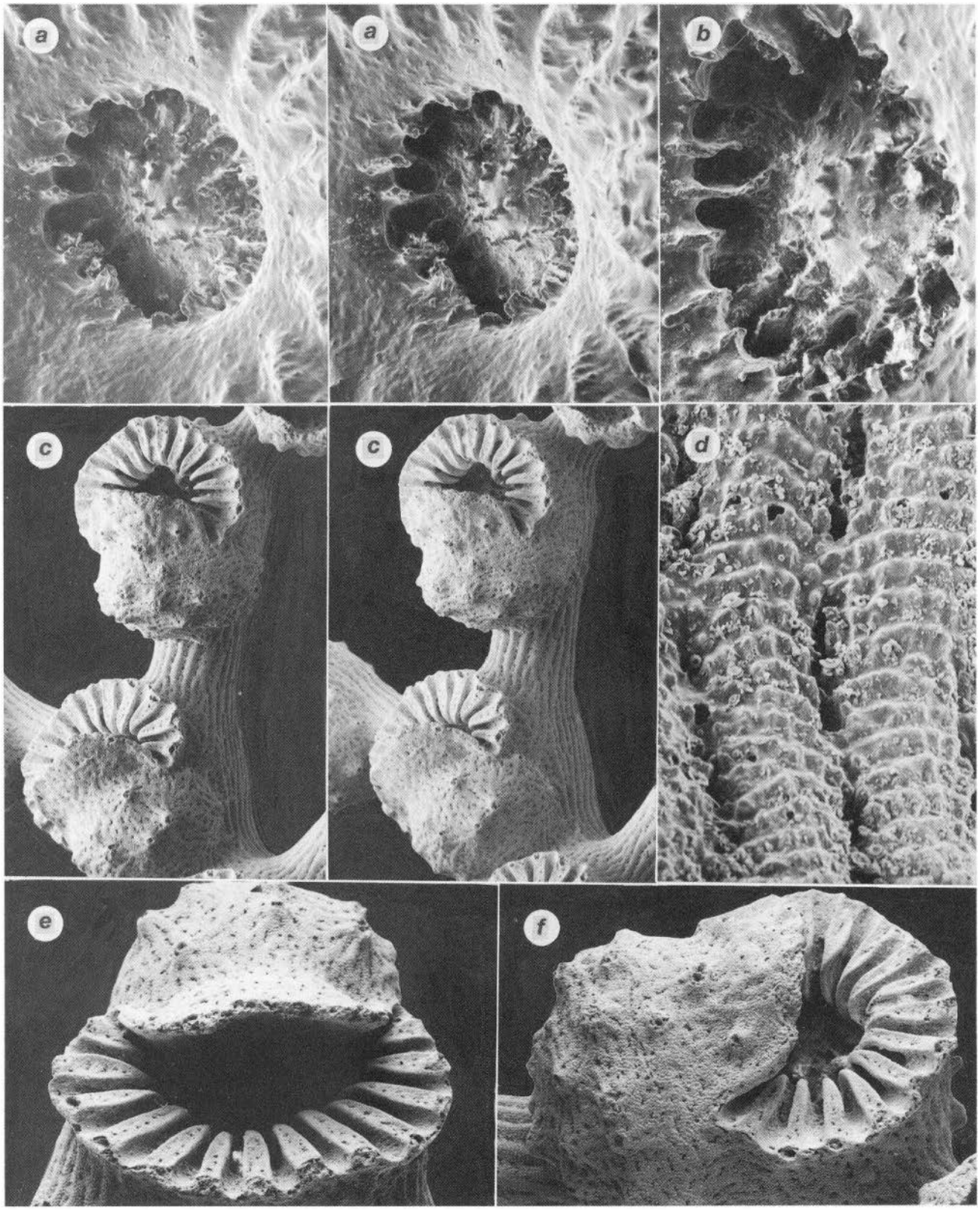

PLATE 66. *"Conopora" anthohelia* (a, b, holotype, P947, NZOI): a, b, view of gastropore ring constriction and central "gastrostyle" mound, x 52.5, x 78, respectively (a is a stereo pair). *Astya aspidopora* (c–f, U599, USNM 87559, female): c, e, f, cyclosystems, each with a prominent female ampulla, x 27, x 53, x 52, respectively; d, worn linear-imbricate coenosteal texture, x 460.

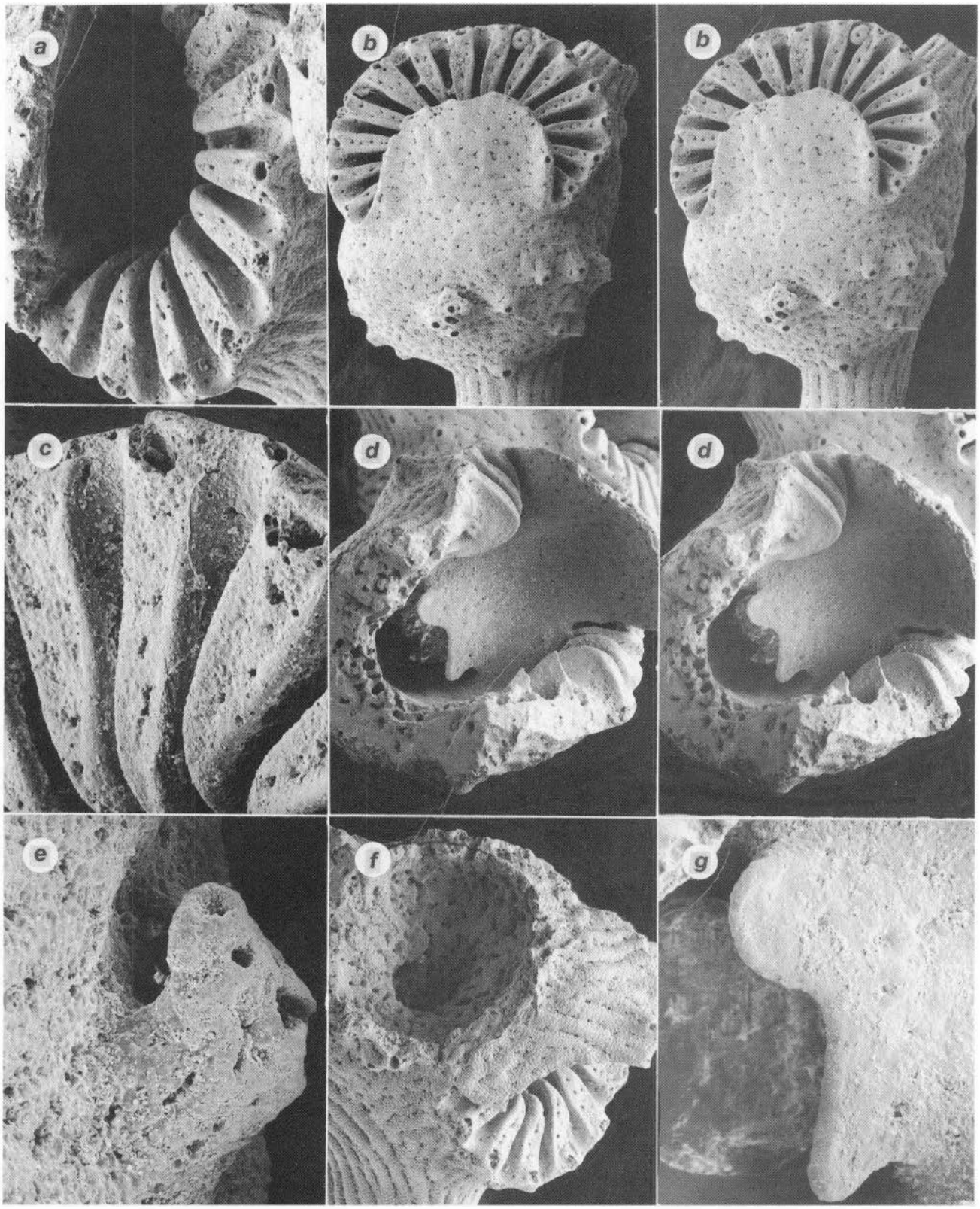

PLATE 67. *Astya aspidopora* (a–g, U599, USNM 87559): a, pseudosepta, each having one nematopore on its upper outer edge, x 80; b, intact cyclosystem illustrating pseudosepta, lid, and a male ampulla with ten conical nematopore mounds and one efferent pore (*see also* fig. e), x 43.5, stereo pair; c, pseudosepta, x 19; d, longitudinal section of a gastropore tube illustrating its notched inner shelf, x 45, stereo pair; e, enlargement of spur covering male efferent pore, x 275; f, fractured female ampulla revealing efferent pore that leads into lower gastropore chamber, x 53; g, upper gastropore chamber notched shelf, x 162.

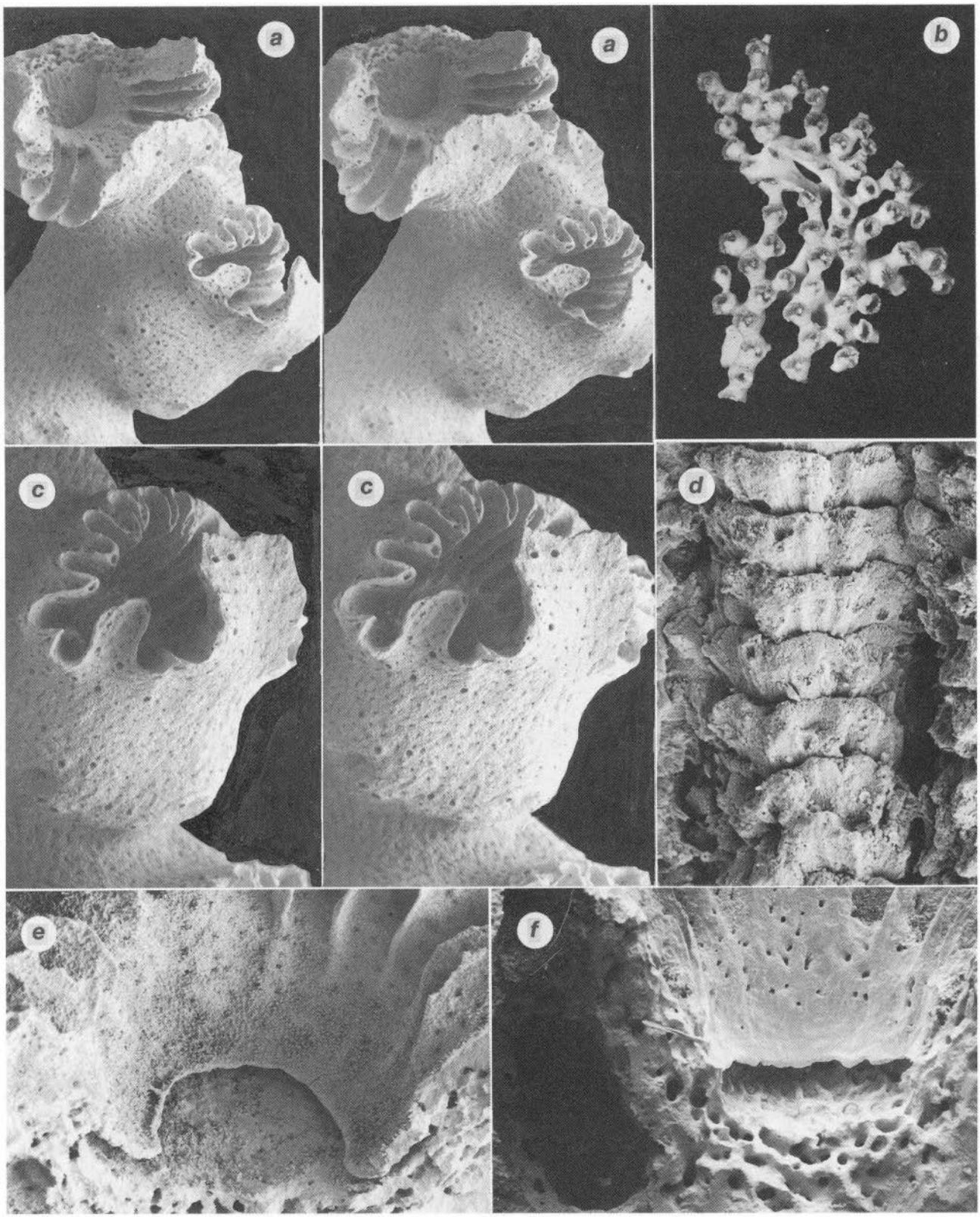

PLATE 68. *Crypthelia studeri* (a-c, f, holotype, D39, NZOI; d, e, *Eltanin* 1851, USNM 60094): a, c, cyclosystems having circumferential male ampullae, apical efferent pore also visible, x 20, x 31, respectively (both stereo pairs); b, holotype colony, x 2.05; d, linear-imbricate coenosteal texture, x 575; e, f, longitudinal section of gastropores illustrating gastropore ring constriction and flattened lower chamber, x 66, x 58, respectively.

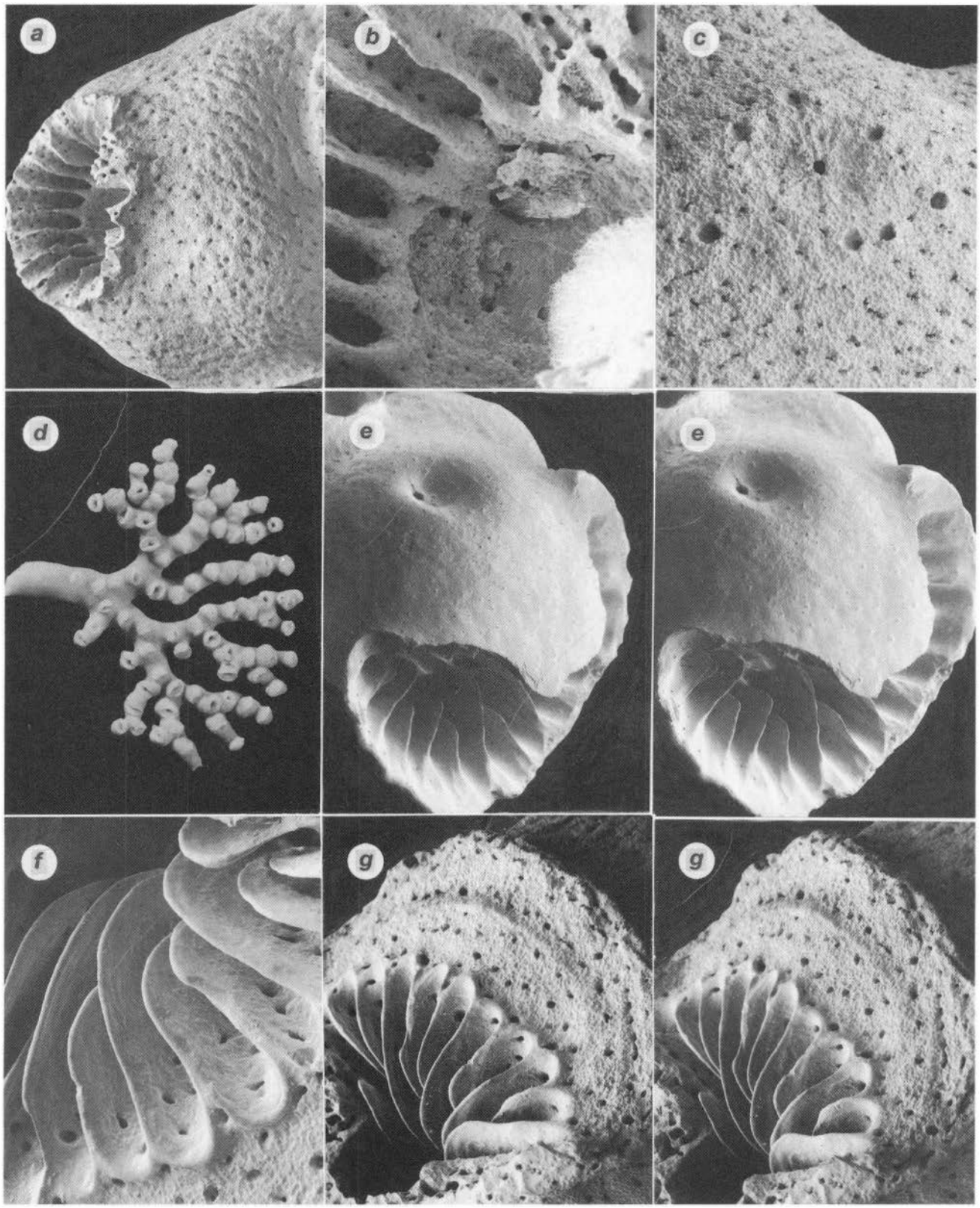

PLATE 69. *Crypthelia studeri* (a, b, *Eltanin* 1991, USNM 60265; c, holotype, D39, NZOI): a, cyclosystem (with lid removed) with large female ampulla, x 21; b, two large female efferent pores in upper gastropore chamber, x 60; c, convex, centrally perforate male efferent pore surrounded by seven nematopores, x 66. *Crypthelia robusta* (d, holotype, I97, NZOI; e–g, I97, USNM 87562): d, holotype colony, x 1.25; e, cyclosystem with male ampulla having an efferent pore in lower lid, x 25, stereo pair; f, thin, unequal pseudosepta, x 78; g, cyclosystem illustrating unequal pseudosepta and a broad lip, x 47.5, stereo pair.

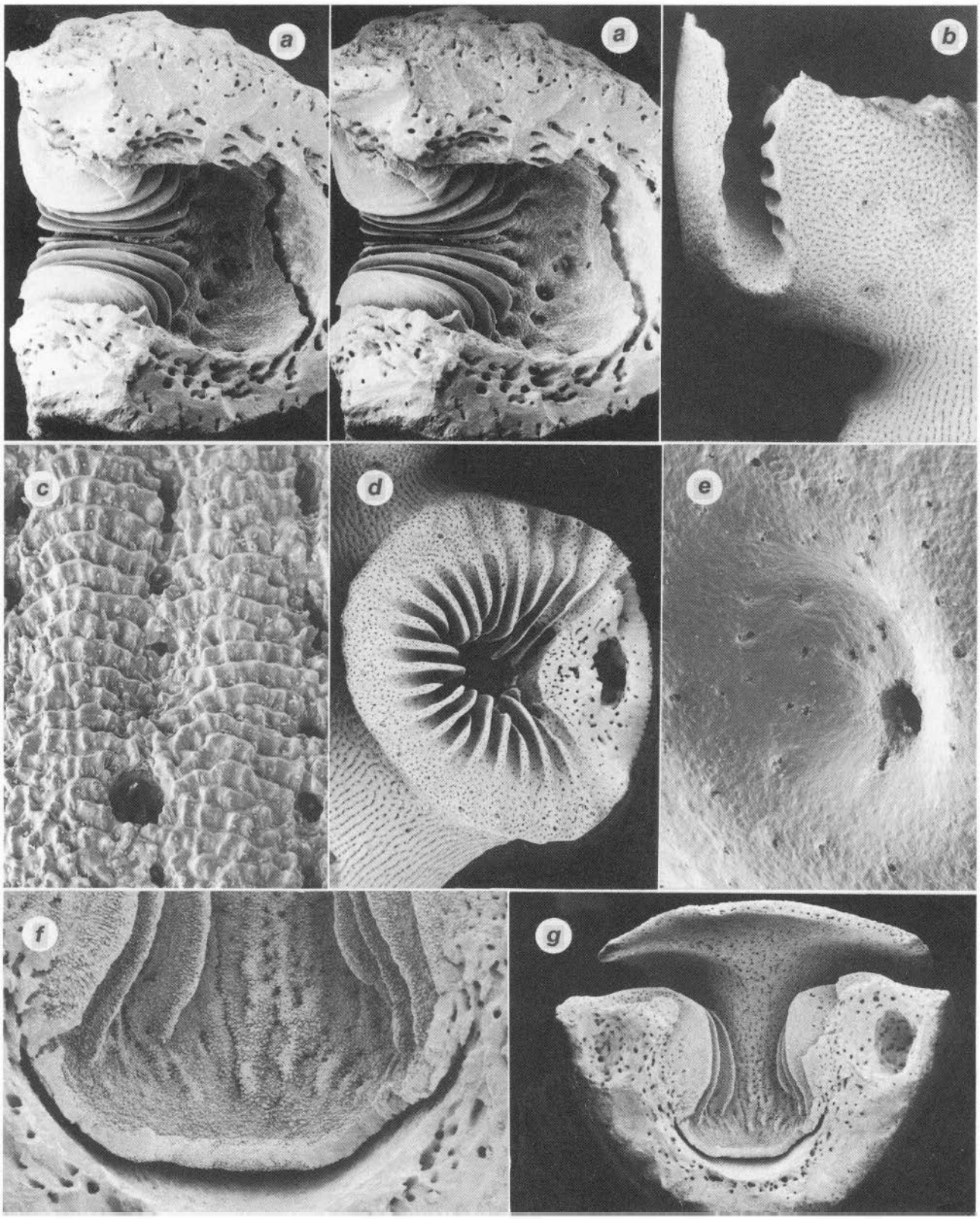

PLATE 70. *Crypthelia robusta* (a, c, e, I97, USNM 87562; b, d, f, g, P9, NZOI): a, rotated longitudinal section of a gastropore tube illustrating thin-edged, recurved pseudosepta, x 30.5, stereo pair; b, lateral view of a male cyclosystem illustrating four efferent pores, x 20; c, linear-imbricate coenosteal texture, x 240; d, oral view of a cyclosystem with lid removed to reveal pseudosepta of unequal lengths, x 17; e, male efferent pore, x 120; f, g, longitudinal section of gastropore tube illustrating very thin lower chamber and circumferential male ampullae, x 48, x 16, respectively.

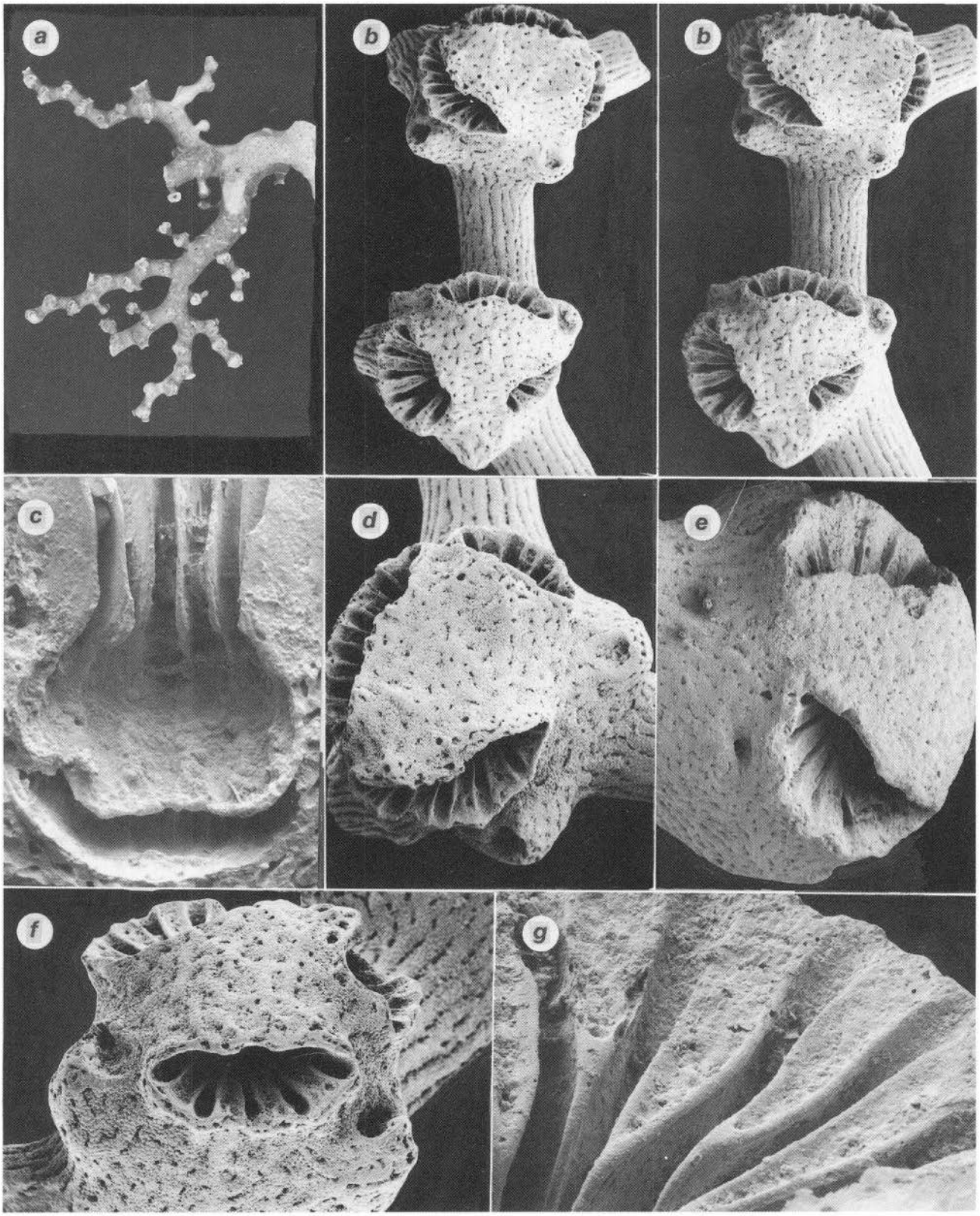

PLATE 71. *Crypthelia polypoma* (a, c, e, g, holotype, T256; b, d, f, G3, USNM 87563): a, holotype colony, x 1.15; b, d, f, cyclosystems with multiple fused lids, each cyclosystem surrounded by male ampullae with spurs overhanging their efferent pores, x 24, x 40, x 46, respectively (b is a stereo pair); c, longitudinal section of a gastropore tube illustrating the spherical upper chamber and flat lower chamber, x 58.5; e, cyclosystem with fused lids, x 30; g, broad, concave pseudosepta, x 115.

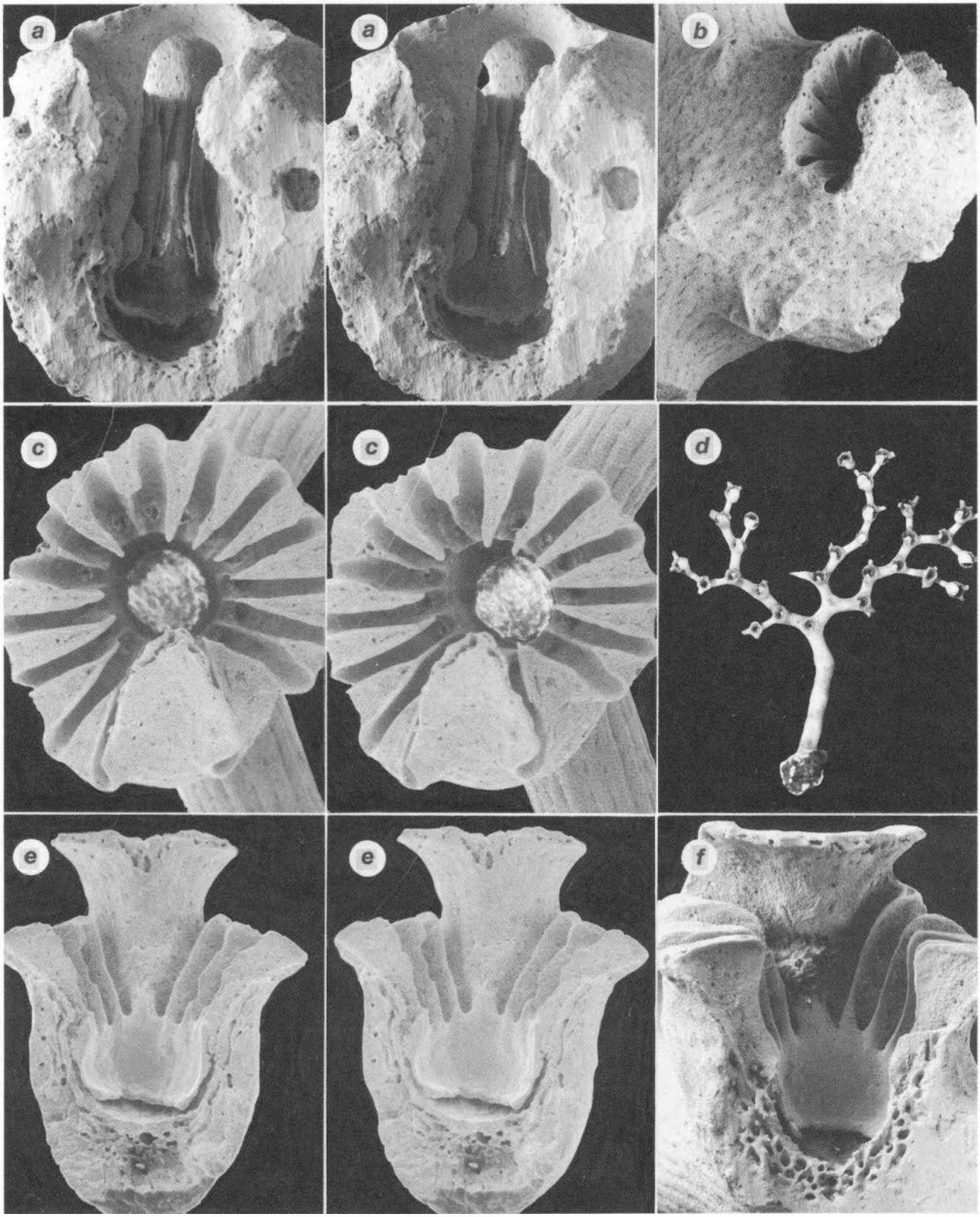

PLATE 72. *Crypthelia polypoma* (a, b, U599, USNM 87564): a, longitudinal section of a gastropore tube illustrating male ampullae and fused lids, x 30, stereo pair; b, cyclosystem surrounded by male ampullae, x 30. *Crypthelia fragilis* (c, e, f, *Eltanin* 17–5, USNM 60089, paratypes; d, *Eltanin* 1852, USNM 60091): c, oral view of a cyclosystem, x 41, stereo pair; d, paratype colony, x 2.2; e, longitudinal section of gastropore tube illustrating chambers, stereo pair; f, longitudinal section of a gastropore tube illustrating female efferent pore beneath lid, x 380.

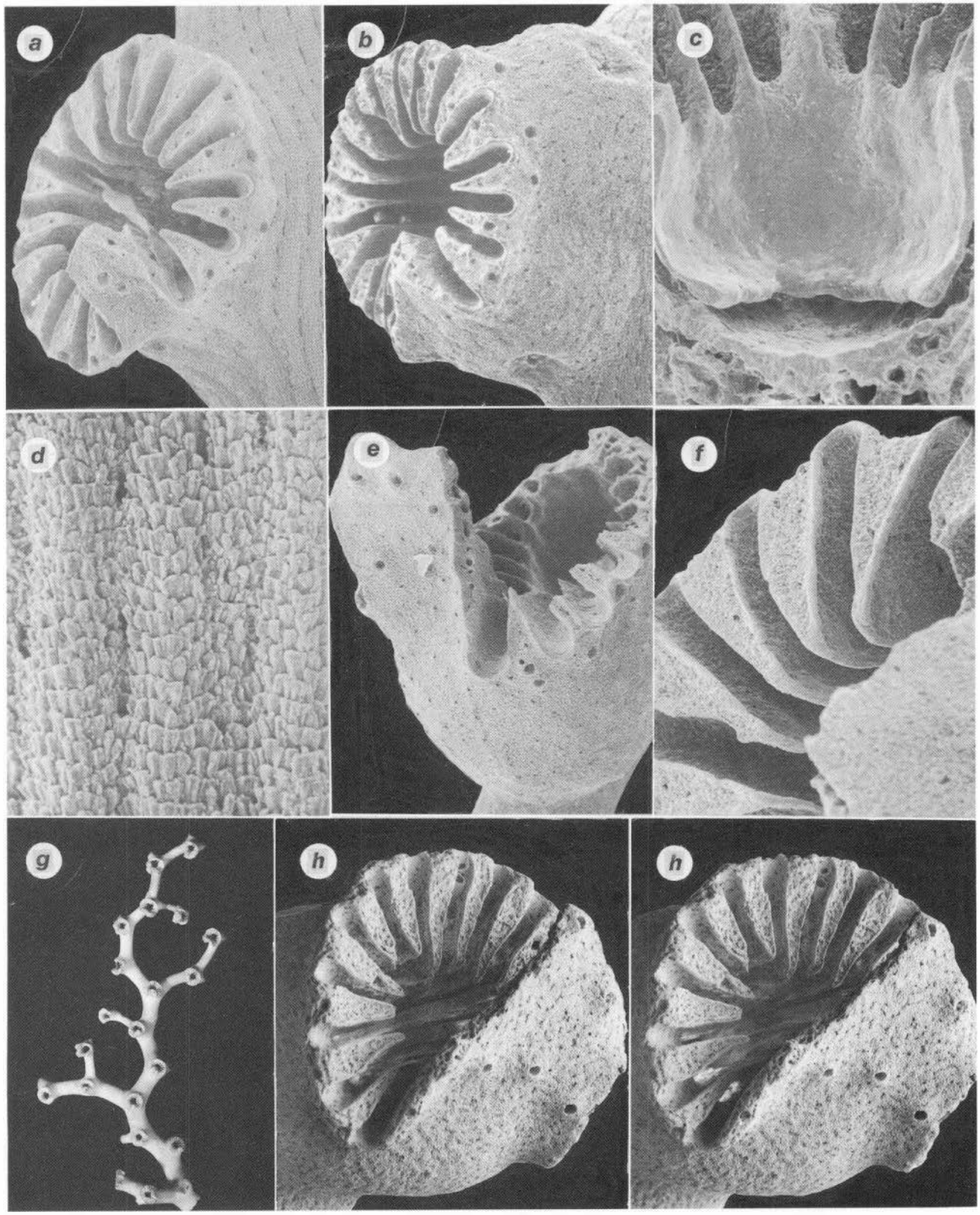

PLATE 73. *Crypthelia fragilis* (a–f, *Eltanin* 17–5, paratypes, USNM 60089): a, cyclosystem, x 44; b, cyclosystem with two male ampullae and corresponding efferent pores (nematopores common on pseudosepta), x 36; c, longitudinal section of cyclosystem illustrating spherical upper chamber, gastropore ring constriction, and flat lower chamber, x 92; d, linear-imbricate coenosteal texture, x 240; e, cyclosystem with female ampulla in lid base, x 40; f, concave pseudosepta, x 88. *Crypthelia curvata* (g, holotype, E860, NZOI; h, U599, USNM 87566): g, holotype colony, x 1.8; h, cyclosystem with partially broken lid revealing concave pseudosepta, x 33, stereo pair.

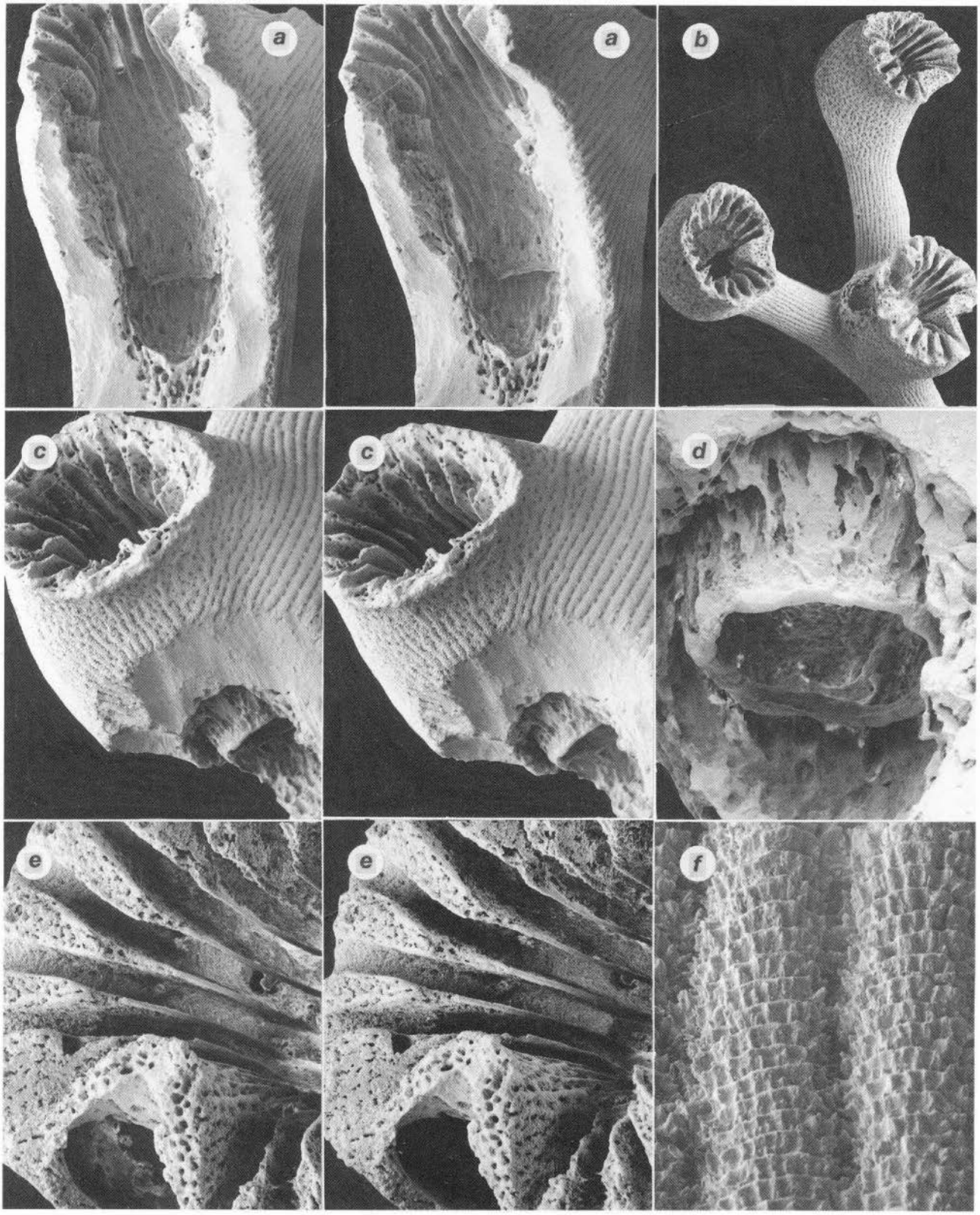

PLATE 74. *Crypthelia curvata* (a, c, d, f, S568, NZOI; b, e, E305, USNM 87565): a, longitudinal section of a curved gastropore tube, x 23.5, stereo pair; b, three cyclosystems lids broken away), x 13.5; c, excavation of lower gastropore tube revealing gastropore ring constriction of figured cyclosystem, x 28, stereo pair; d, enlargement of gastropore ring constriction, x 78.5; e, cyclosystem with lid removed to show male efferent pore on pseudoseptum adjacent to lid, x 61, stereo pair; f, linear-imbricate coenosteal texture, 32.5.

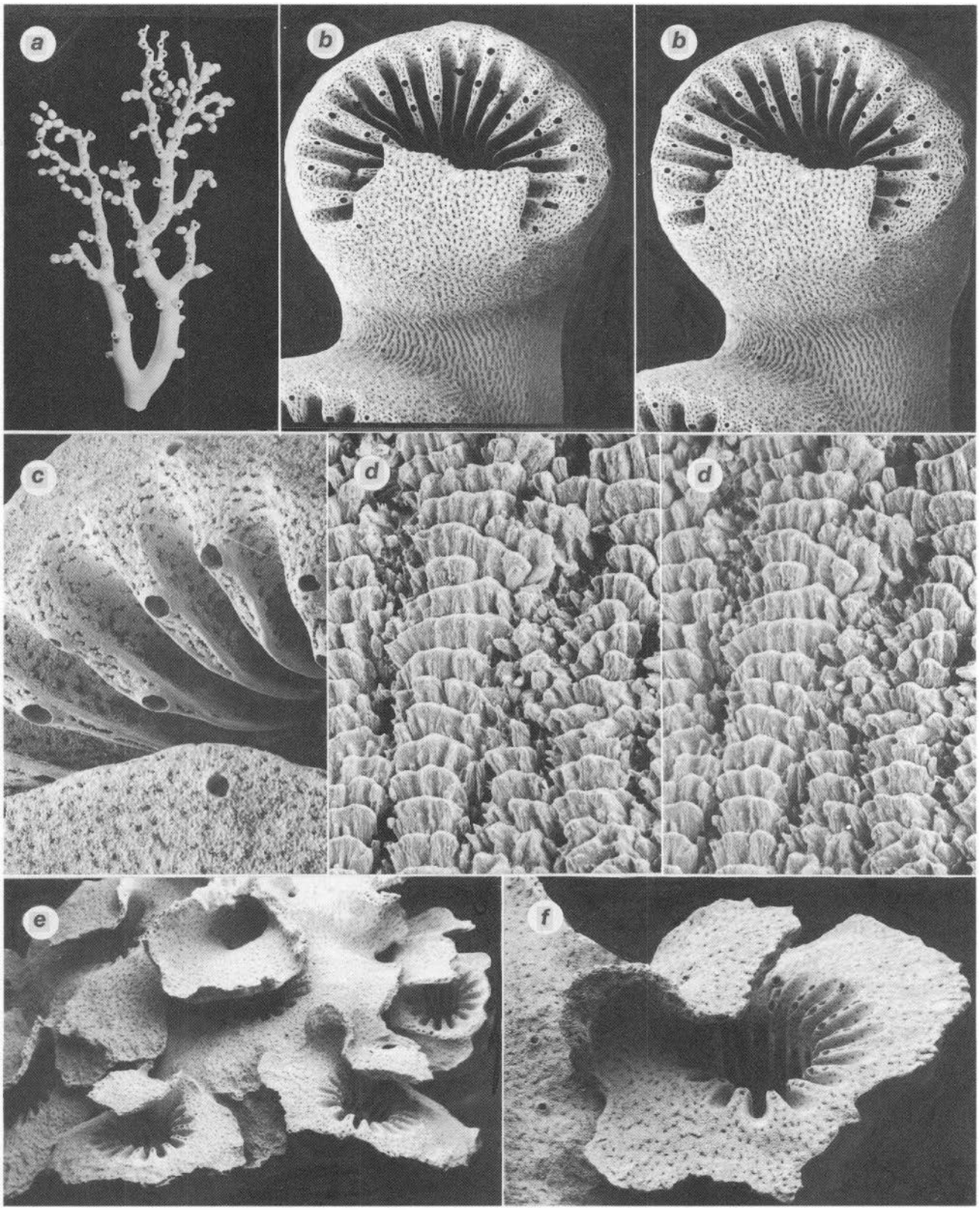

PLATE 75. *Crypthelia cymas* (a–f, E861, USNM 87569, male): a, colony, x 0.72; b, oral view of a typical cyclosystem (with broken lid) having 2–3 nematopores per pseudoseptum and two efferent pores on upper right pseudosepta (*see also* Plate 76, c), x 21, stereo pair; c, pseudosepta bearing large nematopores, x 68; d, linear-imbricate coenosteal texture, x 335; e, f, anomalous cyclosystems with broad lips, x 16.5, x 36, respectively.

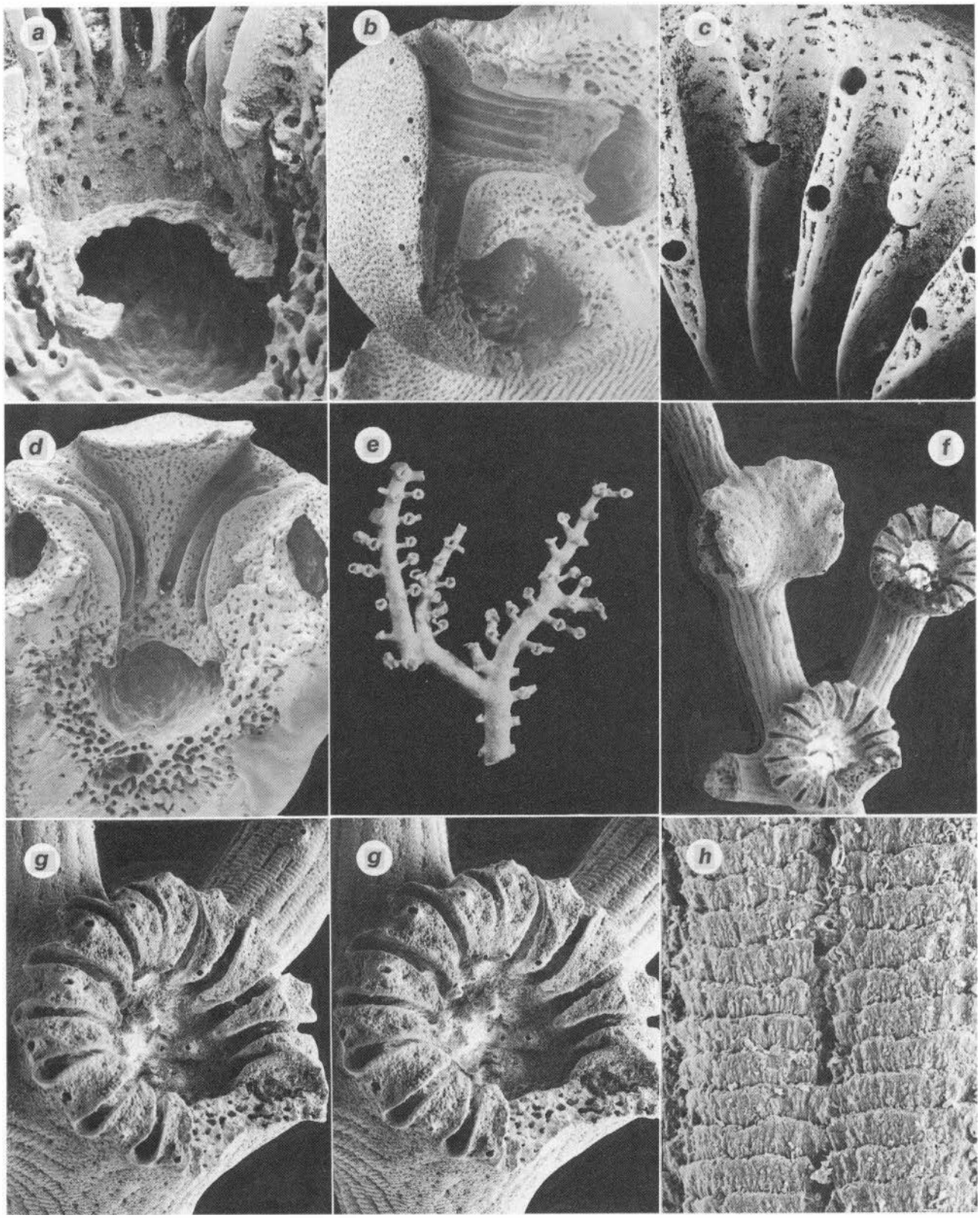

PLATE 76. *Crypthelia cymas* (a–d, E861, USNM 87569): a, gastropore ring constriction, x 66; b, rotated view of longitudinal section of a gastropore tube illustrating female ampullae and swollen lid, x 25.5; c, pseudosepta, each bearing 1 or 2 nematopores and two bearing larger male efferent pores (*see also* Plate 75, b), x 76; d, longitudinal section of a cyclosystem illustrating circumferential male ampullae, x 26. *Pseudocrypthelia pachypoma* (e–h, G3, USNM 87567): e, colony, x 3.1; f, three cyclosystems, only one having an intact lid, x 28; g, cyclosystem with lid removed to reveal broad, concave pseudosepta and nematopores in upper chamber, x 73, stereo pair; h, worn linear-imbricate coenosteal texture, x 470.

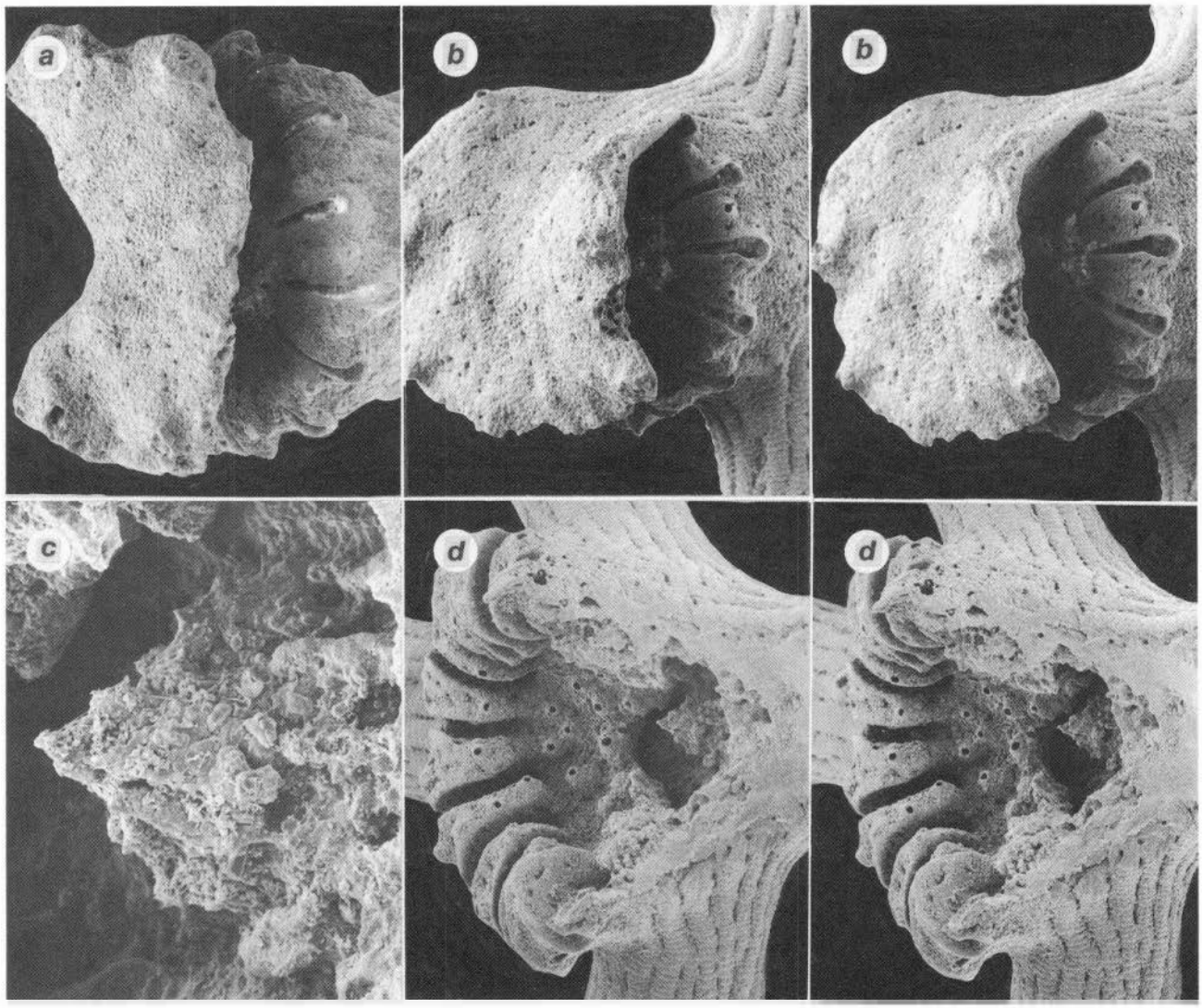

PLATE 77. *Pseudocrypthelia pachypoma* (a–d, G3, USNM 87567): a, b, cyclosystem with a broad lid, x 74, x 66, respectively (b is a stereo pair); c, gastrostyle, x 365; d, longitudinal section of a gastropore tube illustrating a gastrostyle, gastropore ring constriction, and nematopores in upper chamber and on pseudosepta, x 73.