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New seamount- and ridge-associated cyclostome Bryozoa from New Zealand

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Abstract

Recent sampling of seamount and ridge habitats in the New Zealand Exclusive Economic Zone has yielded new cyclostome bryozoan taxa. We describe here one new genus, a new name, *Dartevellopora* (to replace the generic homonym *Dartevellia* Borg, 1944) and ten new species, comprising *Filicisparsa albobrunnea* **n. sp.** (Oncousoeciidae), *Discantenna tumba* **n. gen.**, **n. sp.** (Diastoporidae), *Supercytis gracilis* **n. sp.** (family incertae sedis), *Filifascigera brevicaudex* (Frondiporidae); *Plagioecia parva* **n. sp.** (Plagioeciidae), *Favosipora bathyalis* **n. sp.** (Densiporidae), and *Dartevellopora neozelanica* **n. sp.**, *D. rugosa* **n. sp.**, *Disporella minicamera* and *D. minutissima* **n. sp.** (Lichenoporidae). Seven of the new species occurred in the "Graveyard Seamount Complex" on the north-central Chatham Rise to the east of the South Island. Of these, three species and one new genus are known only from the type locality on "Graveyard" Seamount — the most intensively fished of the seamounts in the complex by heavy bottom-trawl gear, which has implications for species conservation. Evidence based on discrimination between benthic invertebrate assemblages of hard bottoms on fished and unfished seamounts in the area suggests that small, short-lived taxa like cyclostome bryozoans might not be disadvantaged by bottom-trawling.

Key words: Bryozoa, Cyclostomata, new genus, new species, *Filicisparsa*, *Discantenna*, *Supercytis*, *Plagioecia*, *Favosipora*, *Dartevellopora*, *Dartevellia*, *Disporella*, New Zealand, endemism, bottom trawling

Introduction

The living cyclostome bryozoan fauna of the New Zealand region has, until fairly recently, been very poorly known and is still inadequately characterised. Gray (1843) reported one nominal species in an appendix to Ernst Dieffenbach's *Travels in New Zealand* but the identity of the species is not known with certainty. Three decades later, when indigenous sampling of New Zealand's biota had begun to take place, along with the establishment of a national institution to receive and store specimens, numerous species of the diverse and abundant bryozoan fauna of New Zealand had been collected and identified. Hutton (1873) listed 17 nominal cyclostome species (Tubuliporina 10, Rectangulata 2, Cancellata 3, Articulata 2), using European names for many. New Zealand cyclostomes were listed in subsequent works by Hutton (1877, 1880, 1891, 1904) and Hamilton (1898) but, as Gordon & Taylor (2001) pointed out, it is not easy to harmonise the various names used in these publications, especially in the absence of voucher specimens. Suffice it to say that, by 1904, Hutton listed 29 Recent New Zealand cyclostomes [cf. 32 species in Hamilton's (1898) list].

Very little taxonomic work was carried out on New Zealand Recent cyclostomes during the rest of the twentieth century until the 1990s, although they were mentioned in some ecological studies and faunal reviews (e.g., Morton & Miller 1968; Ryland 1975; Gordon & Ballantine 1977; Taylor 1991, 1994; Gordon & Mawatari 1992). Late twentieth-century taxonomic papers describing or redescribing New Zealand Recent cyclostomes, or fossil cyclostomes with implications for the nomenclature of living taxa, were those of Taylor *et al*. (1989) (hermit-crab associates), Boardman *et al*. (1992) (Cinctiporidae), Gordon & Taylor (1997) (secular range and redefinition of *Lichenopora*) and Taylor & Gordon (1997) (a new tubuliporine genus). The new century began with the publication of several taxonomic papers dealing with New Zealand cyclostomes

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— Taylor & Gordon (2001, 2003) (*Liripora*, *Mesenteripora* and two new taxa from Spirits Bay), and Gordon & Taylor (2001) (Densiporidae and Lichenoporidae). The latter authors estimated a diversity of 100 living cyclostome species — the highest for any country — in the New Zealand 200-nautical-mile Exclusive Economic Zone (EEZ). Gordon *et al*. (2009) subsequently listed 121 species of Cyclostomata in the EEZ, 37 of them named and 84 unnamed.

Some of this novel cyclostome diversity is associated with seamounts and other topographic highs that are prominent in New Zealand's EEZ. More than 800 elevated features, comprising pinnacles, knolls and mountains, are associated with the tectonic plate boundary between the Australian and Pacific plates, as well as ridges and plateaus (Rowden *et al*. 2005). Some of these features coincide with novel and/or high species diversity and there has been some concern in the New Zealand region, as elsewhere, about the negative effects of bottom trawling on habitat integrity (Clark & O'Driscoll 2003; Clark & Rowden 2009). During the past decade, partly in connection with assessing such effects on seamount faunas in the New Zealand EEZ, numerous samples of bryozoans have been obtained from rocky substrata in deep water. In order for comparative ecological analyses to be conducted on fished and unfished seamounts (Rowden *et al*. 2002) and other areas of the deep sea floor (Rowden *et al*. 2003, 2004), identifications (often provisional) had to be made of all benthic species in the samples, including the Bryozoa. These samples yielded many new taxa, including cyclostomes.

This paper deals with cyclostomes primarily from seamounts (Fig. 1), comprising the Cavalli Seamounts off northeastern North Island, some smaller features off the Bay of Plenty continental shelf, and especially the "Graveyard Seamount Complex" on the north central Chatham Rise. This complex consists of about 20 features ranging in depths at their peaks from 750 m to 1200 m. They lie in close proximity to one another, being distributed over 140 km^2 and 1.5–12.6 km apart with small knolls and rocky outcrops between, all mostly separated by soft sediment. The largest feature in the complex, known informally as Graveyard Seamount, has an area of 4.1 km^2 and is the most intensively trawled (for orange roughy *Hoplostethus atlanticus*), experiencing 21–220 trawls per year throughout the 1990s for a total of 1480 trawls (Clark & Rowden 2009). Three of the new cyclostome species and the new monotypic genus *Discantenna*, described below, are known only from this seamount. The implications of bottom trawling to this cyclostome diversity are discussed.

Material and methods

The species described were studied by scanning electron microscopy (SEM), using type and other specimens. Sorted material was immersed in undiluted liquid domestic bleach (comprising 42 g.l^{-1}sodium hypochlorite) overnight to remove all cuticularised membranes and soft parts in preparation for SEM. In New Zealand, all specimens thus prepared were coated in gold-palladium and photographed using a LEO 440 SEM. Specimens imaged at the NHM were left uncoated and examined in a low-vacuum LEO1455-VP SEM with a back-scattered electron detector. Measurements of zooids were made directly from specimens using a light microscope (Zeiss Stereomicroscope SV-11) with an eyepiece graticule.

Primary types of the new species were lodged in the NIWA Invertebrate Collection at the National Institute of Water & Atmospheric Research in Wellington. Some paratypes have been registered into the collection of the NHM, London. Station data are listed in the appendix.

Systematic account

Order Cyclostomata Busk, 1852

Suborder Tubuliporina Milne Edwards, 1838

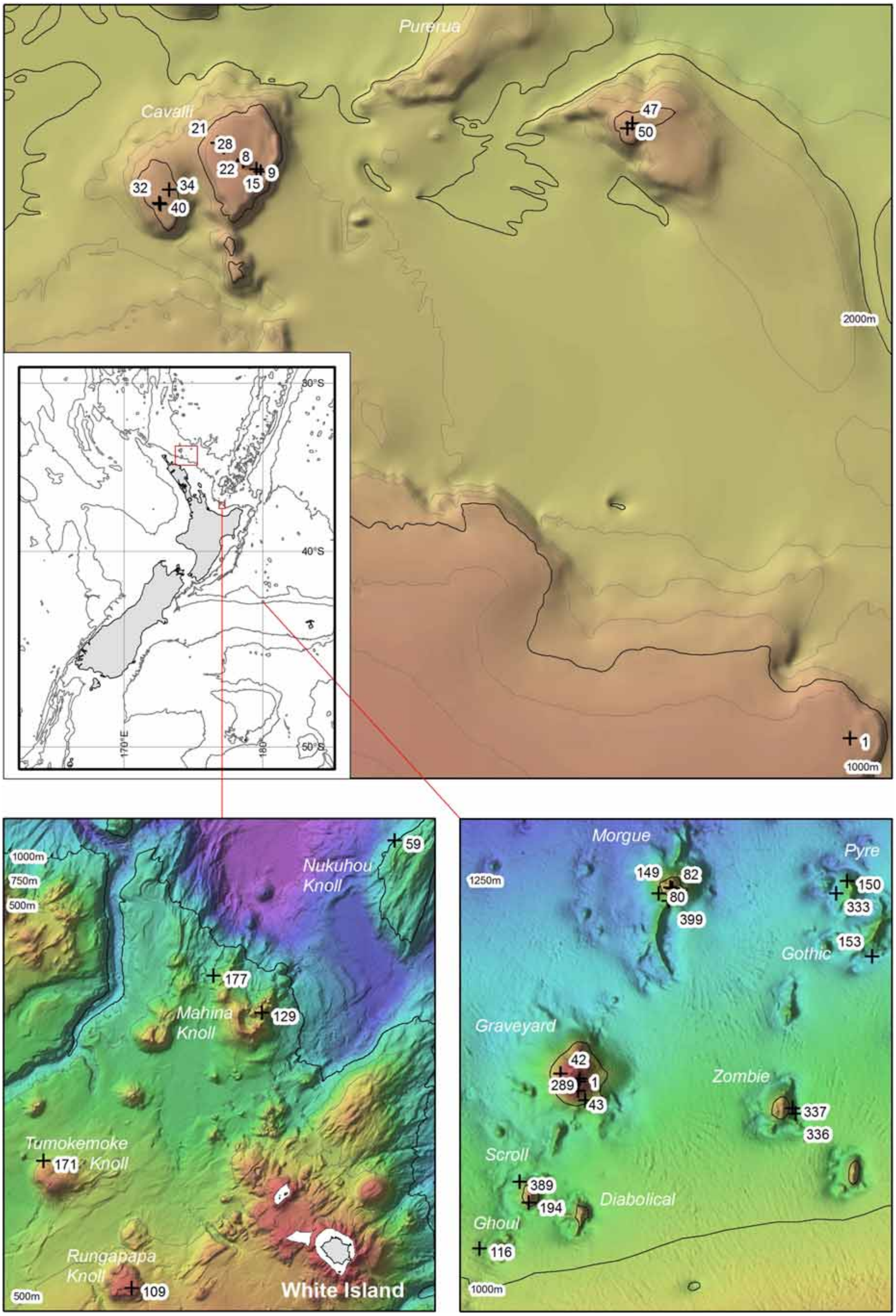

FIGURE 1. Station localities in the New Zealand region. The inset shows the locations of the swath-bathymetry images covering, from north to south, the Cavalli Seamounts (KAH0204 stations), the Bay of Plenty continental slope (TAN0413 stations), and the "Graveyard Seamount Complex" on the north-central Chatham Rise (TAN0104 stations).

Family Oncousoeciidae Canu, 1918

Filicisparsa Voigt, 1994

Type species. *Filicisparsa sommerae* Voigt, 1994, by monotypy.

Filicisparsa albobrunnea n. sp.

(Fig. 2 A–E)

Material examined. *Holotype:* NIWA 61240, from TAN0104 cruise, Stn 3, 42°45.48–42°45.18'S, 179°59.47–179°59.54' W, "Graveyard" Seamount, Chatham Rise, 943–1097 m depth, collected 15 April 2001. *Paratypes:* NIWA 61241, same locality as holotype. Other material: TAN0104 Stns 1, 43, 80, 82, 149, 150, 194, 336, 389, 399.

Distribution. "Graveyard Seamount Complex", north-central Chatham Rise, New Zealand, 750–1181 m.

Etymology. Latin *albus*, white, and *brunneus*, brown, alluding to the tan coloration of the ephebic parts of colonies contrasting with the white distal branches.

Description. Colony initially encrusting, ramifying, forming biserial lobes by branching laterally on the substratum from the primary branch that originates from the ancestrula, which has not been seen. Once the basal parts of a colony are established, an erect biserial branch is formed, accompanied by the development of robust kenozooidal calcification at its base, 0.92–0.93 mm in diameter.

Branching dichotomous. Erect branches attaining 10–15 mm in height, straight or curving, angled at c. 45 degrees to the substratum, subtriangular in cross section near the base of the branch, becoming subcircular to circular in cross section in distal parts; diameter of erect branches distal to first bifurcation 0.49–0.62 mm. Zooidal peristomes 0.14–0.15 mm diameter, borne only on the frontal sides of branches, arranged in pairs that are deflected alternately to left and right of the branch axis, the frontalmost peristome of each pair longer than the one beneath it, their openings facing abfrontally. Gonozooids sporadic, occurring frontally at branch dichotomies, brood chamber subglobular, 0.99–1.17 mm in diameter, densely pseudoporous, the ooeciostome simple, 0.16 mm in diameter, opening mid-distally, the ooeciopore circular.

Remarks. Colonies are distinctive and easily recognised, not only because of their general size and morphology but because of the tan coloration of older parts of branches in many instances, whereas distal parts are always white.

The generic attribution of this species is problematic. Two Recent genera can be ruled out, *Exidmonea* because of its more complex gonozooids, and *Tervia* because the gonozooids of this genus are on the dorsal sides of the branches. The type species of *Filicisparsa* is from the Late Cretaceous (Santonian to Upper Maastrichtian) of western Europe. Its erect branches have laterally alternating pinnules — short lateral projections comprising a small cluster of 4–5 zooidal peristomes — and sparse apertures on the frontal sides of the branch, which is not the case in the new species. Brood chambers are somewhat globular and borne frontally on branches. The species from the Chatham Rise resembles *F. sommerae* in overall colonial morphology, i.e. having erect, dichotomously branching colonies with zooids on one side only, no dorsal kenozooids, and a similar frontally borne brood chamber. The 'pinnules' in our material comprise only a pair of peristomes, not a cluster, and there are no frontal apertures; furthermore, the frontally borne brood chambers are located at branch bifurcations. To create yet another new monotypic genus of Cyclostomata would highlight the apparent differences between the Late Cretaceous species and our Recent material but would not otherwise advance our understanding of their actual relationships. Accordingly, we provisionally use *Filicisparsa* for the Recent specimens from the Chatham Rise.

Family Diastoporidae Busk, 1859

Remarks. While Diastoporidae and Plagioeciidae have generally been regarded as synonymous, molecular evidence (Waeschenbach *et al*. 2009) suggests that the two families may differ: *Plagioecia* falls within a major clade that also contains Lichenoporidae and Densiporidae, whereas the other sequenced genera (*Cardioecia*, *Diplosolen*, *Entalophoroecia*) traditionally assigned to Plagioeciidae belong to a second major clade that contains *Frondipora* and Horneridae. The type genus of Diastoporidae is a Jurassic–Cretaceous fossil. However, morphologically it appears closer to *Cardioecia* and *Entalophoroecia* than to *Plagioecia*. Therefore, we provisionally recognise Diastoporidae and Plagioeciidae as distinct families pending a more complete study of cyclostome phylogeny.

Discantenna n. gen.

Type species. *Discantenna tumba* **n. sp.**, by monotypy.

Etymology. From the resemblance of the elevated discoidal part of the colony to a dish antenna (Latin *discus*, plate, dish + *antenna*, antenna).

Diagnosis. Colony with narrow encrusting base, initially forming a linear biserial structure, its distal end developing an erect column that flares outwards at its summit as a bereniciform disk in which zooids are centripetally arranged. Brood chamber simple, transversely oval, densely pseudoporous, not pierced by zooidal peristomes; ooeciostome terminal, cowl-like, concealing ooeciopore.

Remarks. A new monotypic genus is introduced here for the following species. It invites comparison with *Penciletta* Gray, 1848 (Tubuliporidae), the type species of which, *P. penicillata* (Fabricius, 1780), has an oligo- to pluriserial encrusting portion with erect peristomes; from this base arise one or more erect capitula, each with an apical disc. The brood chamber in fertile colonies occupies much of this disc, ramifying between the short rows of connate peristomes. *Discantenna* differs most significantly from *Penciletta* in the form of the brood chamber, which is more “diastoporiform”, being transversely elongate with a short, cowl-like ooeciostome. The genus *Plagioecia* Canu, 1918 contains some species with erect branches but these arise from an initial radially encrusting colony and the brood chamber is pierced by zooidal peristomes. *Discantenna* is not included in the Oncousoeciidae because the brood chamber is transversely elongate and, while not pierced by zooidal peristomes, is crossed by at least one peristome so that the brood chamber appears on either side of it.

Discantenna tumba **n. sp.**

(Figs 3A–D, 4 A–C)

Material examined. *Holotype:* NIWA 61242, from cruise TAN0104, Stn 3, 42°45.48–42°45.18’S, 179°59.47–179°59.54’ W, “Graveyard” Seamount, Chatham Rise, 943–1097 m depth, collected 15 April 2001. *Paratypes:* NIWA 61243, same locality as holotype.

Distribution. “Graveyard Seamount Complex”, north-central Chatham Rise, New Zealand, 943–1097 m.

Etymology. From Latin *tumba*, grave, alluding to the provenance of the species.

Description. Colony with a narrow encrusting base, initially uniserial, becoming biserial, up to 2 mm long, its distal end developing an erect column that flares outwards at its summit as a shallow, circular discoidal structure, 2.57 mm diameter, in which zooids are centripetally arranged; colony height 2.46 mm.

Ancestrula with a subcircular protoecium, large, 0.19 mm wide, the peristome angled upwards relative to the substratum, its distal end upturned frontally, the aperture transversely oval, the sides of the peristome produced as an expanded lamina on either side.

The first budded autozooid is orientated at 45° to the axis of the ancestrula; it initiates biseriality by budding two daughter zooids in quick succession, their respective peristomes directed alternately to the left and right; succeeding peristomes likewise alternate, forming about 10 in all before budding the conical capitulum. As each peristome forms it is produced at a higher elevation from the substratum than the preceding one so that, from the side, the colony appears stepped, the peristomes being supported upon a solid

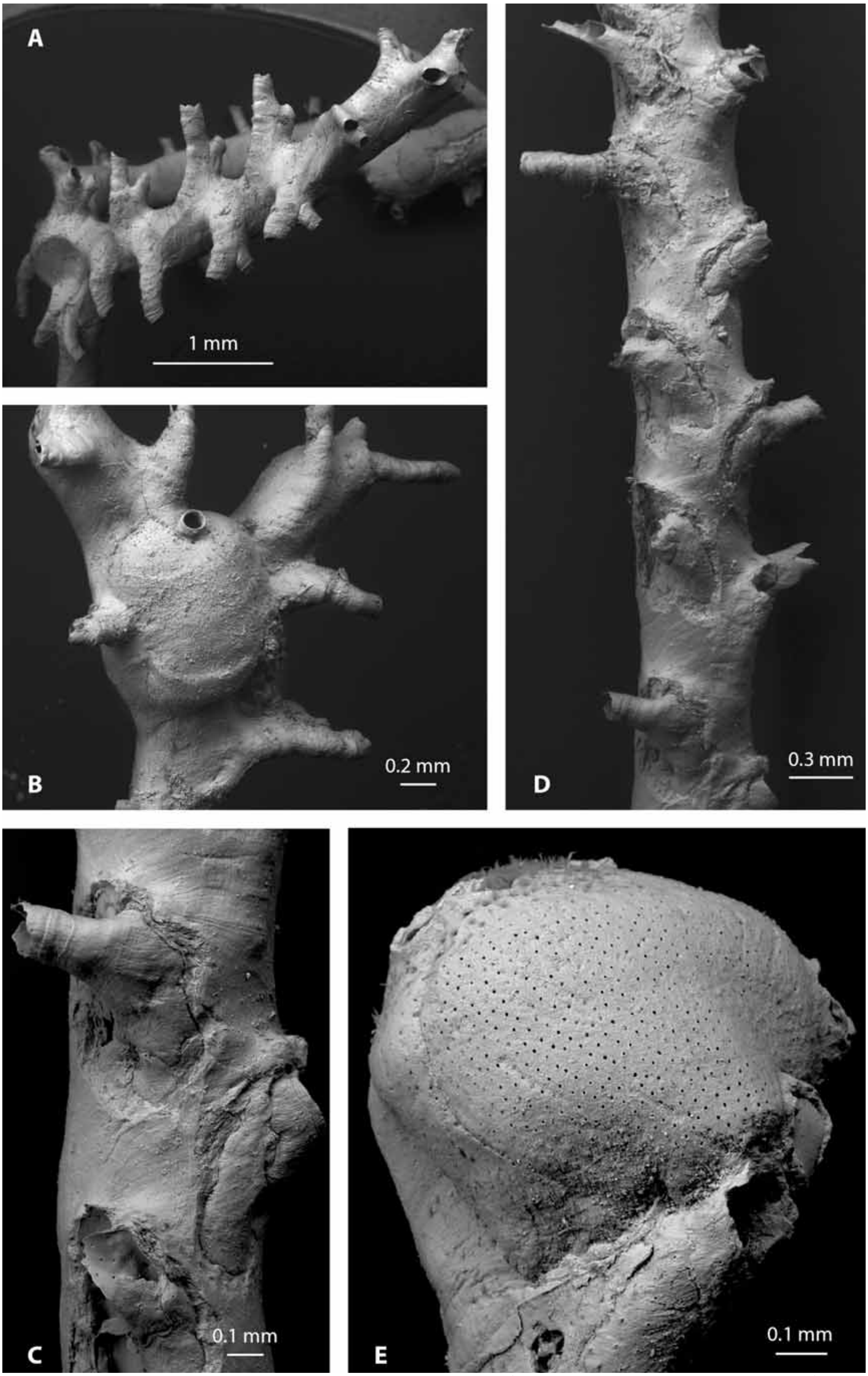

FIGURE 2. *Filicisparsa albobrunnea* **n. sp.** (TAN0104 Stn 3). A, reflexed branch showing disposition of peristomes; B, brood chamber at branch bifurcation (holotype); C, D, parts of ephebic branches showing reparative calcification; E, abfrontal side of a brood chamber.

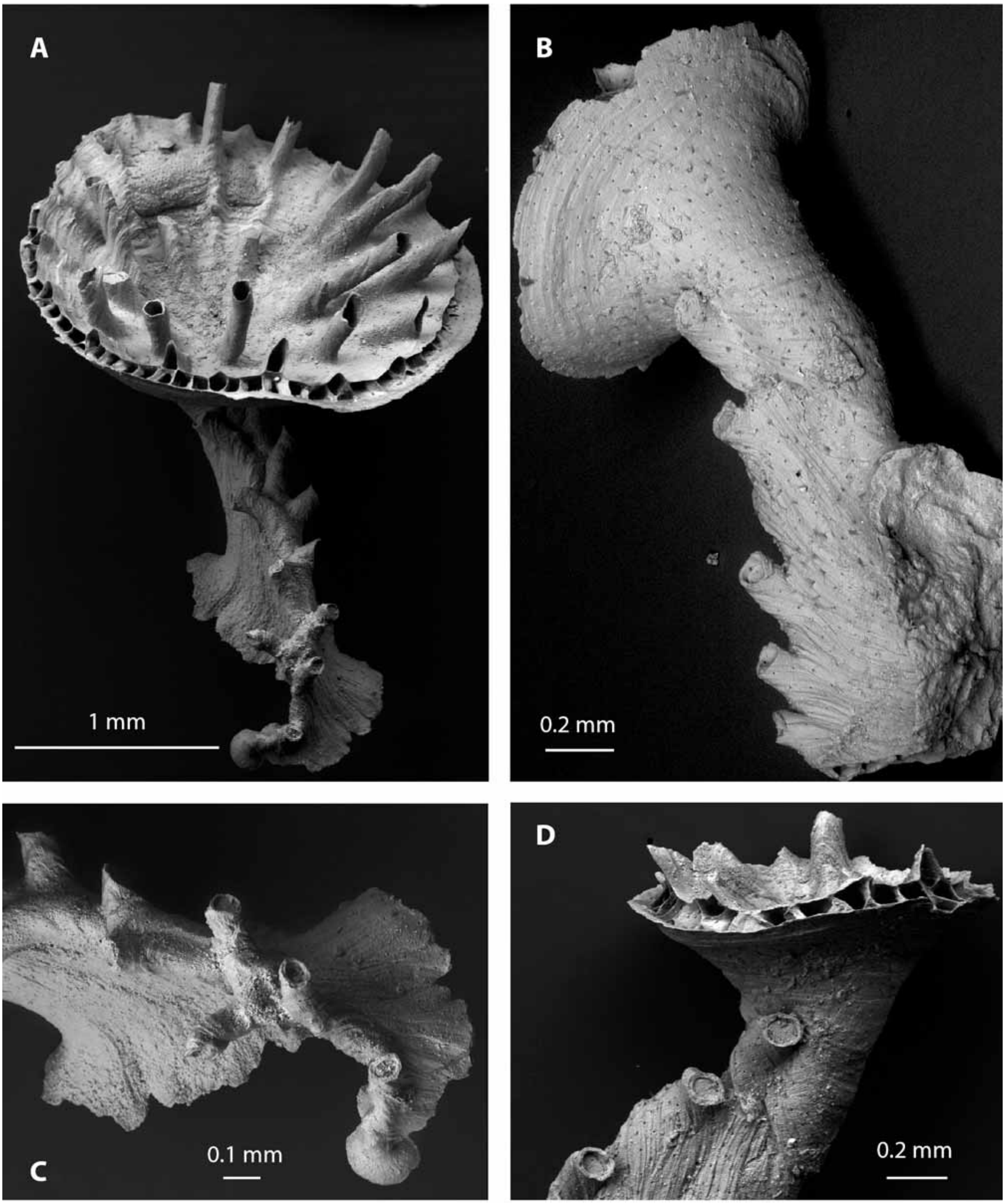

FIGURE 3. *Discantenna tumba* **n. gen., n. sp.** (TAN0104 Stn 3). A, whole fertile colony including ancestrula and brood chamber in elevated disk (holotype); B, abfrontal side of same colony; C, proximal part of same colony; D, profile of immature colony lacking brood chamber, showing the stepped arrangement of zooidal peristomes.

crest of calcium carbonate that spreads somewhat laterally upon the substratum; all external skeletal surfaces pseudoporous. Free peristome length up to 0.67 mm, aperture diameter 0.08 mm.

Apical disk bereniciform; long zooidal peristomes (free peristome length up to 0.60 mm) angled obliquely outwards from the depressed centre of the disk; peripheral common bud thin, with a narrow marginal lamina pierced by pseudopores and a skeletal microstructure of distally imbricated foliated crystallites.

Brood chamber simple, oval (0.72 mm wide in transverse direction), densely pseudoporous, not pierced by zooidal peristomes but at least one peristome may cross its surface; ooeciostome 0.08 mm wide, terminal and medial, its cowl-like distal rim concealing the ooeciopore.

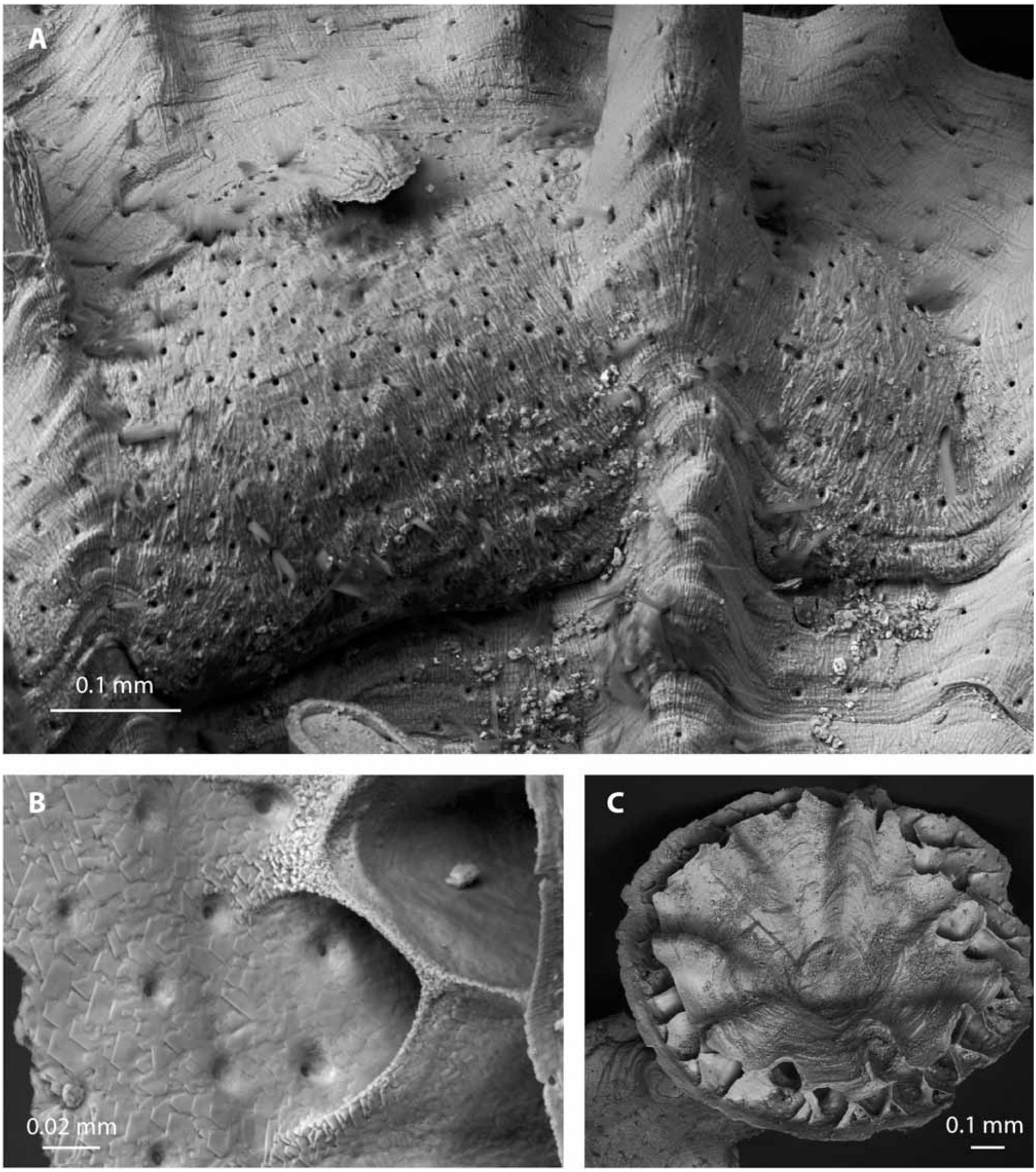

FIGURE 4. *Discantenna tumba* **n. gen., n. sp.** (TAN0104 Stn 3). A, brood chamber and ooeciostome of holotype colony; B, marginal lamina of disk showing imbricated crystallites; C, disk of infertile colony.

Remarks. This species is so far known only from the type locality, which yielded one fertile and three infertile colonies. As noted above, the colony form of this new species most closely resembles *Penciletta penicillata* but the brood chamber has a simpler morphology and each colony gives rise to a single erect column whereas many columns may be produced in colonies of *P. pencillata*.

Family Incertae sedis

Supercytis d'Orbigny, 1853

Type species. *Supercytis digitata* d'Orbigny, 1853, by subsequent designation (Gregory 1899).

Supercytis gracilis n. sp.

(Fig. 5 A–D)

Material examined. *Holotype:* NIWA 61244, from cruise TAN0104, Stn 130, 42°42.60' S, 179°58.09' W, lower northwest slope of "Morgue" Seamount, Chatham Rise, 1067 m depth, collected 17 April 2001. *Paratype:* NIWA 61245, same locality as holotype. Other material: TAN0104 Stns 3, 80, 149, 150, 194, 288, 289, 333, 389, 399.

Distribution. "Graveyard Seamount Complex", north-central Chatham Rise, New Zealand, 757–1181 m.

Etymology. Latin *gracilis*, slender, alluding to the form of the colony and the sparsely fascicled branches.

Description. Colony erect, up to 4 mm high and 3.3 mm wide, infundibuliform; the proximal end tapering to 0.26 mm diameter and anchored by a short encrusting base and the expanded distal end with a funnel-like whorl of irregular fascicles of zooidal peristomes; one or more subcolonies may originate from individual fascicles. Colony anchored by a small attachment base to a hard substratum (rocks, encrusting bryozoans), the stem comprising a bundle of long zooidal peristomes that are partly or wholly enveloped in a thin calcareous layer; peristomes with transverse growth lines, all exterior walls pseudoporous, with more pseudopores visible in transparency in transmitted light than externally by SEM. Ancestrular protoecium transversely oval, evident in young colonies, the peristome long, extending the full length of the stem; daughter and later zooids budded behind the peristome, their proximal ends cemented to the substratum and to each other by common calcification. Stem becoming infundibuliform distally as more zooids are budded axially.

Colony centre concave, comprising obliquely polygonal zooidal apertures that face the colony periphery; these can become calcified over. Radial fascicles numbering 6–7, slender, the zooidal peristomes not connate through their length, the terminal portion free with circular aperture 0.10–0.11 mm diameter, some of the more proximal openings with very short apertures that can be calcified over as the colony becomes older.

Brood chamber 0.7–1.11 mm in diameter, occupying much of the colony centre, ventricose, not pierced by zooidal peristomes, its densely pseudoporous exterior-walled surface initially with a clear perimeter that can become less discrete as a layer of thin surface calcification develops across it; ooeciostome 0.33 mm wide, set in the margin of the brood chamber, transversely oval, sometimes adjacent to an autozooidal peristome.

Remarks. The generic and family attributions of this species are uncertain. There are two genera whose species have a similar colony form — *Supercytis* d'Orbigny, 1853, with the Late Cretaceous type species *S. digitata* d'Orbigny, 1853, and *Telopora* Canu & Bassler, 1920, with the Recent type species *Supercytis watersi* Harmer, 1915 (see Taylor & Grischenko 1999). The major obvious difference is in the brood chamber, which is traversed by zooidal peristomes in *Telopora*. The New Zealand shallow coastal/shelf species *Supercytis lobata* (Tenison-Woods, 1880) has been attributed to *Telopora* (Gordon *et al.* 2009) because, while zooidal peristomes do not open above the brood chamber as in *T. watersi*, they nevertheless pass through the brood chamber to the level of the roof, where they are sealed. Similarly, *Supercytis savii* Ramalho, Muricy & Taylor, 2009 from Brazil was attributed to *Supercytis* by its authors mainly because the gonozooid is simple and not traversed by peristomes; unlike *S. digitata*, however, the brood chamber in *S. savii* is inflated, lacking a clear boundary, and apparently located at a branch bifurcation, not in the colony centre. The brood chamber of *S. gracilis* is more like that of *S. digitata* in having a clear boundary, and, in all three species, the ooeciopore is against the margin of the brood chamber; that in *S. digitata* lacks an ooeciostome (raised rim).

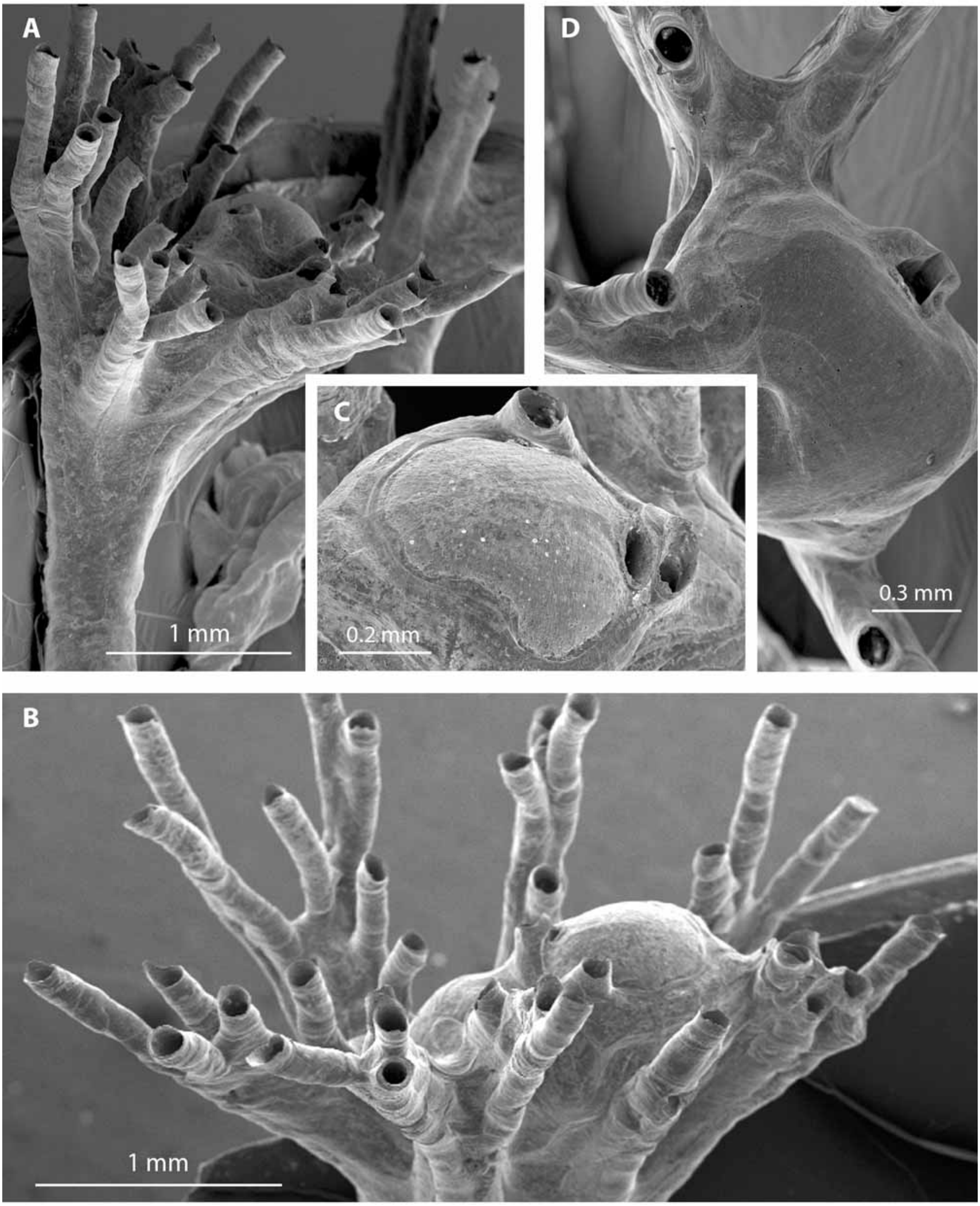

FIGURE 5. *Supercytis gracilis* **n. sp.** (TAN0104 Stn 3). A, B, profiles of the same fertile colony; C, surface view of the brood chamber of the colony in A, B; D (TAN0104 Stn 150) brood chamber of a smaller colony.

Historically, *Supercytis* was included in the cancellate family Cytididae (d'Orbigny 1853, Harmer 1915, as Cytisidae; Bassler 1953) but *Cytis* d'Orbigny, 1854 has a very different colony form and non-feeding surfaces of kenozooids. In contrast, Canu & Bassler (1920) included *Supercytis watersi* (i.e., *Telopora*), in their family Tretocycloeciidae (= Heteroporidae) (suborder Cerioporina) — a taxon with which it has little in common. The family attribution of both *Supercytis* and *Telopora* remains to be clarified.

Family Frondiporidae Busk, 1875

Filifascigera d'Orbigny, 1853

Type species. *Tubulipora megaera* Lonsdale, 1845, by subsequent designation (Bassler 1935, p. 112) of the first of three species included by d'Orbigny (1853) in this genus.

Filifascigera brevicaudex n. sp.

(Fig. 6 A–C)

Material examined. *Holotype:* NIWA 61246, from NIWA Stn I97, 32°23.29' S, 167°28.20' E, West Norfolk Ridge, 540–544 m depth, collected 25 July 1975. *Paratype:* NIWA 61247, from KAH0204/15, 34°05.98–34°06.21' S, 174°06.82–174°06.91' E, Cavalli Seamount, 470–480 m depth, collected 15 April 2002. Other stations: Cruise KAH0204, Stns 1, 8, 9, 21, 22, 28, 32, 34, 40, 47, 50, Cavalli Seamounts, off northeastern North Island.

Distribution. From Cavalli Seamounts off northeastern North Island and West Norfolk Ridge, 470–930 m depth.

Etymology. Latin, *brevis*, short + *caudex*, stem, trunk, alluding to the short, erect fascicles of zooids.

Description. Mature colony comprising ramifying and occasionally anastomosing branches from which arise relatively short fascicles of zooids; spread of colony about 5 cm. Width of ramifying branches 0.67–0.90 mm, these containing 5–11 zooidal cross sections in profile, 3–6 zooids having their basal wall against the substratum. Fascicles arising at intervals of about 1.5–3.5 mm from each other depending on the irregularity of the substratum, about 0.6–2.2 mm high and 0.78–0.87 mm in diameter, with about 7–11 peristomes occurring in a cluster at the flattish summit; a few other peristomes opening at intervals on the stem. Peristome diameter 0.13–0.16 mm, whether in ramifying or erect portions of colony. Gonozooid borne at the top of an erect fascicle, brood chamber ventricose, 0.84 mm in diameter, the ooeciostome subcircular, 0.15 mm diameter.

Ancestrula not seen but immediate post-ancestrular zooids preserved in one colony; branch width rapidly increases to incorporate several zooids adnate to the substratum before the first fascicle is produced; a branch bifurcation occurs near the base of the fascicle and all subsequent branching is generally of this nature except that not all fascicles are succeeded by a bifurcation.

Remarks. Relatively few species of *Filifascigera* have been described. The type species is from the Paleocene of New Jersey. Canu & Bassler (1929) attributed six other species to the genus, ranging in stratigraphic distribution from the Cretaceous to the present day. Osburn (1953) recognised two more Recent species, and Brood (1972) and Taylor & McKinney (2006) have named additional Cretaceous species. Of the five putative Recent species, nominally from Ireland, the Pacific coast of America, Hawaii and the Philippines, *F. brevicaudex* differs from them particularly in the dimensions of the fascicles and numbers of peristomes in each fascicle. The two Philippines species illustrated by Canu & Bassler (1929) have no peristomes emerging from the stem of the fascicle. In *F. clarionensis* from California, the brood chamber occurs between a close pair of fascicles, extending from one fascicle to the next (Osburn 1953).

Family Plagioeciidae Canu, 1918

Plagioecia Canu, 1918

Type species. *Tubulipora patina* Lamarck, 1816, by original designation.

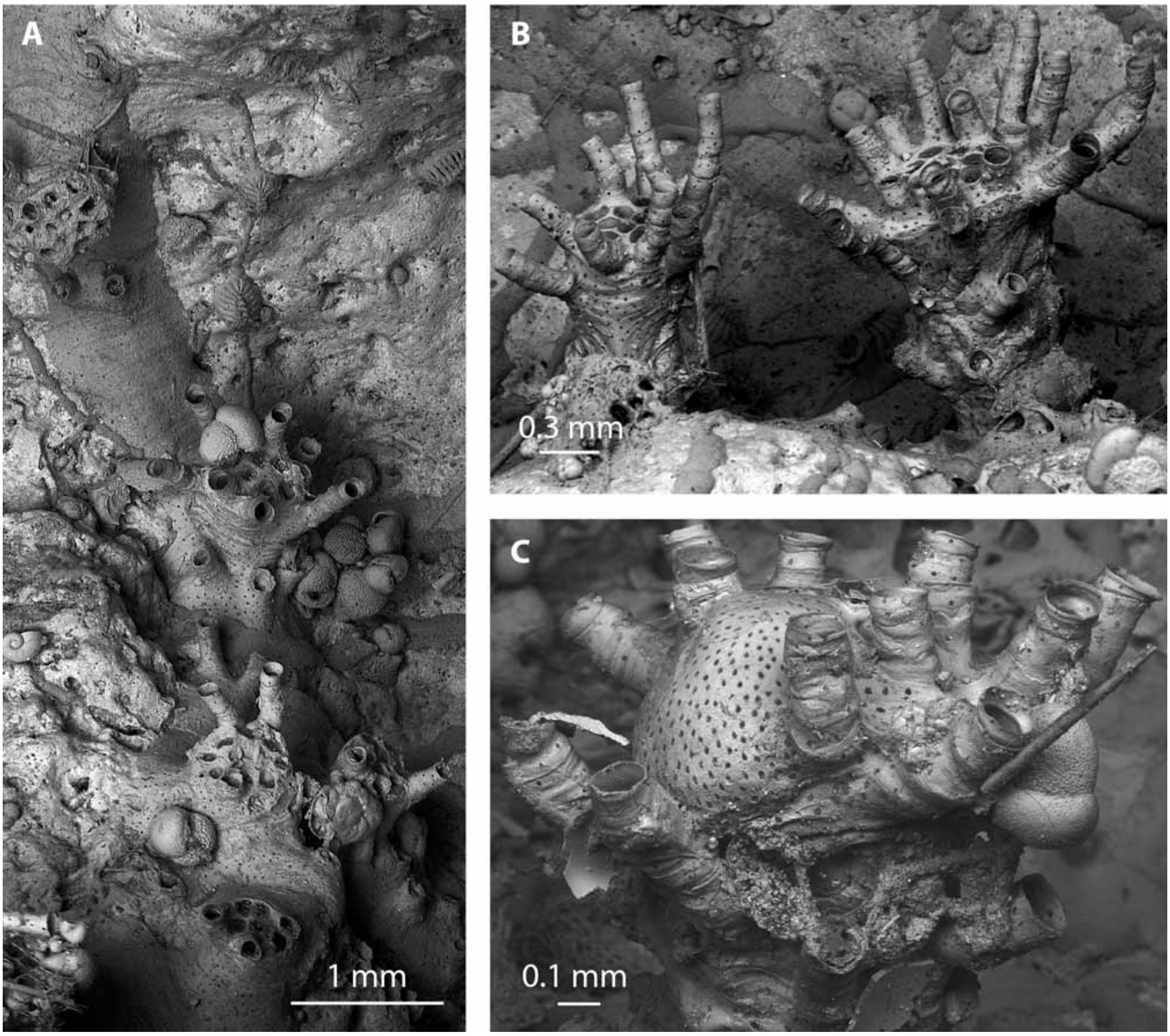

FIGURE 6. *Filifascigera brevicaudex* **n. sp.** (NZOI Stn I97). A, part of holotype colony in frontal view showing an adnate branch with fascicles; B, profile of two fascicles; C, fascicle with brood chamber.

***Plagioecia parva* n. sp.**
(Fig. 7 A–D)

Material examined. *Holotype:* NIWA 61248, from cruise TAN0413, Stn 129, 37°20.40–37°20.25’S, 177°06.69–177°06.81’ E, Bay of Plenty, on Mahina Knoll northwest of White Island, 275–335 m depth, collected 14 November 2004. *Paratypes:* NIWA 61249, same locality as holotype.

Distribution. Continental slope, central Bay of Plenty, New Zealand, 275 m.

Etymology. From Latin *parvus*, small.

Description. Colony encrusting, more or less circular, central disc of zooids 1.90–2.24 mm diameter, with a broad, thin peripheral lamina that may increase overall colony diameter up to 3.08 mm. One or two small subcolonies able to develop at the colony margin in the zooidal budding zone. Autozooidal peristomes longest behind the peripheral budding zone, up to 0.37 mm high; apertures circular to oval, 0.06–0.10 mm in diameter, those in broad central zone comprising only short rims, the zooidal tubes all sealed with finely porous calcareous diaphragms. Zooids with peristomes separated or several peristomes more or less connate in short radial rows; centralmost zooids somewhat spirally disposed; surface calcification of colony between peristomes with fine, wavy, growth lines. Peristomial interiors lacking mural spines.

Gonozooid at colony periphery, brood chamber transversely elongate and broadly crescentic, tapering somewhat on each side laterally, 1.28 mm wide, up to 0.45 mm long; ooeciostome mid-distal, forming a short tube bent towards the colony centre, the ooeciopore transversely oval, 0.014 mm in transverse width.

Remarks. This species is so far known only from the type locality, which yielded three fertile colonies. Compared to the type species of *Plagioecia*, this new species has smaller zooids with more distantly spaced apertures.

Suborder Rectangulata Waters, 1887

Family Densiporidae Borg, 1944

Favosipora MacGillivray, 1885

Type species. *Favosipora rugosa* MacGillivray, 1885, by monotypy.

Favosipora bathyalis n. sp.

(Fig. 8 A–D)

Material examined. *Holotype:* NIWA 61250, from cruise TAN0413, Stn 177, 37°18.72’ S, 177°03.93–177°04.26’ E, Bay of Plenty, northwest of Mahina Knoll, 550 m depth, collected 16 November 2004. *Paratypes:* NIWA 61251, same locality as holotype. Other material: TAN0413 Stns 59, 109, 171.

Distribution. Continental slope, central Bay of Plenty, New Zealand, 136–910 m.

Etymology. In reference to the relatively deep-water occurrence of this species of *Favosipora*.

Description. Colony encrusting, circular, up to 3.47 mm in diameter, frequently supported by basal struts and typically forming smaller subcolonies above the primary layer so that a fully formed colony can resemble a three-tiered wedding cake in profile; zooids arranged more or less quincuncially, with short series (2–3) of zooidal peristomes separated by kenozooids; subcolonies 0.56–1.29 mm in height.

Young colonies fully or partially adnate, depending on substratum irregularity, surrounded by a thin, planar or upturned marginal lamina. Colony centre mainly comprising thick-walled kenozooids with rounded outlines; kenozooidal apertures 0.15–0.17 mm in diameter, reduced or closed by smooth calcification; open kenozooids with pinhead mural spines on wall interiors. Autozooidal peristomes 0.08–0.11 mm in diameter, the apertures circular; some sealed by terminal diaphragms with radial surface fabric.

Marginal lamina in some colonies with several indentations, marking shafts that descend to the substratum as hollow narrow props or broad struts. Skeletal ultrastructure of lamina comprising imbricating platey crystallites; these relatively large between developing lateral walls of zooidal chambers, minute and narrowly lath-like to granular where walls develop.

Budding of subcolonies takes place from a kenozooid and its quincuncial neighbours in the macular centre of the primary colony. The subcolony spreads across a quarter to a third of the parent colony, raising itself above it as a shallow dish. The only gonozooid encountered in this species was in the middle tier of a three-tiered colony (holotype), near the edge; brood chamber is short (0.45 mm) and very wide (1.33 mm) with a raised rim and has a densely pseudoporous exterior-walled surface and relatively large round ooeciopore, 0.09 mm in diameter, atop a short ooeciostome.

Remarks. *Favosipora bathyalis* is the sixth species of the genus to be discovered in the New Zealand EEZ, the other species having only recently been recognised as belonging to the genus or newly described (Gordon & Taylor 2001). This species is also the deepest-known in the genus. The tiny, transverse brood chamber is unlike those of congeneric species, including the Australian type species of *Favosipora*, *F. rugosa*.

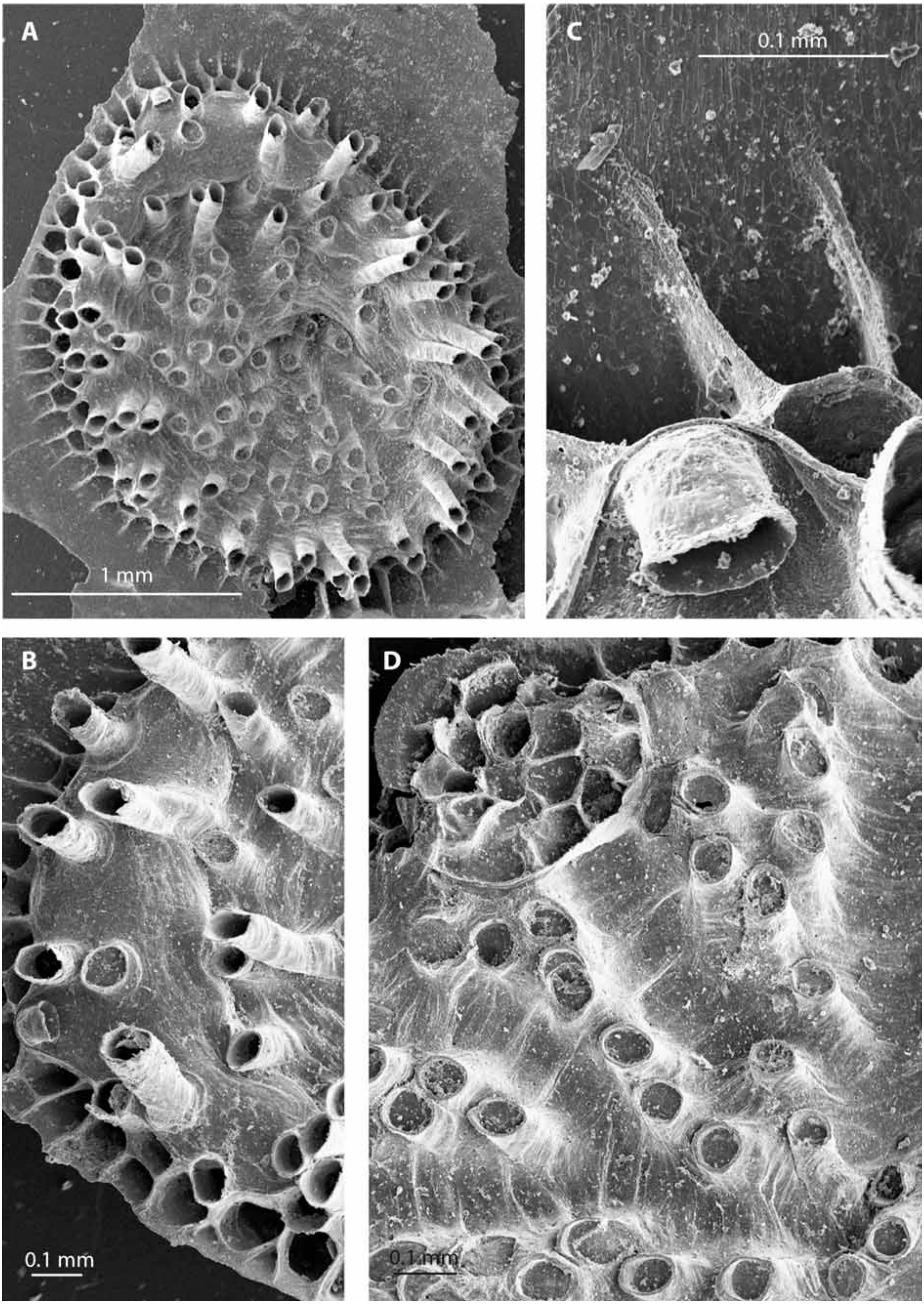

FIGURE 7. *Plagioecia parva* **n. sp.** (TAN0413 Stn 129). A, holotype colony with brood chamber; B, brood chamber in A; C, ooeciostome, and crystallites of marginal lamina; D, another colony with a developing subcolony.

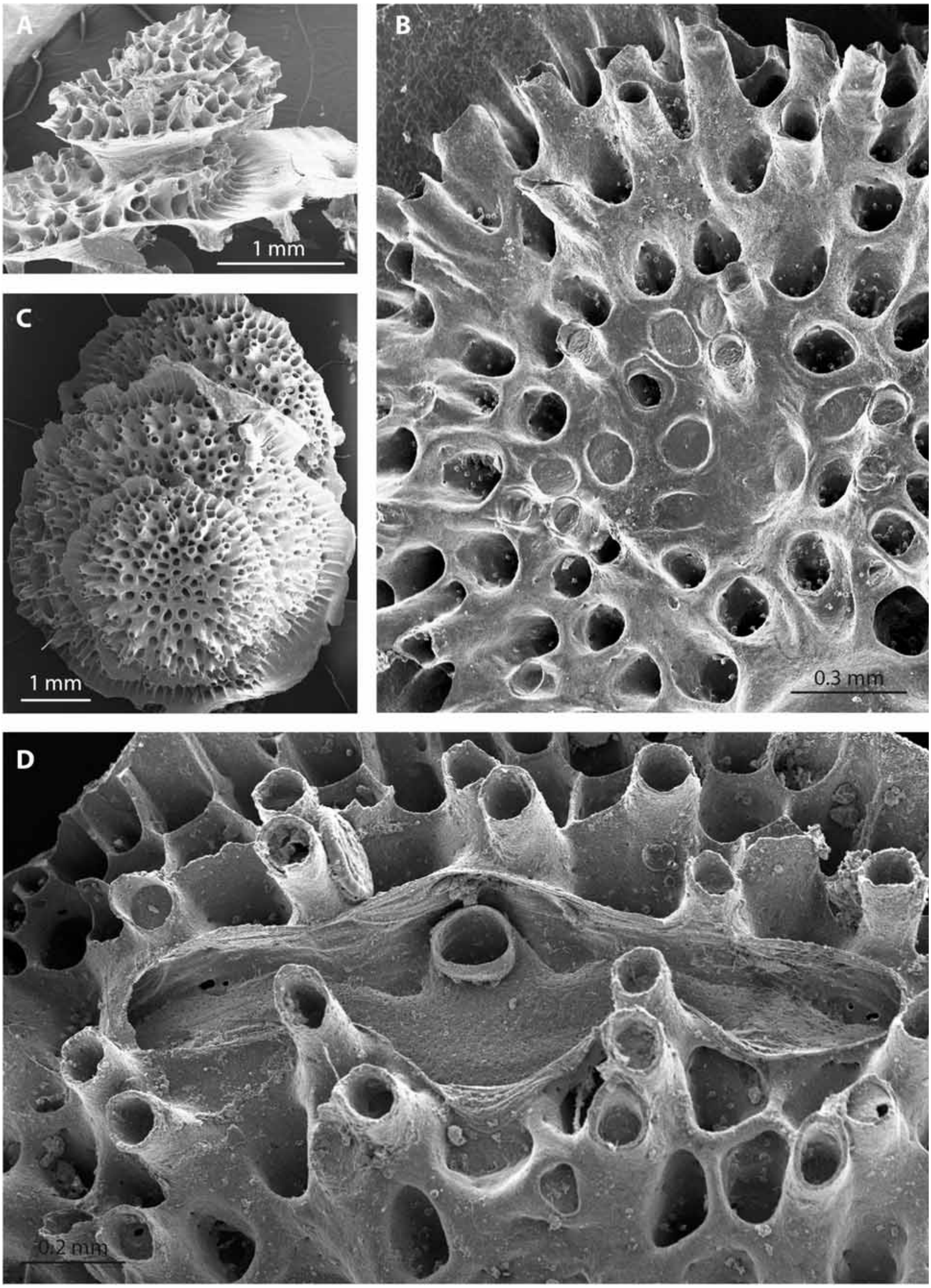

FIGURE 8. *Favosipora bathyalis* **n. sp.** (TAN0413 Stn 177). A, profile of a three-tiered colony with basal struts; B, tiered holotype colony, the middle tier with very narrow brood chamber at far left; C, infertile colony centre; note pinhead spinules within zooidal peristomes; D, brood chamber and ooeciostome of holotype colony in B.

Family Lichenoporidae Smitt, 1867

Dartevellopora nom. nov.

Type species. *Dartevellia cylindrica* Borg, 1944.

Remarks. *Dartevellia* Borg, 1944 is a homonym of *Dartevellia* Brian, 1939 (Copepoda). We here propose *Dartevellopora* nom. nov. to replace it. This name preserves Borg's intent to honour the Belgian scientist Edmond Dartevelle, 1907–56, Curator of Molluscs at the then Musée Royale du Congo Belge in Tervuren, who published some papers on fossil Bryozoa. The suffix -opora is commonly used for stenolaemate bryozoans.

Dartevellopora neozelanica n. sp.

(Fig. 9 A–H)

Material examined. *Holotype:* NIWA 61252, from cruise TAN0104, Stn 3, 42°45.48–42°45.18'S, 179°59.47–179°59.54' W, "Graveyard" Seamount, Chatham Rise, 943–1097 m depth, collected 15 April 2001. *Paratypes:* NIWA 61253, from TAN0104/149, 42°43.02' S, 179°57.60–179°57.90' W, "Morgue" Seamount, 903–1162 m depth, collected 18 April 2001. Other material: TAN0104 Stns 43, 150, 336.

Distribution. "Graveyard Seamount Complex", north-central Chatham Rise, New Zealand, 750–1181 m.

Etymology. From New Zealand (in contradistinction to the provenance of the type species — Tierra del Fuego).

Description. Colony erect, up to 3.5 mm high, with an apron-like base, columnar, devoid of zooidal apertures in the column, topped by a capitulum of open zooids that, depending on its width (up to 2.8 mm in diameter), results in a clavate or fungiform shape for the distal half of the colony.

Base of colony comprising a small circular disc (2.91 mm diameter), the lower part of the column smooth or somewhat pedunculate, the remainder generally with short rounded protuberances marking the locations of occluded apertures. All surfaces interior-walled.

Capitulum comprising short autozooidal peristomes in quincunx with kenozooids, the openings of which are of variable diameter depending on the degree of closure by calcification. Autozooids opening more or less around the periphery of the capitulum in well-formed colonies, the apertures circular, 0.10–1.12 mm in diameter. Capitulum surface relatively planar in infertile colonies, more domed in fertile colonies.

Gonozooids 1–3 per colony, produced sequentially, brood chambers ventricose, their surfaces generally with a small, flat, circular depressed area 0.72–1.12 mm in diameter, bordered by a rim, within which is the ooeciopore, 0.09 mm in diameter. Floor of brood chamber smooth.

Ancestrula not seen.

Remarks. The genus is scarcely known. Borg (1944) introduced *Dartevellia* monotypically for several infertile colonies of a small columnar bryozoan on a gastropod shell from 8 m depth off Ushuaia, Tierra del Fuego, Argentina. Borg's species is illustrated only by very poor half-tone photographs. They have the general form of the Chatham Rise colonies here attributed to *Dartevellopora* but, although Borg's description is comprehensive, the lack of proper illustrations makes some aspects of his description ambiguous. For example, he mentions the column in *D. cylindrica* as "rising from a *Tubulipora*-like initial growth" but that the "proximal portion of the peduncle is surrounded by at least two layers of kenozooids, one outside the other" and "the surface of the peduncle" is "marked by numerous longitudinal septal lines." A kenozooid layer is not externally visible in *D. neozelanica*, which otherwise conforms to *D. cylindrica* in the unique colony shape, the capitulum with a relatively small number of autozooids, the occurrence of kenozooids in the capitulum, and the rarity of pseudopores.

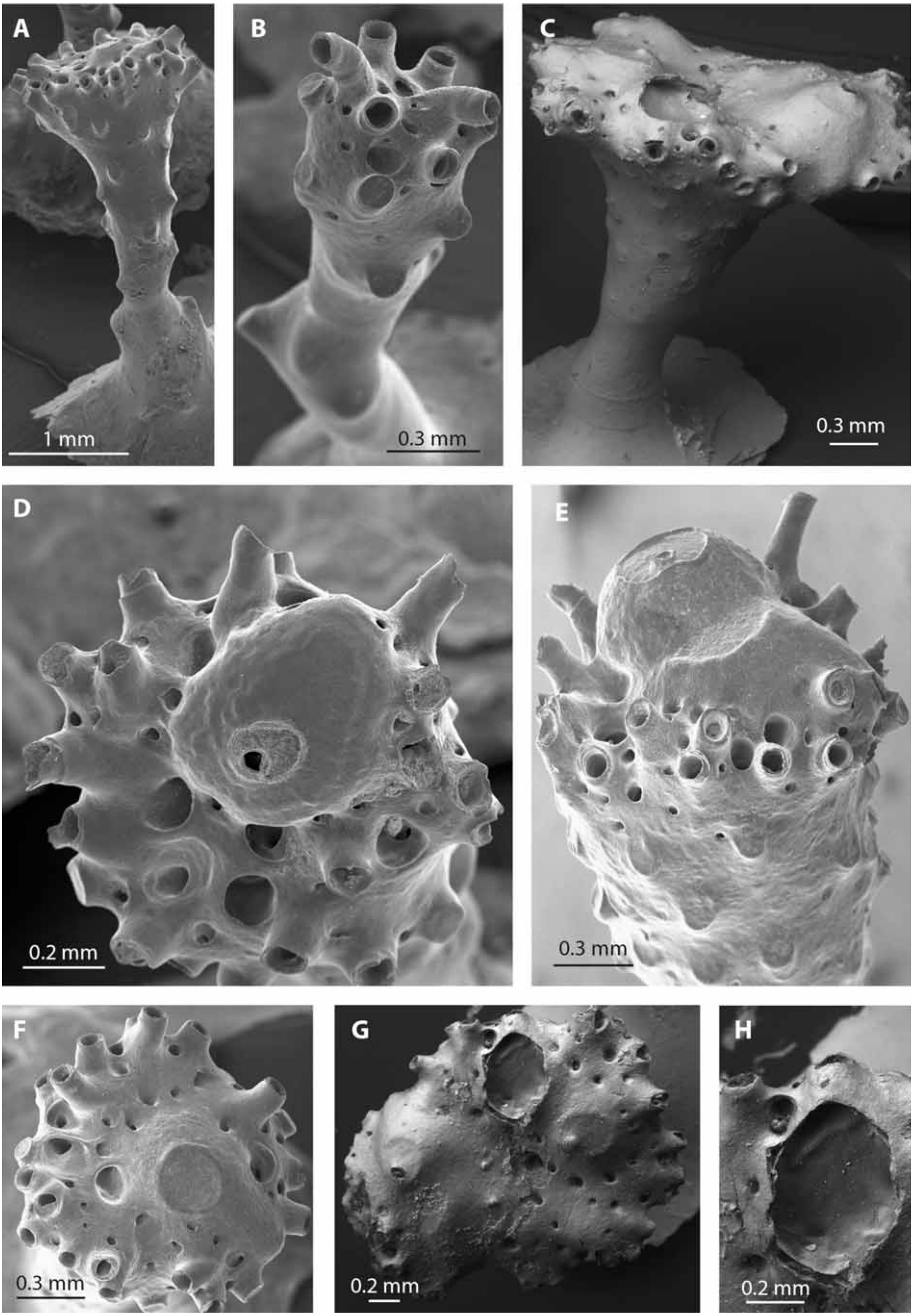

FIGURE 9. *Dartevellopora neozelanica* **n. sp.** (TAN0104 Stn 3). A, C, profiles of fertile colonies with brood chambers in capitulum disk; B, infertile colony; D–H, apical views of brood chambers; note the smooth brood-chamber floor in G and H.

Dartevellopora granulosa **n. sp.**
(Fig. 10 A–D)

Material examined. *Holotype:* NIWA 61254, from cruise TAN0104, Stn 3, 42°45.48–42°45.18’S, 179°59.47–179°59.54’ W, “Graveyard” Seamount, Chatham Rise, 943–1097 m depth, collected 15 April 2001. *Paratypes:* NIWA 61255, same locality as holotype.

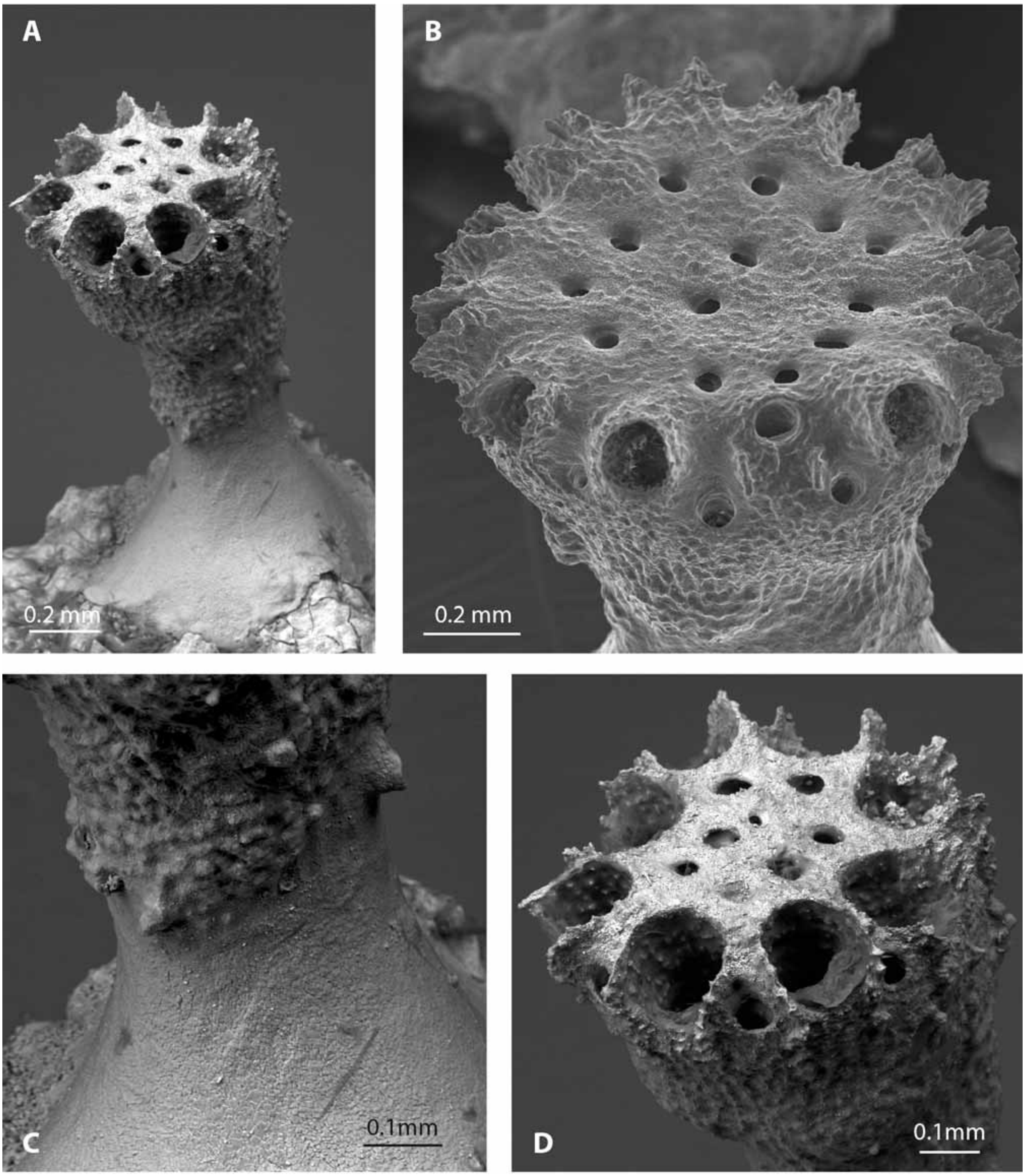

FIGURE 10. *Dartevellopora granulosa* **n. sp.** (TAN0104 Stn 3). A, profile of entire infertile colony; B, capitulum of a larger colony; C, D, base of column and capitulum of colony in A.

Distribution. "Graveyard Seamount Complex", north-central Chatham Rise, New Zealand, 943–1097 m.

Etymology. Latin *granulum*, little grain, alluding to the granular surface.

Description. Colony erect, up to 1.8 mm high, with an apron-like base, columnar, devoid of zooidal apertures on the column, and a slightly expanded, flat-topped capitulum 0.95 mm in diameter.

Basal apron smooth, with a granular microstructure of small platey crystallites, the column and capitulum rugose, with a granular-tubercular surface; a few occluded apertures evident in the sides of the column. Autozooids having relatively short peristomes, apertural diameter 0.18 mm, disposed in a single whorl around the periphery of the capitulum, the centre occupied solely by kenozooidal chambers 0.04–0.07 mm in diameter; additional kenozooids occurring just below the level of the autozooidal apertures, comprising one kenozooid between each pair of apertures.

Gonozooids and ancestrula not seen.

Remarks. This species is so far known only from the type locality, which yielded only two infertile colonies. It differs from its congener *D. neozelanica* in its rugosity and the disposition of autozooids and kenozooids in the capitulum. *Disporella cookae* David & Pouyet, 1986, from 4283 m in the Indian Ocean south of Madagascar, probably belongs to *Dartevellopora*; it is interior-walled and, although it has a relatively short column, the zooidal peristomes issue in a single whorl around the periphery of the capitulum.

Disporella Gray, 1848

Type species. *Discopora hispida* Fleming, 1828, by monotypy.

Disporella minicamera n. sp.

(Fig. 11 A–D)

Material examined. *Holotype:* NIWA 61256, from cruise TAN0104, Stn 3, 42°45.48–42°45.18'S, 179°59.47–179°59.54' W, "Graveyard" Seamount, Chatham Rise, 943–1097 m depth, collected 15 April 2001. *Paratypes:* NIWA 61257, same locality as holotype. Other material: TAN0104 Stns 43, 116, 149, 150, 153, 194, 288, 289, 333, 336, 337, 389, 399.

Distribution. "Graveyard Seamount Complex", north-central Chatham Rise, New Zealand, 750–1181 m.

Etymology. Latin *minus*, small + *camera*, chamber.

Description. Colony small, circular, generally with a single macular centre, but a secondary macula can develop in fertile colonies. Maximum diameter 1.9 mm. Completely adnate, with entire basal surface affixed to substratum. Frontal surface granular-tubercular.

Fertile colonies with only 15–16 autozooidal peristomes in 1–2 cycles around the colony periphery, radiating outwards, the apertural rims coarsely fimbriated. Colony centre hummocky, with small openings (kenozooidal?) in the depressions. Autozooidal peristomes up to 0.19 mm in external diameter; apertures 0.08 mm in internal diameter.

Gonozooid comprising a subglobular sac-like brood chamber, 0.38 mm wide, 0.44–0.47 mm long, prominent on the colony surface near the periphery, not embedded; exterior surface calcification granular-tubercular like the rest of the colony, the ooeciopore very broad, wider (0.12–0.16 mm) than long, set low on the side facing the colony margin, the narrow rim of the ooeciostome very thin with little granulation. Ancestrula not seen.

Remarks. Gordon & Taylor (2001) described the known species of Lichenoporidae from New Zealand, comprising five species of *Disporella* and one of *Doliocoitis*. Two of the *Disporella* species are quite small — *D. humilis*, from 107 mm on Puysegur Bank, has a maximum diameter of 2.5 mm; *D. sacculus*, from 972–1350 m at the Norfolk and Kermadec Ridges and the Bay of Plenty, achieves 5 mm diameter — but both of these species have concealed brood chambers, although *D. sacculus* has 1–3 sequentially functional brood chambers that are somewhat saccate. The closest species in morphology to *D. minicamera* is *Disporella minima* Moyano, 1991; it is equally tiny (not exceeding 2 mm diameter) and has an inflated sac-like gonozooid that is not concealed by kenozooids and secondary calcification. Its brood chamber is located entirely in the macular centre of the colony. Moyano (1991) noted some apparent differences between *D. minima* and other species of *Disporella*, suggesting that *D. minima* could represent a new genus. This possibility occurred to the present authors but we think that *D. minima* and *D. minicamera* can be accommodated within *Disporella* on the grounds that:

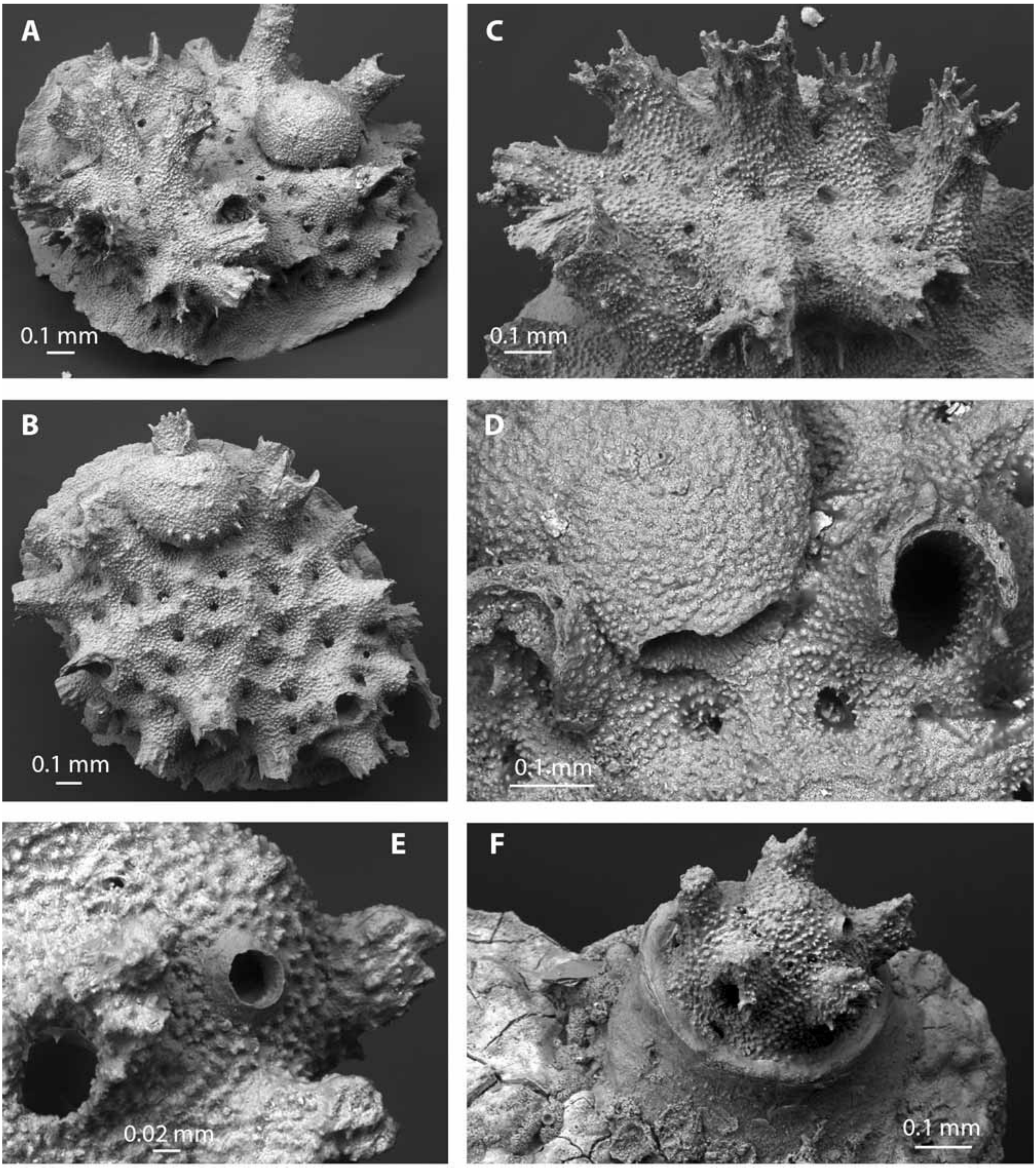

FIGURE 11. A–D. *Disporella minicamera* **n. sp.** (TAN0104 Stn 3). A, B, whole colonies with globular brood chambers; C, infertile colony; D, brood chamber with broad transverse ooeciostome. E, F. *Disporella minutissima* **n. sp.** (TAN0104 Stn 3); E, close-up of ooeciostome; F, whole colony with short, smooth base and central brood chamber with ooeciostome.

1. The small size and saccular nature of the brood chamber is probably no more than a consequence of small colony size: large colonies, large chambers; small colonies, small chambers.
2. The occurrence of the brood chamber on the surface of the colony instead of being embedded in it is probably also associated with small colony size and limited growth; large species have the capacity for increase in colony thickness, such that frontal growth of kenozooidal chambers can be achieved relatively quickly, partially or wholly concealing brood-chamber surfaces.
3. Schäfer (1991) showed that the brood chamber in *Disporella* species has a definite floor, unlike the situation in *Patinella* (*Lichenopora* auctt.); the floor of the brood chamber in *D. minicamera* conforms to that of other *Disporella* species.

Disporella minutissima n. sp.

(Fig. 11 E, F)

Material examined. *Holotype:* NIWA 61258, from cruise TAN0104, Stn 3, 42°45.48–42°45.18'S, 179°59.47–179°59.54' W, "Graveyard" Seamount, Chatham Rise, 943–1097 m depth, collected 15 April 2001.

Distribution. "Graveyard Seamount Complex", north-central Chatham Rise, New Zealand, 943–1097 m.

Etymology. Latin, superlative of *minutus*, small.

Description. Colony exceedingly tiny, comprising just five autozooids and a central gonozooid, supported on a smooth, short pedestal. Typical cancelli lacking, but five small pores present, one basal to each zooidal aperture. Peristomes relatively thick-walled, with up to five short, blunt processes; all exterior surfaces of zooidal disc relatively coarsely granular. Brood chamber small, oval, its granular surface merging into that of the peristomes that surround it, the ooeciostome circular, smooth with a thin rim.

Remarks. This species is so far known only from the type locality, which yielded a single fertile colony. It is unquestionably the smallest cyclostome species known — in fact the smallest calcified bryozoan known — and the entire colony could easily fit inside an individual zooid of most cheilostome species; its individual zooids are smaller than the mature zooids of the interstitial ctenostome bryozoan *Monobryozoon ambulans* (see Hayward 1985) which has minute colonies with only one autozooid.

The generic attribution is uncertain. The zooids of *D. minutissima* closely resemble those of *D. minicamera* but the smooth basal pedestal is lacking in this species. The pedestal, which is exterior-walled, may be homologous with the conical peduncle of the Cretaceous–Miocene genus *Lichenopora* (Gordon & Taylor 1997). The ooeciostome of *D. minutissima* is round, quite unlike the broad transverse opening in *D. minicamera*.

Discussion

Gordon *et al*. (2009) listed 121 species of Cyclostomata in the New Zealand EEZ, 37 of them named and 84 unnamed. Seven of the unnamed species are described here, reducing that component to 77 species; three other new species were recognised during the course of this study, hence the known New Zealand cyclostome fauna now comprises 124 species or 12.8% of the entire New Zealand bryozoan fauna. Based on known distributions and taxonomy, the percentage of endemic cyclostome species is 53% (cf. 37.5% for Ctenostomata and 63.8% for Cheilostomata). With the addition of *Discantenna* **n. gen.**, the New Zealand cyclostome fauna has four endemic living genera, the others being *Attinopora* Boardman, McKinney & Taylor, 1992 and *Cinctipora* Hutton, 1873 in the family Cinctiporidae (endemic to New Zealand in the Recent), and *Spiritopora* Taylor & Gordon, 2003 (Diaperoeciidae).

Sampling in deeper water of the EEZ during the past decade has revealed a large number of novel taxa of many phyla including Bryozoa, on both soft and hard bottoms. Seamount faunas in particular have yielded a relatively high number of species, of which large proportions are undescribed. For example, in 2001, 42 epibenthic sled samples at 750–1181 m depth in the “Graveyard Seamount Complex” on the north-central Chatham Rise yielded 414 invertebrate species, including 60 bryozoan species (37 undescribed), the fifth most diverse phylum after Porifera (70 species) (Rowden *et al*. 2002). In 2004, 25 sled samples at 470–930 m depth on the Cavalli seamounts of northeastern North Island yielded 396 invertebrate species, of which the most species-rich group was Bryozoa, with 110 species (70 undescribed) (Rowden *et al*. 2004). In 2006, 5 epibenthic sled samples at 968–1140 m on Christable Seamount, west of subantarctic Auckland Island, yielded 54 bryozoan species (30 undescribed) (unpubl. NIWA data). The importance of this level of bryozoan species diversity is underscored by the fact that Rogers’ (1994) review of global seamount studies found that only 597 invertebrate species from a range of phyla had been recorded since direct sampling began at the end of the nineteenth century. The high degree of taxonomic novelty and diversity in Bryozoa reflects similar findings for other phyla. Sampling of seamounts in the southeast Coral Sea and Tasman Sea recorded more than 850 macrofaunal species, of which 16–36% were deemed both new to science and potentially endemic to seamounts (Richer de Forges *et al*. 2000).

Only the data from the 2001 cruise (above) have been fully analysed, mainly to ascertain if there were any distinctions in the benthic fauna between fished and unfished seamounts in the Graveyard complex. Clark & Rowden (2009) found that the invertebrate assemblage composition was significantly different between fished and unfished seamounts. Among the species that best discriminated the observed assemblage dissimilarity (mostly stylasterid hydrocorals) was a small cheilostome bryozoan, *Lagenipora* sp., which occurred more frequently in samples from fished seamounts. In the absence of biological and life-history data for the bryozoan species, it is difficult to apply this finding to the cyclostomes decribed here but some comments are germane. *Lagenipora* sp. is a small encrusting species that, judging from the presence of ovicells, reproduces at a small colony size. In shallow water such a species would be expected to be a short-lived opportunist, which is the case for many small cyclostome species that have spot-like colonies with semi-determinate or determinate growth (Winston 1985; Bishop 1989; McKinney *et al*. 1996). Such may also be the case in the deep sea. As Bishop (1989) noted, species that reproduce at a small colony size may die following reproduction simply because the heavy allocation of resources to embryo production, fuelled by very few feeding autozooids, leaves little reserves available for growth and regeneration. Nevertheless, given the clonal nature of reproduction in cyclostomes (polyembryony), even though they tend to be poor spatial competitors, the genome is able to survive and persist despite a very low reproductive effort (cf. Jackson & Winston 1981).

Of the ten new species described here, seven are found on “Graveyard Seamount” and three of them, including the sole species of the new genus *Discantenna*, are known only from there. This is the most intensively fished of the seamounts in the complex, posing the question: does the level of bottom trawling on this seamount constitute a threat to the relatively high number of endemic taxa? The results of the study between fished and unfished seamounts (Clark & Rowden 2009) suggests a positive correlation between habitat modification and the survival of an opportunistic taxon like *Lagenipora* sp. and it may well be that such could be the case for the cyclostomes with their small colonies and precocious sexual reproduction.

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APPENDIX

NIWA Station Data
New Zealand Oceanographic Institute/National Institute of Water & Atmospheric Research

NZOI
Stn I97: 25 July 1975, 32°23.29’ S, 167°28.20’ E, 540–544 m

NIWA R.V. Tangaroa cruise TAN0104
Stn 1: 15 April 2001, 42°45.60–42°45.54’ S, 179°59.26–179°59.85’ W, 770–979 m
Stn 3: 15 April 2001, 42°45.48–42°45.18’ S, 179°59.47–179°59.54’ W, 943–1097 m
Stn 43: 16 April 2001, 42°45.75–42°45.84’ S, 179°59.29–179°59.13’ W, 750–1064 m
Stn 80: 17 April 2001, 42°43.09–42°42.91’ S, 179°57.81–179°57.48’ W, 1000–1150 m
Stn 82: 17 April 2001, 42°43.02–42°43.17’ S, 179°57.56–179°57.66’ W, 964–1051 m
Stn 116: 17 April 2001, 42°47.88–42°47.85’ S, 179°58.90–179°58.68’ W, 922–1000 m
Stn 130: 17 April 2001, 42°42.60’ S, 179°58.09’ W, 1007 m
Stn 149: 18 April 2001, 42°43.02’ S, 179°57.60–179°57.90’ W, 903–1162 m
Stn 150: 18 April 2001, 42°42.93–42°42.66’ S, 179°54.37–179°54.43’ W, 1004–1181 m
Stn 153: 18 April 2001, 42°43.95–42°44.26’ S, 179°53.91–179°54.01’ W, 990–1076 m
Stn 194: 18 April 2001, 42°47.26–42°45.63’ S, 179°59.80–179°59.27’ W, 880–1042 m
Stn 288: 18 April 2001, 42°45.63–42°45.78’ S, 179°59.27–179°59.53’ W, 890–972 m
Stn 289: 19 April 2001, 42°45.88–42°46.05’ S, 179°59.16–179°59.00’ W, 757–800 m
Stn 333: 20 April 2001, 42°43.09–42°43.17’ S, 179°54.57–179°54.87’ W, 1008–1075 m
Stn 336: 20 April 2001, 42°46.06–42°46.15’ S, 179°55.31–179°55.12’ W, 890–955 m
Stn 337: 20 April 2001, 42°45.99–42°46.08’ S, 179°55.36–179°55.18’ W, 900–970 m
Stn 389: 21 April 2001, 42°46.98–42°46.81’ S, 179°59.64–179°59.37’ W, 870–1000 m
Stn 399: 21 April 2001, 42°43.20–42°43.32’ S, 179°57.63–179°57.66’ W, 890–1012 m

NIWA R.V. Kaharoa cruise KAH0204
Stn 1: 13 April 2002, 34°57.81–34°58.44’ S, 175°12.64–175°12.63’ E, 602–614 m
Stn 8: 14 April 2002, 34°06.91–34°06.84’ S, 174°08.70–174°08.59’ E, 610–640 m
Stn 9: 14 April 2002, 34°06.67–34°06.40’ S, 174°08.29–174°07.81’ E, 562–600 m
Stn 15: 15 April 2002, 34°05.98–34°06.21’ S, 174°06.82–174°06.91’ E, 470–480 m
Stn 21: 16 April 2002, 34°04.32–34°04.74’ S, 174°04.08–174°04.75’ E, 560–630 m
Stn 22: 16 April 2002, 34°04.68–34°04.75’ S, 174°04.72–174°04.81’ E, 550–610 m
Stn 28: 16 April 2002, 34°05.77–34°05.56’ S, 174°06.88–174°07.05’ E, 490–515 m
Stn 32: 17 April 2002, 34°09.72–34°10.09’ S, 173°57.70–173°57.97’ E, 780–810 m
Stn 34: 17 April 2002, 34°08.53–34°08.92’ S, 173°58.78–173°58.45’ E, 855–930 m
Stn 40: 18 April 2002, 34°09.85–34°09.84’ S, 173°57.84–173°58.33’ E, 805–820 m
Stn 47: 19 April 2002, 34°02.55–34°02.95’ S, 174°49.02–174°48.70’ E, 792–880 m
Stn 50: 19 April 2002, 34°02.98–34°02.49’ S, 174°48.46’ E, 790–800 m

NIWA R.V. Tangaroa TAN0413
Stn 59: 11 November 2004, 37°12.54–37°12.96’ S, 177°14.25–177°14.20’ E, 701–910 m
Stn 109: 13 November 2004, 37°32.92–37°32.91’ S, 177°59.26–177°59.13’ E, 136–142 m
Stn 129: 14 November 2004, 37°20.40–37°20.25’S, 177°06.69–177°06.81’ E, 275–335 m
Stn 171: 16 November, 37°27.15–37°27.19’ S, 176°54.24–176°54.40’ E, 310–440 m
Stn 177: 16 November 2004, 37°18.72’ S, 177°03.93–177°04.26’ E, 550–725 m