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To cite this article: A. G. Beu & F. M. Climo (1974) Mollusca from a recent coral community in Palliser bay, cook strait, New Zealand Journal of Marine and Freshwater Research, 8:2, 307-332, DOI: [10.1080/00288330.1974.9515507](https://doi.org/10.1080/00288330.1974.9515507)

To link to this article: <https://doi.org/10.1080/00288330.1974.9515507>



Published online: 29 Mar 2010.



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MOLLUSCA FROM A RECENT CORAL COMMUNITY IN PALLISER BAY, COOK STRAIT

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(Received for publication 21 June 1973)

ABSTRACT

From a trawling at 448–512 m in Palliser Bay, Cook Strait, New Zealand, molluscs associated with Tertiary siltstone concretions and with a large colony of *Goniocorella dumosa* (Alcock) are listed. A juvenile *Acesta*, extremely tall and extremely broad forms of *Emarginula striatula* Quoy & Gaimard, and the animals of *Stilifer neozelanica* Dell and of *Waipaoa marwicki* Dell are described. *Sculptifer*, a new genus provisionally included in the Fossaridae, is proposed for *Stilifer neozelanica*. New species of *Danilia* and *Pholadidea* are described and their relationships discussed. *Emarginula lophelia* Beu, 1967 is synonymized with *E. striatula* Quoy & Gaimard, 1834, and the recent New Zealand forms of *Emarginula* are reviewed.

INTRODUCTION

On 11 May 1972, a National Museum party trawled in Turakirae Trench, Palliser Bay, east of Wellington, from Mr A. J. Black's r.v. *Acheron*. A large beam trawl was used, and the single trawling brought up a relatively large mass of the coral *Goniocorella dumosa* (Alcock) and several boulders of Tertiary siltstone, some up to 0.6 m long, presumed to be concretions weathered from or broken off submarine outcrops. Most of the coral consisted of dead fragments, but a few pieces up to 0.2 m high were alive, and the total amount of coral collected filled two 3-gal (approximately 13.5 litre) buckets. The boulders were extensively bored by a new species of *Pholadidea* described here, and about 25 species of molluscs were sorted from the sample by one of us (F.M.C.) and are listed and discussed below.

LOCALITY: National Museum Biological Station (BS) 292, 41° 30.7' S, 174° 58.4' E to 41° 35.4' S, 175° 00.8' E, eastern edge of Turakirae Trench, Palliser Bay, Cook Strait, in 448–512 m (245–280 fathoms), 11 May 1972, r.v. *Acheron*, by 2 m beam trawl.

TABLE 1—List of Mollusca in BS 292, 448–512 m on eastern edge of Turakirae trench, Palliser Bay, Cook Strait, New Zealand, 11 May 1972

SPECIES	REMARKS	NATIONAL MUSEUM REG. No.
BIVALVIA		
<i>Saccella hedleyi</i> Fleming	2 live & 5 valves	M29163
<i>Jupiteria wolffi</i> Dell	2 valves	M29164
<i>Austrotindaria</i> n.sp.	1 valve	M29162
" <i>Ledella</i> " <i>herdmanni</i> Dell	1 valve	M29165
aff. <i>Yoldiella</i> 2 n.spp.	1 valve each	M29166, —67
<i>Neilo rugata</i> Dell	1 broken valve	M29161
<i>Monia zelandica</i> (Gray)	3 live & 6 valves	M29147
<i>Chlamys kiwaensis</i> Powell	1 live, 5 valves & many juveniles	M29148
<i>Acesta</i> n.sp.	1 live juvenile	M29159
<i>Notolepton antipodum</i> (Filhol)	3 valves	M29158
<i>Leptomya retiaria</i> (Hutton)	3 paired dead & 1 valve	M29157
<i>Hiatella arctica</i> (Linnaeus)	5 paired dead	M29149
<i>Pholadidea acherontea</i> n.sp.	Abundant	M29171, —72
GASTROPODA		
<i>Emarginula striatula</i> Q. & G.	2 live & 1 dead	M29153
<i>Maoricrater explorata</i> Dell	6 live	M29150
<i>Danilia insperata</i> n.sp.	1 live	M29170
<i>Proxiuber</i> sp.	1 dead juvenile	M29160
<i>Sculptifer neozelanica</i> (Dell)	25, mostly alive	M29169
<i>Cymatona kampyla</i> (Watson)	1 live & 1 dead juvenile	M29151
<i>Fusitriton laudandus</i> (Finlay)	4 large live	Spirit coll.
? <i>Euthrenopsis</i> n.sp.	1 dead	M29156
<i>Pleia cryptocarinata</i> Dell	1 dead	M29154
<i>Waipaoa marwicki</i> Dell	1 live	M29152
<i>Antiguraleus subtruncatus</i> Powell	2 dead	M29155
<i>Strombiformis</i> n.sp.	1 broken dead	M29168
POLYPLACOPHORA		
<i>Parachiton</i> aff. <i>mestayerae</i> Iredale	6 live	M30820

FAUNAL LIST: In addition to the molluscs listed in Table 1, the following animals occurred: abundant large pink ophiuroids, *Placophiothrix aristulata* (Lyman); numerous small comatulid crinoids, *Comanthus* sp.; a few large purple spatangoid urchins, *Spatangus multispinus* (Mortensen); several lobster krill, *Munida* sp.; one crab, *Carcinoplax victoriensis* Rathbun; two hermit crabs, *Porcellanopagurus edwardsi* Filhol; a series of "squat lobsters", *Uroptychus* sp.; several isopods, *Serolis bromleyana* Suhm; and several solitary corals, *Caryophyllia profunda* Moseley.

TAXONOMY

Family NUCULANIDAE

The Nuculanidae listed in Table 1 were identified by Mr P. A. Maxwell, N.Z. Geological Survey. Two represent new species of *Yoldiella* or a related genus, not previously recorded from New Zealand, but

New Zealand Nuculanidae, including the Recent species, are in need of revision, and there is little point in discussing the present limited material.

Family PECTINIDAE

Genus *Chlamys* Roding, 1798

TYPE SPECIES (by subsequent designation, Herrmannsen, 1847): *Pecten islandicus* Müller, 1776. Recent, North Atlantic.

Subgenus *Mimachlamys* Iredale, 1929

TYPE SPECIES (by original designation): *Pecten asperrimus* Lamarck, 1819. Recent, southern Australia.

Chlamys (*Mimachlamys*) *kiwaensis* Powell, 1933

1933. *Chlamys kiwaensis* Powell, *Trans. N.Z. Inst.* 63 (3): 371, pl. 40, figs 1-5.

This species was originally obtained attached to a telegraph cable 400 miles (644 km) west of New Plymouth in 600-700 fathoms (about 1100-1300 m) (Powell 1933) and has not been commented on since, although Dell (1956, p. 165) has recorded it from five stations in 100-700 fathoms (about 180-1300 m). Having been brought up on a cable, *Chlamys kiwaensis* evidently lives byssally attached to hard objects. Although the situation of individual specimens in BS 292 was not recorded, specimens were subsequently collected (BS 300, Turakirae Trench, 350-360 fathoms, r.v. *Acheron*, 6 September 1972) byssally attached to *Goniocorella dumosa*. *C. kiwaensis* may be merely an unencrusted phenotype of a more common species such as *C. gemmulata* (Reeve).

The sample in BS 292 is a growth series from minute specimens, resembling adult *Cyclopecten*, up to shells 13 mm high. The "Camptonectes microsculpture" mentioned by Powell (1933, p. 372) is prominent on minute specimens so that they strongly resemble the more finely sculptured species of *Cyclopecten* such as *C. aupouria* Powell, but the juvenile *Chlamys* can be readily distinguished from *Cyclopecten* by the large brownish-olive prodissoconchs.

Family LIMIDAE

Genus *Acesta* H. & A. Adams, 1858

TYPE SPECIES (by monotypy): *Ostrea excavata* Fabricius, 1779. Recent, north-eastern Atlantic.

Acesta n.sp.

A single limid 7.5 mm high was taken alive and was initially assumed to be a species of *Ctenoides* related to *C. gracillissimus* Beu (Beu 1967, p. 94) from the late Pliocene coral thicket in the cliffs at the head of Palliser Bay. However, the Recent shell has a large wing-like posterior ear extended at right-angles to the long axis of the shell, has no anterior

ear so that the umbones are at the anterior end of the hinge, and is sculptured with simple, fine, close, undivarcating radial ribs. These features are markedly different from the equilaterally-eared hinge and divarcating sculpture of *Ctenoides*, and the Recent shell is assumed to be a juvenile *Acesta*. Large Recent specimens of *Acesta* from New Zealand have been recognized in the collections of the N.Z. Oceanographic Institute and the National Museum and are being described by Mr E. W. Dawson.

Family PHOLADIDAE

Genus *Pholadidea* Turton, 1819

1819. *Pholadidea* Turton, *Conchological Dictionary of the British Islands*: 147. Type species (by monotypy): *Pholadidea loscombiana* Turton ex. Goodall MS, 1819. Recent, eastern Atlantic.

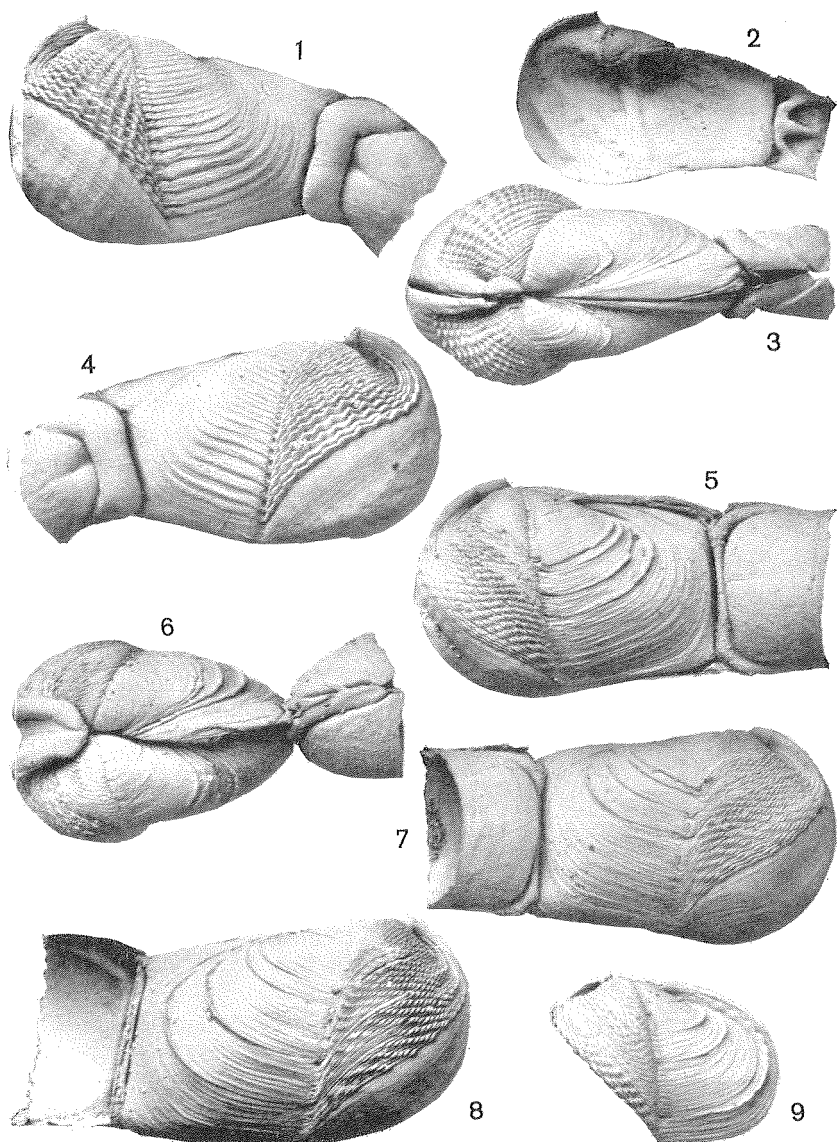
Pholadidea acherontea n.sp.

Figs 5-9, 11, 12

The new species is similar to and evidently closely related to the well-known *Pholadidea tridens* (Gray, 1843), a species that commonly bores in Tertiary mudstone in the littoral zone in New Zealand. The new species is described by comparison with *P. tridens*, which is figured here for comparison (Figs 1-4). The only other species of *Pholadidea* known from New Zealand, *P. spathulata* (Sowerby, 1850), does not have the periostracum calcified into a distinct siphonoplax, is longer and narrower, and has more prominent closely spaced concentric folds on the posterior half of the shell than *P. acherontea* and *P. tridens*, and thus does not seem closely related to the latter two species.

The greatest difference between *Pholadidea tridens* and *P. acherontea* is seen in the siphonoplax. In both species the siphonoplax has a deep groove parallel to its dorsal, anterior, and ventral margins, seen interiorly as a narrowly rounded, prominent ridge, but whereas the siphonoplax of *P. acherontea* is smooth and regularly rounded except for the marginal groove, that of *P. tridens* bears an additional deep, narrow groove down the centre of the anterior two-thirds of the siphonoplax. This ridge is visible inside as an additional prominent, narrowly rounded ridge, and the siphonoplax is thus divided into separate portions for the inhalent and the exhalent siphons. In addition, the marginal groove is markedly nearer the edges of the siphonoplax in *P. acherontea* than it is in *P. tridens*.

The regularly concentrically sculptured posterior portion of the shell behind the umbonal-ventral sulcus (which is equally deep in both species) is markedly shorter and thus relatively deeper and has a more rounded posterior end on untruncated growth-lines in *Pholadidea acherontea* than that in *P. tridens*. The overall shape of *P. acherontea* is thus slightly shorter, higher and more inflated than that of *P. tridens*. The sculpture of the posterior portion of the shell is similar in the two species, but the widely spaced, thin, raised, concentric lamellae developed after every four or five normal, fine, low, concentric riblets in a small proportion of populations of *P. tridens* are consistently present in all specimens of *P. acherontea*.



FIGS 1-9—(All enlarged $\times 2$)

1-4—*Pholadidea tridens* (Gray), St Heliers Bay, Auckland, near low tide, in Tertiary mudstone; Dell Collection, National Museum, M.4956;

1, 3, 4—Left, dorsal, and right exterior views of a moderately large specimen;

2—Interior view of right valve of a smaller specimen to show three prominent ridges inside siphonoplax.

5-9—*Pholadidea acherontea* n.sp., BS 292, Palliser Bay;

5, 6, 7—Left, dorsal, and right exterior views of holotype, M.29171;

8—Right view of paratype (right siphonoplax missing) to show single narrow marginal ridge inside siphonoplax;

9—Juvenile paratype with periostracum not calcified.

All paired specimens of *Pholadidea acherontea* in the type population have the valves joined along the plane of the commissure, and a thin calcified sheet fills a relatively wide gape between the calla and joins the upper and lower edges of the two plates of the siphonoplax. This sheet is absent in all specimens of *P. tridens* we have examined. Evidently calcification of the periostracum is carried a little further in *P. acherontea* than in *P. tridens* or, indeed, than in most previously named species of *Pholadidea*.

The shapes of the posterior ends of large specimens that have become truncated through developing the siphonoplax are slightly but consistently different, that of *Pholadidea acherontea* sloping slightly backwards towards the venter, whereas that of *P. tridens* is vertical or slopes slightly forwards towards the venter. Finally, the anterior, coarsely sculptured area of the shell in front of the umbonal-ventral sulcus is relatively longer and the callum consequently markedly narrower in *P. acherontea* than in *P. tridens*. All specimens of *P. acherontea* have this area relatively strongly sculptured, but the sculpture can be matched in some individuals of *P. tridens*. All other features, including the mesoplax, appear to be identical in the two species.

DIMENSIONS: *Holotype*: length including siphonoplax 23.5 mm, length excluding siphonoplax 16.2 mm, height 12.1 mm, inflation (two valves) 11.9 mm. *Largest paratype*: measurements in same order, 28.0 mm, 21.2 mm, 14.3 mm, 13.5 mm.

TYPE MATERIAL: Holotype (M29171) and seventeen paratypes (M29172) and about 100 further specimens (M30821) in National Museum, Wellington; one paratype (TM 5360) in New Zealand Geological Survey; two paratypes in Auckland Institute and Museum; two paratypes in Mollusk Department, Museum of Comparative Zoology, Harvard University.

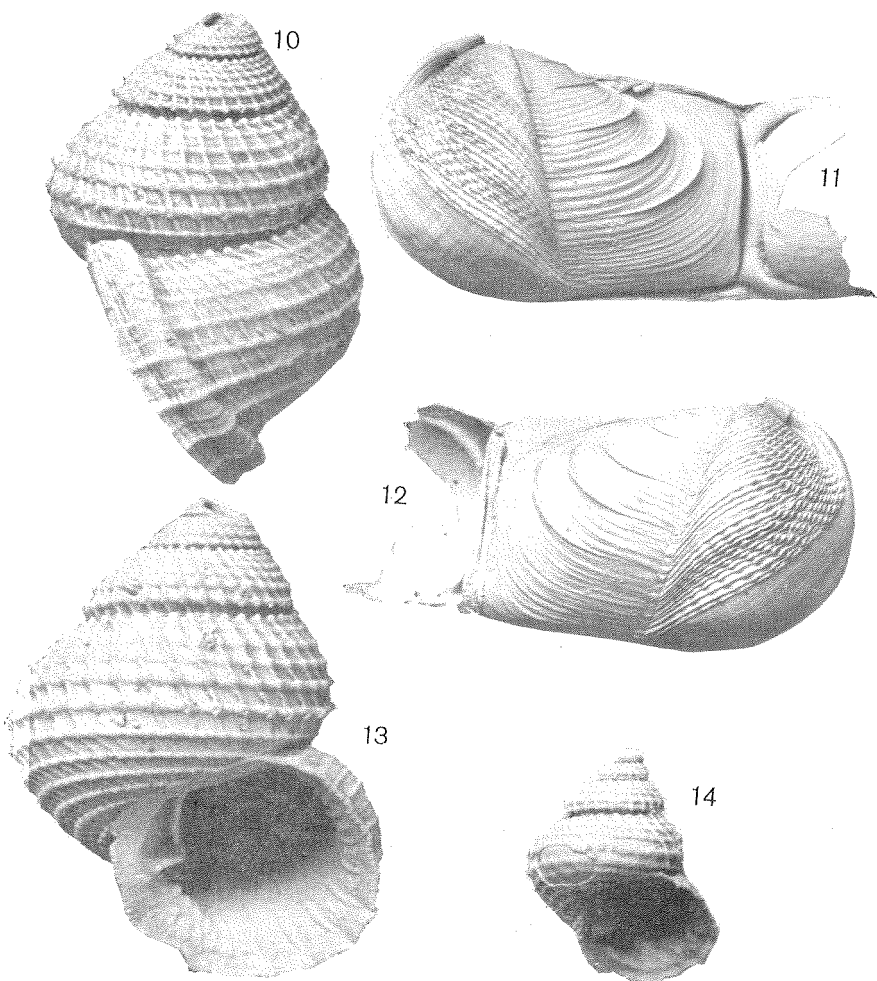
LOCALITIES: Holotype and many paratypes removed from boulders, BS 292, Turakirae Trench, Palliser Bay, in 448–512 m; Victoria University Zoological Station VUZ 51, 40° 35' S, 174° 53' E, Palliser Bay in 400–600 m, 22 November 1956 (National Museum Reg. No. M15926, one valve); large sandstone boulder trawled by m.v. *San Victoria*, 19 fathoms (35 m), off Utea, Ninety Mile Beach, Northland, September 1965, C. Wormald, specimens in Auckland Institute and Museum examined by F.M.C.; Auckland University Zoological Station AUZ 53, about 850 m, off Three Kings Islands, 1962 (National Museum, M17515, one valve); Canyon E, ENE of Taiaroa Head, Otago, in about 600 m, 2 March 1954 (National Museum, M9111, one valve).

The species appears to be widespread in the New Zealand region below about 30 m, and all specimens we have seen identified as *P. tridens* from below this depth are the new species. It is named for Mr A. J. Black's r.v. *Acheron*, which on her first few trawling operations has been as productive of new material as her well-known predecessor m.v. *Alert*.

Family FISSURELLIDAE

Genus *Emarginula* Lamarck, 1801

TYPE SPECIES (by monotypy): *Emarginula conica* Lamarck, 1801. Recent, Mediterranean and eastern Atlantic.



FIGS 10-14

- 10, 13—*Danilia insperata* n.sp., left and apertural views of holotype, M.29170, BS 292, Palliser Bay (enlarged $\times 5$);
 11, 12—*Pholadidea acherontea* n.sp., left and right view of largest paratype, BS 292, Palliser Bay (enlarged $\times 2$);
 14—*Danilia neozelanica* Laws, GS11,214, upper part of volcanics on south side of Bridge Point, south of Kakanui, North Otago, Runangan (late Eocene) (enlarged $\times 5$).

***Emarginula striatula* Quoy & Gaimard, 1834**

1834. *Emarginula striatula* Q. & G., *Voy. Astrolabe, Zoologie* 3: 332, pl. 68, figs 21–22.
1913. *Emarginula striatula* Q. & G., Suter: *Man. N.Z. Moll.* 99; Atlas of Plates (1915), pl. 8, fig. 5.
1928. *Emarginula striatula valentior* Finlay, *Trans. N.Z. Inst.* 59: 235, figs 56–57.
1960. *Emarginula striatula* Q. & G., Dell: *N.Z. Dept. Sci. Industr. Res. Bull.* 139: 149.
1967. *Emarginula lophelia* Beu, *Trans. R.Soc. N.Z., Geology* 5 (3): 96, pl. 1, figs 5 & 6.

Three specimens of *Emarginula* in BS 292 could not be identified without a review of the shell variation of *E. striatula*. One is a tall, narrow shell with its apex overhanging the posterior end of the aperture, closely resembling Palliser Bay Pliocene specimens of *E. lophelia* Beu, 1967. The other two are low, broad shells with extremely prominent sculpture of large, ventrally hollow, scale-like nodules developed at the junctions of narrow collabral lamellae with broad radial ribs. At first these appeared to represent two distinct species, but examination of collections of *Emarginula* from a variety of localities and stations around New Zealand in the National Museum and the N.Z. Geological Survey, with the comments of Dell (1960, p. 149) on the great variability of populations of *E. striatula*, suggested they are probably merely extremes of variation of *E. striatula*.

Five topotypes of *Emarginula lophelia* in the collection of Mr B. A. Marshall show a greater range of variation than previously seen, and specimens with weaker radial sculpture and stronger collabral sculpture than the specimens available to Beu (1967, p. 96) intergrade with extreme specimens. The range of variation falls within that of Recent tall specimens of *E. striatula*, and we consider that *Emarginula lophelia* was based on a tall phenotype of *E. striatula* that lived on *Lophelia*, and we synonymize *E. lophelia* with *E. striatula*. The tall phenotype of *E. striatula* in BS 292, like *E. lophelia*, probably lived on a restricted, narrow substrate, such as the narrowly cylindrical coral *Goniocorella dumosa*, and enlarged its shell upwards rather than laterally.

A population of relatively tall *Emarginula* discussed by Dell (1960, p. 149) from R.R.S. *Discovery II* Station 2772, Discovery Bank, in 140 m, in the National Museum (14 specimens, M8445), has coarser sculpture than other Recent tall specimens in the National Museum (e.g., Portobello Alert Station 54-22, Canyon A, ENE of Taiaroa Head, E Otago, in 600 m, one specimen, M9197; off E Otago, Canyon B, 45° 47' S, 171° 7' E, in 500–600 m, 2 specimens, M8895). An unusual feature of the Discovery Bank population is that the nodules at the junction of the radial and collabral sculptural elements are larger than in any other specimens seen, except those in BS 292, and are intermediate between those found in variable shallow-water populations of *E. striatula* and those of the broad, low specimens in BS 292. The low specimens in BS 292 are therefore considered to be coarsely sculptured

individuals of *E. striatula*, and probably represent a phenotype living on the deep water boulders rather than the coral.

The single New Zealand Recent specimen of *Emarginula* examined during this review that may not belong in *E. striatula* is from *New Golden Hind* Station B 75, East Channel between Johns Island and mainland, Breaksea Sound, Fiordland, dredged in 58 m, in the N.Z. Geological Survey Collection. The shell has broad, widely-spaced radial ribs, the posterior ones not crossed by narrow, widely-spaced collabral lamellae that cross their interspaces, but bearing numerous fine radial threads on their crests, and its solenizone protrudes prominently between high, narrow ribs. It is possibly a new species, but more specimens are needed to be sure that its features are constant. A normal specimen of *E. striatula* was taken in the same sample. Fleming (1950, p. 25) did not list the possible new species.

Wanganui Fossils: Among identifications of specimens of *Emarginula* from the Pliocene and Pleistocene rocks of the Wanganui coastal section, Fleming (1953, pp. 120–272) identified specimens from Mangapanian (late Pliocene) to Oturian (Hawera Series, early Upper Pleistocene) stages as *E. striatula*. He identified some specimens from the Okehuan Substage (Castlecliffian, late Lower Pleistocene) as *Emarginula* n.sp. (p. 181, Okehu Shell Grit; p. 182, Upper Okehu Siltstone; p. 187, Kaimatira Pumice Sand; p. 186, Lower Westmere Siltstone; p. 198, Kaikokopu Shell Grit). Examination of these specimens in the collection of the N.Z. Geological Survey showed that all are referable to *E. striatula*.

The shells Fleming (1953) identified as *Emarginula* n.sp. are small, narrow shells of moderately tall form, intermediate between the extremes seen in Recent populations, and agree closely in sculptural details with the flatter fossils and with Recent specimens. Tall shells from Okehu Shell Grit, Kaimatira Pumice Sand, and Kaikokopu Shell Grit (all of which comprise coarse sediments containing many fossils that lived in inshore environments, and were apparently deposited in shallow water) have their surfaces abraded, and were probably derived by reworking from the underlying siltstones. To judge from depths of deposition suggested for the siltstones by Fleming (1953, pp. 193, 195, 200) all the tall fossils lived in depths of about 20–50 m; we deduce that, like Recent tall specimens, they reflect the increasing scarcity of large areas of hard substrate as depth increases. Relative height of specimens of *Emarginula* may be a useful clue to depth of deposition in paleoecological studies.

Family TROCHIDAE

Genus *Danilia* Brusina, 1865

1835. *Olivia* Cantraine, *Bull. Acad. R. Bruxelles* 2: 387 (non *Olivia* Bertolini, 1810, Porifera?). Type species (by monotypy): *Olivia otaviana* Cantraine, 1835. Pleistocene, Italy.
1847. *Craspedotus* Philippi, *Zeit. f. Malakozool.*, Feb. 1847: 23 (non *Craspedotus* Schoenherr, 1844, Coleoptera). Type species (by monotypy): *Monodonta limbata* Philippi, 1844 (= *Danilia tinei* (Calcara, 1839)), Recent, Mediterranean.

1861. *Heliciella* O. G. Costa, *Microdioride Mediterr.*: 64. Type species (by monotypy): *Heliciella costellata* Costa, 1861 (perhaps the embryonic shell of *Danilia tinei* (Calcara, 1839)). Recent, Mediterranean.
1865. *Danilia* Brusina, *Verh. zool.-bot. Ges. Wien* 15: 25. New name for *Olivia* Cantraine, 1835, non *Olivia* Bertolini, 1810.

A few recent authors have used *Olivia* Cantraine rather than *Danilia* Brusina, perhaps because Neave (1940, p. 406) did not list a homonym of the former. Sherborn (1929, p. 4565) gave also "*Olivia* A. Bertolini, Rar. ital. plant. (3) 1810; 117.- Calc. Alga", but we cannot see why he would list an alga in "Index Animalium". Ghisotti & Steinmann (1970) noted "*Olivia* Cantraine . . . pre-occupato da Bertolini, nel 1810, per un genere di Poriferi", and Pilsbry (1889, p. 448) and Schepmann (1908, p. 73) also considered Bertolini's supposed calcareous alga to be a sponge. As *Craspedotus* Philippi is certainly preoccupied and the status of *Heliciella* Costa conjectural, the currently used *Danilia* is retained here.

***Danilia insperata* n.sp.**

Figs 10; 13; 15A, C-O; 16 E-F.

Shell small, imperforate, turbinate, with moderately tall spire and large, circular aperture. Whorls inflated, regularly rounded. External sculpture of narrow, raised, spiral cords separated by flat interspaces of about three times their width that bear only weak axial growth-ridges; 11 cords on last whorl and 6 on last part of penultimate whorl. Whole surface crossed by very narrow, well-raised axial lamellae markedly less prominent than spiral cords, but spaced identically with them (except over last quarter of last whorl where spacing is closer) markedly prosocline in conformity with aperture, forming small, sharply rounded nodules at their junctions with spiral cords; 34 axial lamellae behind varix on last whorl, 32 on penultimate whorl.

Outer lip prominently variced behind by a high, narrow, but regularly rounded rib, increasing gradually at lower end and terminating suddenly at suture, crossed without increase in size by all spiral cords, followed by thin-edged, expanded lip 0.7 mm wide sculptured with spiral cords and faint axial growth-ridges. Inside outer lip bears numerous low, narrow, spiral cords passing as far as can be seen inside aperture, corresponding in position with external cords, with one to several fine, indistinct threads in each interspace, all becoming weaker towards top of outer lip; innermost cord only slightly higher than others, terminating at columellar notch. Inner lip spread as thin, highly polished, slightly nacreous glaze on previous whorl, expanded slightly to continue circular outline of outer lip.

Columella deeply notched relatively low down, with a prominently thickened ridge along adaperatural edge of columella forming a blunt nodule where it meets a raised, rounded, spiral plait at upper border of notch, the two forming right and lower boundaries of a marked hollow at left side of columella that is bordered at left edge by a low ridge callused over lowest spiral cord of previous whorl. Right edge of columella callused with prominence increasing towards top and then sharply notched immediately below parietal wall. Right columellar callus porcellaneous white, remainder of columella nacreous.

Exterior pale straw-coloured, with small, ill-defined, pale, reddish-brown blotches between spirals on terminal varix. Protoconch missing.

DIMENSIONS: Height 12.9 mm, diameter 10.4 mm, height of aperture and lip (parallel to aperture) 7.2 mm, height of spire from top of lip (parallel to spire) 7.4 mm.

TYPE MATERIAL: Holotype shell, radular and opercular mounts in type collection (M29170) and animal in spirit collection of National Museum.

LOCALITY: BS 292, eastern side of Turakirae Trench, Palliser Bay, Cook Strait, 448-512 m, one live specimen.

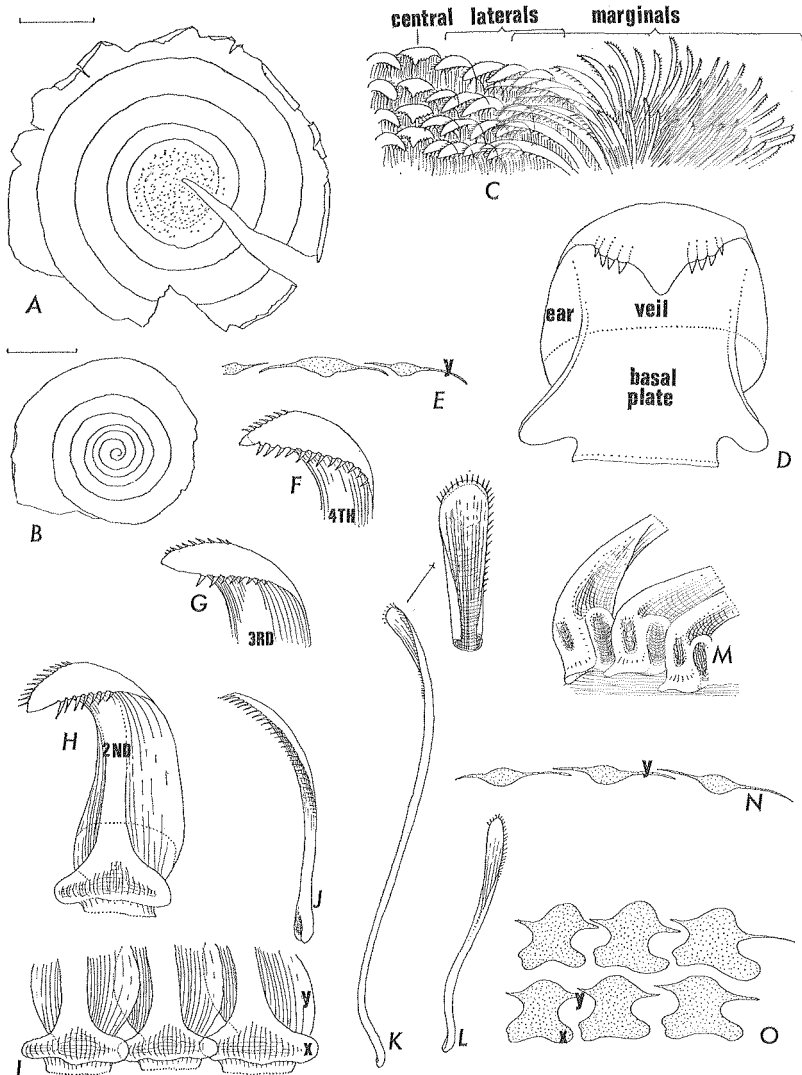


FIG. 15—A. *Danilia insperata* n.sp., operculum of holotype.

B. *Herpetopoma bella* (Hutton), operculum.

C—O. *Danilia insperata* n.sp., radula of holotype;

C. General view of half of four rows of radular teeth; D. Central tooth;

E. Transverse section of central and first lateral teeth to show overlap;

F—H. Fourth, third, and second lateral teeth, to show denticles on cusps;

I. Interlocking buttresses and plates on bases of lateral teeth; J. Inner

marginal tooth; K. Central marginal tooth; L. Outer marginal tooth; M. Inter-

locking buttresses of inner marginal teeth; N. Transverse section of lateral

teeth to show overlapping plates of adjacent teeth in one row; O. Transverse

section near base of lateral teeth to show interlocking buttresses of adjacent

teeth in adjacent rows.

(Scales = 1 mm; figs E, N, O are diagrammatic; x and y are reference

points for comparison between diagrams; radula stained with picric acid

and drawn freehand at $\times 400$ magnifications.)

HEAD FEATURES: Terminology of structures in Fig. 16F after Fretter & Graham (1962, p. 96, fig. 53). Optic tentacles short, about one-fifth length of cephalic tentacles; cephalic lappets large, weakly papillate on free edges and overlain by the long cephalic tentacles. Both neck lobes folded upon themselves and strongly plicate on free edges, right neck lobe overhung by anus. Free, pointed end of ctenidium very close to entrance of pallial cavity on left side of animal (Fig. 16F).

RADULA: Formula $\infty+4+1+4+\infty$; typical trochid form, with central and lateral teeth bordered marginally and partially overhung by the dense tuft of marginal teeth.

Crown of central tooth approximately triangular, upper surface evenly rounded, with one large central cusp and four lateral cusps symmetrically placed on each side; tooth eared laterally by extensions of the cutting edge, the ears extending across the face of newly formed teeth as a thin veil inside which the thickened central portion of the basal plate extends. Thickened, central portion of basal plate descends from a point about level with the outer lateral cusps and curves outwards laterally on both sides to form two buttresses as wide as or slightly wider than cutting edge of tooth; basal plate flat based and merging into lingual membrane below the buttresses. All interlocking processes weakly developed and plate-like in recently formed teeth, becoming heavier and socketed further along the ribbon.

Lateral teeth four, the first slightly overlapping the central tooth just below cutting edge. All lateral teeth similar, but basal plate becoming longer and more oblique outwards, cusp pattern progressively changing along series, and having the veil across the face of newly formed teeth as in the central tooth; cutting edges set obliquely inwards and at a sharp angle (almost a right angle) to basal section. Basal portion of outer cutting edge of all laterals thinner than cutting surface, forming a broad, flat plate. Cusps on outer edge larger than and extending further down than those on equivalent smaller plate on inside of tooth; plates much wider on inner lateral than on the others, becoming progressively smaller outwards. Locking buttresses and sockets essentially similar on all laterals. Viewed *in situ* (as in Fig. 15N), their structure is as follows: facing edge (i.e., edge to which cutting point of tooth projects) of basal plate buttressed on either side, the inner buttress provided with a shallow socket on facing edge to accept buttress of adjacent inner tooth; thickened portion of basal plate tapering upwards and extending as a ridge on the midline before merging laterally with the thickened undersurface of the cutting edge; area between basal buttresses on facing edge excavated to accept reciprocal structure on opposite side of tooth in next row. These complex interlocking structures are shown in transverse section, at two levels, in Fig. 15. Cutting edges of laterals all have similar cusps, with a non-cusped point; numbers of cusps on cutting surfaces change progressively across each row, inner edges of teeth having 20 cusps on inner tooth and 7 on outer tooth, and outer edges of teeth having 5 or 6 cusps on inner tooth and 12-15 on outer tooth; cusps on cutting points extend further towards apices of teeth on inner than on outer edges, and result in asymmetrical apices to teeth.

Marginal teeth too numerous and closely-packed to count, under low power appearing as hairy rope down each side of radular ribbon. Teeth on inner edge of series short, curved inwards over outer two or three laterals; near centre of series teeth longer and nearly vertical; on outer edge teeth extremely long, curved initially inwards then outwards in a weak sigmoid curve. Inner marginals pointed at tips, becoming progressively more spatulate outwards; inner marginals an open, twisted blade, but outer marginals have both edges in-rolled for four-fifths of their length; fine needle-like cusps present only on tip and outer edge of blade-like portion. Embryonic, flat, non-twisted, spatulate-tipped marginals occur outside the long, thin, fully-developed outer marginals, arising by splits appearing in the lingual membrane. Basal locking devices similar to those discussed for laterals, but buttresses not as strongly developed, and outline of base more nearly square than in lateral teeth.

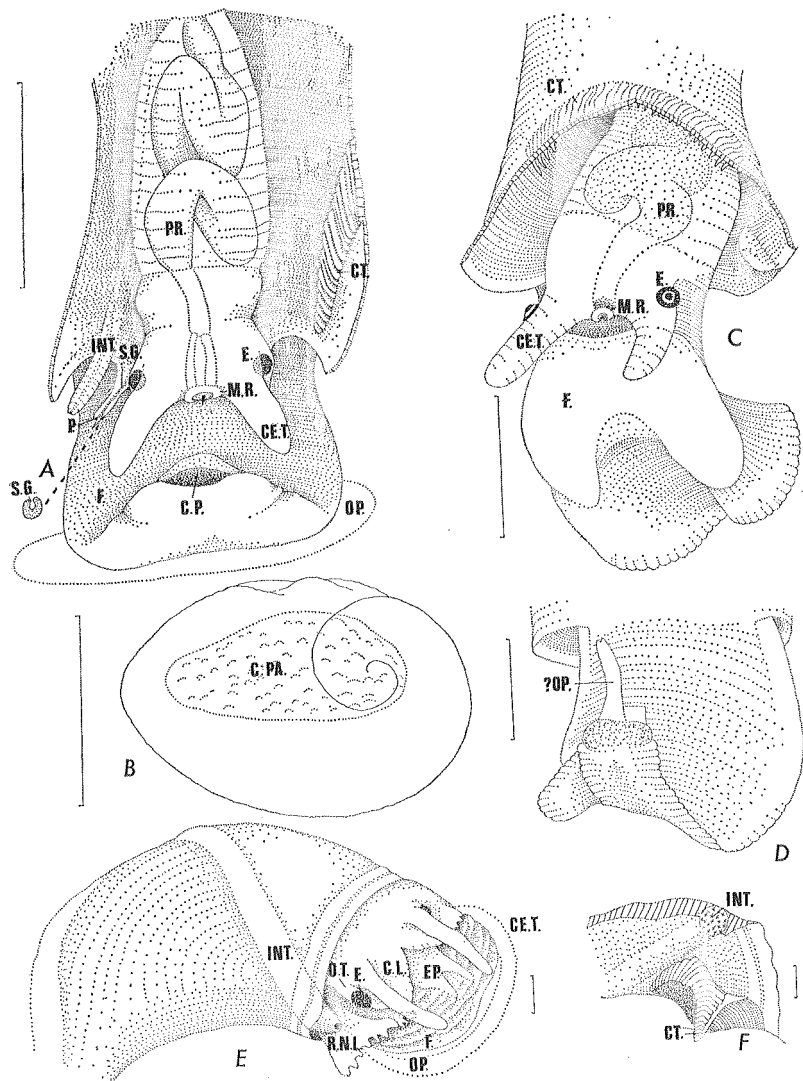


FIG. 16—A, B. *Sculptifer neozelanica* (Dell), BS 292, Palliser Bay; A. Anterior portion of animal in dorsal view, with mantle cavity opened; B. Operculum. C, D. *Waipaoa marwicki* Dell, BS 292, Palliser Bay; C. Anterior portion of animal in dorsal view; D. Enlarged view of posterior extremity of foot. E, F. *Danilia insperata* n.sp., holotype, BS 292, Palliser Bay; E. Head features of animal in right dorso-lateral view; F. Ctenidium enlarged. (All scales = 1 mm).

Abbreviations: C.L.—cephalic lobe; C.P.—caudal pore; C.P.A.—calcareous pad of operculum; C.T.—ctenidium; C.E.T.—cephalic tentacle; EP.—epipodium; F.—foot; INT.—intestine; M.R.—muscle ring; OP.—operculum; O.T.—optic tentacle; P.—penis; PR.—proboscis; P.T.—palial tentacle; R.N.L.—right neck lobe; S.G.—seminal groove; E.—eye.

DISCUSSION: The eared central tooth of *Danilia insperata* is very similar in basal characters to that of *Zediloma (Fractarmilla) subrostrata* (Gray, 1835) (Clark 1958, p. 66, fig. 14), and, judging from Clark's illustrations, the interlocking structures on the lateral teeth of several species of *Zediloma* Finlay, 1926 have the same basic design as those of *Danilia insperata*.

The presence of only four lateral teeth on the radula of *Danilia insperata* is significant because when diagnosing the family Trochidae, Pilsbry (1889, p. 5) stated: "lateral teeth generally 5 on each side, sometimes more numerous". Although Fischer (1885, p. 826, fig. 584) illustrated the radula of *Solariella* Wood, 1842 as having only four laterals, Pilsbry (1889, p. 308) attributed five to seven median (= lateral) teeth to the genus, although only four are obvious in his illustration (pl. 50, fig. 17).

The most closely allied genus to *Danilia*, judged from shell and radular morphology, is *Herpetopoma* Pilsbry, 1889. Hutton's (1883, pl. 14, fig. 1) figure of the radula and operculum of *Herpetopoma bella* were reproduced by Pilsbry (1889, pl. 50, figs 11 & 8, respectively). The central tooth is eared as in *Danilia insperata*, and both the laterals and marginals are similar in structure. However, the base of the central tooth is not flat in *Herpetopoma*, and it also has a fifth lateral tooth.

Cotton (1959, p. 188, fig. 117) crudely figured the radula of the southern Australian *Herpetopoma aspersa* (Philippi, 1846) and showed only four lateral teeth. This species is closely allied to the New Zealand species *H. mariae* Finlay, 1930, both having relatively large, thin shells. We examined a radula and operculum from a specimen of *H. aspersa* collected at Kelso, Tasmania, and confirm that the species has only four lateral teeth. A feature of its lateral teeth is the complete absence of lateral cusps, the cutting edge having an acutely triangular, smooth blade. Whereas Cotton (1959, fig. 117) showed the central tooth of his specimen to have lateral cusps, these were completely lacking in the specimen we examined.

OPERCULUM: The operculum of *Danilia insperata* is multispiral, consisting of 6-7 whorls, initially tightly coiled, but expanding more rapidly towards the edge, exactly as in *Herpetopoma bella* (Hutton), the operculum of which is figured here for comparison (Fig. 15B). Pilsbry (1889) reproduced Hutton's illustration of the operculum of *H. bella* and figured this as typical of *Euchelus* Philippi, 1847 (in which he placed *H. bella*). As an example of the more tightly coiled "normal" trochid operculum Pilsbry (1889, pl. 50, fig. 7) figured the operculum of *Solariella varicosa* Mighels, which is similar to that of most New Zealand trochids. Pilsbry (1889, p. 429) stated for *Euchelus* s. str.: "Operculum with few whorls, like that of *Littorina*". This description does not apply to his figure of the operculum of *Herpetopoma bella*, because, like that of *Danilia insperata* described here, its operculum is not paucispiral as in *Littorina*, although certainly it is not as tightly coiled as in most

trochids. This misinterpretation of the structure of the operculum of *H. bella* led Pilsbry to synonymise *Huttonia* Kirk, 1882 (*Huttonia iricolor* Kirk, 1882 = *Herpetopoma bella* (Hutton)) with *Euchelus* s. str., when, in fact, it is a synonym of *Herpetopoma*. This does not, however, alter the usage of *Herpetopoma*, because *Huttonia* of Kirk is preoccupied by *Huttonia* Pickard-Cambridge, 1880. Finlay (1926, p. 362) stated, referring to the New Zealand usage of *Euchelus*: "This genus may be replaced by *Herpetopoma* Pilsbry, 1890, the New Zealand species having a multispiral operculum, and otherwise agreeing generically with *H. scabriusculus* Angas, the type of the genus".

The operculum of the specimen of "*Herpetopoma*" *aspersa* from Kelso, Tasmania, mentioned above, is of the littorinoid paucispiral type typical of *Euchelus*, and the species cannot be placed in *Herpetopoma*.

GENERIC RELATIONSHIPS: *Danilia insperata* has four lateral teeth, all strongly denticulate; *Herpetopoma bella* is similar, but has five lateral teeth; *Herpetopoma aspersa* (and, to judge from shell characters, *H. mariae*) has only four lateral teeth, but they are smooth; *D. insperata* and *H. bella* have weakly multispiral opercula, whereas *H. aspersa* has a littorinoid paucispiral operculum. The extra lateral tooth serves at present to distinguish *Danilia* from *Herpetopoma* (*sensu stricto*), and the cusplless lateral teeth and the opercular characters distinguish the *aspersa-mariae* group of *Herpetopoma* from the typical *scabriusculus-bella* group.

Euchelus Philippi seems the only trochid genus in which *H. aspersa* and *H. mariae* can be placed. Apart from a doubtful record of the genus from Victoria (*E. atratus* Gmelin, 1791, recorded by Cotton, 1959, p. 96), *Euchelus* has previously been recorded in the Australasian region only from northern Australia. Whether *Euchelus* can be used to accommodate *H. aspersa*, and perhaps *H. mariae*, will not be known until a careful comparative anatomical study is made of species included in *Herpetopoma* in both Australia and New Zealand and until the radula of the type species of *Euchelus* is adequately described.

SPECIES RELATIONSHIPS: Six Recent species of *Danilia* have been recorded previously:

Danilia tinei (Calcara, 1839). Ghisotti & Steinman (1970) fully figured and discussed the Mediterranean species and recorded its synonymy, original reference and distribution. Their map records 31 localities in the Mediterranean Sea, the adjacent eastern Atlantic, and Madeira, and it is much the commonest and best-known species of the genus. The sculpture is markedly coarser, the varix more prominent, and the nodule above the columellar notch larger than those of *D. insperata*.

Danilia affinis Dautzenberg & Fischer, 1896; stated by Okutani (1968, p. 27) to be from *Hirondelle* Station 70, in 454 m, off the Azores, 1888. We have not seen the original reference, but Schepmann (1908, p. 74) considered *D. affinis* closely related to *D. tinei* and markedly different from *D. weberi*.

Danilia weberi Schepmann, 1908 (Schepmann 1908, p. 73, pl. 2, figs 6a-c) was based on six specimens from *Siboga* Station 105, 6° 8' N, 121° 19' E, Indonesia, in 275 m, from a coral bottom. It has a taller spire, finer sculpture, and a much more prominent nodule above the columellar notch than those of *D. insperata*.

Danilia telebatha Hedley, 1911 (Hedley 1911, p. 102, pl. 18, figs 16 & 17; figures reproduced by Cotton 1959, p. 180, fig. 109) was based on "several specimens from 100 fathoms (180 m) forty miles [64 km] south of Cape Wiles, South Australia", taken by F.I.S. *Endeavour*. Cotton (1959, p. 181) subsequently recorded a specimen from 10 miles (16 km) east of Schouten Island, eastern Tasmania, in 80 fathoms (150 m). The Australian species has a taller spire, markedly broader spiral cords, a markedly smaller aperture, more numerous axial lamellae placed about half the distance apart, much lower nodules at the sculptural junctions, a much shorter columella, and weaker columellar sculpture than *D. insperata*.

Danilia kuroshio Okutani, 1968 (Okutani 1968, p. 27, pl. 3, fig. 4) was based on two specimens trawled at r.v. *Soyo-maru* Station B 3, 33° 09.7' N, 140° 00' E, off Hachijo Island, Pacific coast of Japan, in 525 m. It has a taller spire, smaller aperture, larger columellar tooth, less evenly rounded whorls, and weaker axial sculpture than *D. insperata*.

Danilia eucheliformis (Nomura & Hatai, 1940) (*Monodonta eucheliformis* Nomura & Hatai 1940, p. 61, pl. 3, figs 1a, b) was based on one specimen from their station 8, off Kyuroku-sima Island, Japan Sea, in 210 m. Habe (1964, p. 9, pl. 4, fig. 7) gave a coloured figure of a specimen of *D. eucheliformis*, and stated that the species is "uncommonly found in 50–200 m in depth from Sagami Bay, Honshu, to Kyushu and the Japan Sea". It closely resembles *D. insperata* in proportions, whorl shape, aperture size, and most sculptural details, but differs in having closer axial ribs and a markedly longer and narrower columellar tooth, with a markedly larger notch below the tooth. It seems very similar to *D. telebatha* Hedley.

The seven Recent species of *Danilia* are so similar as to suggest that their relationship is much closer than our classification indicates. We have followed the traditional procedure of regarding *D. insperata* as a distinct species because of its distinct sculpture, as without comparative radula and anatomical information we cannot decide whether *Danilia* has a number of distinct Recent species, or relatively few widespread species varying considerably in sculptural details, or one or a few species each with several geographic subspecies.

Many fossil species of *Danilia* have been recorded, and 38 were catalogued by Ryckholt (1862), mainly from the Cenomanian of Europe but ranging in age from Albian (Lower Cretaceous) to Quaternary. *Danilia neozelanica* Laws (Laws 1935, p. 30, pl. 5, fig. 2) was based on a single poor specimen from Trig. M, Totara, south of Oamaru (calcareous tuff band in Totara Limestone, Runangan Stage, Upper Eocene) but is rarely collected there. It has subsequently been found by Mr P. A. Maxwell, N.Z. Geological Survey, to be common at Bridge Point, Kakanui, south of Oamaru (calcareous tuff of Waiareka Volcanic Formation, at this locality of Runangan age). It is a small species, rarely more than 6.5 mm high, and has the outer lip flared over the adapertural face of the varix. Although all Recent species are over 10 mm high and have the varix situated noticeably behind the flared outer lip, *D. neozelanica* has the characteristic cancellate sculpture and ridged and notched columella of *Danilia*, and is apparently correctly placed in this genus. A specimen of *D. neozelanica* is figured here (Fig. 14) for comparison with *D. insperata*.

Family FOSSARIDAE ?

Genus *Sculptifer* n.gen.

TYPE SPECIES: *Stilifer neozelanica* Dell, 1956. Recent, New Zealand.

Shell turbate, opaque, imperforate, thick and solid, outer surface not polished. Protoconch tall, of three and three-quarter dextral whorls, the initial one and one-quarter whorls low, smooth and gently rounded, succeeded sharply by two and one-half tall, slightly convex, closely axially ribbed and finely spirally ribbed whorls, terminating in a low varix. Teleoconch sculptured with five or six low, broad, widely spaced spiral cords crossed by high, regularly spaced, axial growth ridges that form small, sharply rounded nodules at their junctions with spiral cords; all sculpture fades out gradually on last half whorl, which is markedly inflated. Animal operculate, with large foot, lacking propodium, pseudopallium, and radula.

The thick, unpolished, sculptured shell, the tall axially ribbed protoconch, and the presence of an operculum render *Stilifer neozelanica* highly distinctive, and we propose the new genus *Sculptifer* for it.

RELATIONSHIPS: Of genera included in the Stiliferidae by Wenz (1940, pp. 840-3), only *Plicifer* H. Adams, 1868 has a prominently sculptured teleoconch. Adams (1868, pp. 292-3, pl. 18, fig. 16) described the type species, *Plicifer nevillei* H. Adams, as “. . . spira in stylum producta, nucleo sinistral; columella plicata; . . .” and “. . . columella callosa, spiraliter plicata; . . . found on coral”. The plicate columella, the heterostrophic protoconch, and the low spiral sculpture of *Plicifer* suggest that it is a pyramidellid opisthobranch rather than a stiliferid.

Since Wenz's work was published, Habe (1952, p. 82) has included *Kiramodulus* Kuroda, 1949 in the Stiliferidae. *Kiramodulus* has a low, trochoid shell resembling that of *Modulus* but with a smooth columella, has a sculpture of low, flat-topped, closely spaced spiral cords, has a typically stiliferid peg-shaped protoconch, lacks a radula and an operculum, and lives on the exterior of asteroids, and thus seems to be correctly regarded as a stiliferid. The genus *Caledoniella* Souverbie, 1869, included in the Stiliferidae by Wenz, was shown by Rosewater (1969) to belong in a family of its own in the Hipponicacea; it differs from *Sculptifer* in having a large propodium and in lacking an operculum. All other genera that have been placed in the Stiliferidae contain tall to globular, unsculptured, usually highly polished shells with simple peg-like protoconchs, and all lack opercula. The related family Eulimidae contains similar polished species that have opercula.

Thus the prominently sculptured, terminally variced, multiwhorled protoconch, the sculptured, unpolished teleoconch, and the operculum of *Sculptifer* strongly suggest that it should not be placed in the Stiliferidae. The strongly coiled shell and the presence of an operculum discount relationship with *Thyca*, a capulid ectoparasitic on asteroids. The shell

shape closely resembles those of several genera of the Fossaridae figured by Wenz (1940, pp. 880-4). Especially similar are *Megalomphalus* Brusina, 1871, *Couthouyia* A. Adams, 1860, and *Micreschara* Cossmann, 1888. Other Fossaridae from New Zealand (notably *Zeradina* (*Naridista*) Laws (Laws 1939, p. 483)) resemble *Sculptifer* in their sculptured shells and their tall, sculptured protoconchs. Ponder (1967, p. 220, pl. 11, figs 5-9) has figured the opercula and radulae of *Nilsia cuvieriana* (Suter) and *Zeradina producta* (Odhner), but these features have not been described for other New Zealand fossarids. The opercula figured by Ponder (1967, pl. 11, figs 6, 8) are very similar to those of *Sculptifer neozelanica* and support its inclusion in the Fossaridae.

Another possible relationship should be pointed out. The protoconch of *Sculptifer neozelanica* is extremely similar to those of Epitoniidae of the subfamily Nystiellinae, figured by Clench & Turner (1952; *Nystiella*, pl. 163-4; *Solutiscula*, pl. 169-170) and by Rex & Boss (1973; *Eccliseogyra*, fig. 3). The sculpture of early teleconch whorls of *Sculptifer* resembles that of several epitoniids such as *Amaea* and *Acrilla*, and the general shell form is not so markedly different from that of squat epitoniids that a position in the Epitoniidae is unacceptable for *Sculptifer*. However, the lack of a radula would make *Sculptifer* a most peculiar epitoniid, and we are unhappy about placing it in the Epitoniidae on protoconch evidence alone. Possibly the Nystiellinae will prove to be a family of suctorial Epitoniacea that includes *Sculptifer*.

A tentative position in the Fossaridae seems the most acceptable for *Sculptifer* at present.

FEATURES OF ANIMAL: Foot large, operculate, with a large caudal pore (Fig. 16A); operculum thin, paucispiral, of two rapidly expanding whorls, horny brown in colour; a broad calcareous callus pad extends from the nucleus laterally three-quarters of the way across the last whorl.

Cephalic tentacles relatively short, eyes situated on a lateral swelling at their bases; proboscis opening terminally on head between cephalic tentacles, opening surrounded externally by a raised muscular ring and two blocks of muscle extend posteriorly for a short distance from this opening on either side of proboscis, proboscis then running posteriorly to sac behind head where it becomes broader and strongly convoluted. Radula, pseudopallium, and propodium absent.

Pallial cavity large; anterior end of ctenidium near lower left anterior margin of pallial cavity, curving gently dorsally and posteriorly.

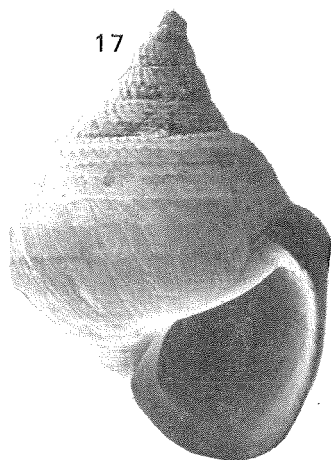
Two organs project from the entrance of the pallial cavity on the right side of the animal, the outer structure interpreted here as the termination of the intestine, the inner small structure as the penis. Penis with an open seminal groove.

***Sculptifer neozelanica* (Dell, 1956)**

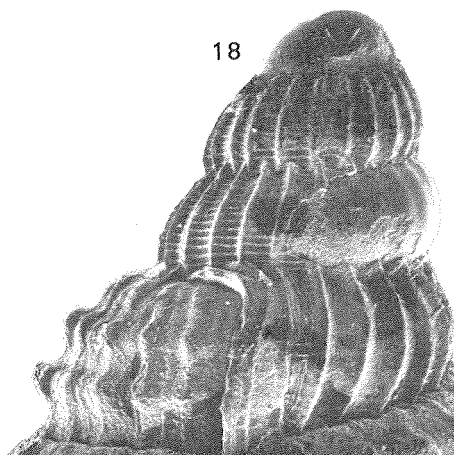
Figs 16A & B, 17-20

1956. *Stilifer neozelanica* Dell, *Bull.Dom.Mus.Wellington*, 18: 82, pl. 11, figs 107 & 103.

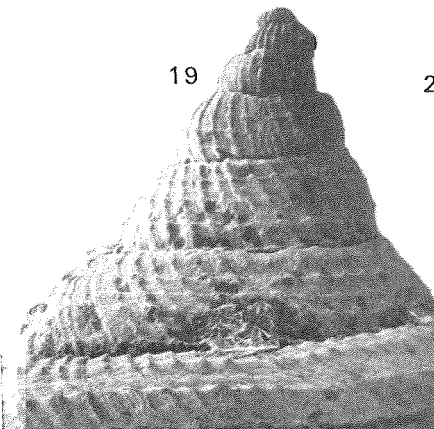
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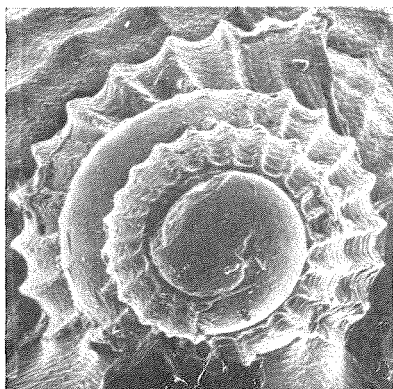
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- FIGS 17-20—*Sculptifer neozelanica* (Dell), scanning electron photomicrographs of specimens from BS 292, Palliser Bay;
- 17—Mature specimen in ventral view, $\times 11$;
- 18—Protoconch of a smaller specimen (second whorl partly decorticated) $\times 98$;
- 19—Apex of specimen in Fig. 17 (protoconch broken) showing sculpture of spire whorls and of abapertural edge of last whorl, $\times 26$;
- 20—Dorsal view of protoconch in Fig. 18, $\times 120$ (slight distortion is an artifact produced by the microscope; lower surface partly covered by PVA mountant).

All specimens of *Sculptifer neozelanica* in BS 292 were free in the fine fraction of the sample, although most were alive when collected. Two specimens of the ophiuroid *Placophiothrix*, the most abundant echinoderm in the sample, were observed by one of us (F.M.C.) and Dr A. N. Baker, National Museum, Wellington, to have a circular scar on the outer surface, which probably were former feeding sites of *Sculptifer*. Compared with other known ectoparasitic gastropods, *Sculptifer* is

strikingly little modified for a parasitic mode of life. Its foot, far from enveloping the shell, can be extended only a short distance, if at all, up the last whorl, and there is no propodium or pseudopallium. We conclude that *Sculptifer* is a mobile ectoparasitic mollusc (like some eulimids and pyramidellids), feeding on *Placophiothrix* and not embedded like some stiliferids, or fixed by a sucker-like foot and immobile at the surface as in *Venustilifer* Powell (Climo 1970). If embedded, it is so shallowly so that all specimens were dislodged during trawling. The lack of a polished external shell surface, and the presence of shell sculpture, a large operculum, and an unmodified foot presumably reflect the free-living ectoparasitic mode of life. Dell (1956, p. 82) pointed out that the protoconch is coloured reddish-brown, and concluded that only this coloured tip protruded from the parasitized host, as in many species of *Stilifer*. However, this is not so, and thus the colour of the protoconch has no obvious significance.

As Dell (1956) noted, the tip of the protoconch is missing in almost all specimens. Where complete, the protoconch consists of three and three-quarter dextral whorls, the initial one and one-quarter low, smooth, gently rounded, with a simple rounded initiation, translucent and paler in colour than the rest; succeeded sharply by two and one-half tall, slightly convex, closely axially ribbed and finely spirally ribbed whorls that terminate in a low, sharp-edged varix.

Family BUCCINIDAE

Genus *Euthrenopsis* Powell, 1929

TYPE SPECIES (by original designation): *Euthrenopsis otagoensis* Powell, 1929. Recent, New Zealand.

? *Euthrenopsis* n.sp.

A single specimen in BS 292 differs from previously described members of *Euthrenopsis* in having spiral sculpture of low, broad cords with interspaces of linear grooves, not raised into nodules where they cross the low, evenly rounded, widely spaced, slightly sinuous and opisthocline axial folds. The columella is uncalloused. *Euthrenopsis* is the only New Zealand genus available for its inclusion. However, the specimen closely resembles the type species of the South American buccinid genus *Glypteuthria* Strebel, 1905, *G. meridionalis* (Smith, 1881), illustrated by Dell (1972, p. 36, fig. 10). Study of animals alone can determine whether the Palliser Bay specimen is a form of *Euthrenopsis* closely paralleling *Glypteuthria*, or whether it represents the first New Zealand record of the latter genus. There is a third incipient cusp on the lateral teeth of *Glypteuthria* resulting from bifurcation of the inner cusp, but the radula of *Euthrenopsis* is unknown. Powell (1929, j. 88) did not compare *Euthrenopsis* with *Glypteuthria*, and the two names may be synonyms.

Family CANCELLARIIDAE

Subfamily ADMETINAE

Genus *Waipaoa* Marwick, 1931

TYPE SPECIES (by original designation): *Admete cristata* Marwick, 1926. Upper Miocene, New Zealand.

***Waipaoa marwicki* Dell, 1956**

Figs 16 C & D

1956. *Waipaoa marwicki* Dell, *Bull. Dom. Mus. Wellington*, 18: 112, pl. 11, fig. 113.

1967. *Waipaoa marwicki* Dell: Beu, *Trans. R.Soc. N.Z., Geology*, 5 (3): 109.

A single large but otherwise typical specimen of *Waipaoa marwicki* was collected alive at BS 292. As the external features of the animal have not been described, some are recorded here.

Foot non-operculate, posterior portion flattened, wide, lobate at the edges, tapering at the tip and ending in two circular, glandular patches of tissue from which project posteriorly two thin, light-brown, chitinous plates (Fig. 16d), presumably a greatly simplified operculum.

Cephalic tentacles large, the eyes situated near base on outer edge. Eyes large three-dimensional structures projecting strongly from edge of tentacles, with a cap of pigment followed by an equatorial non-pigmented band, then a broad pigment band at base. Proboscis opening on head between cephalic tentacles, surrounded by a raised muscular ring; proboscis strongly pigmented near opening, running straight posteriorly through muscular portion of head, becoming strongly convoluted and more darkly pigmented in sac behind head. Radula absent.

Pallial cavity large, with ctenidium curving laterally and dorsally across its roof in a shallow U behind head; a thickened portion of the pallial lip extends into the pallial cavity a short distance on the left side of the animal. Neither an osphradium nor termination of intestine were observed during the dissection.

DISCUSSION

Sample BS 292 is of interest because most molluscs in it were associated with a colonial coral, and the fauna and ecological conditions can be compared with that suggested for the Pliocene fossil coral thicket at the head of Palliser Bay by Squires (1964), Vella (1964) and one of us (Beu 1967, pp. 119–20).

Species and genera of molluscs occurring both in the Palliser Bay cliffs and in BS 292 are *Saccula* (see Beu 1969, p. 485), *Neilo*, *Monia zelandica*, *Chlamys kiwaensis* (see Beu 1967, p. 93), *Emarginula striatula*, *Proxiuber*, *Cymatona kampyla*, *Euthrenopsis* (see Beu 1969, p. 493; ? *Euthrenopsis* n.sp. in BS 292), *Pleia cryptocarinata*, *Waipaoa marwicki*, and *Antiguraleus*. The absence in BS 292 of many genera and species of molluscs that are common in the Palliser Bay cliffs and are

usually also prominent members of the New Zealand Recent bathyal fauna, such as *Comitas onokeana* (King), *Aeneator* (*Ellicea*), *Cominella* (*Eucominia*) of the *onokeana* (King) group, *Splendrillia*, *Aoteadrillia*, can be attributed in part to the small size of sample BS 292 and in part to its being taken from a substrate unsuitable to many silt-dwelling prosobranchs such as turrids and buccinids. The now abundant bathyal cymatiid *Fusitriton laudandus* (Finlay) is absent from Pliocene localities, presumably because it did not reach New Zealand until late Pleistocene time (Beu in press.). Proof that most molluscs common to the Recent bathyal fauna and the Pliocene fauna at Palliser Bay also occur in Turakirae Trench has been provided by two other recent trawlings on silt substrata. In BS 220 (600–800 m, Turakirae Trench, Victoria University of Wellington, r.v. *Tirohia*, 5 March 1970) *Fusitriton laudandus* and *Comitas onokeana vivens* Dell were taken, and in BS 300 (about 720 m, Turakirae Trench, 4.5 miles (about 7.2 km) off Cape Turakirae, 41° 30.5' S, 174° 54' E, r.v. *Acheron*, 6 September 1972), *Cominella* (*Eucominia*), *Aeneator* (*Ellicea*), and *Fusitriton laudandus* were taken. Almost all other apparent absences from the Recent fauna have been filled by material trawled on other nearby silt substrates in Palliser Bay at other National Museum stations and at Victoria University of Wellington Zoological stations, and listed by Dell (1962, pp. 74–6). Thus, the lists of silt-dwelling molluscs in the two faunas are very similar.

Resemblances between species in the coral-dwelling genera in the Recent and fossil faunas are also high. Genera, and species where relevant, recorded as ecologically dependant on the special conditions brought about by the coral in the Palliser Bay cliffs by Beu (1967, p. 120) were *Lima*, *Limatula*, *Ctenoides*, *Promantellum* (= *Limaria*), *Monia zelandica*, *Ostrea*, *Tugali*, and *Emarginula striatula* (= *lophelia*). It now appears that the specimens of *Chlamys kiwaensis* (Beu 1967, p. 93) from the fossil thicket may also have been living on the coral. Genera and species in BS 292 that seem to have been attached to the coral, whether by foot or byssus, are *Chlamys kiwaensis*, *Monia zelandica*, *Acesta* n.sp. juvenile, *Emarginula striatula* (tall form), *Maoricrater*, and perhaps *Danilia* (since this unusual sample contained the only record from New Zealand). Rare genera such as *Danilia* can be ignored for this comparison, and the faunas differ mainly by their completely different limid assemblages. None of the four genera of limids in the Pliocene thicket was collected in BS 292, and the Recent *Acesta* was not collected from the Pliocene thicket. During Pliocene time in New Zealand, the colonial coral inhabited by the limids was *Lophelia parvisecta* (Tenison Woods), a species not found living here now although still extant elsewhere whereas the Recent species is *Goniocorella dumosa*; both corals have a similar branching colonial habit, but belong in different suborders (Squires & Keyes 1967). Perhaps the different genera of corals support different limid assemblages.

Colonies of *Goniocorella dumosa* appear to be relatively common in Turakirae Trench, living specimens having been taken in BS 292, 41° 30.7' S, 174° 58.4' E to 41° 35.4' S, 175° 00.8' E, along the eastern

wall of the trench, and in BS 300 (live fragments probably living on small areas of hard substratum projecting from the flat silt plain), 41° 30.5' S, 174° 54' E, near the head of the trench. Samples containing *Goniocorella dumosa* were recorded from much of the New Zealand region, including Cook Strait, by Squires & Keyes (1967, fig. 4), and probably it has been taken at other stations in Turakirae Trench we are not aware of. Squires (1965) recorded large, deep-water banks of *Goniocorella dumosa* on Campbell Plateau in southern New Zealand and presumed banks on southern Chatham Rise. The structures he reported are very large (up to 40 m high and 1 km wide) and can be recognised on echo-sounder profiles, whereas the Palliser Bay colonies appear to be merely scattered clumps of coral on the walls of the trench where suitable firm substrates occur, perhaps in the earliest stages of formation of a bank.

ACKNOWLEDGMENTS

We are grateful to: Mr P. A. Maxwell, N.Z. Geological Survey, for providing comparative material of *Danilia neozelanica*, for suggesting that *Sculptifer* is a fossarid, and for identifying the Nuculanidae; Mr I. W. Keyes, N.Z. Geological Survey, for identifying the corals and for providing references to *Goniocorella*; Drs A. N. Baker and J. C. Yaldwyn, National Museum, for identifying the non-molluscan animals; and Mr B. A. Marshall for comparative material of *Emarginula*. Dr W. F. Ponder (Australian Museum) provided a copy of an MS. on Eulimidae and specimens of *Thyca* that helped to show that *Sculptifer* does not belong there. Drs R. K. Dell, National Museum and C. A. Fleming, N.Z. Geological Survey, and Messrs Maxwell and Marshall provided helpful comments on the manuscript. Figures 17–20 are photomicrographs taken for us by Mr Barry Burt, N.Z. Geological Survey, on a scanning electron microscope at Physics and Engineering Laboratory, DSIR, Lower Hutt. Other photographs are by Mr D. L. Homer, N.Z. Geological Survey.

We wish to thank particularly Mr A. J. Black, owner of r.v. *Acheron*, for his skill in handling a trawl in deep water.

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