

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

Characters	<i>I. labiata</i> (Moseley, 1879)	<i>I. spinosa</i> n. sp.	<i>I. lowei</i> (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 covered with spinules	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  $\mu\text{m}$  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 dactylostye, usually composed of three unilinear series (two lateral and one longitudinal) of large, blunt elements up to 50  $\mu\text{m}$  tall and 25  $\mu\text{m}$  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  $\mu\text{m}$  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  $\mu\text{m}$  tall and 35  $\mu\text{m}$  in diameter, the uppermost elements clearly visible in upper gastropore tube. Although gastropores are unlined, 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  $\mu\text{m}$  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 dactylostye, 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  $\mu\text{m}$  tall and 20–22  $\mu\text{m}$  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 gastrostyes (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 axes; branches robust and blunt. Coenosteal texture variable — porous, reticulate-granular, or reticulate-imbricate. Gastro- and dactylopoles flush with coenosteal surface. Gastropores long (axial), lacking a ring palisade. Dactylopoles also long (axial), lacking dactylostyles. Gastrostomes 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 axes. 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  $\mu\text{m}$  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. Gastrostomes 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. Gastrostomes highly ridged, the ridges bearing small spines or cluster of spines. Dactylopoles 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  $\mu\text{m}$  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 inflection 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  $\mu\text{m}$  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. Dactylopoles 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 unusually 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  $\mu\text{m}$  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  $\mu\text{m}$  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 0.27 mm in diameter ( $H : W = 4.89$ ); no tabulae observed. Gastrostyles ridged, the thin ridges bearing a succession of tiny, sharp spines up to 16  $\mu\text{m}$  tall and 4  $\mu\text{m}$  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  $\mu\text{m}$  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 dactylopoles 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* (Pourtales, 1867)) also share this character. However, *Phalangopora* is quite different in lacking gastrostypes 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 unilineally arranged on both branch faces; dactylopores also unilineally 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. Gastrostypes 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). Gastrostypes 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, gastrostypes, 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. Dactylostypes lacking. Ampullae usually superficial but in some species submerged in coenosteum; efferent pores rarely seen and sexual dimorphism not pronounced.

TYPE SPECIES: *Millepora aspera* Linnæus, 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 dactylopoles 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 dactylopare, 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 dactylopare 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 dactylopare spine width and shape but no consistent pattern among specimens or covariance with other characters. Accessory, conical dactylopare spines are more common on the "*benhami*" facies but also occur on the "*ramosa*" facies. Clustering of dactylopare 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 dactylopare spines; and usually unlipped gastropores. The "*benhami*" form has thicker branches; abundant conical dactylopare spines; narrow adcauline dactylopare 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. chatamensis* n.sp. in colony size and branching pattern, but can be distinguished by having: 1) a greater density of dactylopare spines, 2) fewer compound dactylopare 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. chatamensis* is known from the Chatham Rise and usually at greater depth. *Errina chatamensis* is also known to occur in a white form.

*Errina chatamensis* 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. Gastrostomes variable in shape, being conical to elongate-conical and occupying approximately three-quarters length of tube. H : W ratios range from 2 to 6. Gastrostomes 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 dactylome width of 70–89 µm. Adcauline dactylopore spines often compound, each having 2–6 dactylomes 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 dactylopare spines. Coenosteum composed of slightly convex, parallel, linear strips 70–75  $\mu\text{m}$  wide, bordered by shallow, almost continuous slits about 5  $\mu\text{m}$  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. Gastropare tubes cylindrical, lacking a ring palisade. Gastrostomes 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 ( $N = 10$ ). Gastrostomes prominently and obliquely ridged, at least in the illustrated style; ridges bear simple, elongate, sharp spines up to 32  $\mu\text{m}$  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  $\mu\text{m}$ . 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  $\mu\text{m}$  in diameter), and only slightly raised. Dactylopore spines shorter and more slender (about 15  $\mu\text{m}$  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  $\mu\text{m}$  wide arranged in reticulate order, the strips flanked by deep, fairly continuous coenosteal slits approximately 6  $\mu\text{m}$  wide. Tops of strips smooth; however, small granules about 4  $\mu\text{m}$  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.

Dactylopare spines of one type: thick-walled, relatively short, and primarily adcauline-orientated spines, which are never compound. Dactylopare 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 dactylopare 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 (Labicopora) 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-zelandiae* [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 dactylopoles 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. Gastrostomes elongate but no tabulae noted; illustrated gastrostyle (Plate 38, e) 0.46 mm tall and 61 µm in diameter ( $H : W = 7.5$ ). Gastrostomes 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 commensals 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. Gastrostomes 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.

Dactylopare spines of medium height (0.3–0.4 mm tall), thick walled, and primarily adcauline in orientation; often compound. Dactylopare 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 dactylopare.

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 dactylopare variable — in some specimens (e.g., NZOI Stn K842) gastro- pores occur only on branch faces and dactylopare are restricted to branch edges; however, in other specimens (e.g., NZOI Stn K844) both gastro- and dactylopare 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.

Dactylopare spines primarily short, thin walled, and exclusively adcauline in orientation, never compound. Dactylopare 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 dactylopare 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. Gastrostyle 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. macrogastera* 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 anastomosis. 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 dactylopore 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. Unequivocal 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 flabellae. 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 approximately 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 *dendyi* [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 dactylopare 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 dactylome 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, "Allopore"), 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 dactylopoles 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  $\mu\text{m}$  wide, bordered by deep slits about 10  $\mu\text{m}$  wide, and covered with irregularly-shaped granules 3.5–10  $\mu\text{m}$  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 exert as much as 1 mm above coenosteum. Based on 31 cyclosystems, the range of dactylopores per cyclosystem was 6–10, average 14.51 ( $\sigma = 0.99$ ), and mode 8 (Cairns 1983a). Boschma (1966) reported a range of 5–16 dactylopoles 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  $\mu\text{m}$  tall and 9–14  $\mu\text{m}$  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  $\mu\text{m}$  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 exert 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  $\mu\text{m}$  wide, bordered by deep slits about 10  $\mu\text{m}$  wide. Strips densely covered with tall, slender spines up to 13  $\mu\text{m}$  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 ( $\sigma = 3.1$ ), 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. Gastro-styles covered with robust, sharp spines up to 25  $\mu\text{m}$  tall. Dactylotomes 75–85  $\mu\text{m}$  wide; pseudosepta 1–2 times dactylotide width; diastemas often present, up to 2–4 times dactylotide width. Dactylostyles robust, composed of 2 or 3 contiguous rows of tall, cylindrical, blunt elements up to 50  $\mu\text{m}$  tall and about 12  $\mu\text{m}$  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  $\mu\text{m}$  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 porcellaneous 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 C941, 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 ( $\sigma = 1.22$ ), 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 abcauline 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 dactylopoles arranged in cyclosystems, which are usually unilinearily 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	<i>S. eguchii</i> (Boschma, 1966)	<i>S. brunneus</i> Boschma, 1970	<i>S. horologium</i> n. sp.	<i>S. imbricatus</i> n. sp.	? <i>S. gracilis</i> Milne Edwards & Haime, 1850
Colony size	Moderate to large	Large	Moderate	Small	Moderate
Polychaete commensal	Present (polynoid)	Absent	Absent	Present (euniciid)	Absent
Coenosteal colour and texture	White, reticulate-granular	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
Cyclostom 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/cyclostom	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 ampillae	Low bulges; internal e.p. open into gastro-pore 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 *Pseudocryptphelia* Cairns, 1983c; and *C. complanata* (Pourtales, 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.

*Calyptopora* [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 (nemato pores) 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 dactylopoles 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  $\mu\text{m}$  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  $\mu\text{m}$  tall, clustered in tufts on gastrostyle. Dactylomes 70–120  $\mu\text{m}$  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  $\mu\text{m}$  tall and 16  $\mu\text{m}$  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  $\mu\text{m}$  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 polychaete 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  $\mu\text{m}$  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 dactylopoles; however, based on 25 cyclosystems the range of dactylopoles per cyclosystem was 9–16, average 12.36 ( $\sigma = 1.73$ ), and mode 12.

Upper gastropore tube large, open, and chalciform, 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. pauciseptata* 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 dactylopoles 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 dactylopoles 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  $\mu\text{m}$  wide, bordered by deep, discontinuous slits about 12  $\mu\text{m}$  wide. Platelets quite narrow (4–5  $\mu\text{m}$  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 dactylomes. 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  $\mu\text{m}$  tall and 2  $\mu\text{m}$  in basal diameter. Dactylomes uniformly 61–65 mm wide; pseudosept 2–3 times dactylome 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  $\mu\text{m}$  tall and 18  $\mu\text{m}$  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 over-

lays 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 dactylopoles per cyclosystem (average 10.42); robust, clavate dactylostyle elements; reticulate-imbricate coenosteal texture; and in lacking ring palisades. It is most similar to *S. pauciseptata* Cairns, 1986a (Lesser Antilles, 300–514 m), both species having a low number of dactylopoles 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 dactylopoles per cyclosystem (average 15.54), and large, porous ampullae.

### Conopora Moseley, 1879

Gastro- and dactylopoles 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. 6a–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 dactylopoles 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 dactylopoles per cyclosystem and averages of 7.07 and 7.13 for two populations (mode = 8). Cairns (1983a), based on 29 nondiastematic cyclosystems, reported a range of 8–15 dactylopoles per cyclosystem, an average of 10.41 ( $\sigma = 1.50$ ), 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 dactylopoles) 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°22'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 *Cryptelia* 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); 710–130–1035 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 ( $\sigma = 1.43$ ), 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 them 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, porcellaneous 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 sym-

podially 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 dactylopoles 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 dactylopoles 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, NZOIP-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 ( $\sigma = 0.86$ ), 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  $\mu\text{m}$  wide), often bifurcating and rejoining one another or simply terminating after a short distance. Coenosteal slits very narrow: about 1  $\mu\text{m}$  wide. Strips covered with very low, rounded granules 3–4  $\mu\text{m}$  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 ( $\sigma = 0.86$ ), 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 dactylotide 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 dactylopoles per cyclosystem was 14–21, average 18.41 ( $\sigma = 1.42$ ), 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 dactylopoles per cyclosystem was 8–13, average 9.66 ( $\sigma = 1.00$ ), 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 dactylotide, 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 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 dactylopoles 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	<i>C. verrucosa</i> (Studer, 1878)	<i>C. laevis</i> (Studer, 1878)	<i>C. candelabrum</i> n.sp.	<i>C. tetrastichopora</i> n.sp. <i>C. unifacialis</i> n.sp.	<i>C. gigantea</i> 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	Large, robust, uniplanar, equal sparse branching
Polychaete commensal	Present	Absent	Absent	Absent	Absent
Coenosteal texture	Linear-imbricate	Linear-imbricate	Linear-imbricate to linear-smooth	Linear-granular	Linear-granular, pointed
Arrangement of cyclo-systems (Group designation)	Exclusively sym-podially (Group A)	Exclusively sym-podially (Group A)	Exclusively sym-podially (Group A)	Four discrete rows (quadriserially), no group designation	Unifacial medial row, no group designation
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
Range and average no. of dactylopores/cyclo-system	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	No discrete upper chamber or gprc	Unique: intermediate tube instead of gprc	Unique: cylindrica, 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 absent	1 : 0.25–0.33; 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	Enormous internal tubes; e.p. apical face
Male ampullae; e.p. location	Internal; e.p. open into gastropore tube	Superficial; e.p. lateral	Primarily internal; e.p. open into gastropore tube	Massed on posterior face; e.p. apical	Unknown
Distribution	Widespread in New Zealand region, Sub-antarctic, and Antarctic; 198–2355 m	Norfolk and Three Kings Ridges, Campbell Plateau; 403–1035 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, porcellaneous 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 cycosystem diameter. Based on 14 cyclosystems (all available for analysis) the range of dactylopores per cyclosystem was 17–20, average 18.42 ( $\sigma = 0.77$ ), 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 dactylopoles. 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 dactylopoles 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, porcellaneous coenosteal texture.

"*Conopora*" *anthohelia* also resembles the genus *Pseudocryptethelia* 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 dactylopoles arranged in cyclosystems, which occur exclusively on anterior branch faces;