

NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
BULLETIN 180

**The Marine Fauna of New Zealand:
Intertidal Foraminifera of the
Corallina officinalis Zone**

by

R. H. HEDLEY

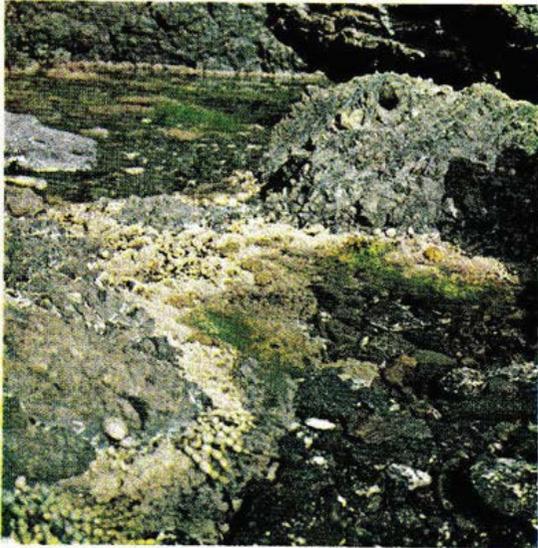
C. M. HURDLE

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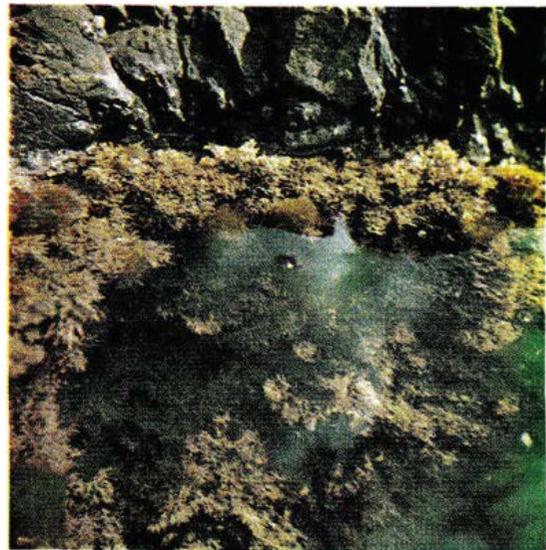
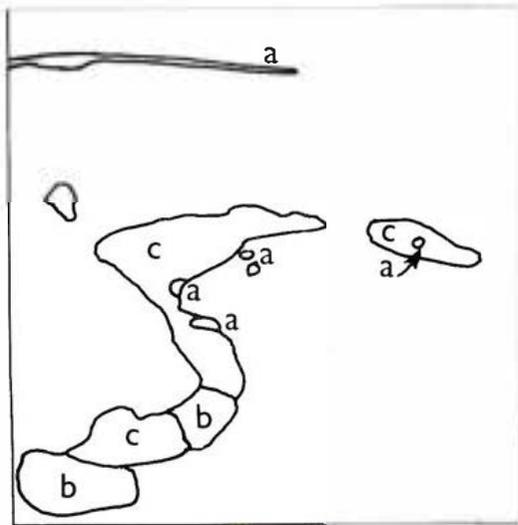


Typical rocky pools on the South Wellington Coast showing the *Corallina officinalis* zone.

- Left: (a) *Corallina officinalis* (pale, pinkish-brown alga)
 (b) *Hormosira banksii* (greenish-brown, beaded alga)
 (c) *Leathesia difformis* (brownish-green)

Below: *Corallina officinalis* interspersed with fine, green tufts of *Polysiphonia* sp.

Photos: John Whalan, D.S.I.R



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FOREWORD

THIS memoir forms a second substantial contribution to our knowledge of the systematics and distribution of the Recent New Zealand Foraminifera. Dr Hedley and his co-authors have by their present work and by virtue of their access to type material been able to eliminate considerable confusion that had arisen in this group of the Foraminifera.

This manuscript has been prepared for publication by Mrs P. M. Cullen.

J. W. BRODIE,
Director,
New Zealand Oceanographic Institute.

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Intertidal Foraminifera of the *Corallina officinalis* Zone

By R. H. HEDLEY, C. M. HURDLE, and I. D. J. BURDETT, Department of Zoology, British Museum (Natural History), Cromwell Road, London S. W. 7.

ABSTRACT

SIXTY-THREE species of Foraminifera are reported from the intertidal region of New Zealand; most of these are living forms obtained either from the fronds, or from the sand which forms a basal tuft to the calcareous alga *Corallina officinalis* L. Three new species are described, belonging to the genera *Trochammina*, *Massilina* and *Plauulinoides*, and eight known species are reported from the New Zealand region for the first time. Numerous nomenclatural changes and misidentifications are discussed in the light of the examination of type and other specimens of d'Orbigny, Parker and Jones, Williamson, Brady, Heron-Allen and Earland, and Vella, all of which, except those of d'Orbigny, are deposited in the British Museum (Natural History).

The species recorded are considered to be hardy forms; there is no indication of a significant change in the foraminiferal fauna over the 1,000-mile latitudinal range covered by this study.

INTRODUCTION

During 1960–61 one of us (R. H. H.) collected samples of the widely distributed calcareous alga *Corallina officinalis* L. (pl. 1, fig. 1) from numerous New Zealand intertidal localities (table 1: text fig. 1) ranging 1,000 miles in latitude from Whangaparoa Peninsula in the north to Portobello in the south. This memoir is a systematic account of those Foraminifera found either attached to the fronds, or living free in the sand around the basal tuft of the weed.

Almost all species were recognised as living in this habitat, either through direct observation of the animals in culture pots, or through staining the alcohol-preserved protoplasm with an aqueous solution of Rose Bengal as recommended by Walton (1952). The species recorded are hardy forms and we consider, from an analysis of their distribution (table 3), that there is no indication of a significant change in the foraminiferal fauna studied over the 1,000-mile latitudinal range.

The significance of the work lies in the remarks made following detailed examination and comparison

of our material with that of other authors. Throughout the study attention has been paid to previous work on New Zealand Recent Foraminifera (table 2) and reference has been made to type specimens in the following important collections in the British Museum (Natural History): Parker and Jones, Williamson, Brady, and Heron-Allen and Earland. A collection of ideotypes of New Zealand Foraminifera, donated by Dr P. Vella, has also been available for reference, while a prolonged visit to the Department of Zoology, British Museum (Natural History), during 1962–63 by Mr N. de B. Hornibrook – micropalaeontologist of the New Zealand Geological Survey – provided us with the opportunity to discuss many species and systematic problems familiar to him.

One of us (C. M. H.) visited Madame Y. le Calvez at the Bureau des Recherches Géologiques et Géophysiques during November 1963 to study the d'Orbigny Collection of Recent and Tertiary Foraminifera from Cuba, the Canaries, the American Meridional, and Vienna, and examined the following types relevant to this paper.

Quinqueloculina agglutinans
Quinqueloculina bicostata
Quinqueloculina cuvieriana
Quinqueloculina magellanica
Quinqueloculina secans
Quinqueloculina triangularis
Rosalina isabelleana
Rosalina mediterraneensis
Rosalina poeyi
Rosalina squamosa
Rosalina vilardeboana

Rosalina candeiana
Rosalina orbicularis
Rosalina peruviana
Rosalina propinqua
Rosalina rugosa
Rosalina soldani
Rosalina subrotunda
Rosalina valvulata
Textularia gramen
 **Triloculina labiosa*
Uvigerina peregrina
Valvulina pileolus

The following types were unavailable; those with an asterisk were either badly damaged or assumed to be finally lost according to Madame Y. le Calvez.

Gaudryina rugosa
Nonionina canariense
Quinqueloculina araucana
Quinqueloculina ariminensis
 **Quinqueloculina auberiana*
Quinqueloculina bicarinata
Quinqueloculina carinata
 **Quinqueloculina contorta*
Quinqueloculina costata
Quinqueloculina ferussacii
 **Quinqueloculina isabellei*
Quinqueloculina laevigata
 **Quinqueloculina lamarckiana*
 **Quinqueloculina patagonica*
Quinqueloculina suborbicularis
Rosalina bertheloti
Rosalina bulloides

Each synonymy is restricted to the original description and to records from New Zealand for which we have seen the specimens concerned, or to New Zealand records accompanied by a figure and description which leave no doubt that the animals are identical with ours. Where records from New Zealand exist which do not fulfil these requirements these are noted in the remarks section.

The classification of the Order Foraminiferida used is that given by Loeblich and Tappan (1964 a, b).

One set of specimens, including those figured, is deposited in the British Museum (Natural History); duplicate sets have been sent to the N.Z. Oceanographic Institute and to the N.Z. Geological Survey. The "R.M." stations denote Recent Marine Collections in the Micropalaeontological Section of the N.Z. Geological Survey.

TABLE I.—New Zealand Stations Reported on in the Present Paper, also Including one Station from Chatham Islands

Locality	N.Z.O.I. Station No.	Coordinates
Whangaparoa Peninsula, Tyndall's Bay, North Island	B 420	36° 36' 30"S; 174° 40' 48"E
Mount Maunganui, North Island	B 434	37° 37' 56"S; 176° 10' 05"E
Kawarua Park, New Plymouth, North Island	B 439	39° 3' 24"S; 174° 3' 54"E
Porirua and Plimmerton Inlet, North Island	B 388	41° 6' 36"S; 174° 51' 42"E
Wellington (1), North Island	B 368	41° 20' 31"S; 174° 51' 28"E
Wellington (2), North Island	B 374	41° 17' 39"S; 174° 50"E
Taylor's Mistake, Christchurch, South Island	B 391	43° 34' 36"S; 172° 46' 42"E
Off Ripa Island, Lyttelton Harbour, Christchurch, South Island	B 400	43° 37' 20"S; 172° 45' 25"E
Aquarium Point, Portobello, South Island	B 405	45° 49' 48"S; 170° 30' 25"E
Chatham Islands, ½ mile out from Waitangi wharf, 12 metres	C 621	43° 56"S; 176° 31'W

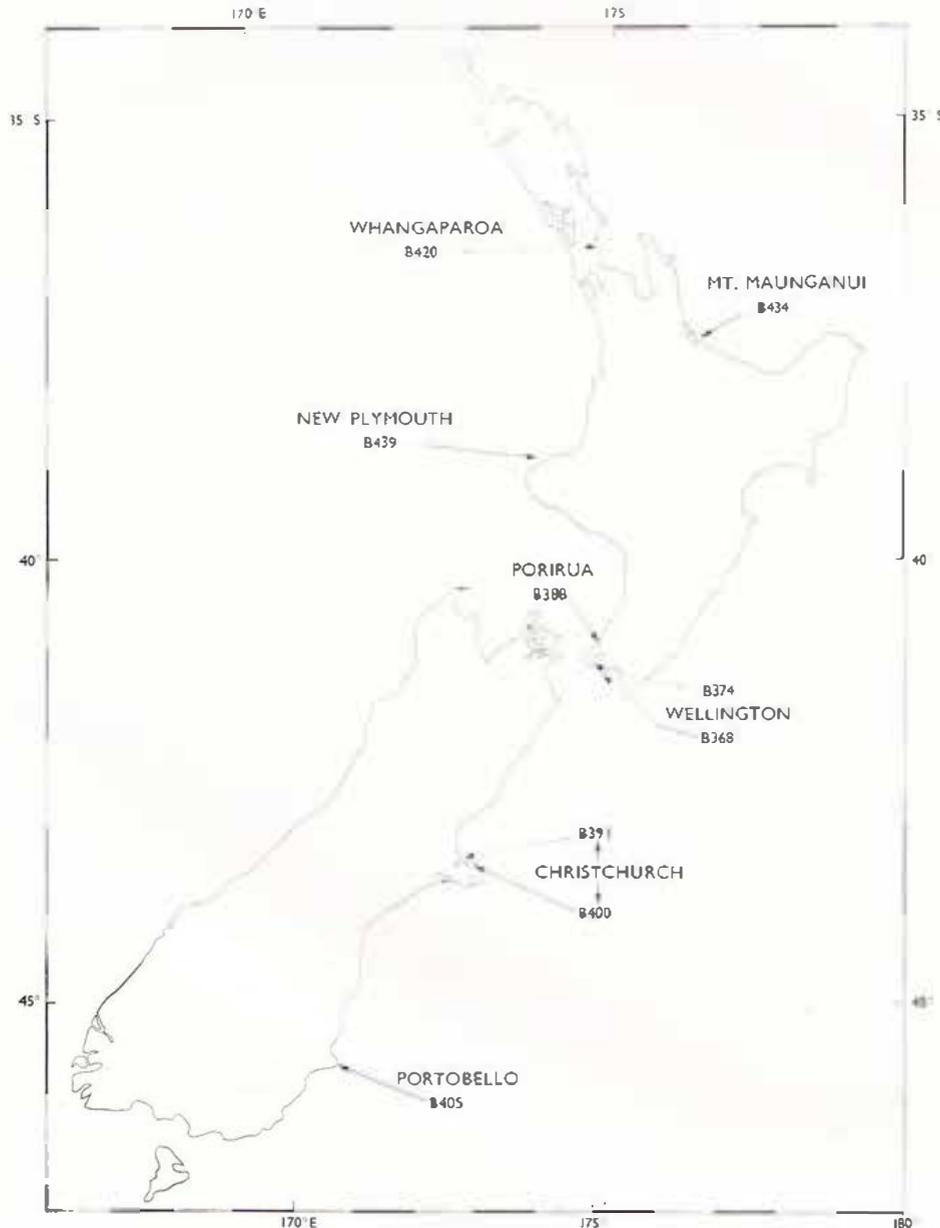
ACKNOWLEDGMENTS

One of us (R. H. H.) is indebted to Mr J. W. Brodie and staff of the N.Z. Oceanographic Institute and to Mr N. de B. Hornibrook of the N.Z. Geological Survey for facilities and hospitality extended to him during the tenure of a New Zealand National Research Fellowship, 1960-61, when part of this work was carried out. Professor G. A. Knox and Dr E. J. Batham kindly facilitated the collection of material when visits were made to Christchurch and Portobello respectively.

Another (C. M. H.) is grateful to Madame Y. le Calvez for those facilities she enjoyed during her visit to Paris to examine the d'Orbigny Collections in 1963.

We should like to thank our colleagues, Miss Gillian Wallace, for her help in the final stages of the work, and Dr C. G. Adams for his willingness to discuss problems during the period of study.

Permission to use plate 3 has been given by Academic Press Ltd., New York.



Text-fig 1: Distribution map of New Zealand localities from which intertidal Foraminifera have been described in the present report. The station numbers are those of the N.Z. Oceanographic Institute, details of which are referred to in the text and table 1.

TABLE 2—New Zealand localities referred to in present paper and reported on by previous Authors

Author	Year	Station	Locality	Depth	Coordinates
Brady, H. B.	1884	Challenger Sta. 167	West Coast	274 m	39°32'S; 171°48'E
Cushman, J. A.	1919	***	Off Poor Knights I., east coast; dredged		35°30'S; 174°43'E
	1936	***	Dredgings in Dusky Sound	Intertidal	
	1936	***	Caroline Bay, Timaru. east coast, shore sand		
Cushman, J. A., and Edwards, P. G.	1937	***	"From off New Zealand"		
Finlay, H. J.	1940	F 5091	Dunedin Harbour; subfossil		
Hedley, R. H.	1962a	N.Z.O.I. Sta. B 359, B 386	Wellington area	Intertidal	
		N.Z.O.I. Sta. B 379	Porirua and Plimmerton inlet	Intertidal	41°6'19"S; 174°52'18"E
		N.Z.O.I. Sta. B 393	Taylor's Mistake, Christchurch	Intertidal	43°34'36"S; 172°46'42"E
		N.Z.O.I. Sta. B 399, B 402	Off Ripa I., Lyttelton Harbour	Intertidal	43°37'20"S; 172°45'25"E
		N.Z.O.I. Sta. B 404	Aquarium Point, Portobello	Intertidal	45°49'48"S; 170°30'25"E
		N.Z.O.I. Sta. B 420	Tyndalls Bay, Whangaparoa Peninsula	Intertidal	36°36'30"S; 174°40'48"E
		N.Z.O.I. Sta. B 437	Mount Maunganui	Intertidal	37°37'30"S; 176°10'39"E
Hedley, R. H.	1962b	N.Z.O.I. Sta. B 416	Lower Portobello Bay	Intertidal	45°49'38"S; 170°31'57"E
		N.Z.G.S. Sta. R.M. 1417	Te Pua Point, Manukau Harbour	Intertidal	
		N.Z.G.S. Sta. R.M. 1443	Ladies Bay, Auckland Harbour	Intertidal	
		N.Z.G.S. Sta. R.M. 1482	Rakino Channel, Auckland	20 m	
		N.Z.G.S. Sta. R.M. 1502	Wellington Harbour	9 m	
Hedley, R. H.; Hurdle, C. M. and Burdett, I. D. J.	1965	Discovery II, Sta. D 939	Off west coast of North Island	87 m	35°49'S; 173°27'E
Heron-Allen, E. and Earland, A.	1922	Terra Nova Sta. 90	From summit of Great King, Three Kings I., S. 14° W, 8 miles	183 m	
		Terra Nova Sta. 91	From summit of Great King, Three Kings I., S. 10° W, 25 miles	550 m	
		Terra Nova Sta. 96	7 miles east of North Cape	128 m	
		Terra Nova Sta. 134	From Spirits Bay, near North Cape	20-36 m	
		Terra Nova Sta. 144	From Cape Maria van Diemen, W by S 7 miles	64-73 m	
		Terra Nova near Sta. 208		252 m	49°26'3"S; 172°04'3"E
		Terra Nova near Sta. 242		1445 m	45°13'1"S; 172°45'3"E
Hornibrook, N. de B.	1961	***	Oamaru: 60 samples from marine Tertiary rocks (Danian-Paleocene, Middle Eocene through to Lower Miocene)		
Hulme, S. G.	1964	***	Manukau Harbour, Auckland, 64 Bottom samples	3½-29 m	
Karrer, F.	1865	***	Orakei Bay, near Auckland		
Kustanowich, S.	1965	***	Milford Sound		
Parr, W. J. and Collins, A. C.	1930	***	"Off the Snares, south of New Zealand."	110 m	
Rhumbler, L.	1906	***	Chatham Islands, "J. no-2", east of New Zealand		
Vella, P.	1957	***	Cook Strait: 61 stations from Cook Strait and Marlborough Sounds		
		N.Z.G.S. Sta. R.M. 1002	East of Musgrave Peninsula, Auckland Islands, south of New Zealand	11 m	
	1957		Marlborough Sounds	2-22 m	

TABLE 3

Distribution Chart

	Whangaparoa B 420	Mt. Maunganui B 434	New Plymouth B 439	Porirua B 388	Wellington (1) B 368	Wellington (2) B 374	Christchurch (1) B 391	Christchurch (2) B 400	Portobello B 405
<i>Gromia oviformis</i> Dujardin	*	*	*	*	*	*	*	*	*
<i>Iridia diaphana</i> Heron-Allen and Earland	*	*	*	*	*	*	*	*	*
<i>Shepherdella taeniformis</i> Siddall	*	*	*	*	*	*	*	*	*
<i>Saccamina alba</i> Hedley	*	*	*	*	*	*	*	*	*
<i>Daitroia lens</i> (Göes)	*	*	*	*	*	*	*	*	*
<i>Hemisphaerammina depressa</i> (Heron-Allen and Earland)	*	*	*	*	*	*	*	*	*
<i>Tholosina protea</i> Heron-Allen and Earland	*	*	*	*	*	*	*	*	*
<i>Tolypammina</i> sp.	*	*	*	*	*	*	*	*	*
<i>Haplophragmoides canariense</i> (d'Orbigny)	*	*	*	*	*	*	*	*	*
<i>Ammobaculites exiguus</i> Cushman and Bronnimann	*	*	*	*	*	*	*	*	*
<i>Textularia proxispira</i> Vella	*	*	*	*	*	*	*	*	*
<i>Textularia torquata</i> Parker	*	*	*	*	*	*	*	*	*
<i>Siphotextularia mestayerae</i> Vella	*	*	*	*	*	*	*	*	*
<i>Trochammina adaperata</i> Rhumbler	*	*	*	*	*	*	*	*	*
<i>Trochammina bartrami</i> sp. nov.	*	*	*	*	*	*	*	*	*
<i>Trochammina inflata</i> (Montagu)	*	*	*	*	*	*	*	*	*
<i>Trochammina sorosa</i> Parr	*	*	*	*	*	*	*	*	*
<i>Gaudryina convexa</i> (Karrer)	*	*	*	*	*	*	*	*	*
<i>Cyclogyra involvens</i> (Reuss)	*	*	*	*	*	*	*	*	*
<i>Calcituba polymorpha</i> von Roboz	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina agglutinans</i> d'Orbigny	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina auferiana</i> d'Orbigny	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina colleenae</i> Vella	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina incisa</i> Vella	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina patagonica</i> d'Orbigny	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina seminulum</i> (Linnaeus)	*	*	*	*	*	*	*	*	*
<i>Quinqueloculina tenagos</i> Parker	*	*	*	*	*	*	*	*	*
<i>Massilina brodiei</i> sp. nov.	*	*	*	*	*	*	*	*	*
<i>Pateoris hauerinoides</i> (Rhumbler)	*	*	*	*	*	*	*	*	*
<i>Miliolinella labiosa</i> (d'Orbigny)	*	*	*	*	*	*	*	*	*
<i>Miliolinella labiosa</i> var. <i>schauinslandi</i> (Rhumbler)	*	*	*	*	*	*	*	*	*
<i>Bolivina pseudoplicata</i> Heron-Allen and Earland	*	*	*	*	*	*	*	*	*
<i>Bolivina compacta</i> Sidebottom	*	*	*	*	*	*	*	*	*
<i>Brizalina cacozela</i> Vella	*	*	*	*	*	*	*	*	*
<i>Brizalina spatulata</i> (Williamson)	*	*	*	*	*	*	*	*	*
<i>Cassidulinoides orientalis</i> (Cushman)	*	*	*	*	*	*	*	*	*
<i>Virgulopsis turris</i> (Heron-Allen and Earland)	*	*	*	*	*	*	*	*	*
<i>Discorbis dimidiatus</i> (Parker and Jones)	*	*	*	*	*	*	*	*	*
<i>Glabratella radiata</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Glabratella zelandica</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Discorbinella bertheloti</i> (d'Orbigny)	*	*	*	*	*	*	*	*	*
<i>Planulinoides norcotti</i> sp. nov.	*	*	*	*	*	*	*	*	*
<i>Patellinella inconspicua</i> (Brady)	*	*	*	*	*	*	*	*	*
<i>Rosalina bradyi</i> (Cushman)	*	*	*	*	*	*	*	*	*
<i>Rosalina irregularis</i> (Rhumbler)	*	*	*	*	*	*	*	*	*
<i>Rosalina</i> sp.	*	*	*	*	*	*	*	*	*
<i>Spirillina vivipara</i> Ehrenberg	*	*	*	*	*	*	*	*	*
<i>Patellina corrugata</i> Williamson	*	*	*	*	*	*	*	*	*
<i>Ammonia aoteanus</i> (Finlay)	*	*	*	*	*	*	*	*	*
<i>Elphidium novozealandicum</i> Cushman	*	*	*	*	*	*	*	*	*
<i>Criboelphidium argenteum</i> (Parr)	*	*	*	*	*	*	*	*	*
<i>Criboelphidium charlottensis</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Criboelphidium simplex</i> (Cushman)	*	*	*	*	*	*	*	*	*
<i>Polystomellina depressa</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Polystomellina finlayi</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Polystomellina inornata</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Polystomellina zelandica</i> (Finlay)	*	*	*	*	*	*	*	*	*
<i>Acervulina inhaerens</i> Schultze	*	*	*	*	*	*	*	*	*
<i>Loxostomum karrerianum</i> (Brady)	*	*	*	*	*	*	*	*	*
<i>Cassidulina neocarinata</i> Thalmann	*	*	*	*	*	*	*	*	*
<i>Astronomion novozealandicum</i> Cushman and Edwards	*	*	*	*	*	*	*	*	*
<i>Floerilus flemingi</i> (Vella)	*	*	*	*	*	*	*	*	*
<i>Zaflorilus parri</i> (Cushman)	*	*	*	*	*	*	*	*	*

LIST OF SPECIES

- Order **GROMIDA** Claparède and Lachmann, 1859
 Family GROMIIDAE Reuss, 1862
- Gromia oviformis** Dujardin Pl. 2, fig. 1, 2
- Order **FORAMINIFERIDA** Eichwald, 1830
 Family LAGYNIDAE Schultze, 1854
- Iridia diaphana** Heron-Allen and Earland Pl. 5, fig. 2A, B
- Family ALLOGROMIIDAE Rhumbler, 1904
- Shepherdella taeniformis** Siddall Pl. 3A, B
- Family SACCAMMINIDAE Brady, 1884
- Saccamina alba** Hedley Pl. 4A, B, text-fig. 2-3
Daitrona lens (Göes) text-fig. 4A, B
- Hemisphaerammina depressa** (Heron-Allen and Earland) Pl. 5 fig. 1
Tholosina protea Heron-Allen and Earland
- Family AMMODISCIDAE Reuss, 1862
- Tolypammina** sp. Pl. 1, fig. 5;
 Pl. 5, fig. 3;
 text-fig. 5-6
- Family LITUOLIDAE de Blainville, 1825
- Haplophragmoides canariense** (d'Orbigny) Pl. 5, fig. 4A, B;
 text-fig. 7
- Ammobaculites exiguus** Cushman and Bronnimann Pl. 5, fig. 5A, B
- Family TEXTULARIIDAE Ehrenberg, 1838
- Textularia proxispira** Vella Pl. 5, fig. 6A, B
Textularia torquata Parker Pl. 5, fig. 7A, B
Siphotextularia mestayerae Vella Pl. 5, fig. 8A, B
- Family TROCHAMMINIDAE Schwager, 1877
- Trochammina adaperta** (Rhumbler) Pl. 6, fig. 1A-C;
 text-fig. 8
Trochammina bartrami sp. nov. Pl. 6, fig. 2A-C;
 text-fig. 9-10
- Trochammina inflata** (Montagu) Pl. 6, fig. 3A-C
Trochammina sorosa Parr Pl. 6, fig. 4A-C;
 text-fig. 11-15
- Family ATAXOPHRAGMIIDAE Schwager, 1877
- Gaudryina convexa** (Karrer) Pl. 6, fig. 5A, B
- Family FISCHERINIDAE Millett, 1898
- Cyclogyra involvens** (Reuss) text-fig. 16
- Family NUBECULARIIDAE Jones, 1875
- Calcituba polymorpha** von Roboz Pl. 7A-C
- Family MILIOLIDAE Ehrenberg, 1839
- Quinqueloculina agglutinans** d'Orbigny
Quinqueloculina auberiana d'Orbigny Pl. 8, fig. 5A-C
Quinqueloculina colleenae Vella
Quinqueloculina incisa Vella
Quinqueloculina patagonica d'Orbigny Pl. 8, fig. 6A-C
Quinqueloculina seminulum (Linnaeus)
Quinqueloculina tenagos Parker Pl. 9, fig. 1A-C
Massilina brodiei, sp. nov. Pl. 8, fig. 1A-C;
 text-fig. 17-19
- Pateoris hauerinoides** (Rhumbler) Pl. 8, fig. 4A-C

- Miliolinella labiosa** (d'Orbigny) Pl. 8, fig. 2A-C
Miliolinella labiosa var. **schauinslandi** (Rhumbler) Pl. 8, fig. 3A, B
- Family BOLIVINITIDAE Cushman, 1927
Bolivina pseuduplicata Heron-Allen and Earland Pl. 9, fig. 4A, B
Bolivina compacta Sidebottom Pl. 9, fig. 3A, B;
text-fig. 20-27
- Brizalina cacozela** (Vella) Pl. 9, fig. 2A, B
Brizalina spathulata (Williamson)
- Family ISLANDIELLIDAE Loeblich and Tappan, 1964
Cassidulinoides orientalis (Cushman) Pl. 12, fig. 5A, B
- Family BULIMINIDAE Jones, 1875
Virgulopsis turris (Heron-Allen and Earland) Pl. 9, fig. 5A, B
- Family DISCORBIDAE Ehrenberg, 1838
Discorbis dimidiatus (Parker and Jones) Pl. 1, fig. 4;
Pl. 10 figs. 1-4;
text-fig. 28-49
- Discorbinella bertheloti** (d'Orbigny)
Patellinella inconspicua (Brady) Pl. 9, fig. 7A, B, C
Planulinoides norcotti sp. nov. Pl. 11, fig. 1A-C
- Family ROSALINIDAE Reiss, 1963
Rosalina bradyi (Cushman) Pl. 1, fig. 3;
Pl. 11, fig. 2A-C;
text-fig. 50-55
Rosalina irregularis (Rhumbler) Pl. 11, fig. 3A, B
Rosalina sp. Pl. 9, fig. 6A-C
- Family GLABRATELLIDAE Loeblich and Tappan, 1964
Glabratella radiata (Vella)
Glabratella zealandica (Vella)
- Family SPIRILLINIDAE Reuss, 1862
Spirillina vivipara Ehrenberg
Patellina corrugata Williamson
- Family ROTALIIDAE Ehrenberg, 1839
Ammonia aoteanus (Finlay) Pl. 11, fig. 4A-C;
text-fig. 56-60
- Family ELPHIDIIDAE Galloway, 1933
Elphidium novozealandicum Cushman Pl. 12, fig. 4A, B
Criboelphidium argenteum (Parr) Pl. 12, fig. 2A, B
Criboelphidium charlottensis (Vella) Pl. 12, fig. 3A, B
Criboelphidium simplex (Cushman) Pl. 12, fig. 1A, B
Polystomellina depressa (Vella)
Polystomellina finlayi (Vella)
Polystomellina inornata (Vella)
Polystomellina zelandica (Finlay)
- Family ACERVULINIDAE Schultze, 1854
Acervulina inhaerens Schultze Pl. 1, fig. 2
- Family LOXOSTOMIDAE Loeblich and Tappan, 1962
Loxostomum karrerianum (Brady)
- Family CASSIDULINIDAE d'Orbigny, 1839
Cassidulina neocarinata Thalmann Pl. 12, fig. 6A, B
- Family NONIONIDAE Schultze, 1854
Astrononion novozealandicum Cushman and Edwards
Florilus flemingi (Vella)
Zeallorilus parri (Cushman)

SYSTEMATICS

Genus *Gromia* Dujardin, 1835

Gromia oviformis Dujardin, 1835. (Pl. 2, figs. 1, 2.)

Gromia oviformis Dujardin, 1835. p. 343-77.

Gromia oviformis. Hedley, 1962a, p. 121-36, figs. 1-7

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded by Hedley (1962a) from Wellington (B 359 - B 376), Porirua Harbour (B 379), Lyttelton Harbour (B 393, B 399, B 402), Portobello (B 404, B 405), Auckland (B 420), and Mount Maunganui (B 434, B 437).

NEW RECORDS FROM NEW ZEALAND: Living at Whangaparoa (B 420), New Plymouth (B 439), Porirua (B 388), and Christchurch (B 391, B 400).

Remarks

A detailed account of the distribution, structure, and biology of this enigmatic form has been given recently by Hedley (1962a).

Genus *Iridia* Heron-Allen and Earland, 1914

Iridia diaphana Heron-Allen and Earland, 1914. (Pl. 5, fig. 2A, B.)

Iridia diaphana Heron-Allen and Earland, 1914. p. 371. pl. 36, figs. 1-12.

Iridia diaphana. Heron-Allen and Earland, 1922. pp. 75, 76.

Iridia diaphana. Heron-Allen and Earland, 1932. p. 324.

Iridia diaphana. Earland, 1933, p. 53.

Iridia diaphana. Earland, 1934, p. 54.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded by Heron-Allen and Earland (1922) from *Terra Nova* stations 91, 96, and 144.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Christchurch (B 400), Whangaparoa (B 420), Mount Maunganui (B 434), New Plymouth (B 439), and at Portobello (B 405).

MATERIAL: Six specimens, all having been attached to *Corallina*. The specimen size ranges from 0.4-4 mm.

Remarks

This genus and species were first described by Heron-Allen and Earland (1914) from the Kerimba Archipelago, Mozambique; the New Zealand intertidal specimens closely resemble the type specimens. Among the intertidal specimens are small circular compressed forms resembling that figured by Heron-Allen and Earland (1914, pl. 36, fig. 8), while the larger branching form illustrated (1914, pl. 36, fig. 12) is also present.

Genus *Shepherdella* Siddall, 1880

Shepherdella taeniformis Siddall, 1880. (Pl. 3A, B.)

Shepherdella taeniformis Siddall, 1880, p. 131, pl. 15-16.

PREVIOUS RECORDS FROM NEW ZEALAND: None.

NEW RECORDS FROM NEW ZEALAND: Living at Christchurch (B 391).

MATERIAL: Six specimens emerged from sand at the base of *Corallina* when this was placed in a dish with fresh seawater and allowed to stand for a few days.

Remarks

The New Zealand specimens were indistinguishable from those described by Siddall (1880) from the shore at Tenby, Pembroke, Wales, and from two specimens observed by one of us (R. H. H.) from shallow water near Plymouth, England, during August 1963. All six New Zealand specimens died in the laboratory over a period of six weeks and none was preserved.

Genus *Saccammina* Carpenter, 1869

Saccammina alba Hedley, 1962. (Pl. 4A, B; text-fig. 2-3.)

Saccammina alba Hedley, 1962b, p. 387, figs. 1-6.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded by Hedley (1962b) from Porirua Harbour (B 388), Wellington (B 359), Porirua Harbour (B 379), Lyttelton Harbour (B 399), Lower Portobello Bay (B 416), Manukau Harbour (RM 1417*), Auckland Harbour (RM 1443*; 1482*), Wellington Harbour (RM 1502*).

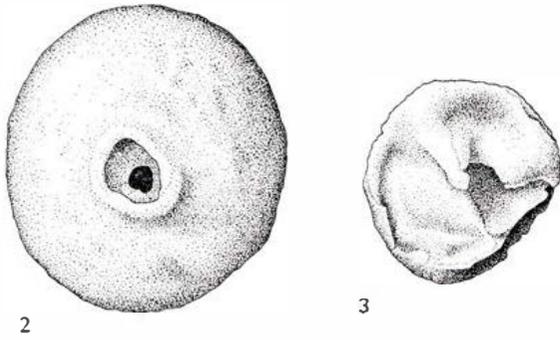
NEW RECORDS FROM NEW ZEALAND: Living free in sand at Porirua (B 388), Whangaparoa (B 420), Mount Maunganui (B 434), and Portobello (B 405).

MATERIAL: Two hundred specimens have been examined.

Remarks

This species was described from Porirua Inlet (Porirua Harbour) and occurs in intertidal and shallow water coastal localities between Auckland and Dunedin. A detailed study of the structure, variation and possible relationships of *S. alba* has been given by Hedley (1962b).

*The "RM" stations denoted Recent Marine Collections in the Micropalaeontological Section of the N.Z. Geological Survey. B.M. (N.H.) denotes collections housed in British Museum (Natural History).



Text-fig. 2-3: *Saccammina alba* Hedley

2: apertural view of the holotype ($\times 104$); 3: dry paratype which has contracted almost beyond recognition ($\times 89$). From Hedley (1962 b). Drawn by Mr R. Brazier, N.Z. Geological Survey, Lower Hutt. N.Z.G.S. collection: TF1438/1 and TF1438/2.

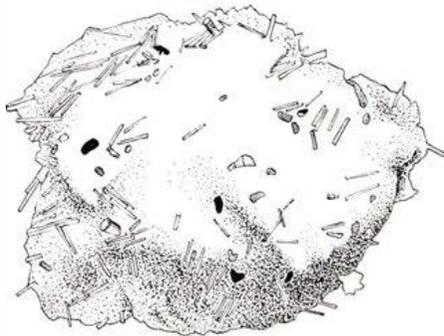
Genus *Daitrona* Loeblich and Tappan, 1961

Daitrona lens (Göes), 1896. (Text-fig. 4A, B.)

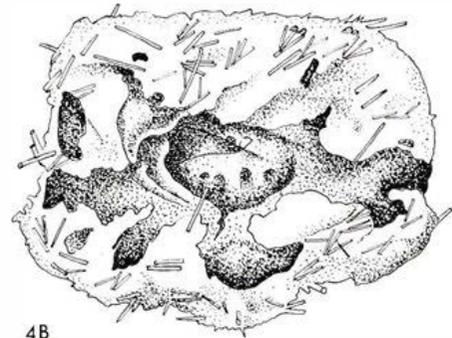
Crithionina lens Göes, 1896, p. 24, pl. 2, figs. 5-8.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) from *Terra Nova* stations 90, 96.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368), Christchurch (B 391), Whangaparoa (B 420), Mount Maunganui (B 434), New Plymouth (B 439).



4A



4B

Text-fig. 4A, B: *Daitrona lens* (Göes).

A: upper surface of a specimen detached from *Corallina*, showing test composed of fine sand grains and sponge spicules ($\times 66$); B: lower surface, showing central chamber with radiating partitions, which, if undamaged, do not lead to the exterior ($\times 66$).

Although *Daitrona lens* is stated to occur free by Loeblich and Tappan (1961), many of the New Zealand intertidal specimens were found to be attached to *Corallina*.

From N.Z.O.I. Sta. B 420, Whangaparoa, B.M. (N.H.) Reg. No. 1964.10.13.2.

MATERIAL: Eighteen specimens displaying a wide range of shape. Maximum length, 0.28-1.17 mm. Found attached to *Corallina*, occasional specimens found free (see legend to text-fig. 4).

Remarks

Heron-Allen and Earland (1922) recorded a small number of *Crithionina lens* from *Terra Nova* Stations 90 and 96. We have examined these and note that they do not have the radial tubes typical of *C. lens*. Höglund (1947) also commented on the identity of Heron-Allen and Earland's specimens and considered them to resemble *Crithionina goesi* Höglund. Most of our specimens have the radial tubes and central chamber, as shown in Göes's figure, but others have a more irregular arrangement as described by Cushman (1910, pp. 54-55, text-figs. 60-62).

Loeblich and Tappan (1961b, p. 218) designated *Crithionina lens* as the type species of a new genus, *Daitrona*, differing from *Crithionina* Göes in living free and in having numerous secondary partitions subdividing the chambers.

Genus *Hemisphaerammina* Loeblich and Tappan, 1957

Hemisphaerammina depressa (Heron-Allen and Earland), 1932. (Pl. 5, fig. 1.)

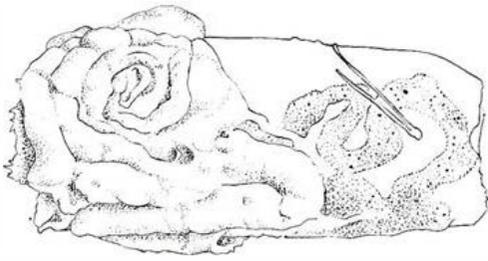
Webbinella depressa Heron-Allen and Earland, 1932, p. 329, pl. 7, figs. 10-11.

Webbinella depressa. Earland, 1933, p. 63.

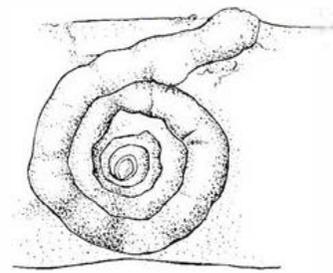
Webbinella depressa. Earland, 1934, p. 67.

PREVIOUS RECORDS FROM NEW ZEALAND: None.

FIRST RECORD FROM NEW ZEALAND: Living at Wellington (B 374).



5



6

Text-fig. 5-6: Tolypammina sp.

5: view of specimen attached to a frond of *Corallina* showing irregular growth of test ($\times 50$).

From N.Z.O.I. Sta. B 374, Wellington, B. M. (N.H.) Reg. No. 1964.10.13.5.

6: view of attached specimen, showing large initial coil ($\times 55$).

From N.Z.O.I. Sta. B 374, Wellington, B.M. (N.H.) Reg. No. 1964.10.13.6.

MATERIAL: Three living specimens attached to small pieces of rock. They are smaller than Heron-Allen and Earland's type specimens and range in length between 0.34-0.48 mm.

Genus *Tholosina* Rhumbler, 1895

Tholosina protea Heron-Allen and Earland, 1932

Tholosina protea Heron-Allen and Earland, 1932, p. 330, pl. 8, figs. 5-8.

Tholosina protea. Earland, 1933, p. 63.

Tholosina protea. Earland, 1934, p. 69.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded from Manukau Harbour, Auckland, by Hulme (1964).

NEW RECORDS FROM NEW ZEALAND: Living at Christchurch (B 391).

MATERIAL: Approximately 20 living specimens attached to *Corallina*. Diameter range 0.44-0.57 mm.

Genus *Tolypammina* Rhumbler, 1895

Tolypammina sp. (Pl. 1, fig. 5; pl. 5, fig. 3; text-fig. 5-6.)

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Christchurch (B 400), and Whangaparaoa (B 420).

MATERIAL: Sixty-three specimens attached to *Corallina*.

Remarks

The specimens examined are identical with some of those recorded as *Ammodiscus gordialis* (Jones and Parker) by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 96, 144.

Based on information given by Cushman (1948, p.

98), Barnard (1950, p. 353), Ireland (1956, p. 838). Gutschick and Treckman (1959, p. 245), we tentatively assign our specimens to the genus *Tolypammina*, although it is noted that forms resembling *Ammodiscus* and *Lituotuba* occur with them.

Genus *Haplophragmoides* Cushman, 1910

Haplophragmoides canariense (d'Orbigny), 1839. (Pl. 5, fig. 4A, B; text-fig. 7.)

Nonionina canariensis d'Orbigny, 1839b, p. 128, pl. 2, figs. 33-34.

Haplophragmium canariense (part). Brady, 1884 p. 310, pl. 35, fig. 1.

Haplophragmium canariense (part). Heron-Allen and Earland, 1922, p. 100.

Haplophragmium canariensis. Heron-Allen and Earland (part), 1932, pp. 339-340.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded by Heron-Allen and Earland (1922) as *Haplophragmium canariense* from *Terra Nova* Stations 90, 91, 96, 134, 144; and as *Haplophragmoides canariensis* from Cook Strait by Vella (1957) and by Hulme (1964) from Manukau Harbour, Auckland.

NEW RECORDS FROM NEW ZEALAND: Living at New Plymouth (B 439); one damaged specimen found at Wellington (B 368).

MATERIAL: Ten specimens in sand among tufts of *Corallina*. Size range: length, 0.15-0.31 mm; thickness, 0.05-0.11 mm; width, 0.12-0.24 mm.

Remarks

Nonionina canariensis was originally described from Recent shore sand, Teneriffe, Canary Islands, and was subsequently made the type species of *Haplophragmoides* by Cushman (1910, p. 99). Höglund (1947,

pp. 132–133) clarified Cushman's definition of *Haplophragmoides* and restricted the genus to forms possessing an interio-marginal aperture. Forms with interio-areal apertures were included in the genus *Labrospira* Höglund, 1947, a name later suppressed as a junior synonym of *Alveolophragmium* Stschredrina, 1936, by Loeblich and Tappan (1953, p. 28). *Labrospira* is now placed in the synonymy of *Cribrostomoides* Cushman by Loeblich and Tappan (1964a). As pointed out by Parker (1952, p. 401), d'Orbigny may have misinterpreted the apertural characteristics of *Haplophragmoides canariensis*. Later, Barker (in Barker, 1960, p. 72) suggested that if Brady's figured specimens (1884, pl. 35, figs. 1–3, 5), which possess interio-areal apertures, are the same as d'Orbigny's species, then *Alveolophragmium* and *Haplophragmoides* are synonymous. Lacking material from Tenerife, we examined material from Palma, Canary Islands, but were unable to find any specimens resembling *Haplophragmoides*. According to Heron-Allen and Earland (1932, p. 340), d'Orbigny's type specimen is unavailable.

Among the specimens of *H. canariense* recorded by Heron-Allen and Earland (1922) there is considerable variation and, as noted by these authors, there is a tendency for the species to merge into *H. emaciatum*, *H. nanum*, and *H. crassimargo*. We have restricted the synonymy of the *Terra Nova* specimens to the flattened, involute form of the species. The New Zealand specimens compare well with Brady's figured specimen (1884, pl. 35, fig. 1) and other specimens from *Challenger* station 135, from 100–150 fm off Tristan da



Text-fig. 7: Haplophragmoides canariense (d'Orbigny). Apertural view of Brady's figured specimen of *H. canariense* (Brady, 1884, pl. 35, fig. 1), to show interio-areal aperture ($\times 50$). From *Challenger* Sta. 135, South Atlantic, 100–150 fm. B.M. (N.H.) Reg. No. ZF1526.

Cunha; both Brady's (1884) specimens – one of which is illustrated (text-fig. 7) – and those from New Zealand (pl. 5, fig. 4A, B), possess interio-areal apertures.

In view of the doubts expressed concerning the apertural characteristics of d'Orbigny's species, and the absence of an alveolar structure in the test wall, we have referred our specimens to *Haplophragmoides*.

Genus *Ammobaculites* Cushman, 1910

Ammobaculites exiguus Cushman and Bronnimann, 1948. (Pl. 5, fig. 5A, B.)

Ammobaculites exiguus Cushman and Bronnimann, 1948, p. 38, pl. 7, figs. 7, 8.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded from Manukau Harbour, Auckland, by Hulme (1964).

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Porirua (B 388), Christchurch (B 400), and Portobello (B 405).

MATERIAL: Twenty-seven specimens in sand among tufts of *Corallina* and among the eel grass which grows at Porirua. Size range: length 0.14–0.48 mm; width of coiled portion 0.11–0.26 mm.

Remarks

This species was originally described by Cushman and Bronnimann (1948) from shallow water in the Gulf of Paria, Trinidad, British West Indies. Occurring among the 27 specimens are fragments of the cylindrical uniserial portion which have become detached from the initial coil. The test appears fairly coarse and black grains of ironsand occur together with the lighter sand grains.

Genus *Textularia* Defrance, 1824

Textularia proxispira Vella, 1957. (Pl. 5, fig. 6A, B.)

Textularia proxispira Vella, 1957, pp. 15, 16, pl. 3, figs. 48, 52.

Textularia sagittula (part). Heron-Allen and Earland, 1922, p. 118.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded from Cook Strait by Vella (1957) and as part of *Textularia sagittula* by Heron-Allen and Earland (1922) from *Terra Nova* stations 90, 91, 96, 134.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374) and New Plymouth (B 439).

MATERIAL: Thirteen specimens living free in sand at base of *Corallina*. Size range of the smallest megalos-

spheric individual: length, 0.32 mm; breadth, 0.31 mm; thickness, 0.17 mm. Of the microspheric individual: length, 0.57 mm; breadth, 0.33 mm; thickness, 0.21 mm.

Remarks

The New Zealand intertidal specimens, although slightly smaller than the holotype, are identical with three topotypes of *Textularia proxispira* donated by Dr P. Vella.

According to Vella (1957, p. 15), the microspheric form has a distinctly coiled initial portion, which is not evident in megalospheric forms. Unfortunately most of our New Zealand intertidal specimens have a damaged initial portion, and we are, therefore, unable to confirm Vella's remarks.

Although some of the specimens identified as *Textularia sagittula* by Heron-Allen and Earland from Terra Nova Stations are identical with the New Zealand intertidal specimens, they are not identical with *T. sagittula* identified by Parker and Jones from the Pliocene of Coroncini, Italy (the type locality of *T. sagittula*, is given by DeFrance as Fossil, Italy). As Parker and Jones's specimens closely resemble the type figures of DeFrance (1824, p. 177, pl. 13, fig. 5, a, b) and also the figures of Lacroix (1929, pp. 1, 12, text-figs. 1-12), Höglund (1947), pp. 167, 171, pl. 12, figs. 3, 4, text-figs. 143-146), and Loeblich and Tappan (1964a, p. C252-253, fig. 165: 1-2), we have referred the New Zealand intertidal specimens and part of *Textularia sagittula* Heron-Allen and Earland (1922) to *Textularia proxispira* Vella (1957).

***Textularia torquata* Parker, 1952. (Pl. 5, fig. 7A, B.)**

Textularia torquata Parker, 1952, p. 403, pl. 3, figs. 9-11.

PREVIOUS RECORDS FROM NEW ZEALAND: None.

FIRST RECORDS FROM NEW ZEALAND: Living at Portobello (B 405).

MATERIAL: Thirty-seven specimens living free in the sand in the tufts of *Corallina*. Size range: length, 0.14-0.28 mm; width, 0.09-0.16 mm; thickness, 0.05-0.09 mm. Number of chambers varies from three to six pairs.

Remarks

The New Zealand intertidal specimens are identical with the species described by Parker (1952) from Portsmouth, New Hampshire, U.S.A. The aperture of

the Portobello specimens is a narrow elongate slit extending along the apertural face, though none of our specimens possess a coil at the initial end mentioned in Parker's description of *T. torquata*. It is noted that two of our specimens possess a single uniserial chamber following the biserial portion of the test, thus resembling the genus *Bigennerina*. Unfortunately, the terminal chamber of both specimens is damaged and the aperture is not visible; the larger specimen is 0.32 mm. in length, 0.14 mm. in width, and 0.13 mm. in thickness. These two specimens are otherwise identical with the specimens referred to as *Textularia torquata*. Loeblich and Tappan (1953, p. 35-36, pl. 2, figs. 19-21) have recorded *Textularia torquata* from the coasts of Alaska and Greenland, and their figures closely resemble the New Zealand form.

Genus *Siphotextularia* Finlay, 1939

***Siphotextularia mestayerae* Vella, 1957. (Pl. 5, fig. 8A, B.)**

Siphotextularia mestayerae Vella, 1957, p. 17, pl. 4, figs. 55-57.

Textularia concava (part). Heron-Allen and Earland, 1922, p. 117.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded from Cook Strait by Vella (1957); from Manukau Harbour, Auckland by Hulme (1964) and as part of *Textularia concava* by Heron-Allen and Earland (1922) from Terra Nova Stations 90, 91, 96, 134, 144.

NEW RECORDS FROM NEW ZEALAND: Empty shells at New Plymouth (B 439).

MATERIAL: Five empty shells found free in sand at the base of *Corallina* tufts. Two of the specimens are damaged and the following dimensions refer to the three complete specimens: length, 0.56-0.61 mm; breadth, 0.29-0.32 mm; thickness, 0.18-0.19 mm.

Remarks

The New Plymouth specimens were compared with two topotypes of *Siphotextularia mestayerae* kindly donated by Dr P. Vella and found to be slightly smaller, but otherwise identical.

Several specimens of *Textularia concava* recorded from New Zealand Terra Nova Stations by Heron-Allen and Earland (1922) are identical with *S. mestayerae*. We consider that *T. concava* in this instance was a misidentification.

Genus *Trochammina* Parker and Jones, 1859

Trochammina adaperta Rhumbler, 1938. (Pl. 6, fig. 1A-C; text-fig. 8.)

Trochammina squamata adaperta Rhumbler, 1938, p. 184. textfigs. 21-26.

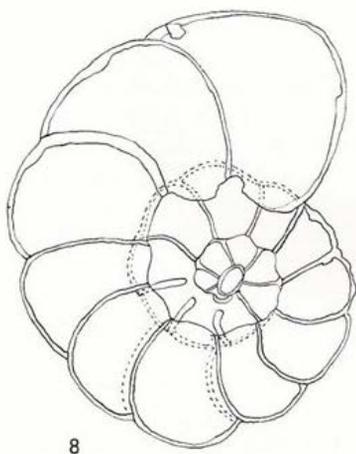
PREVIOUS RECORDS FROM NEW ZEALAND: Recorded from Manukau Harbour, Auckland, by Hulme (1964).

NEW RECORDS FROM NEW ZEALAND: Living at Portobello (B 405), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Twenty-five specimens, some attached to *Corallina* and others living free in the sand around the tuft. Dimensions: maximum diameter, 0.10-0.19 mm; height, 0.03-0.06 mm; number of chambers, 10-18.

Remarks

The New Zealand specimens are very similar to figures of *T. adaperta* given by Rhumbler (1938) in his description of the species from Heligoland. *T. adaperta* was subsequently figured by Höglund (1947, pp. 204-206, pl. 15, fig. 1, text-fig. 185) from the Gullmar Fjord and the Skagerak, Sweden. Compared with the specimens described by Höglund, the New



Text-fig. 8: *Trochammina adaperta* Rhumbler.

Optical section of a specimen mounted in balsam and drawn from the umbilical side to show the lobulate terminal chamber, loosely coiled chambers, and the extra-umbilical-umbilical, interio-marginal aperture ($\times 290$). The umbilicus is non-stellate. For a definition of terms see glossary in Loeblich and Tappan (1964).

From N.Z.O.I. Sta. B 439, New Plymouth. B.M. (N.H.) Reg. No. 1964.10.13.13.

Zealand specimens are slightly smaller and possess fewer chambers. It is noted that some specimens are loosely coiled and possess a broadly rounded terminal chamber and a deeply excavated open umbilicus which exposes the initial coils (text-fig. 8). In more closely coiled forms the umbilicus is small and tends to obscure the initial coils, and the final chamber is strongly lobulate (pl. 6, fig. 1). The aperture is extra-umbilical-umbilical and interio-marginal.

Genus *Trochammina* Parker and Jones, 1859

Trochammina bartrami sp. nov. (Pl. 6, fig. 2A-C; text-fig. 9-10.)

Trochammina ochracea (part). Heron-Allen and Earland, 1922, p. 111-112.

Description

Test free, small, trochoid, concavoconvex, with low dorsal spire, ventrally excavated and umbilicate; periphery almost circular in outline; chambers numerous, between 24 and 32, up to $4\frac{1}{2}$ whorls visible on spiral side, and 5-8 chambers per whorl; only the chambers of the final whorl visible on umbilical side; sutures distinct, curved strongly backwards on spiral side, sigmoid and slightly depressed on umbilical side; wall thin, finely arenaceous, with occasional larger sand grains, smoothly finished; colour greyish-brown, initial whorls slightly darker in colour; aperture interio-marginal and extra-umbilical-umbilical; umbilicus fairly large, stellate with acute points, which coincide with the sutures of each whorl.

Dimensions of Holotype: Diameter 0.18 mm., thickness 0.06 mm.

The size range of other specimens: Diameter 0.11-0.25 mm., thickness 0.03-0.07 mm.

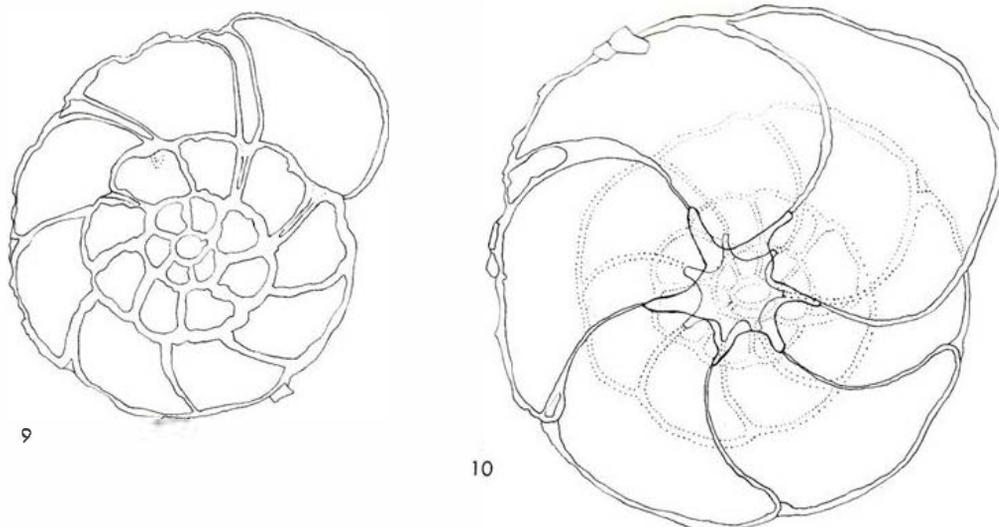
TYPE MATERIAL: Deposited in the British Museum (Natural History):

- (a) Holotype (pl. 6, fig. 2A-C); B.M. (N.H.) Reg. No. 1964. 10. 13. 14.
- (b) Hypotypes (text-fig. 9-10); B.M. (N.H.) Reg. No. 1964, 10. 13. 15. 16.
- (c) Paratypes and topotypic material.

Six paratypes (five dry and one balsam mount) are deposited in the N.Z. Geological Survey.

Approximately 60 specimens have been examined; all were found living free in the residual sand among the tufts of *Corallina*.

TYPE LOCALITY: Mount Maunganui, North Island, New Zealand, N.Z.O.I. Station B 434, $37^{\circ}37'56''S$, $176^{\circ}10'04''E$. *Corallina* tufts and residual sand, intertidal.



Text-fig. 9–10: *Trochammina bartrami* sp. nov.

9: spiral view of paratype, mounted in balsam ($\times 408$); B.M. (N.H.) Reg. No. 1964.10.13.15.

10: umbilical view of another paratype, also mounted in balsam, showing sigmoid-shaped sutures and stellate umbilicus. The acute points of the stellate umbilicus coincide with the sutures of each whorl. The aperture is extra-umbilical-umbilical and interior-marginal. The specimen is drawn in optical section ($\times 435$). From N.Z.O.I. Sta. B 434, Mount Maunganui. B.M. (N.H.) Reg. No. 1964.10.13.16.

OTHER LOCALITIES: *Trochammina bartrami* occurs also at N.Z.O.I. Station B 439, Kawaroa Park, New Plymouth, North Island, $39^{\circ}3'24''S$, $174^{\circ}3'54''E$ among *Corallina* tufts, residual sand and on encrusted stones; it was previously recorded as part of *Trochammina ochracea* (Williamson) by Heron-Allen and Earland from *Terra Nova* Station 96, 7 miles east of North Cape, North Island, New Zealand, in 128m (see remarks).

Remarks

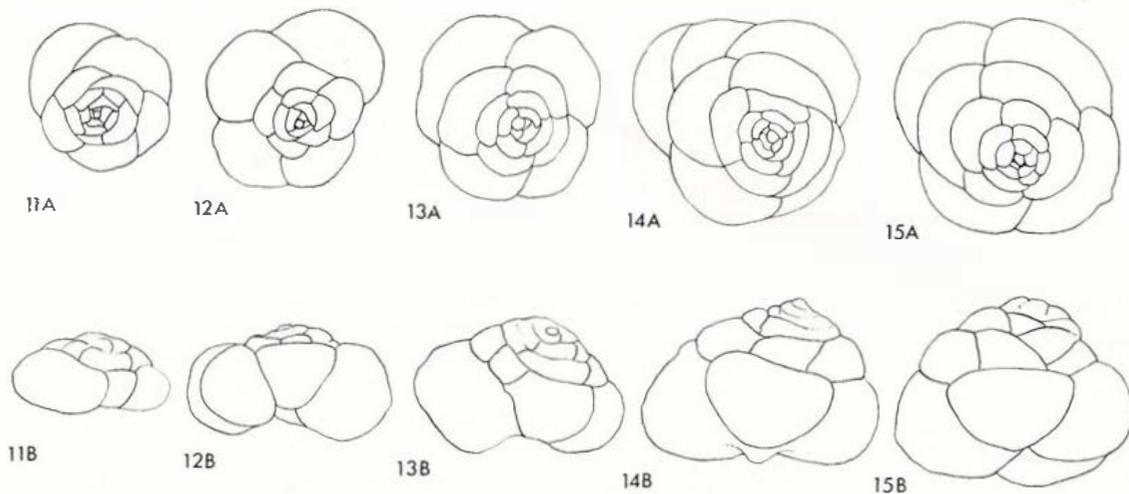
Although in the stellate nature of the umbilicus this new species resembles *T. labiosa* Höglund, described from the Gullmar Fjord and the Skagerak, it differs principally in the character of the aperture, and by not having the characteristic inflexion of the chamber septa. *T. bartrami* differs from *T. multiloculata* Höglund, described from the Skagerak and Koster Channel, in having fewer chambers per whorl, a less lobulate periphery and a distinct, open umbilicus. It differs from *T. squamiformis* Cushman and McCulloch, 1939, in

having less inflated chambers and a stellate umbilicus.

Detailed studies of the various species included in the "*Trochammina squamata* group" have been reported by Rhumbler (1938) and Höglund (1947). The latter author stresses the usefulness of a clearing fluid such as clove oil if the finer details of shell morphology are to be seen. None of the New Zealand specimens appears to resemble any of the species of *Trochammina* described by Rhumbler (1938) from Heligoland.

Some specimens of *T. ochracea* reported by Heron-Allen and Earland (1922) from *Terra Nova* Station 96 are identical with *T. bartrami* and the use of *T. ochracea* in this case is a misidentification. Williamson's syntypes of this species are deposited in the British Museum (Natural History) and they are being re-figured and redescribed elsewhere. (Hedley, Hurdle and Burdett, 1964b).

This new form is named after Mr F. Bartram of Mount Maunganui who was host to one of us (R.H.H.) when the collections were made.



Text-fig. 11-15: *Trochammina sorosa* Parr.

Outline drawings ($\times 100$) to illustrate variation from a small, compressed form into a conical and inflated form.

A: spiral view; B: side view.

From N.Z.O.I. Sta. B 405, Portobello. B.M. (N.H.) Reg. No. 1964.10.13.33-37.

Trochammina inflata (Montagu), 1808. (Pl. 6, fig. 3 A-C.)

Nautilus inflatus Montagu, 1808, p. 81, pl. 18, fig. 3.
Trochammina inflata. Brady, 1884, p. 338, pl. 41, figs. 4a-c.
Trochammina inflata. Parr, 1945, p. 194, pl. 8, fig. 3, 4a, b.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922), *Terra Nova* Station 96, and by Hulme (1964), Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Found at Porirua (B 388).

MATERIAL: Five dead specimens. Size range: diameter, 0.29-0.58 mm; height, 0.15-0.23 mm.

Remarks

These New Zealand intertidal brackish water specimens are identical with those figured by Brady (1884, pl. 41, figs. 4a-c) from Alnmouth, Northumberland, England, and with specimens from other brackish water, British Recent localities. The specimens of *T. inflata* reported by Heron-Allen and Earland from *Terra Nova* Station 96 are much smaller than the New Zealand intertidal specimens, and the composition of the test is very variable.

Trochammina sorosa Parr, 1950. (Pl. 6, fig. 4 A-C; textfig. 11-15.)

Trochammina sorosa Parr, 1950, p. 278, pl. 5, figs. 15-17.
Trochammina vesicularis. Earland, 1934, pp. 103-104, pl. 3, figs. 44-46.

PREVIOUS RECORDS FROM NEW ZEALAND: None.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Christchurch (B 391, B 400), Whangaparoa (B 420), Mount Maunganui (B 434), New Plymouth (B 439), and Portobello (B 405); empty tests at Porirua (B 388).

MATERIAL: Two hundred and sixty-six specimens found living in the organic debris surrounding the fronds and holdfasts of *Corallina*. Size range: diameter, 0.11-0.34 mm; height 0.07-0.24 mm; the final whorls have between four and five chambers; the total number of whorls varies between three and five.

Remarks

Trochammina sorosa was described by Parr (1950) from BANZARE Station 113, off Maria Island, off the east coast of Tasmania in 122-155 m. Two forms of the species occur in our samples, one being conical

cal and inflated, grading into a more compressed and smaller form (text-figs. 11–15). Thin sections were prepared to show the internal features, proloculum and aperture, but the results were not conclusive in establishing the existence of microspheric and megalospheric forms in the samples. We have examined a sediment from near Maria Island, off Tasmania, from 20–25 fm, and have found many specimens which bear a close resemblance to our own, and which we believe are identical with Parr's *T. sorosa*. Höglund (1947, pp. 202–203) has pointed out that Göes's type material of *T. vesicularis* is no longer to be found in the collections of the State Museum of Natural History, Stockholm, and until a neotype is designated we have hesitated to refer our specimens to the form described by Göes from Spitzbergen (Göes, 1894, p. 31, pl. 6, figs 235–237.) *Trochammina vesicularis* has been recorded from the coasts of California, Mexico, and South America by Cushman and McCulloch (1939, p. 106, pl. 12, fig. 1 a-c); our specimens are not as sharply conical as the specimen illustrated by these authors. Among the species of *Trochammina* described from the Antarctic there appear to be several closely allied forms which are difficult to separate. Such a plexus is found within the group comprising *T. malovens* Heron-Allen and Earland, *T. sorosa* Parr, *T. wiesneri* Parr, and *T. rotaliformis* Wright.

Genus *Gaudryina* d'Orbigny, 1839

Gaudryina convexa (Karrer), 1865. (Pl. 6, fig. 5A, B)

- Textilaria convexa* Karrer, 1865, p. 78, pl. 16, fig. 8a-c.
Gaudryina convexa. Burdett, Hedley, Hornibrook and Hurdle, 1963.
Gaudryina rugosa. Brady, 1884 p. 381, pl. 46, figs. 14–16.
Gaudryina rugosa. Heron-Allen and Earland, 1922, p. 122, pl. 4, figs. 16–17.
Gaudryina hastata Parr, 1932, p. 219, pl. 22, figs. 40a, b.
Gaudryina (Pseudogaudryina) hastata Vella, 1957, p. 8.
Gaudryina crespinae Cushman, 1936a, p. 14, pl. 2, figs. 15a, b.
Gaudryina crespinae. Hornibrook, 1961, p. 26, pl. 2, fig. 29.
Gaudryina (Pseudogaudryina) concava Collins, 1958, p. 355, pl. 1, figs. 14a-c.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Textilaria convexa* by Karrer (1865) from the Lower Miocene of Orakei Bay; as *Gaudryina rugosa* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, 144; as *Gaudryina (Pseudogaudryina) hastata* by Vella (1957) from Cook Strait; and as *Gaudryina crespinae* by Hornibrook (1961) from the Tertiary of Oamaru.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), New Plymouth (B 439).

Dead specimens at Mount Maunganui (B 434). All specimens were found in sand at the base of *Corallina* tufts.

MATERIAL: Thirtysix specimens. Size range: length, 0.28–0.96 mm; breadth, 0.21–0.58 mm.

Remarks

The holotype and topotypes of *Textilaria convexa* have been examined and found to belong to the genus *Gaudryina*. *Gaudryina convexa* (Karrer) is a common, very variable species in the New Zealand and Australian region ranging from Upper Eocene to Recent. *G. hastata* Parr, *G. crespinae* Cushman and *G. (Pseudogaudryina) concava* Collins, are regarded as synonyms of *G. convexa*, whilst the records of *G. rugosa* of Brady (1884) and Heron-Allen and Earland (1922) also belong to the present species. For a full taxonomic discussion of *G. convexa* see Burdett, Hedley, Hornibrook and Hurdle (1963).

Genus *Cyclogyra* Wood, 1842

Cyclogyra involvens (Reuss), 1849. (Textfig. 16.)

- Operculina involvens* Reuss, 1849, p. 370, pl. 45, fig. 20.
Cornuspira involvens. Heron-Allen and Earland, 1922, p. 74.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Cornuspira involvens* by Cushman (1919) off "Poor Knights" Island, east coast of New Zealand, by Heron-Allen and Earland (1922) from *Terra Nova* Stations 91, 96, 134, and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living free in sand and attached to stones at Wellington (B 368, B 374), Christchurch (B 391, B 400), Portobello (B



Text-fig. 16: *Cyclogyra involvens* (Reuss).

Peripheral view ($\times 100$). Drawn by Mr R. Brazier, N.Z. Geological Survey, Lower Hutt. Intertidal, Wellington. B.M. (N.H.) Reg. No. 1964.10.13.38.

405), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 150 specimens. Size range: maximum diameter, 0.11–0.26 mm.

Remarks

The New Zealand intertidal specimens are identical with *Cornuspira involvens* recorded by Heron-Allen and Earland (1922) from New Zealand *Terra Nova* Stations.

Cornuspira Schultze, 1854, has been suppressed as a junior synonym of *Cyclogyra* Wood, 1842, by Loebllich and Tappan (1964a).

Genus *Calcituba* von Roboz, 1884

Calcituba polymorpha von Roboz, 1884. (Pl. 7A-C.)

Calcituba polymorpha von Roboz, 1884, p. 421, figs. 1-16.

PREVIOUS RECORDS FROM NEW ZEALAND: None.

NEW RECORDS FROM NEW ZEALAND: Growing abundantly in culture pots set up with broken *Corallina* stems from Wellington (B 374), Porirua (B 388) and Christchurch (B 391), but not seen in preserved and stained samples of *Corallina* or washings of *Corallina* tufts.

Remarks

Schaudinn (1895), in a detailed account, illustrates morphological variation and some aspects of the cytology of this species. Cultures of *C. polymorpha* established in New Zealand during March 1961 are at the present time – October 1964 – still thriving (pl. 7) in the British Museum (Natural History).

Genus *Quinqueloculina* d'Orbigny, 1826

Quinqueloculina agglutinans d'Orbigny, 1839.

Quinqueloculina agglutinans d'Orbigny, 1839a, p. 195, pl. 12, fig. 11-13.

Miliolina agglutinans. Heron-Allen and Earland, 1922, p. 69.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Miliolina agglutinans* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 91, 96, as *Quinqueloculina agglutinans* by Hulme (1964) from Manukau Harbour, Auckland, and by Hedley, Hurdle and Burdett (1965) from *Discovery* Station D 939, off West Coast of North Island.

NEW RECORDS FROM NEW ZEALAND: Living at Porirua (B 388), Portobello (B 405), and Whanga-

paroa (B 420); empty tests at Mount Maunganui (B 434).

MATERIAL: Eighteen specimens living free in sand around tufts of *Corallina*.

Quinqueloculina auberiana d'Orbigny, 1839. (Pl. 8, fig. 5A-C.)

Quinqueloculina auberiana d'Orbigny, 1839a, p. 193, pl. 12, figs. 1-3.

Miliolina auberiana (part). Heron-Allen and Earland, 1922, p. 68.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as part of *Miliolina auberiana* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, 144.

NEW RECORDS FROM NEW ZEALAND: Living at Christchurch (B 400), Portobello (B 405), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Thirty-nine specimens. Size range: length, 0.20–0.80 mm; breadth, 0.17–0.60 mm; thickness, 0.15–0.49 mm.

Remarks

D'Orbigny described *Quinqueloculina auberiana* from the Recent sands of Cuba and illustrated a specimen approximately 0.5 mm in length. As the type specimens are not available in Paris, a specimen slightly larger (length 0.83 mm.) but otherwise identical with d'Orbigny's type figure was examined for comparison, from material from La Chorrera, Habana, Cuba, presented to the B.M. (N.H.) by P. J. Bermudez. The New Zealand intertidal specimens include forms approximately 0.5 mm in length which are identical with d'Orbigny's figures (pl. 12, fig. 1-3). A few of the specimens identified by Heron-Allen and Earland (1922) as *Quinqueloculina auberiana* are identical with our New Zealand intertidal specimens while the bicostate variety described by them (1922, p. 68) is identical with *Quinqueloculina bicostoides* described by Vella (1957, p. 25, pl. 5, figs. 89-92).

Quinqueloculina colleenae Vella, 1957.

Quinqueloculina (*Lachlanella*) *colleenae* Vella, 1957, p. 25, pl. 5, figs. 86, 93.

Miliolina ferussacii (part). Heron-Allen and Earland, 1922, p. 70.

Miliolina contorta (part). Heron-Allen and Earland, 1922, p. 69.

PREVIOUS RECORDS FROM NEW ZEALAND: As part of *Miliolina ferussacii* by Heron-Allen and Earland

(1922) *Terra Nova* Stations 90, 134, and 144; as part of *Miliolina contorta* by Heron-Allen and Earland (1922) from *Terra Nova* Station 96; and as *Q. (L.) colleenae* by Vella (1957).

NEW RECORDS FROM NEW ZEALAND: Living at New Plymouth (B 439); empty shells at Whangaparaoa (B 420).

MATERIAL: Eleven specimens free in the sand around tufts of *Corallina*.

Remarks

The New Zealand intertidal specimens are identical with specimens of *Q. colleenae* presented by Mr P. Vella. See also remarks on this species in Hedley, Hurdle and Burdett (1965). The subgenus *Lachlanella*, proposed by Vella (1957), is regarded as a synonym of *Quinqueloculina* by Loeblich and Tappan (1964a).

Quinqueloculina incisa Vella, 1957.

Quinqueloculina incisa Vella, 1957, p. 24, pl. 6, figs. 118-121.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded from Marlborough Sounds in 1 fm by Vella (1957) and from Manukau Harbour by Hulme (1964).

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Porirua (B 388), Christchurch (B 391, B 400), Whangaparaoa (B 420), Mount Maunganui (B 434), New Plymouth (B 439), and Portobello (B 405).

MATERIAL: Two hundred specimens. Size range: length, 0.24-0.62 mm; width, 0.15-0.34 mm; thickness, 0.10-0.22 mm.

Quinqueloculina patagonica d'Orbigny, 1839. (Pl. 8, fig. 6A-C.)

Quinqueloculina patagonica d'Orbigny, 1839c, p. 74, pl. 4, figs. 14-16.

PREVIOUS RECORDS FROM NEW ZEALAND: None.

NEW RECORDS FROM NEW ZEALAND: Empty shells at Porirua (B 388), Christchurch (B 400), Mount Maunganui (B 434), and Portobello (B 405).

MATERIAL: Twenty-one specimens. Size range: length, 0.34-0.58 mm; breadth, 0.16-0.33 mm; thickness, 0.13-0.22 mm.

Remarks

When reporting this species from Antarctic localities and Tasmania, Parr (1950) noted that, "While *Q. patagonica* has been neglected by most authors since it was described, it is probable that some of the Recent records of *Q. pygmaea* Reuss relate to this species". We have examined the *Miliolina pygmaea* of Heron-Allen and Earland (1922) from *Terra Nova* stations and consider them to be distinct from the *Q. patagonica* reported here.

The type specimens of *Q. patagonica* are not available in the d'Orbigny collection in Paris.

Quinqueloculina seminulum (Linnaeus), 1758.

Serpula seminulum Linnaeus, 1758, p. 786.

Quinqueloculina magellanica d'Orbigny, 1839c, p. 77, pl. 9, fig. 19-21.

Miliolina seminulum. Heron-Allen and Earland, 1932, pp. 313-314, pl. 6, figs. 25-27.

Quinqueloculina (Quinqueloculina) triangularis. Vella, 1957, p. 23, pl. 6, figs. 100, 101, 108.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Miliolina seminulum* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, and 134, as *Quinqueloculina (Quinqueloculina) triangularis* by Vella (1957) from Cook Strait, as *Quinqueloculina seminula* by Hornibrook (1961) from Oamaru, and as *Quinqueloculina seminulum* by Hedley, Hurdle and Burdett (1965) from the west coast of New Zealand.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Christchurch (B 391, B 400), Whangaparaoa (B 420), and Mount Maunganui (B 434).

MATERIAL: Approximately 30 specimens. Size range: length, 0.26-0.78 mm; width, 0.17-0.49 mm; thickness, 0.13-0.35 mm.

Remarks

Quinqueloculina seminulum has been recorded by numerous authors from many parts of the world; but owing to the inadequate description and figure given by Linnaeus, widely differing forms have been referred to this species. Loeblich and Tappan (1964a, p. C458) have erected a neotype for *Q. seminulum*, from the type locality, Recent shore sand, at Rimini. We have examined specimens of *Miliolina seminulum*, identified by Parker and Jones from Rimini shore-sand, and these specimens include forms very similar to the neotype proposed by Loeblich and Tappan. The New Zealand intertidal specimens, though smaller, are otherwise identical with the Rimini specimens. Specimens

of *Q. seminulum* in the New Zealand material exhibit a range of variation from forms similar to the neotype of Loeblich and Tappan (1964a), to others with a more rounded periphery and more slightly inflated chambers. *Quinqueloculina* (*Quinqueloculina*) *triangularis* recorded by Vella (1957) is considered to fall within the range of *Q. seminulum* (Hedley, Hurdle and Burdett, 1965). *Quinqueloculina triangularis* d'Orbigny, was described from the Tertiary of the Vienna Basin, and is placed in the synonymy of *Quinqueloculina akneriana* d'Orbigny by Marks (1951, p. 38).

Heron-Allen and Earland (1932, pp. 313, 314) discuss the *Quinqueloculina seminulum* complex and consider *Quinqueloculina araucana* d'Orbigny, *Quinqueloculina magellanica* d'Orbigny and *Quinqueloculina isabellei* d'Orbigny to come within their accepted range of *Q. seminulum*. The New Zealand intertidal specimens are identical with d'Orbigny's type specimens of *Quinqueloculina magellanica*, and with those identified as *Miliolina magellanica* by Heron-Allen and Earland (1932) from the Falkland Islands.

For further information concerning the synonymy of this species, see discussion in Hedley, Hurdle and Burdett (1965).

***Quinqueloculina tenagos* Parker, 1953. (Pl. 9, fig. 1A-C.)**

Quinqueloculina costata d'Orbigny, 1826, p. 135 (p. 301, nomen nudum).

Quinqueloculina costata. Terquem, 1878, p. 63, pl. 6, fig. 3-5.

Quinqueloculina rhodiensis Parker, new name, Parker, Phleger and Peirson, 1953, p. 12, pl. 2, fig. 15-17.

Quinqueloculina tenagos Parker, new name, Parker 1962, p. 110.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Quinqueloculina costata* by Hulme (1964) from Manukau Harbour, Auckland.

NEW RECORDS FROM NEW ZEALAND: Living at Porirua (B 388).

MATERIAL: Fifty specimens living free in sand. Size range: length, 0.17–0.53 mm; width, 0.10–0.35 mm; thickness, 0.06–0.25 mm.

Remarks

The 50 specimens of *Q. tenagos* examined from Porirua range between finely and coarsely ribbed specimens. The aperture, also variable, is in some specimens situated at the end of a short neck. The type of *Q. costata*, is not available in the d'Orbigny Collections.

Genus **Massilina** Sehlumberger, 1893

***Massilina brodiei* sp. nov. (Pl. 8, fig. 1A-C; text-fig. 17-19.)**

Type Description

Test free, compressed, initial chambers arranged in a quinqueloculine plan, later chambers spiroloculine; periphery variably acute; chambers distinct, very slightly inflated; sutures fairly distinct in last formed chambers; wall calcareous, smooth, opaque, imperforate, aperture terminal, elongate with a slight lip and bifid tooth occupying almost the entire apertural opening.

DIMENSIONS OF THE HOLOTYPE: Length, 0.55 mm; width, 0.39 mm; thickness, 0.21 mm.

SIZE RANGE OF OTHER SPECIMENS: Length, 0.40–0.68 mm; width, 0.26–0.47 mm; thickness, 0.18–0.22 mm.

TYPE MATERIAL: Deposited in the British Museum (Natural History):

- (a) Holotype (pl. 8, fig. 1A-C). B.M. (N.H.) Reg. No. 1964. 10. 13. 42.
- (b) Hypotype (text-fig. 17–19). B.M. (N.H.) Reg. No. 1964. 10. 13. 43–45.
- (c) Thirty paratypes and topotypic material.

Two paratypes are deposited in the N.Z. Geological Survey. Thirty-five specimens have been examined, all were living free in the sand among the tufts of *Corallina*.

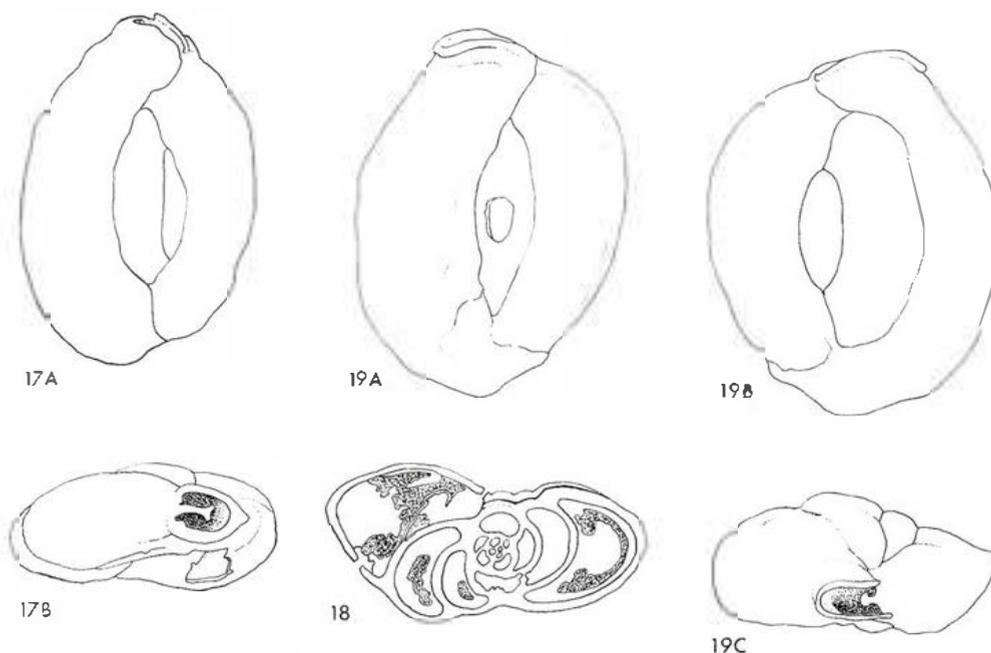
VARIATION: The apertural tooth is variable (text-fig. 17b, 19c) ranging from a simple tooth to a typically “quinqueloculine” bifid tooth. The chambers of some specimens are more inflated, and the test appears less compressed.

TYPE LOCALITY: Wellington, North Island, New Zealand: N.Z. Oceanographic Institute Station B 374, 41°20'55"S, 174°48'30"E. *Corallina* tufts and washings. Intertidal.

OTHER LOCALITIES: *Massilina brodiei* occurs also in *Corallina* tufts and washings at the following intertidal localities:

- (a) Wellington N.Z.O.I. Sta. B 368.
- (b) Taylors Mistake, Christchurch, N.Z.O.I. Sta. B 391.
- (c) Aquarium Point, Portobello, N.Z.O.I. Sta. B 405.
- (d) Mount Maunganui, N.Z.O.I. Sta. B 434.
- (e) Kawaroa Park, New Plymouth, N.Z.O.I. Sta. B 439.





Text-fig. 17–19: *Massilina brodiei* sp. nov.

17A: peripheral view of hypotype ($\times 95$); B: apertural view showing bifid tooth ($\times 103$). From N.Z.O.I. Sta. B 434, Mount Maunganui. B.M. (N.H.) Reg. No. 1964.10.13.43.

18: section of hypotype, showing chamber arrangement. The earliest chambers are arranged in a quinqueloculine plan, whilst the later chambers are spiroloculine. The latter chambers contain protoplasmic material ($\times 68$).

From N.Z.O.I. Sta. B 391, Christchurch. B.M. (N.H.) Reg. No. 1964.10.13.45.

19A, B: opposite peripheral views of holotype ($\times 102$); C: apertural view, showing short bifid tooth ($\times 104$).

From N.Z.O.I. Sta. B 434, Mount Maunganui. B.M. (N.H.) Reg. No. 1964.10.13.44.

Remarks

Massilina brodiei n. sp. was found alive at six New Zealand intertidal stations and appears distinct from any previously described species from the area. This species is most closely allied to *Pseudomassilina australis* (Cushman), previously *Miliolina secans* of Brady (1884, p. 167, pl. 6, fig. 1, 2), but differs in having a regular outline, less compressed test, and a large apertural tooth. The intertidal specimens are referred to *Massilina* as defined by Schlumberger (1893, p. 218)—forms with a quinqueloculine arrangement of the initial chambers with the later chambers added on opposite sides in a single plane and the aperture simple with a bifid tooth.

Nothing comparable with the New Zealand intertidal specimens was found on examination of material identified by Heron-Allen and Earland from the Kerimba Archipelago (1914–15), *Terra Nova* Stations (1922), Lord Howe Island (1924), and *Discovery* Stations (1932, 1933, 1934, 1936). This new form is named after Mr J. W. Brodie, Director of the N.Z. Oceanographic Institute, Wellington.

Genus *Pateoris* Loeblich and Tappan, 1953

Pateoris hauerinoides (Rhubler), 1936. (Pl. 8, fig. 4A–C.)

Quinqueloculina subrotunda forma *hauerinoides* Rhumbler, 1936. pp. 206. 217. 226. text-figs. 167 (p. 205). 208–212 (p. 225).

Miliolina subrotunda, Heron-Allen and Earland (part). 1922, p. 65.

Pateoris hauerinoides, Loeblich and Tappan, 1953, p. 42. pl. 6, fig. 8–12; text-figs. 1 A and B.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as part of *Miliolina subrotunda* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 91 and 134.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Christchurch (B 391, B 400), Portobello (B 405), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439); empty shells at Porirua (B 388).

MATERIAL: Approximately 130 specimens, and many juvenile forms which may be referable to this species. Size range: length, 0.23–0.60 mm; width, 0.30–0.74 mm; thickness, 0.15–0.33 mm.

Remarks

Pateoris hauerinoides was first described by Rhumbler (1936) as *Quinqueloculina subrotunda* forma *hauerinoides* from Kiel Bay, North Germany. *P. hauerinoides* was raised to specific rank and designated the type species of *Pateoris* by Loeblich and Tappan (1953), because this species, lacking the typical “Miliolinella” type of aperture, and with a massiline arrangement of the later chambers, was not considered to be a variety of *Quinqueloculina subrotunda*, designated the type species of *Miliolinella* by Wiesner (1931, p. 63). According to Loeblich and Tappan (1953, p. 43) this species has often been confused with *Miliolinella subrotunda* (Montagu) and we suggest that it may have been previously recorded from the New Zealand area under this name. *M. subrotunda* of Heron-Allen and Earland (1922) is poorly represented, but the smaller specimens are identical with the intertidal specimens.

Genus *Miliolinella* Wiesner, 1931

Miliolinella labiosa (d’Orbigny), 1839. (Pl. 8, fig. 2A–C.)

Triloculina labiosa d’Orbigny, 1839a. p. 157, pl. 10. fig. 12–14.

Miliolina labiosa. Heron-Allen and Earland. 1922, p. 65.
Miliolinella labiosa. Wiesner, 1931, p. 108. pl. 15, figs. 181–182.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Miliolina labiosa* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 96 and 134, as *Triloculina labiosa* by Cushman (1919) off Poor Knights Island, New Zealand, and as *Miliolinella labiosa* by Hulme (1964) from Manukau Harbour, Auckland.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Porirua (B 388), Christchurch (B 391, B 400), Portobello (B 405), Whangaparaoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 500 specimens, the majority free in the sand, while some are attached to *Corallina*. Size range: length, 0.21–0.53 mm; width, 0.17–0.66 mm; thickness, 0.13–0.41 mm.

Remarks

Miliolinella labiosa is a very common, variable, intertidal species, although specimens from Porirua (B

388) are more regular in both size and shape of test.

“*Triloculina*” *labiosa* was first described by d’Orbigny (1839a) from the Recent sands of Cuba and later by Bermudez (1935) from “La Chorrera, Habana, 2–5 fathoms”. As the type specimens are missing from the d’Orbigny Collections, we have examined topotypic material, presented by P. J. Bermudez. Approximately 50 specimens were selected, which correspond with d’Orbigny’s type figure and description. These Cuban specimens were compared with those from intertidal localities of New Zealand and with the “*Miliolina*” *labiosa* reported by Heron-Allen and Earland (1922) from *Terra Nova* Stations 96 and 134 and all were found to be identical.

The genus *Miliolinella* is discussed by Loeblich and Tappan (1953, p. 45).

Miliolinella labiosa var. *schauinslandi* (Rhumbler), 1906. (Pl. 8, fig. 3A, B.)

Miliolina schauinslandi Rhumbler, 1906. p. 41.

Nubecularia schauinslandi. Heron-Allen and Earland. 1924, p. 601. pl. 35, figs. 2–5.

Triloculina labiosa var. *schauinslandi*. Parr, 1932. p. 220. pl. 22, fig. 43.

Triloculina hibiosa var. *schauinslandi*. Parr, 1945. p. 198.

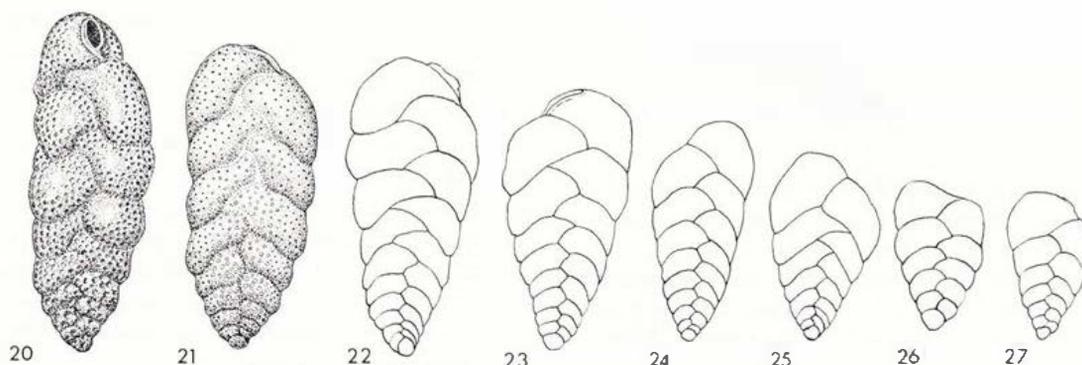
PREVIOUS RECORDS FROM NEW ZEALAND: None.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368), B 374), Christchurch (B 391, B 400), Portobello (B 405), Whangaparaoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 100 specimens living free in sand. The “length” of the largest of these distorted forms is 1.32 mm.

Remarks

This wild growing variety of *Miliolinella labiosa* is a very common intertidal form, except at Porirua where more regular forms persist. The intertidal specimens compare favourably with those referred to *Nubecularia schauinslandi* by Heron-Allen and Earland (1924, p. 601) from Lord Howe Island, with the figures given by Parr (1932, p. 220, pl. 22, fig. 43) of *Triloculina labiosa* var. *schauinslandi*, and are identical with specimens selected by us from shore sand, “Barwon Heads, below little jetty” described by Parr (1945, p. 198). The variation is such that the “Miliolinella” type of aperture becomes less distinct with a tendency to become “cruciloculine”.



Text-fig. 20-21: *Bolivina compacta* Sidebottom.

20-21: peripheral view ($\times 96$), drawn by Mr R. Brazier, N.Z.G.S., Lower Hutt. Intertidal, Wellington. B.M. (N.H.) Reg. No. 1964.10.13.62-63.

Text-fig. 22-27:

Outline drawings illustrating variation in outline and chamber arrangement showing the gradation of forms intermediate between *B. compacta* and *B. inflata*.

B. inflata is regarded as a synonym of *B. compacta*.

(22: $\times 96$; 23: $\times 92$; 24: $\times 94$; 25: $\times 90$; 26: $\times 97$; 27: $\times 103$).

From N.Z.O.I. Sta. B 405, Portobello. B.M. (N.H.) Reg. No. 1964.10.13.64.69.

Genus *Bolivina* d'Orbigny, 1839

Bolivina pseudoplicata Heron-Allen and Earland, 1930. (Pl. 9, fig. 4A, B.)

Bolivina pseudoplicata Heron-Allen and Earland, 1930, p. 81, pl. 3, figs. 36-40.

Bolivina plicata (part). Heron-Allen and Earland, 1922, p. 135.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Bolivina plicata* by Heron-Allen and Earland (1922) from Terra Nova Stations 90, 91, 96, 134 and as *Bolivina pseudoplicata* by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Porirua (B 388), Portobello (B 405), Mount Maunganui (B 434), and New Plymouth (B 439); empty tests at Christchurch (B 400) and Whangaparoa (B 420).

MATERIAL: Approximately 120 specimens. Size range: length, 0.18-0.43 mm; width, 0.12-0.18 mm; thickness, 0.08-0.11 mm.

Remarks

The New Zealand intertidal specimens are identical with the syntypes of *Bolivina pseudoplicata* Heron-Allen and Earland (1930) from Plymouth, England. Both the syntypes and New Zealand specimens show

similar variation; in some forms the chambers are more inflated and the ornamentation less pronounced, while others are much more compressed with well defined ornamentation.

Bolivina compacta Sidebottom, 1905. (Pl. 9, fig. 3A, B; text-fig. 20-27.)

Bolivina robusta var. *compacta* Sidebottom, 1905, p. 15, pl. 13, fig. 7a, b.

Bolivina inflata Heron-Allen and Earland, 1913, p. 68, pl. 4, figs. 16-19.

Bolivina inflata. Heron-Allen and Earland, 1922, p. 135.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Bolivina inflata* by Heron-Allen and Earland (1922) from Terra Nova Stations 134, 144 and as *Bolivina inflata* by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Porirua (B 388), Christchurch (B 391, B 400), Portobello (B 405), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 200 specimens. Size range: length, 0.18-0.40 mm; width, 0.10-0.18 mm; thickness, 0.08-0.14 mm.

Remarks

Bolivina compacta represented at all stations is a very common New Zealand intertidal species. At Portobello (B 405) the specimens show considerable variation, and include forms identical with *Bolivina inflata* of Heron-Allen and Earland (1913), and others identical with syntypes (text-figs. 20–27) of *Bolivina compacta* Sidebottom (1905). Many specimens intermediate between these forms are also represented, and we consider that with a large suite of specimens it is impossible to distinguish between them. Several specimens of both the *inflata* and *compacta* types have been sectioned, but microspheric and megalospheric forms cannot be clearly distinguished.

Bolivina compacta was first described as a variety of *Bolivina robusta* by Sidebottom (1905) from 8–14 fm, off the coast of the Island of Delos, Grecian Archipelago. As we are unable to find the specimen illustrated by Sidebottom (pl. 3, fig. 7a, b), we have selected one of the syntypes deposited in the collection of the B.M. (N.H.), as lectotype of *Bolivina compacta*. Description of Lectotype B.M. (N.H.) Reg. No. 1964. 10. 13. 61.

Test free, small, elongate, tapering gradually with slightly compressed initial end; periphery rounded, slightly lobulate; 21 chambers biserially arranged throughout, low and broad at first, increasing in relative height as added, later ones more inflated; sutures distinct, depressed, strongly curved, slightly oblique, wall thin, opaque, perforate; aperture elongate bordered with a lip.

Size of Lectotype: Length, 0.37 mm; width, 0.16 mm; thickness, 0.095 mm. Size range of Sidebottom's syntypes: length, 0.31–0.58 mm; width, 0.17–0.21 mm; thickness, 0.11–0.15 mm.

Genus *Brizalina* Costa, 1856

Brizalina cacozela (Vella), 1957. (Pl. 9, fig. 2A, B.)

Bolivina cacozela Vella, 1957, p. 33. pl. 8. fig. 162. 163.
Bolivina punctata (part). Heron-Allen and Earland, 1922, p. 132.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Bolivina cacozela* by Vella (1957) from Cook Strait and as part of *Bolivina punctata* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134 and 144.

NEW RECORDS FROM NEW ZEALAND: Living at Portobello (B 405), Whangaparoa (B 420), and New Plymouth (B 439).

MATERIAL: Approximately 50 specimens. Size range: length, 0.16–0.40 mm; width, 0.09–0.13 mm; thickness, 0.06–0.07 mm.

Remarks

Loeblich and Tappan (1964a, p. C 549) have restricted the genus *Bolivina* d'Orbigny, 1839, to include species possessing broad, low chambers, the basal margins of which are bordered by retral processes or crenulations. Many species, formerly included in *Bolivina*, are assigned by these authors to the genus *Brizalina*, characterised by the possession of a compressed test with limbate sutures, but lacking the basal chamber lobes or crenulations of *Bolivina*. Following this emendation of the genus *Bolivina*, we have included *B. cacozela* under *Brizalina*.

According to Vella (1957) *Bolivina cacozela*, although very similar to *Bolivina numerosa*, is distinguished by its narrow shape, less carinate periphery, slightly inflated chambers and less curved limbate sutures. It is worthy of note, however, that at Whangaparoa (B 420) and New Plymouth (B 439) the differences between these two species are less distinct and intermediate forms are found very similar to Williamson's syntypes of *B. spathulata* (see Hedley, Hurdle and Burdett, 1965). Specimens of *Bolivina punctata* identified by Heron-Allen and Earland (1922) show a range of variation identical with that shown by *B. spathulata* and *B. cacozela* from Whangaparoa and New Plymouth. We hesitate to place this latter species in synonymy with *B. spathulata*, but we consider the supposed differences distinguishing the two species may prove to be accounted for by infra-specific variation or differences between micro- and megalospheric forms. Lutze (1964, p. 114), in a statistical study of *Bolivina argentea* Cushman, has suggested that *B. cacozela* may be a synonym of *B. argentea*.

Brizalina spathulata (Williamson), 1858.

Textularia variabilis var. *spathulata* Williamson, 1858, p. 76, pl. 6, figs. 164, 165.
Bolivina dilatata. Brady, 1884, p. 418. pl. 52, figs. 20, 21.
Bolivina dilatata (part). Heron-Allen and Earland, 1922, p. 134.
Bolivina punctata (part). Heron-Allen and Earland, 1922, p. 132.
Bolivina numerosa Vella, 1957, p. 33. pl. 8, figs. 160, 161.
Brizalina spathulata. Hedley, Hurdle and Burdett, 1965, p. 21. pl. 6 fig. 23a, b; text fig. 6a-g.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as part of *Bolivina dilatata* and *Bolivina punctata* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, 144, as *Bolivina numerosa* by Vella (1957) from Cook Strait, and as *Bolivina spathulata* by Hulme (1964) from Manukau Harbour, and as *Brizalina spathulata* by Hedley, Hurdle and Burdett (1965) from *Discovery* Station 939 – West coast, New Zealand.

NEW RECORDS FROM NEW ZEALAND: Empty tests found at Wellington (B 368, B 374), Porirua (B 388),

Christchurch (B 400), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 40 specimens. Size range: length, 0.22–0.43 mm; width 0.12–0.15 mm; thickness, 0.07–0.08 mm.

Remarks

The New Zealand intertidal specimens are identical with Williamson's syntypes of *Bolivina spathulata* and ideotypes of *Bolivina numerosa* Vella. Hedley, Hurdle and Burdett (1965) have noted the variation among Williamson's syntypes and synonymised *Bolivina numerosa* Vella, together with the records of *Bolivina dilatata* by Brady (1884) and Heron-Allen and Earland (1922). At Whangaparoa (B 420) and New Plymouth (B 439) several specimens with gently tapering tests, less carinate periphery, and large proloculi are found intermediate between *B. spathulata* and *Bolivina cacozela* Vella. The *Bolivina punctata* identified by Heron-Allen and Earland (1922) are identical with the New Zealand intertidal specimens of both *B. spathulata* and *B. cacozela*.

For the assignment of this species to *Brizalina*, see remarks on *B. cacozela* and also Hedley, Hurdle and Burdett (1965).

Genus *Cassidulinoides* Cushman, 1927

Cassidulinoides orientalis (Cushman), 1922. (Pl. 12, fig. 5A, B.)

- Cassidulina orientalis* Cushman, 1922, p. 129.
- Cassidulina orientale* Cushman, 1925, p. 37, pl. 7, figs. 6a-c.
- Cassidulina bradyi*. Brady, 1884, p. 431, pl. 54, fig. 10 (not figs. 6-9).
- Cassidulina bradyi*. Heron-Allen and Earland, 1922, p. 139.
- Cassidulinoides*. Cushman, 1927, p. 84.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Cassidulina bradyi* by Cushman (1919), from "Poor Knight" Island—later identified as *C. orientalis* by Cushman (1922, p. 129); as *Cassidulina bradyi* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, and 144, and as *Cassidulinoides orientalis* by Vella (1957) from Cook Strait, by Hornibrook (1961) Tertiary to Recent, Oamaru District, and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374); empty tests at Mount Maunganui (B 434) and New Plymouth (B 439).

MATERIAL: Approximately 50 specimens. Size range: length, 0.23–0.38 mm; width, 0.19–0.30 mm; thickness, 0.14–0.18 mm.

Remarks

Cushman (1922, p. 129), after further examination of the New Zealand specimens previously recorded by him as *Cassidulina bradyi* (Cushman, 1919, p. 606), considered this South Pacific, possibly Indo-Pacific species, distinct from *Cassidulina bradyi* Norman and suggested *Cassidulina orientalis* as a new name. Cushman (1925, p. 37) described this South Pacific form as *Cassidulina orientale* sp. nov. and synonymised *Cassidulina bradyi* (Brady, 1884, pl. 54, fig. 10 but not figs. 6–9).

Specimens of *Cassidulina bradyi* identified by Norman from Oster Fiord, Norway, and off Valentia I., Ireland, were compared by us with *C. bradyi* of Brady from *Porcupine* Station 35, South of Ireland, 96 fm (pl. 54, figs. 6–9) and from *Challenger* Station 305, West of Patagonia (pl. 54, fig. 10). Brady's specimens from *Porcupine* Station 35 are identical with *C. bradyi* of Norman, but Brady's specimens from Patagonia, *Challenger* Station 305, are broader, with a more acute periphery, and the tendency to form an elongate uniserial part is less marked. Both the New Zealand intertidal specimens and *Cassidulina bradyi* of Heron-Allen and Earland from the *Terra Nova* Stations are identical with Brady's specimens from Patagonia, *Challenger* Station 305 (pl. 54, fig. 10).

Genus *Virgulopsis* Finlay, 1939

Virgulopsis turris (Heron-Allen and Earland), 1922. (Pl. 9, fig. 5A, B.)

- Verneuilina turris* Heron-Allen and Earland, 1922, p. 124, pl. 4, figs. 8-12.
- Virgulopsis turris*. Vella, 1957, p. 32.

PREVIOUS RECORDS FROM NEW ZEALAND: Described as *Verneuilina turris* by Heron-Allen and Earland (1922), from *Terra Nova* Stations 91, 96, 134, and 144, as *Virgulopsis turris* by Vella (1957) from Cook Strait and Tertiary Pleistocene faunas, and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living at Christchurch (B 391, Mount Maunganui (B 434), New Plymouth (B 439); empty shell found at Wellington (B 374).

MATERIAL: Approximately 40 specimens. Size range: length, 0.15–0.30 mm; width 0.10–0.14 mm; thickness, 0.11–0.14 mm.

Remarks

Although the size range of the New Zealand intertidal specimens is slightly larger than that recorded by Heron-Allen and Earland (1922), we consider our specimens and theirs and hypotypes identified as *Virgulopsis turris* by Vella (1957) to be identical.

Genus *Discorbis* Lamarck, 1804

Discorbis dimidiatus (Parker and Jones), 1862. (Pl. 1, fig. 4; pl. 10, fig. 1-3; text-fig. 28-43.)

Discorbina dimidiata Parker and Jones, 1862, p. 201, text-fig. 32b.

Discorbina dimidiata. Parker and Jones, 1865, pp. 385, 422, 438, pl. 19, figs. 9a-c.

Discorbina vesicularis. Brady, 1884, p. 651, pl. 87, fig. 2a-c.

Discorbina rosacea. Brady (part), 1884, p. 664, pl. 87, fig. 4a-c.

Discorbis vesicularis var. *acervulinoides* Parr, 1932, p. 229, pl. 21, figs. 30a-c.

Lamellodiscorbis dimidiata. Bermudez, 1952, p. 39, pl. 4, fig. 4a-c.

Discorbis dimidiatus var. Vella, 1957, p. 35, pl. 8, figs. 166, 172-174.

Discorbis dimidiatus. McKenzie, 1962, p. 125, pl. 3, figs. 7-8.

Discorbis dimidiatus var. *acervulinoides*. McKenzie, 1962, p. 125, pl. 3, fig. 9.

Lamellodiscorbis dimidiata. Loeblich and Tappan, 1964a, pp. C 579-C 580, fig. 456: 5-6.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Discorbis dimidiatus* var. by Vella (1957) from Cook Strait and as *Discorbis dimidiatus* by Hulme (1964) from Manukau Harbour, Auckland.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368), B 374), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439); empty shells at Christchurch (B 391) and Portobello (B 405).

MATERIAL: Two hundred and fifty specimens attached to the tufts and fronds of *Corallina*. Size range: length, 0.21-1.28 mm; width, 0.19-0.88 mm; thickness, 0.11-0.66 mm.

Remarks

Discorbis dimidiatus is a very common species among New Zealand intertidal material and, when attached to *Corallina*, is usually bordered by a layer of mucilaginous material in which sand grains are often embedded (pl. 1, fig. 4). Empty tests become detached and occur free in the sand among the tufts of *Corallina*.

The New Zealand specimens were compared with the lectotype and paralectotypes of *Discorbina dimidiata* selected by A. R. Loeblich, jun, from the Parker and Jones collection in the B.M. (N.H.) This species was first described by Parker and Jones (1862) from sponge sand, Melbourne, Australia. Our study of *D. dimidiatus* extends to a comparison of the New Zealand intertidal specimens with material from Australian and other Pacific localities. A comparison has also been made between *D. dimidiatus* and *D. vesicularis*

(Lamarck), the type species of *Discorbis*. Suites of specimens from the localities listed below show wide ranges of variation, and an account is given of the conclusions reached from this study in the light of previous work by Brady (1884), Parr (1932), Bermudez (1952), and Hornibrook and Vella (1954).

Material from the following localities has been examined:

- (1) Barwon Heads, Victoria, Australia, shore sand.
- (2) Barwon Heads, below little jetty, shore sand near mouth of Barwon River.
- (3) Ocean Beach, Barwon Heads, west side of river mouth.
- (4) St. Kilda, Melbourne, shore sand.
- (5) Gulf of St. Vincents, South Australia, shore sand.
- (6) *Challenger* Station 187A off Booby Island, 8 fm.
- (7) Additional material from Henley Beach, Adelaide, was lent by Mr N. de B. Hornibrook of the N.Z. Geological Survey.
- (8) Madame Y. le Calvez and Dr J. Sigal (Paris, France) kindly donated material and specimens of *Discorbis vesicularis* (Lamarck) from the type locality of Grignon, Paris Basin Lutetian.

The lectotype and paralectotypes of *Discorbina dimidiata*, deposited in the B.M. (N.H.), have been compared with specimens of *D. dimidiatus* from New Zealand, Australia, and the Pacific. The types range from 1.28-1.54 mm in length, 1.12-1.26 mm in width, and 0.60-0.52 mm in thickness. The umbilical side of the types is flattened, and the whorls vary from a nearly involute to a partially evolute condition, whilst the umbilical plates become irregular, especially along the margins of the sutures of the terminal chambers (pl. 10, fig. 1A-C). Two paratypes have been figured by Loeblich and Tappan (1964a).

The New Zealand intertidal specimens of *D. dimidiatus* are predominantly evolute, and the shape of the test is extremely variable (text-fig. 28-33); the umbilical plates are short, thickened and bordered by deep clefts. Parr (1932, p. 228) gave an account of three basic variants of the *D. vesicularis*-*D. dimidiatus* group from Australian localities, and also a description of a new variety, *Discorbis vesicularis* var. *acervulinoides*. A similar range of variants occur in the Australian material examined by us from the localities listed. These samples yielded several hundred specimens, which show a gradation from the nearly involute to completely evolute, dome shaped, type of test typified by *D. vesicularis* var. *acervulinoides*. The shape of the test, including the height of the spire, appears to be influenced by the mode of attachment. In spite of Parr's assertion (1932, p. 229) that microspheric and megalospheric forms of *D. vesicularis* var. *acervulinoides* can be distinguished, we have been

unable to do so in 600 specimens from the type locality—Gulf of St. Vincent, South Australia, shore sand. When large suites of specimens are examined the distinction between the microspheric and megalospheric forms mentioned by Parr (1932, p. 229) ceases to be apparent. Furthermore, many intermediate forms between *D. dimidiatus* and *D. vesicularis* var. *acervulinoides* occur among the 600 specimens selected from Gulf St. Vincent, the size range of which is: length, 0.85–1.60 mm; width, 0.76–1.16 mm; thickness, 0.52–0.63 mm (text-fig. 34–43). Similar ranges of variation occur in the other Australian material examined.

Discorbis dimidiatus has been frequently compared with the closely allied Eocene species *Discorbis vesicularis*, for example, by Parr (1932) and Hornibrook and Vella (1954), all of whom have regarded *D. dimidiatus* as specifically distinct from *D. vesicularis*. Bermudez (1952, p. 39), however, erected the genus *Lamellodiscorbis* and designated *D. dimidiatus* as the type species, basing the genus on the figures of *D. vesicularis* by Brady (1884, pl. 87, fig. 2a–c). Hornibrook (1961, p. 97) listed *Lamellodiscorbis* among

the synonyms of *Discorbis*, thus incorporating an earlier opinion regarding the distinctions between these two genera (Hornibrook and Vella, 1954, pp. 27–28).

Approximately 400 specimens of *Discorbis vesicularis* from the type locality at Grignon have been examined. The size range of these specimens is: length, 0.29–2.92 mm; width, 0.28–2.52 mm; thickness, 0.14–0.86 mm. In general, the smaller specimens possess broadly rounded chambers set in a low evolute spire, with deep clefts between the sutures on the umbilical side, whilst the umbilical plates are broad and flat and fused together (pl. 10, fig. 4: text-fig. 45–49). The larger specimens also possess a low evolute spire and the umbilical plates become thickened and somewhat irregular, and in some specimens form raised bosses. These larger specimens are in general agreement with the figure of *D. vesicularis* given by Le Calvez (1949, p. 16, pl. 3, figs. 3.6–3.8). A range of variation similar to that shown by our own specimens of *D. vesicularis* from Grignon has been illustrated by Kaasschieter (1961, p. 206, pl. 11, figs. 11–13) from the Eocene of Belgium. Several specimens of *D. vesicularis* from Grignon were sectioned, both horizontally and verti-

Text-fig. 28–35: Discorbis dimidiatus (Parker and Jones).

28: spiral view (× 38), drawn by Mr R. Brazier, N.Z. Geological Survey, Lower Hutt.

Intertidal, Wellington. B.M. (N.H.) Reg. No. 1964.10.13.77.

29–33: outline drawings illustrating variation in shape of test and extent of the umbilical plates. The New Zealand specimens are predominantly evolute, and the umbilical plates short and thickened.

29A: spiral view (× 41); B: umbilical view (× 40); C: side view (× 40). B.M. (N.H.) Reg. No. 1964.10.13.78.

30A: spiral view (× 40); B: side view (× 39); C: umbilical view (× 40). B.M. (N.H.) Reg. No. 1964.10.13.79.

31A: spiral view (× 38); B: side view (× 40); C: umbilical view (× 38). B.M. (N.H.) Reg. No. 1964.10.13.80.

32A: spiral view (× 39); B: umbilical view (× 39); C: side view (× 45), B.M. (N.H.) Reg. No. 1964.10.13.81.

33A: spiral view (× 41); B: side view (× 42); C: umbilical view (× 40). B.M. (N.H.) Reg. No. 1964.10.13.82.

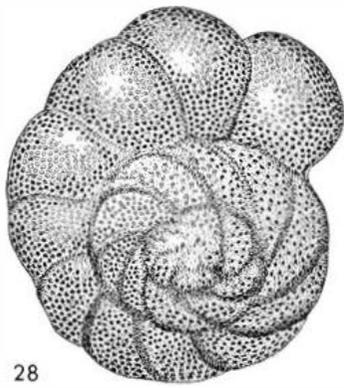
From N.Z.O.I. Sta. B 368, Wellington.

34–35: outline drawings showing range of variants found in South Australian material. Figs 34–35, together with Figs. 36–43, illustrate forms of the species ranging from the nearly involute test, typical of the original types of Parker and Jones, to the complete evolute, dome-shaped test represented by the variant originally described by Parr as *D. dimidiatus* var. *acervulinoides*. Among the latter variants the umbilical plates, which in the types of Parker and Jones are irregular and fairly extensive, become thickened and often restricted in extent.

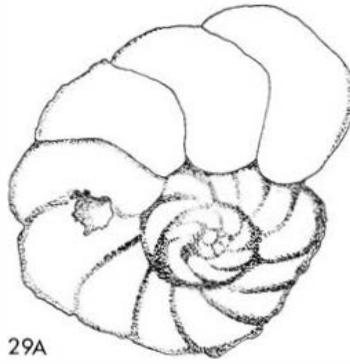
34A: spiral view (× 38); B: side view (× 37); C: umbilical view (× 38). B.M. (N.H.) Reg. No. 1964.10.13.83.

35A: spiral view (× 38); B: umbilical view (× 40); C: side view (× 40). B.M. (N.H.) Reg. No. 1964.10.13.84.

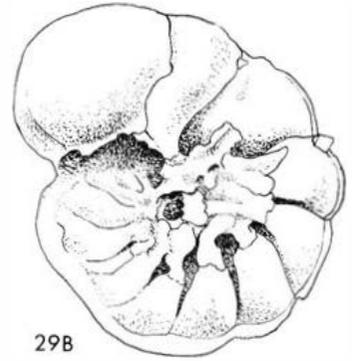
From shore sand, Gulf of St. Vincent, S. Australia.



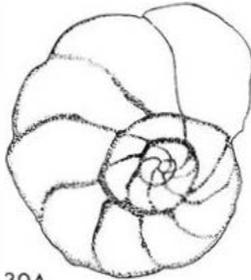
28



29A



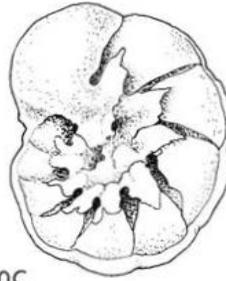
29B



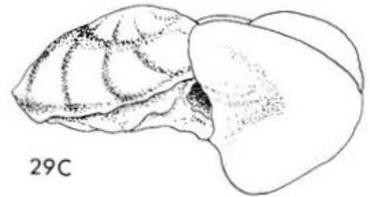
30A



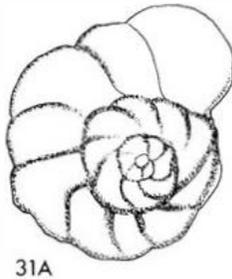
30B



30C



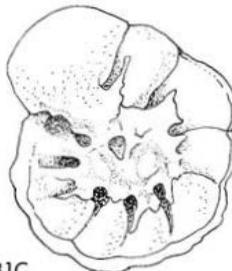
29C



31A



31B



31C



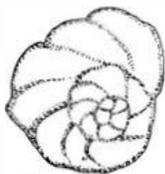
32A



32B



32C



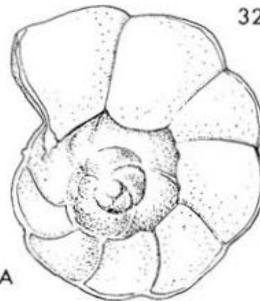
33A



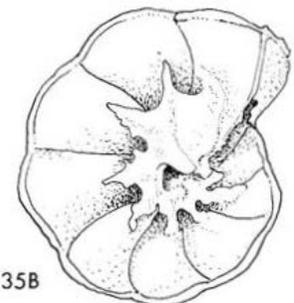
33B



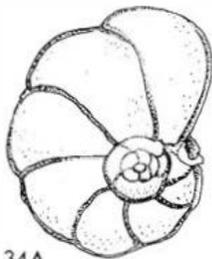
33C



35A



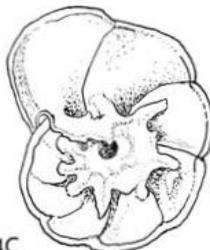
35B



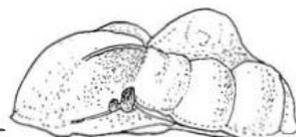
34A



34B



34C



35C

cally, and the terminal chambers laid open by treatment with dilute hydrochloric acid. The ultrastructure of the wall of *D. vesicularis* has been recently investigated by Hay, Towe and Wright (1963, p. 176, pl. 13, figs. 1-3, pl. 14, fig. 1), who also discuss the systematic position of the species in relation to the classifications of Hofker (1951), Reiss (1957), and Loeblich and Tappan (1961a). The systematic position of *D. vesicularis* has been further discussed by Hofker (1963). After examining approximately 2,000 specimens, both Eocene and Recent, we have found it extremely difficult to list the differences between the two species in anything but a general way. *D. vesicularis*, however, differs from *D. dimidiatus* in having fewer chambers, and the umbilical plates are broader and tend to become much thickened, whilst the height of the spire does not reach the degree of development found in *D. dimidiatus*. The internal structures revealed by sectioning specimens of *D. vesicularis* and *D. dimidiatus* indicate that the arrangement of these features is basically similar in both species. The principal differences are only related to the degree of development and the degree of fusion between the various structures. These differences are, in our opinion, of specific value only.

The specimen of *Discorbina vesicularis* recorded by Brady (1884, pl. 87, fig. 2a-c) from shore sand, Melbourne, has been examined by us. Additional specimens from the Brady collection in the B. M. (N. H.) from *Challenger* Station 187A, off Booby Island, 8 fm, and the littoral zone, Melbourne, have also been examined. These specimens fall within the range recognised by us for *D. dimidiatus*. The specimen figured by Brady (1884, pl. 87, fig. 4a-c) as *Discorbina rosacea* is an evolute variant of *D. dimidiatus*, very similar to the New Zealand intertidal specimens. Barker (1960, p. 180) has referred these figured specimens of *D. vesicularis* and *D. rosacea* to *Discorbis* sp. nov., following Hornibrook and Vella (1954). Collins (1958, p. 401, pl. 5, fig. 5a-c) described *Discorbis subvesicularis* from the Great Barrier Reef. The holotype of this species is in the B.M. (N.H.) and appears to be

a form closely allied to *D. dimidiatus*. Subsequent study of more specimens may show it to be a synonym.

Conclusions

- (1) *Discorbis dimidiatus* (Parker and Jones), 1862, is a common, variable shallow-water species occurring in the Australian, New Zealand, and other Pacific regions.
- (2) *Discorbis vesicularis* var. *acervulinoides* Parr, 1932, is a synonym of *D. dimidiatus*.
- (3) *Discorbis vesicularis* (Lamarck), 1804, the type species of *Discorbis* is very similar to *D. dimidiata* in the structure of the test, but is in our opinion specifically distinct. *Lamellodiscorbis Bermudez*, 1952 (type species *D. dimidiata*) is thus a synonym of *Discorbis*, as pointed out by Hornibrook (1961).
- (4) *Discorbis vesicularis* recorded by Brady (1884) from shore sand, Melbourne, and from *Challenger* Station 187A, off Booby Island, and *Discorbina rosacea* (part), from *Challenger* Station 162, Bass Strait, Australia, are synonymous with *D. dimidiatus*.

Genus *Glabratella* Dorreen, 1948

Glabratella radiata (Vella), 1957.

Pileolina radiata Vella, 1957, p. 36, pl. 8, fig. 170, 171.
Discorbina pileolus (part). Heron-Allen and Earland, 1922, p. 204.

PREVIOUS RECORDS FROM NEW ZEALAND: Described as *Pileolina radiata* by Vella (1957) from Cook Strait, as *Discorbis radiata* by Hornibrook (1961) from the Miocene, Rifle Butts formation, Oamaru, and as part of *Discorbina pileolus* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, and 144.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374) and Christchurch (B 391).

Text-fig. 36-39: *Discorbis dimidiatus* (Parker and Jones).

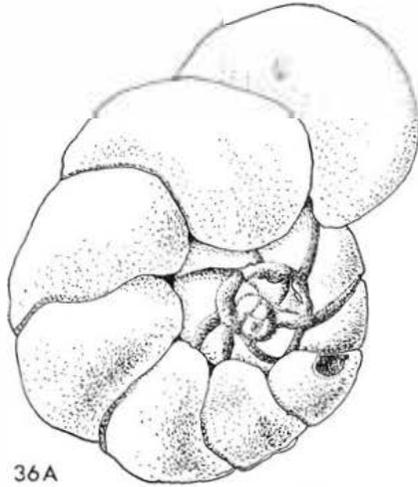
36A: spiral view (× 41); B: side view (× 38); C: umbilical view (× 41). B.M. (N.H.) Reg. No. 1964.10.13.85.

37A: spiral view (× 42); B: side view (× 43); C: umbilical view (× 38). B.M. (N.H.) Reg. No. 1964.10.13.86.

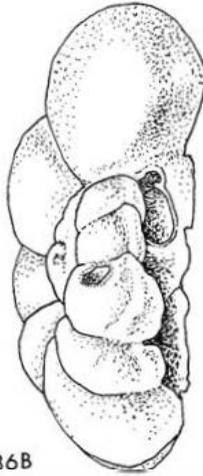
38A: spiral view (× 39); B: side view (× 39); C: umbilical view (× 39). B.M. (N.H.) Reg. No. 1964.10.13.87.

39A: spiral view (× 42); B: side view (× 41); C: umbilical view (× 42). B.M. (N.H.) Reg. No. 1964.10.13.88.

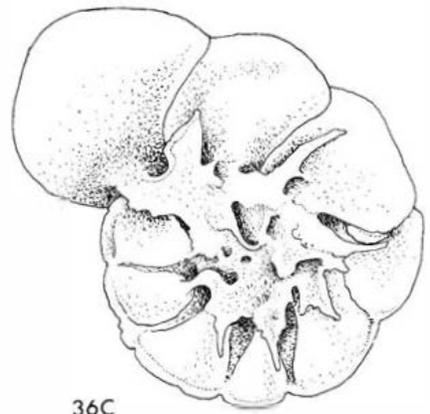
From shore sand, Gulf of St. Vincent, S. Australia.



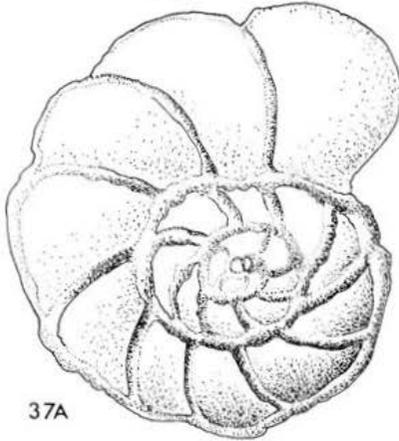
36A



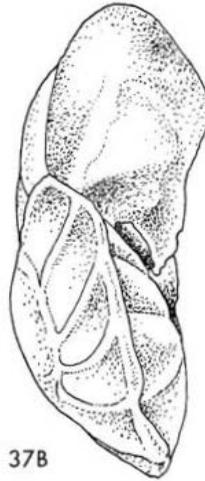
36B



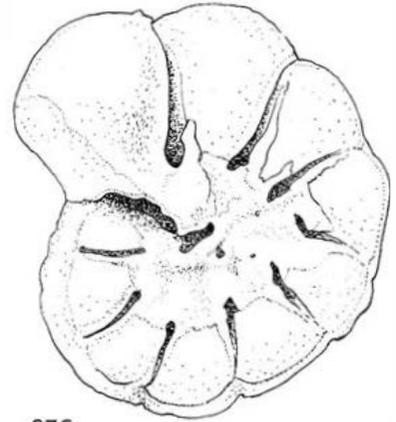
36C



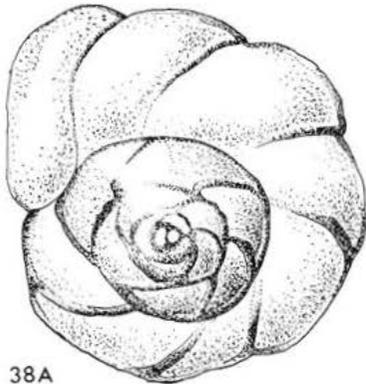
37A



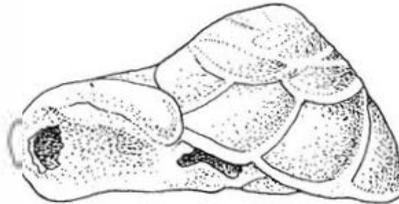
37B



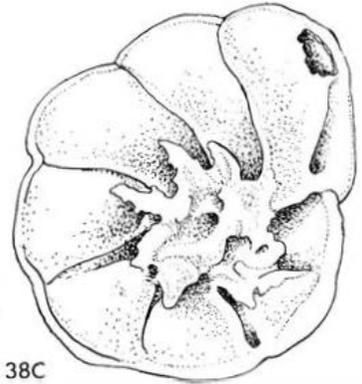
37C



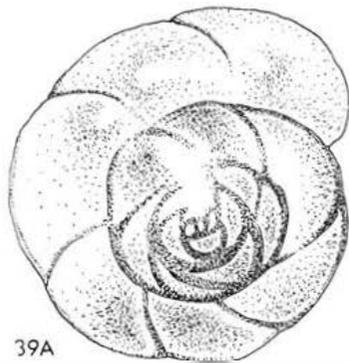
38A



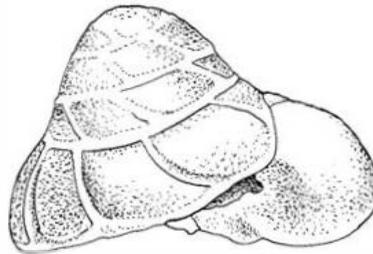
38B



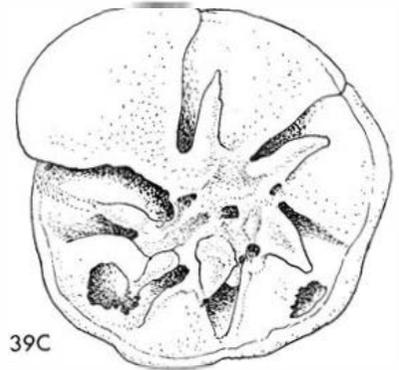
38C



39A



39B



39C

MATERIAL: Approximately 100 specimens with plastogamic pairs frequent. Size range: diameter, 0.12–0.65 mm; height, 0.03–0.32 mm.

Remarks

Ideotypes of "*Pileolina*" *radiata* presented to the British Museum (Natural History) by Mr P. Vella are identical with the New Zealand intertidal specimens, and some specimens identified as *Discorbis pileolus* by Heron-Allen and Earland (1922).

Glabratella radiata was originally described by Vella (1957) as *Pileolina radiata*. The validity of the genus *Pileolina* Bermudez, 1952, has caused considerable confusion because of the uncertain nature of its type species, *Valvulina pileolus* d'Orbigny. The types of this species are not available in Paris, but Heron-Allen and Earland (1932) examined topotypes, selected by them from d'Orbigny's material from Arica, Peru. These specimens differ from the New Zealand intertidal specimens in being flatter, more translucent and having narrower sutures.

Heron-Allen and Earland's (1932) comparison of *V. pileolus* with *Discorbina pulvinata* Brady, 1884, the type species of *Conorbella* Hofker, 1951, indicated a close resemblance between the two species. *Conorbella* is listed as a synonym of *Glabratella* Dorreen, 1948, by Hornibrook and Vella (1954). Heron-Allen and Earland's comparison thus suggested that *Pileolina* and *Glabratella* were synonyms (Hornibrook, 1961). In view of this possibility, and the uncertainty regarding *V. pileolus*, Hornibrook (1961) retained *Pileolina radiata* and several other species, previously included

within *Pileolina*, under *Discorbis*. Loeblich and Tappan (1964a) regard *Conorbella* and *Pileolina* as synonyms of *Glabratella*. However, Seiglie and Bermudez (1965) have reinstated *Pileolina* to include species which possess conical or discoidal tests, with the umbilical side covered by granules, and with an arched, slit-like aperture. *G. radiata* and *G. zealandica* are placed in the genus *Pileolina* by Seiglie and Bermudez (1965). The classification of Loeblich and Tappan (1964a) is here retained because, as noted by these authors, there is a close similarity in reproductive habits among these genera. These features, allied to a general similarity in test morphology, appear to us sufficient to justify the inclusion of the New Zealand specimens in *Glabratella*. The monographic treatment of the family Glabratellidae by Seiglie and Bermudez (1965), based on morphology alone, appears to require support from biological evidence.

Glabratella zealandica (Vella), 1957

Pileolina zealandica Vella, 1957, p. 37, pl. 8, figs. 175, 176.
Discorbina pileolus (part). Heron-Allen and Earland, 1922, p. 204.

PREVIOUS RECORDS FROM NEW ZEALAND: Described as *Pileolina zealandica* by Vella (1957) from Cook Strait, as *Discorbis zealandica* by Hornibrook (1961) from the Lower Miocene to Recent of Oamaru and by Hulme (1964) from Manukau Harbour, and as part

Text-fig. 40–44: *Discorbis dimidiatus* (Parker and Jones) and *Discorbis vesicularis* (Lamarck).

40–43: outline drawings of *D. dimidiatus*.

40A: spiral view ($\times 41$); B: umbilical view ($\times 39$); C: side view ($\times 40$). B.M. (N.H.) Reg. No. 1964.10.13.89.

41A: Spiral view ($\times 40$); B: side view ($\times 39$); C: umbilical view ($\times 44$). B.M. (N.H.) Reg. No. 1964.10.13.90.

42A: spiral view ($\times 43$); B: side view ($\times 39$); C: umbilical view ($\times 38$). B.M. (N.H.) Reg. No. 1964.10.13.91.

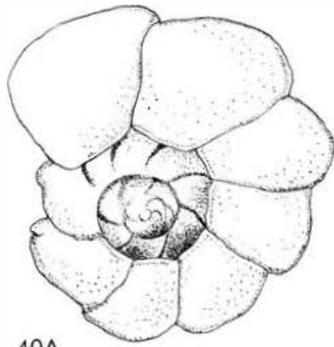
43A: side view ($\times 39$); B: spiral view ($\times 41$); C: umbilical view ($\times 42$). B.M. (N.H.) Reg. No. 1964.10.13.92.

From shore sand, Gulf St. Vincent, S. Australia.

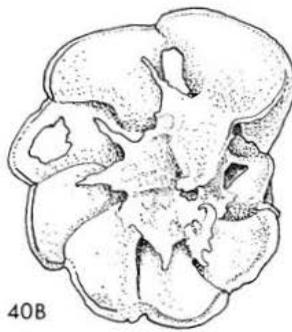
Text-fig. 44: Outline drawing of topotype of *Discorbis vesicularis*. Together with figs. 45–49, fig. 44 illustrates a range of variants in topotypic material. The smaller forms possess short, broad, flat umbilical plates, whilst the plates of larger specimens become more irregular. All specimens examined were coiled in a low evolute spire. *Discorbis vesicularis*, the type species of *Discorbis*, was compared with *D. dimidiatus* (the designated type species of *Lamellodiscorbis*), and the nature of the differences is regarded as of specific value only. *Lamellodiscorbis* is thus a synonym of *Discorbis*, as mentioned by Hornibrook (1961).

A: umbilical view ($\times 74$); B: side view ($\times 72$); C: spiral view ($\times 70$).

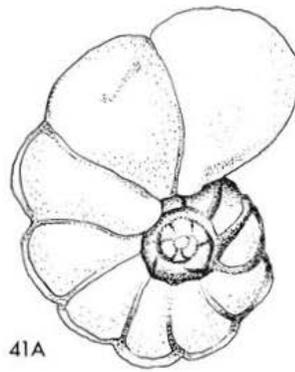
From Corignon, Paris Basin Lutetian. B.M. (N.H.) Reg. No. 1964.10.13.93.



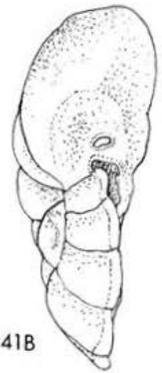
40A



40B



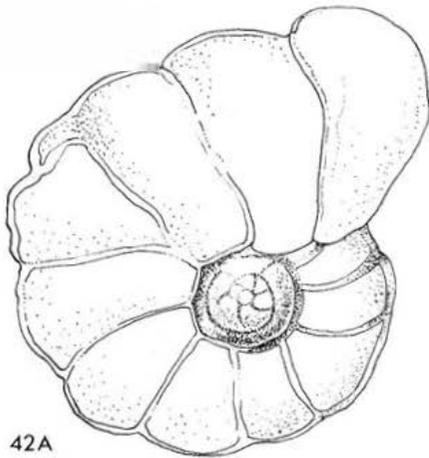
41A



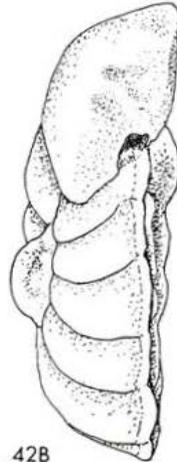
41B



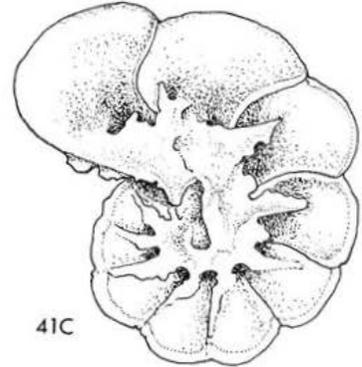
40C



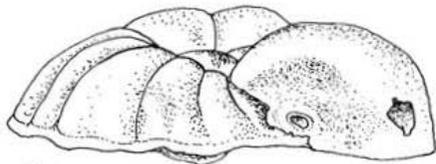
42A



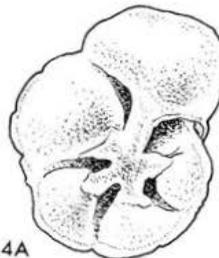
42B



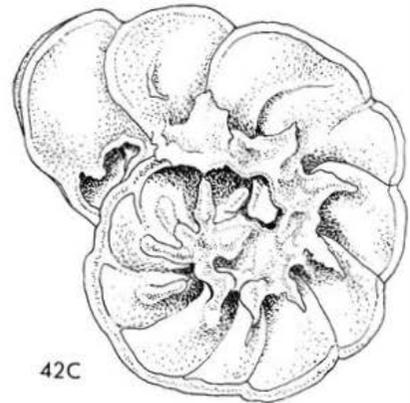
41C



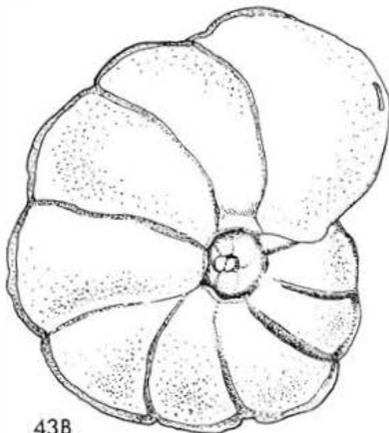
43A



44A



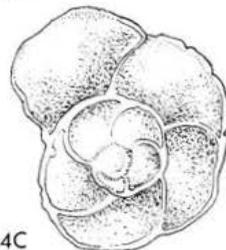
42C



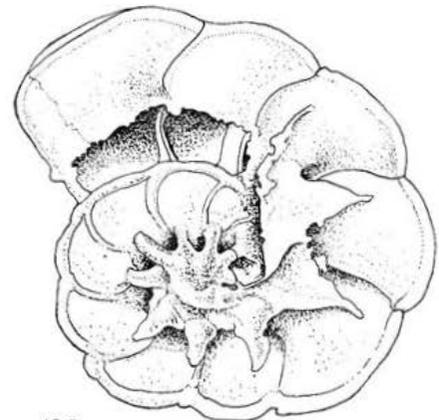
43B



44B



44C



43C

of *Discorbina pileolus* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, and 144.

NEW RECORDS FROM NEW ZEALAND: Empty tests at Wellington (B 374), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 70 specimens with plastogamic pairs fairly common. Size range: diameter, 0.14–0.35 mm; height, 0.05–0.17 mm.

Remarks

The New Zealand intertidal specimens are identical with ideotypes of *Pileolina zealandica* presented to the British Museum (Natural History) by Mr P. Vella, and some specimens identified as *Discorbina pileolus* by Heron-Allen and Earland (1922). See remarks on *Glabrattella radiata* (Vella) for the assignment of this species to *Glabrattella*.

Genus *Discorbinella* Cushman and Martin, 1935

Discorbinella bertheloti (d'Orbigny), 1839b.

Rosalina bertheloti d'Orbigny, 1839b, p. 135, pl. 1, figs. 28-30.

Discorbina bertheloti. Heron-Allen and Earland, 1922, p. 202.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Discorbis bertheloti* by Cushman (1919), as *Discorbina bertheloti* by Heron-Allen and Earland (1922), as *Discopulvinulina bertheloti* by Vella (1957), Hornibrook (1961) and Hulme (1964), and as *Rosalina bertheloti* by Hedley, Hurdle and Burdett (1965).

NEW RECORDS FROM NEW ZEALAND: Living at New Plymouth (B 439); empty shells at Mount Maunganui (B 434).

MATERIAL: Twelve specimens. Size range: length, 0.20–0.42 mm; height, 0.03–0.12 mm.

Remarks

See Hedley, Hurdle and Burdett (1965); also Loc-blich and Tappan (1964a, p. C575).

Genus *Planulinoides* Parr, 1941

Planulinoides norcotti sp. nov. (Pl. 11, fig. 1A-C.)

TYPE DESCRIPTION: Test free, relatively small, smooth, translucent, flattened in cross section, with double keeled periphery; umbilicus excavated and partially overlapped by the rounded plate-like extensions of the chambers; chambers few in number, both whorls visible on spiral side, 5 to 6 chambers per whorl, only the chambers of the last whorl visible on umbilical side, chambers slightly inflated on both spiral and umbilical sides; periphery square, limbate, slightly lobulate; sutures thickened and recurved, continued to form a small flange bordering the edges of the periphery; primary aperture small, peripheral, situated at the base of the last chamber, elongated in axis of coiling, bordered by a lip; supplementary apertures on umbilical side at inner margin of chambers, bordered by umbilical flaps; wall finely and densely perforate.

DIMENSIONS OF HOLOTYPE: Length 0.51 mm; width 0.40 mm; thickness, 0.13 mm. Size range of other specimens: length, 0.17–0.51 mm; width, 0.14–0.41 mm; thickness, 0.07–0.13 mm. The proloculus in all the specimens available seems fairly large, ranging in size from 0.04 to 0.07 mm in diameter.

TYPE MATERIAL: Deposited in the British Museum (Natural History):

Text-fig. 45-49: Discorbis vesicularis (Lamarck).

Outline drawing of topotypes.

45A: spiral view (\times 73); B: side view (\times 74); C: umbilical view (\times 73). B.M. (N.H.) Reg. No. 1964.10.13.94.

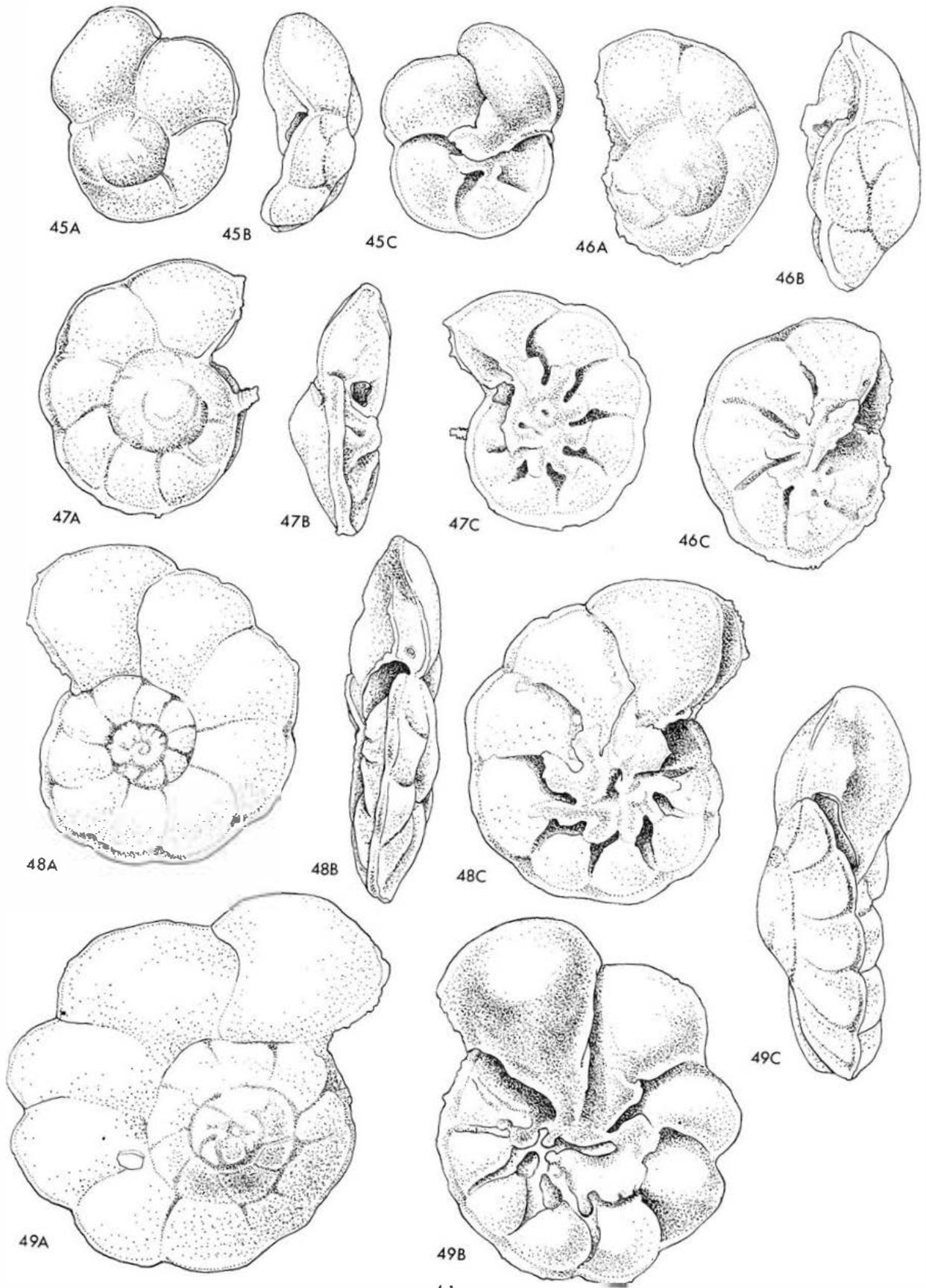
46A: spiral view (\times 52); B: side view (\times 58); C: umbilical view (\times 56). B.M. (N.H.) Reg. No. 1964.10.13.95.

47A: spiral view (\times 32); B: side view (\times 30); C: umbilical view (\times 32). B.M. (N.H.) Reg. No. 1964.10.13.96.

48A: spiral view (\times 30); B: side view (\times 33); C: umbilical view (\times 30). B.M. (N.H.) Reg. No. 1964.10.13.97.

49A: spiral view (\times 32); B: umbilical view (\times 29); C: side view (\times 28). B.M. (N.H.) Reg. No. 1964.10.13.98.

From Grignon, Paris Basin Lutetian.



(a) Holotype (pl. II, fig. 1A-C) B.M. (N.H.) Reg. No. 1964. 10.13.99.

(b) Twenty paratypes and topotypic material.

One paratype is deposited in the N.Z. Geological Survey. Twenty-three specimens have been examined; all were living free in the residual sand among the tufts of *Corallina*. One specimen may have been attached as the umbilical area was covered by accumulated debris of organic and arenaceous material.

VARIATION: The periphery of the juvenile forms is broadly rounded and not the distinct square, limbate periphery typical of the larger specimens.

TYPE LOCALITY: Off Ripa Island, Lyttelton Harbour, Christchurch, South Island, New Zealand. N.Z. Oceanographic Institute Station B 400. (43°37'20"S, 172°45'25"E) among *Corallina* tufts and residual sand. Intertidal. This form has not been seen by the authors at any other New Zealand locality.

Remarks

Planulinoides norcotti was first thought by us to belong to the "*Discorbinella biconcava-planoconcava* group". The syntypes of *Discorbinella biconcava* Parker and Jones (1862, p. 201), described from "recent shore sand, Melbourne, Australia", are present in the B.M. (N.H.). Loeblich and Tappan (1964a, p. C584) have designated a lectotype, B.M. (N.H.) ZF 3646, for *Discorbinella biconcava*, and we have compared the lectotype and paralectotypes with the New Zealand intertidal specimens. It is noted that the latter are flatter, and lack the regular biconcave appearance of the Melbourne specimens.

Discorbinella biconcava was designated the type species of *Planulinoides* by Parr (1941, p. 305), though this genus was considered to be a synonym of *Discorbinella* by Cushman (1948, p. 288). *Planulinoides* has been subsequently recognised as a valid genus by Loeblich and Tappan (1964a). The flattened form of the test of *P. norcotti* seems to specifically distinguish this new species from the biconcave test of *D. biconcava*. In other features, however, *P. norcotti* agrees closely with the generic characters of the type species.

Parr (1932, p. 232, pl. xxii, fig. 34 a-c) figured *Planulina biconcava* var. *planoconcava* Chapman, Parr and Collins MS, a variety described as *Discorbis planoconcava* by Chapman, Parr and Collins (1934, p. 561, pl. 11 fig. 40a-c) from the Oligocene, Balcombe Bay, Victoria, and later as *Discorbinella planoconcava* by Parr (1945, p. 211, pl. xi, figs. 1-2) from Barwon Heads, Victoria. Lacking material from Point Lonsdale, Victoria – the first published locality – we have examined material from the Oligocene, Balcombe Bay, Victoria, and recent material from Barwon Heads, Victoria, both samples having been collected by W. J. Parr. Unfortunately we were unable to find specimens

of either *Discorbinella biconcava* or *Discorbinella planoconcava* in the Oligocene material from Balcombe Bay. From the Barwon Heads material, 17 specimens identical with the syntypes of *Discorbinella biconcava* (Parker and Jones) and a further nine specimens identical with the figure of *Discorbinella planoconcava* given by Parr (1945, pl. xi, figs. 1 and 2) were selected. The New Zealand intertidal specimens do not possess the distinct concave spiral side typical of *Discorbinella planoconcava* and are considered to be distinct. This new form is named after Mr Norcott de B. Hornibrook of the N.Z. Geological Survey.

Genus *Patellinella* Cushman, 1928

Patellinella inconspicua (Brady), 1884. (Pl. 9, fig. 7A, B, C.)

Textularia inconspicua Brady, 1884, p. 357, pl. 42, fig. 6a, b, c.

Textularia inconspicua (part). Heron-Allen and Earland, 1922, p. 116.

Patellinella inconspicua. Vella, 1957, pp. 10, 13.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Discorbis inconspicua* by Cushman (1919) from the east coast of New Zealand, as part of *Textularia inconspicua* by Heron-Allen and Earland from *Terra Nova* Stations 90, 91, 96, 134, and as *Patellinella inconspicua* by Vella (1957) from Cook Strait and Marlborough Sounds, and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368), Porirua (B 388), Whangaparaoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439); empty shells at Wellington (B 374).

MATERIAL: Approximately 40 specimens. Size range: diameter, 0.20–0.35 mm; height, 0.10–0.26 mm.

Remarks

The New Zealand intertidal specimens are identical with the 12 syntypes of Brady (1884) from *Challenger* Station 162, Bass Strait, 38 fm. The size range of Brady specimens is: diameter, 0.24–0.3 mm; height, 0.12–0.2 mm.

Genus *Rosalina* d'Orbigny, 1826

Rosalina bradyi (Cushman), 1915. (Pl. 1, fig. 3; pl. 11, fig. 2A-C; text fig. 50-55.)

Discorbis globularis var. *bradyi* Cushman, 1915, p. 12, pl. 8, fig. 1.

Discorbina globularis. Brady, 1884, p. 643, pl. 86, fig. 8 (not fig. 13).

Discorbina globularis Heron-Allen and Earland, 1922, p. 201.

Rosalina bradyi. Hornibrook and Vella, 1954, p. 25.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Discorbina globularis* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, 144, as *Rosalina bradyi* by Vella (1957, p. 10) from Cook Strait, and Hulme (1964) from Manukau Harbour, Auckland.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Christchurch (B 391), Whangaparua (B 420), Mount Maunganui (B 434), and New Plymouth (B 439); empty shells at Porirua (B 388).

MATERIAL: Two hundred and forty specimens attached to the tufts and fronds of *Corallina*. Size range: length, 0.17–1.06 mm; width, 0.14–0.94 mm; thickness, 0.09–0.55 mm.

Remarks

Like *Discorbis dimidiatus*, *Rosalina bradyi* (Cushman) is found attached to *Corallina* and is usually bordered by a layer of mucilaginous material in which sand grains are often embedded (pl. 1, fig. 3). Empty tests become detached and occur free in the sand among the tufts of *Corallina*. The type species of the genus *Rosalina* was designated by Galloway and Wissler (1927, p. 62) as *Rosalina globularis* d'Orbigny (1826, p. 271, pl. 13, figs. 1–4). No specific type locality for *R. globularis* was mentioned by d'Orbigny in his description of the species, and the identity of the genus remained uncertain, being regarded as a synonym of *Discorbis* (Cushman, 1948, p. 286). Brotzen (1948, p. 72) emended the description of *Rosalina*, but based his emendation on *R. orbicularis*, the type of *Neoconorbina* Hofker, 1951. Bermudez (1952) continued to regard *Rosalina* and *Neoconorbina* as synonymous. Hornibrook and Vella (1954, p. 26), however, restrict *Rosalina* to the *globularis* group of species, Loeblich and Tappan (1964a, p. C584) have figured a specimen of *R. globularis* from the Ross Sea, Antarctica, which they state has been compared by them with d'Orbigny's type specimen in Paris. These authors also recognise *Rosalina* and *Neoconorbina* as valid genera. The New Zealand intertidal specimens agree closely with the generic diagnosis of *Rosalina* given by Loeblich and Tappan (1964a).

The life cycle of *Rosalina globularis* has been investigated by Sliter (1965) and is shown to include a gamontic *Tretomphalus* stage. The agamonts bear a close resemblance to the figure of *R. globularis* given by Loeblich and Tappan (1964 a). The wall structure is shown to be bilamellar by Sliter (1965) and the genus placed in the family Rosalinidae Reiss, 1963. The bilamellar character is also noted by Loeblich

and Tappan (1964b). See also remarks under *Rosalina* sp.

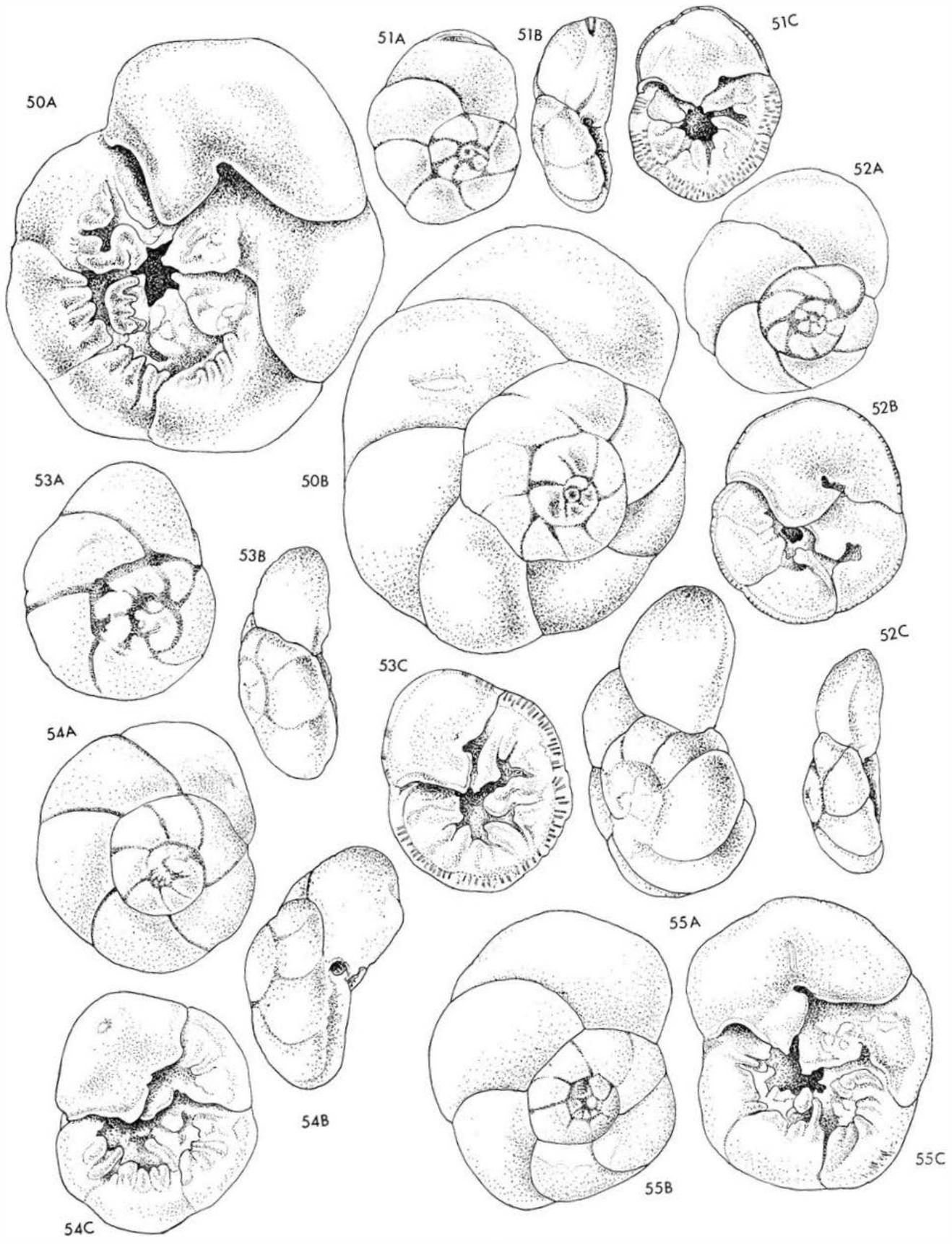
Hedley and Wakefield (1967) observe that *R. bradyi* and *R. irregularis* possess monolamellid septa and emphasise the uncertain systematic position of *Rosalina*. They suggest that it be kept in the Discorbidae, Ehrenberg (Loeblich and Tappan, 1965), a group with monolamellid septa.

Prior to Loeblich and Tappan's description and figure of *R. globularis*, many authors appear to have accepted the record of *Discorbina globularis* given by Brady (1884, p. 643, pl. 86, fig. 13 – not fig. 8), from *Challenger* Station 33, 435 fm, off Bermuda. These specimens appear to be conspecific with the specimen of *R. globularis* figured by Loeblich and Tappan (1964a).

Brady (1884, pl. 86, fig. 8), however, also figured another specimen of *D. globularis* from *Challenger* Station 205A, 7 fm, in Hong Kong harbour. This specimen is placed in the synonymy of *Discorbis globularis* var. *bradyi* described by Cushman (1915, p. 12, pl. 8, fig. 1), from *Albatross* Station D 4893, 106 fm, off Japan. Fifteen specimens of *Rosalina globularis*, including the specimen figured on pl. 86, fig. 8, are present on a slide in the Brady collection in the B.M. (N.H.), and these specimens were examined by us as no topotypic material of *R. bradyi* was available. Brady's specimens of *R. bradyi* from Hong Kong show a size range of: length, 0.45–0.63 mm; breadth, 0.39–0.56; thickness, 0.08–0.52 mm.

Brady's specimens, although slightly smaller, are identical with the New Zealand intertidal specimens of *Rosalina bradyi*. The intertidal specimens exhibit a considerable range of variation (text-fig. 50–55), especially in the degree of development of thickened shelly patches in the umbilical region. In general, the smaller specimens are relatively flattened, and the umbilicus is usually free from clear shell material. A distinct milled edge, due to the perforations, is also present on the umbilical side. In larger specimens, the chambers are more globular and the umbilicus more concave, and often deeply excavated whilst the umbilical area is bordered by the extensive development of clear shelly patches. The appearance of a milled edge is lost owing to the inward extension of the perforate region of the shell, resulting from progressive infolding of the test. The New Zealand specimens of *R. bradyi* form a gradational series of variants.

The New Zealand intertidal specimens and also those of Brady (1884, pl. 86, fig. 8) from Hong Kong are regarded as congeneric with the diagnosis of *Rosalina* given by Loeblich and Tappan (1964a), but differ specifically from the type species, *R. globularis*, in the modification of the umbilical region by the extensive deposition of clear shell material.



Rosalina irregularis (Rhumbler), 1906. (Pl. 11, fig. 3A, B.)

Discorbina irregularis Rhumbler, 1906, p. 70, pl. 5, fig. 57, 58.

Discorbina irregularis. Heron-Allen and Earland, 1922, p. 201.

Discorbina mediterranensis (part): Heron-Allen and Earland, 1922, p. 201.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) recorded a single wild-growing specimen as *Discorbina irregularis* from Terra Nova Station 96, and many irregular forms as *Discorbina mediterranensis* from Terra Nova Stations 90, 91, 96, 134, and 144.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Christchurch (B 391, B 400), New Plymouth (B 439), and Portobello (B 405), Whangaparoa (B 420), Mount Maunganui (B 434).

MATERIAL: Approximately 130 specimens attached to the tufts of *Corallina*. Size range: length, 0.20–0.98 mm; width, 0.17–0.78 mm; thickness, 0.11–0.47 mm.

Remarks

Rosalina irregularis (Rhumbler) is a common New Zealand intertidal species attached to *Corallina* in the same way as are *Discorbis dimidiata* and *Rosalina bradyi*. The very variable form of the test is clearly

related to the mode of attachment. Empty shells become detached and occur free in the sand.

Rhumbler (1906, p. 70, pl. 5, fig. 57, 58) described *Discorbina irregularis* and designated "Chatham Island (J. no. 2)" and "Marshall Island" as type localities. Material from N.Z.O.I. Station C 621, "½ mile out from Waitangi wharf, Chatham Island, 12 metres" was examined and 20 specimens closely resembling *D. irregularis*, as illustrated by Rhumbler, were selected and compared with the New Zealand intertidal specimens. The size range of the Chatham Island specimens is: length, 0.36–0.74 mm; width, 0.28–0.68 mm; thickness, 0.18–0.35 mm. The variable nature of the test of this species has made detailed comparison difficult, but characteristics of the umbilical region and aperture are identical with those of *Rosalina*, as defined by Brotzen (1948, p. 73.)

Many irregular forms identified by Heron-Allen and Earland (1922, p. 201) as *Discorbina mediterranensis* are identical with both the Chatham Island and the New Zealand intertidal specimens.

Rosalina sp. (Pl. 9, fig. 6A-C.)

NEW RECORDS FROM NEW ZEALAND: Living at Portobello (B 405), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Thirty-five specimens examined. Dimensions:

Text-fig. 50–55: Rosalina bradyi (Cushman).

Outline drawings illustrating variation in chamber shape and progressive modification of the excavated umbilical region coincident with increase in size. In general, the smaller specimens possess a distinct milled edge when viewed from the umbilical side, and the umbilicus is relatively free from clear shell material. Larger specimens, however, possess more globular chambers so that the appearance of a milled edge is lost, and the umbilicus is bordered by the extensive development of clear shell material.

50A: umbilical view (× 52); B: spiral view (× 53).

From N.Z.O.I. Sta. B 434, Mount Maunganui. B.M. (N.H.) Reg. No. 1964.10.13.103.

51A: spiral view (× 55); B: side view (× 54); C: umbilical view (× 54). B.M. (N.H.) Reg. No. 1964.10.13.104.

From N.Z.O.I. Sta. B. 420, Whangaparoa.

52A: spiral view (× 75); B: umbilical view (× 74); C: side view (× 74). B.M. (N.H.) Reg. No. 1964.10.13.105.

From N.Z.O.I. Sta. B 434, Mount Maunganui.

53A: spiral view (× 54); B: side view (× 53); C: umbilical view (× 53). B.M. (N.H.) Reg. No. 1964.10.13.106.

From N.Z.O.I. Sta. B 420, Whangaparoa.

54A: spiral view (× 54); B: side view (× 54); C: umbilical view (× 53). B.M. (N.H.) Reg. No. 1964.10.13.107.

From N.Z.O.I. Sta. B 420, Whangaparoa.

55A: side view (× 53); B: spiral view (× 52); C: umbilical view (× 50). B.M. (N.H.) Reg. No. 1964.10.13.108.

From N.Z.O.I. Sta. B 434, Mount Maunganui.

	Specimen with Float Chamber	34 Specimens without Float Chambers
Maximum diameter	0.37 mm	0.25-0.51 mm
Maximum height	0.48 mm	0.13-0.25 mm

Remarks

The specimens here regarded as *Rosalina* sp. were initially placed by us in the genus *Tretomphalus* Möbius, 1880. However, *Tretomphalus* has been suppressed as a junior synonym of *Rosalina* by Sliter (1965) and Douglas and Sliter (1965), because laboratory studies by Sliter (1965) on the life cycle of *R. globularis* indicate that the planktonic gamontic stage is identical with the holotype of *T. myersi* Cushman. As *T. myersi* is apparently identical with *Rosalina bulloides* d'Orbigny, the type species of *Tretomphalus*, the latter genus becomes a synonym of *Rosalina*. Many of the New Zealand specimens possess a rosalinid early stage, as do *R. clavus* (Cushman) and *R. concinnus* (Brady), the other species regarded by Douglas and Sliter (1965) as probable reproductive stages of other, as yet unidentified, rosalinids. Remaining species are placed by Douglas and Sliter (1965) in the genus *Cymbaloporeta* Cushman. Some of the New Zealand specimens appear to possess characteristics diagnostic of *Cymbaloporeta*, but in view of the uncertainty of their biological affinities they are here retained in the genus *Rosalina*.

Although the type specimens of *Rosalina bulloides* are unavailable in the d'Orbigny collection in Paris, the New Zealand intertidal specimens are identical with specimens of *Cymbalopora bulloides* identified by Heron-Allen and Earland (1922, p. 199) from *Terra Nova* Stations 96, 134, and *Cymbalopora* (*Tretomphalus*) *bulloides* of Brady (1884, p. 638, pl. 102, fig. 7-12). Cushman (1934) reviewed the available material relating to *Tretomphalus* and described several new species.

The same author (pp. 86-94) considered *Cymbalopora* (*Tretomphalus*) *bulloides* of Brady (pl. 102, fig. 7-12) to consist of three distinct species, namely, *Tretomphalus atlanticus* (pl. 102, figs. 10, 11), *Tretomphalus planus* (pl. 102, figs. 7, 8 and 12?) and *Tretomphalus milletti* (pl. 102, fig. 9). Unfortunately the specimens figured by Brady (pl. 102, figs. 8 and 9) are badly damaged, and the differences between the remaining specimens (pl. 102, fig. 7, 10, 11, 12) do not appear to us significant.

These three species, *T. atlanticus*, *T. planus*, and *T. milletti*, are placed in the genus *Cymbaloporeta* by Douglas and Sliter (1965).

That species of *Tretomphalus* are involved in rosalinid life histories was earlier suggested by the studies

of Myers (1943). The New Zealand specimens referred to here as *Rosalina* sp. probably represent stages in the life history of one of the previously recorded species of *Rosalina* from the intertidal area. However, the close resemblance of the New Zealand *Rosalina* sp. to specimens and published records of *T. bulloides* suggests that *R. bradyi* is very similar to, if not a variant of, *R. globularis*, differing from the latter species only in the nature of the umbilical shelly patches.

Genus *Spirillina* Ehrenberg, 1843

Spirillina vivipara Ehrenberg, 1843.

Spirillina vivipara Ehrenberg, 1843, p. 442, pl. 3, fig. 41.
Spirillina vivipara. Heron-Allen and Earland, 1922, p. 195.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded by Cushman (1919) "off Poor Knight's Islands, east coast of New Zealand", by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 96, and 144 and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living free in sand and attached to stones at Wellington (B 368, B 374), Christchurch (B 391, B 400), Portobello (B 405), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 130 specimens. Size range: maximum diameter, 0.1-0.22 mm.

Remarks

Spirillina vivipara occurs in shallow water and is assumed to have a cosmopolitan distribution. Myers (1936) gives a detailed account of the life cycle of *Spirillina vivipara* Ehrenberg. The generic description of *Spirillina* has been emended by Loeblich and Tappan (1964a, p. C 600) who have selected a neotype. The New Zealand intertidal specimens are identical with *Spirillina vivipara* identified by Heron-Allen and Earland (1922) from *Terra Nova* New Zealand stations.

Genus *Patellina* Williamson, 1858

Patellina corrugata Williamson, 1858.

Patellina corrugata Williamson, 1858, p. 46, pl. 3, figs. 86-89, 89a.
Patellina corrugata. Heron-Allen and Earland, 1922, p. 198, pl. 7, fig. 5.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134,

144, by Parr and Collins (1930) from South Island, New Zealand, by Vella (1957), from Cook Strait, by Hornibrook (1961) from Oamaru, and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368, B 374), Christchurch (B 400), Portobello (B 405), Whangaparoa (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 110 specimens. Size range: diameter, 0.14–0.45 mm; height, 0.05–0.20 mm.

Remarks

The range of variation among Williamson's syntypes of *Patellina corrugata* is such that the New Zealand specimens are referred to this species without hesitation. Heron-Allen and Earland (1922, p. 198) reported a few specimens of *P. corrugata* var. *annularis* from New Zealand, but we consider these to be simply microspheric forms of *Patellina corrugata* and not to be confused with *Annulopatellina annularis* (Parker and Jones) discussed by Parr and Collins (1930, p. 93). We have examined the type of this form – *Orbitolina annularis* of Parker and Jones – and consider it to be a form distinct from any we have examined in our own or in Heron-Allen and Earland's material.

Genus *Ammonia* Brünnich, 1772

Ammonia aoteanus (Finlay), 1940. (Pl. 11, figs. 4A–C; text-figs. 56–60.)

Streblus aoteanus Finlay, 1940, p. 461.

PREVIOUS RECORDS FROM NEW ZEALAND: Described as *Streblus aoteanus* by Finlay (1940) from Dunedin Harbour, and recorded under that name by Vella (1957) from Cook Strait and Hulme (1964) from Manukau Harbour, and as *Rotalia beccarii* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 96, 134, 144.

NEW RECORDS FROM NEW ZEALAND: Living at Porirua (B 388) and New Plymouth (B 439); empty shells at Christchurch (B 391, B 400), Portobello (B 405), Whangaparoa (B 420), and Mount Maunganui (B 434).

MATERIAL: Approximately 130 specimens. Size range: diameter, 0.12–0.65 mm; height, 0.08–0.38 mm.

Remarks

Ammonia aoteanus (Finlay) is a common New Zealand shallow-water foraminifer, and appears to be

the only recent species of the "*Ammonia beccarii* group" recognised in New Zealand. *Ammonia aoteanus* was first described by Finlay (1940, p. 461) who commented – "Specimens of this Mediterranean species and the good figures of all growth stages given by Cushman (1928b, p. 104, pl. 15) differ from New Zealand specimens in being larger, flatter and more ornate, the sutures heavily limbate and developing nodules when adult, the base very pustulose. True *beccarii* does not occur here and the New Zealand form may be named *Streblus aoteanus*".

The morphology and structure of *Ammonia beccarii* (Linné) has been discussed in detail by Cifelli (1962) and Wood, Haynes and Adams (1963). Until a similar study has been made of *Ammonia aoteanus*, we have referred the New Zealand intertidal specimens to this species. The New Zealand intertidal specimens exhibit considerable variation in size, shape of test, and the degree of ornamentation developed (text-fig. 56–60). We have not placed the *Rotalia beccarii* recorded by Heron-Allen and Earland (1922) in synonymy, as the specimens are small and poorly represented from New Zealand *Terra Nova* Stations.

Genus *Elphidium* Montfort, 1808

Elphidium novozealandicum Cushman, 1936 (Pl. 12, fig. 4A, B.)

Elphidium novozealandicum Cushman, 1936b, p. 85, pl. 15, figs. 4a, b.

Polystomella macella. Heron-Allen and Earland, 1922, p. 230.

PREVIOUS RECORDS FROM NEW ZEALAND: Originally described from "dredgings in Dusky Sound" by Cushman (1936b), from Cook Strait by Vella (1957, p. 11), from Manukau Harbour, Auckland, by Hulme (1964), and as *Polystomella macella* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, 144.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Portobello (B 405), and doubtfully recorded as living from Whangaparoa (B 420); empty shells at Wellington (B 368), Christchurch (B 391, B 400), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIAL: Approximately 120 specimens. Size range: maximum diameter, 0.23–0.67 mm; maximum breadth, 0.18–0.54 mm; maximum thickness, 0.08–0.20 mm.

Remarks

The New Zealand intertidal specimens agree closely with Cushman's type figure of *Elphidium novozealandi-*

cum and those specimens recorded as *Polystomella macella* by Heron-Allen and Earland (1922) from New Zealand Stations. *P. macella* was described and figured by Fichtel and Moll (1798) from an undesignated locality in the Mediterranean Sea. Specimens identified as *P. macella* by Sidebottom from "Mt Athos, Salona Bay" have been examined and differ from the New Zealand forms in the characteristics mentioned by Cushman in his type description of *Elphidium novozealandicum*. Specimens figured by Brady (1884, p. 737, pl. 110, figs. 8a, b) as *P. macella* from Challenger Station 163c, Port Jackson, Sydney, Australia, 11m; are very similar to the New Zealand intertidal specimens of *E. novozealandicum*.

Genus **Criboelphidium** Cushman and Bronnimann, 1948

Criboelphidium argenteum (Parr), 1945. (Pl. 12, fig. 2A, B.)

Elphidium argenteum Parr, 1945, p. 216, pl. 12, fig. 7a, b.
Polystomella striatopunctata. Heron-Allen and Earland, 1922, p. 229.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Polystomella striatopunctata* by Heron-Allen and Earland (1922), *Terra Nova* Stations 90, 96, 134, and 144.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 374), Porirua (B 388), Whangaparoa (B 420), Mount Maunganui (B 434), and New Ply-

mouth (B 439). Empty shells at Portobello (B 405).

MATERIAL: Two hundred and fifty specimens living free in the sand among *Corallina* tufts. Size range: maximum length, 0.22–0.43 mm; maximum breadth, 0.18–0.36 mm; maximum thickness, 0.09–0.17 mm.

Remarks

Previously considered a synonym of *Elphidium*, *Criboelphidium* is now recognised as a valid genus by Loeblich and Tappan (1964a, p. C 635). According to these authors *Criboelphidium* differs from *Elphidium* "in the absence of hollow retral processes, the presence of solid, nonperforate septal bridges, coarser pores in the wall, and a simpler canal system, which does not connect to the chamber interior through retral processes". Loeblich and Tappan have also suppressed *Elphidiononion* Hofker, 1951, as a synonym of *Criboelphidium*; and designated and figured a lectotype of *Polystomella poeyana* d'Orbigny, the type species of *Elphidiononion*. *E. argenteum*, *E. charlottensis*, and *E. simplex* are here assigned to *Criboelphidium*.

Criboelphidium argenteum was described by Parr from the west bank of the Barwon River, Victoria, Australia. Material has been examined from "Ocean Beach, Barwon Heads, north side of the River mouth" donated to the British Museum (Natural History) by Mr A. C. Collins. Although these specimens are not topotypes they agree closely with Parr's figure of *Elphidium argenteum*, but are somewhat larger than the New Zealand intertidal specimens. The internal structure as seen in thin sections of shells from Barwon Heads is very similar to that seen in certain New Zealand intertidal specimens.

Text-fig. 56-60: Ammonia aoteanus (Finlay).

56: spiral view (× 66) drawn by Mr R. Brazier, N.Z.G.S., Lower Hutt.

Intertidal, Wellington. B.M. (N.H.) Reg. No. 1964.10.13.112.

57–60: outline drawings illustrating variation in size, shape of test, and degree of ornamentation. In some specimens the sutures on the spiral side are flush with the surface of the test, but in certain larger specimens the sutures are often thickened and limbate in appearance. The umbilical fissures are bordered by clear shell material but no beads or bosses are present along the sutures. When present, the umbilical plug may be distinct, or pustulate in appearance.

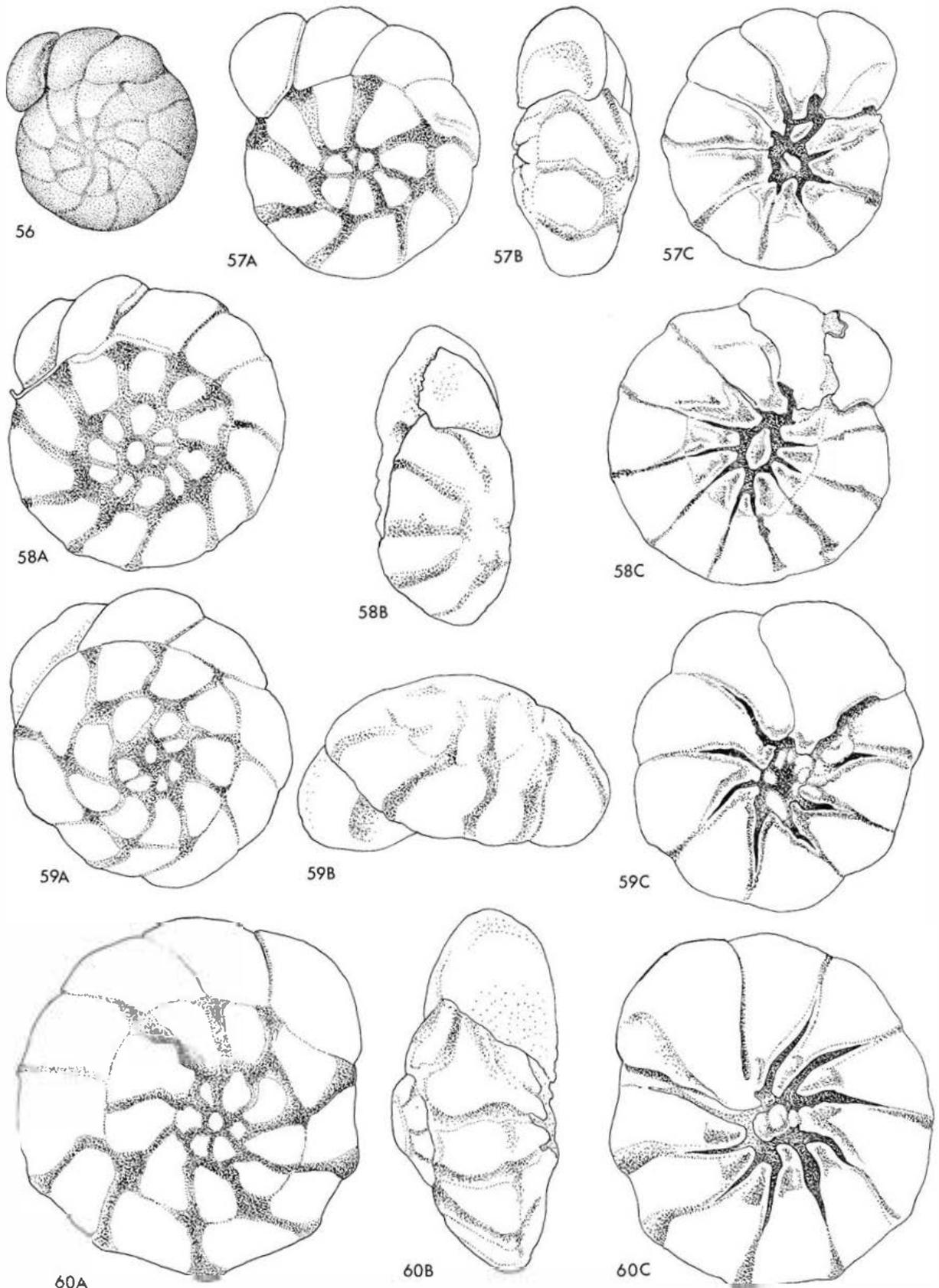
57A: spiral view (× 111); B: side view (× 110); C: umbilical view (× 106). B.M. (N.H.) Reg. No. 1964.10.13.113.

58A: spiral view (× 102); B: side view (× 103); C: umbilical view (× 107). B.M. (N.H.) Reg. No. 1964.10.13.114.

59A: spiral view (× 100); B: side view (× 104); C: umbilical view (× 105). B.M. (N.H.) Reg. No. 1964.10.13.115.

60A: spiral view (× 108); B: side view (× 104); C: umbilical view (× 106). B.M. (N.H.) Reg. No. 1964.10.13.116.

From N.Z.O.I. Sta. B 388, Porirua.



Criboelphidium charlottensis (Vella), 1957. (fig. 3 A, B.)

Elphidium charlottensis Vella, 1957. p. 38. pl. 9. figs. 187-188.

Polystomella subnodosa. Heron-Allen and Earland, 1922. p. 229.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Elphidionion charlottensis* from Cook Strait by Vella (1957) and by Hulme (1964) from Manukau Harbour, Auckland; and as *Polystomella subnodosa* by Heron-Allen and Earland (1922) from Terra Nova Stations 91, 96, 134, 144 and "east coast of New Zealand".

NEW RECORDS FROM NEW ZEALAND: Empty shells at Wellington (B 368, B 374), Christchurch (B 391, B 400), Portobello (B 405), Whangaparoa (B 420), and Mount Maunganui (B 434).

MATERIAL: One hundred specimens in the sand among *Corallina* tufts. Size range: maximum length, 0.16-0.48 mm; maximum breadth, 0.12-0.41 mm; maximum thickness, 0.06-0.22 mm.

Criboelphidium simplex (Cushman), 1933. (Pl. 12, fig. 1A, B.)

Elphidium simplex Cushman, 1933, p. 52. pl. 12. fig. 8-9.
Elphidionion simplex aoteanum Vella, 1957, p. 38, pl. 9, figs. 185-186.

Nonionina asterizans. Heron-Allen and Earland, 1922, p. 226-227.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Nonionina asterizans* by Heron-Allen and Earland (1922) from Terra Nova Stations 96, 134, "East coast of N.Z.", "near Station 208", and "near Station 242", as *Elphidionion simplex aoteanum* by Vella (1957), from Cook Strait, and by Hulme (1964) from Manukau Harbour. Hornibrook (1961) has recorded *Elphidionion* sp. cf. *simplex* from the Tertiary of Oamaru.

NEW RECORDS FROM NEW ZEALAND: Living at Christchurch (B 391), Whangaparoa (B 420), Mount Maunganui (B 434), New Plymouth (B 439), Porirua (B 388), and Portobello (B 405). Empty shells were found at Christchurch (B 400).

MATERIAL: Approximately 180 specimens in the sand among *Corallina* tufts. Size range: maximum length, 0.13-0.54 mm; maximum breadth, 0.11-0.45 mm; maximum thickness, 0.06-0.24 mm.

Remarks

Criboelphidium simplex is a very common species in the New Zealand intertidal region. It was described

by Cushman (1933) from Tonga, and was also recorded by him from various localities in Fiji (Cushman, 1939, p. 62). We have examined topotypic material from 30m, Vavau Anchorage, Tonga, and shore sand from Lefuka Islands, Fiji, and from 22m, Suva Anchorage, Fiji. These topotypes closely resemble Cushman's (1933) figures of *E. simplex* and are identical with the New Zealand specimens. The topotypes of *E. simplex* and the New Zealand intertidal specimens have also been compared with topotypes of *Elphidionion simplex aoteanum* Vella and found to be identical. The New Zealand specimens are also identical with specimens of *Nonionina asterizans* (Fichtel and Moll) recorded by Heron-Allen and Earland (1922). The types of *N. asterizans* were described from Rimini, on the Adriatic (Cushman, 1939, p. 20). Having examined material from this locality we consider Heron-Allen and Earland's specimens to have been misidentified.

Genus *Polystomellina* Yabe and Hanzawa, 1923

The species listed below were formerly placed in the genus *Notorotalia* Finlay, 1939. Loeblich and Tappan (1964a, p. C 642) have shown that *Notorotalia* is a junior synonym of *Polystomellina*.

Vella (1957) provides a detailed account of the Upper Miocene to Recent species of the genus in New Zealand. We have followed this and had available specimens donated by Dr Vella for comparison with our own material.

The following species, with their localities, are recorded. None was found to be living.

Polystomellina depressa (Vella), 1957: Wellington (B 374), Mount Maunganui (B 434), and New Plymouth (B 439) - six specimens.

Polystomellina finlayi (Vella), 1957: Christchurch (B 391, B 400) - three specimens.

Polystomellina inornata (Vella), 1957: Wellington (B 374), Christchurch (B 400), and Whangaparoa (B 420) - 14 specimens.

Polystomellina zelandica (Finlay), 1939a: Wellington (B 374), Christchurch (B 400), Whangaparoa (B 420), Mount Maunganui (B 434) - 20 specimens.

In addition to these records a small number of specimens, considered by us to be juveniles, remain unidentified.

Genus *Acervulina* Schultze, 1854

***Acervulina inhaerens* Schultze, 1854. (Pl. 1, fig. 2.)**

Acervulina inhaerens Schultze, 1854, p. 68, pl. 6, fig. 12.

Gypsina inhaerens. Brady, 1884, p. 718, pl. 102, figs. 1-6.

Gypsina inhaerens. Heron-Allen and Earland, 1922, p. 221.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Gypsina inhaerens* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96.

NEW RECORDS FROM NEW ZEALAND: Living at Wellington (B 368), Christchurch (B 400), Whangaparua (B 420), Mount Maunganui (B 434), and New Plymouth (B 439).

MATERIALS Approximately 25 specimens, all living and attached to *Corallina*. Size range: maximum diameter, 0.36–1.76 mm.

Remarks

Brady's (1884) attached specimen from *Challenger* No. 162, Bass Strait, 38 fm, is particularly typical of the New Zealand intertidal specimens. Heron-Allen and Earland's (1922) specimens of *Gypsina inhaerens* are also identical with the intertidal specimens and exhibit a comparable range of variation.

Nyholm (1961, 1962) discusses the validity of the genera *Acervulina* and *Gypsina* in the light of his study of the life history of *Cibicides lobatulus* (Walker and Jacob).

Genus **Loxostomum** Ehrenberg, 1854 emend.
Loeblich and Tappan, 1962

Loxostomum karrerianum (Brady), 1881.

Bolivina karreriana Brady, 1881, p. 58.

Bolivina karreriana. Brady, 1884, p. 424, pl. 53, figs. 19–21.

Bolivina karreriana. Heron-Allen and Earland, 1922, p. 136.

Loxostomum karrerianum. Vella, 1957, p. 10, 13.

Loxostomum karrerianum. Hedley, Hurdle and Burdett, 1965, p. 22.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Bolivina karreriana* by Cushman (1919) and Heron-Allen and Earland (1922) and as *Loxostomum karrerianum* by Vella (1957) from Cook Strait and Marlborough Sounds, Kustanowich (1965) from Milford Sound, Hulme (1964) from Manukau Harbour, and Hedley, Hurdle and Burdett (1965) from *Discovery* Station 939 – west coast, New Zealand.

NEW RECORDS FROM NEW ZEALAND: Empty shells at Wellington (B 368), Porirua (B 388), New Plymouth (B 439).

MATERIAL: Approximately 25 specimens. Size range: length, 0.34–0.84 mm; width, 0.15–0.23 mm; thickness, 0.10–0.14 mm.

Remarks

This genus has been limited by Loeblich and Tappan

(1962, p. 110) to species without apertural tooth-plates, with a perforate granular wall structure, and a stratigraphical range from Upper Cretaceous to Palaeocene.

Examination of thin sections of specimens from New Plymouth (B 439) show the presence of tooth-plates and a radially perforate wall structure. These three features, the geological range, presence of tooth-plates and wall structure, indicate that this species is not a true *Loxostomum* but is possibly related to *Bolivina*.

Genus **Cassidulina** d'Orbigny, 1826

Cassidulina neocarinata Thalmann, 1950. (Pl. 12, fig. 6A, B.)

Cassidulina laevigata var. *carinata* Cushman, 1922, p. 124, pl. 25, fig. 6. 7 (not *Cassidulina laevigata* var. *carinata* Silvestri, 1896).

Cassidulina neocarinata Thalmann, 1950, p. 44 (new name for above).

Cassidulina laevigata (part). Heron-Allen and Earland, 1922, p. 137.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as part of *Cassidulina laevigata* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96, 134, 144, as *Cassidulina carinata* by Vella (1957) from Cook Strait and as *Cassidulina neocarinata* by Hornibrook (1961) from the Tertiary (Oligocene) of Oamaru District and by Hulme (1964) from Manukau Harbour.

NEW RECORDS FROM NEW ZEALAND: Empty shells at Wellington (B 368) and New Plymouth (B 439).

MATERIAL: Twelve specimens. Size range: length, 0.16–0.31 mm; width, 0.15–0.26 mm; thickness, 0.10–0.13 mm.

Remarks

The New Zealand intertidal specimens are very compressed, with a definite carina; two features which appear to separate this form from the typical *Cassidulina laevigata* of d'Orbigny, as both d'Orbigny's type figure and model show a test less compressed and without a definite carina.

Cassidulina laevigata var. *carinata*, a variety described by Cushman (1922) differs from the typical form in having a thinner, more compressed test, and a very distinct, thin carina forming the periphery of the test. We have, therefore, referred the New Zealand specimens to this variety.

Cassidulina laevigata var. *carinata* Cushman (1922) was preoccupied by *Cassidulina laevigata* var. *carinata* Silvestri (1896, p. 104, pl. 2, fig. 10) described from

the Lower Pliocene of Italy, and Cushman's original variety was renamed *Cassidulina neocarinata* by Thalmann (1950).

Unfortunately Brady's specimens identified as *Cassidulina laevigata* from *Challenger* Station 167, Wellington, New Zealand (Brady, 1884, pl. 54, fig. 2), are missing from the relevant slide in the British Museum (Natural History) and we are therefore unable to comment. Some of the specimens identified as *Cassidulina laevigata* by Heron-Allen and Earland (1922) from *Terra Nova* N.Z. stations are identical with the New Zealand intertidal forms.

Genus *Astrononion* Cushman and Edwards, 1937

Astrononion novozealandicum Cushman and Edwards, 1937.

Astrononion novozealandicum Cushman and Edwards, 1937, p. 35, pl. 3, figs. 18a, b.

Astrononion novozealandicum. Hedley, Hurdle and Burdett, 1965, p. 24.

Nonionina umbilicatula (part). Heron-Allen and Earland, 1922, p. 227.

PREVIOUS RECORDS FROM NEW ZEALAND: Originally described from "off New Zealand" by Cushman and Edwards (1937), from Cook Strait by Vella (1957), from Milford Sound by Kustanowich (1965), from *Discovery* Station 939 by Hedley, Hurdle and Burdett (1965), and by Hulme (1964) from Manukau Harbour; also as part of *Nonionina umbilicatula* by Heron-Allen and Earland (1922) from *Terra Nova* Stations 90, 91, 96.

NEW RECORDS FROM NEW ZEALAND: Living from Wellington (B 374) and New Plymouth (B 439).

MATERIAL: Four specimens in the sand among the tufts of *Corallina*. Size range: maximum diameter, 0.34–0.42 mm; maximum thickness, 0.16–0.22 mm.

Remarks

Vella (1962, p. 289) erected the genus *Pacinionion* and designated *Astrononion novozealandicum* as the type species. According to Vella *Pacinionion* is characterised by the nature of its supplementary chambers which distinguishes it from *Astrononion* and related genera. Hornibrook (1964) has revised the classifica-

tion of this group and considers the genus *Pacinionion* Vella a junior synonym of *Astrononion*.

Genus *Florilus* Montfort, 1808

Florilus flemingi (Vella), 1957.

Nonion flemingi Vella, 1957, p. 37, pl. 9, figs. 183, 184.
Florilus flemingi. Vella, 1962, p. 293.

PREVIOUS RECORDS FROM NEW ZEALAND: Described as *Nonion flemingi* from Musgrave Peninsula, Auckland Islands, by Vella (1957) and by Hulme (1964) from Manukau Harbour, and as *Florilus flemingi* from numerous fossil localities by Vella (1962).

NEW RECORDS FROM NEW ZEALAND: Empty shells at Porirua (B 388), Christchurch (B 391, B 400), and New Plymouth (B 439).

MATERIAL: Approximately 30 specimens. Size range: length, 0.20–0.35 mm; width, 0.15–0.25 mm; thickness, 0.12–0.20 mm.

Genus *Zeaflorilus* Vella, 1962

Zeaflorilus parri (Cushman), 1936.

Nonionella parri Cushman, 1936b, p. 89, pl. 13, figs. 17a-c.

Nonionina boueana var. *janeiformis*, Heron-Allen and Earland, 1922, p. 227, 228.

Pseudononion parri. Vella, 1957, p. 11.

Zeaflorilus parri Vella, 1962, p. 294.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded as *Nonionina boueana* var. *janeiformis* by Heron-Allen and Earland (1922) from *Terra Nova* Station 96, as *Nonionella parri* by Cushman (1936b) from shore sand, Caroline Bay, Timaru, New Zealand, and by Hulme (1964) from Manukau Harbour as *Pseudononion parri* by Vella (1957) from Marlborough Sound and as *Zeaflorilus parri* by Vella (1962).

NEW RECORDS FROM NEW ZEALAND: Living at Mount Maunganui (B 434); empty tests at Christchurch (B 391, B 400) and New Plymouth (B 439).

MATERIAL: Approximately 90 specimens. Size range: length, 0.25–0.66 mm; width, 0.15–0.42 mm; thickness, 0.10–0.30 mm.

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PLATES

PLATE 1.

B.M. (N.H.) Reg. No.

- Fig. 1: A tuft of *Corallina officinalis* Linn. from the intertidal zone, Wellington (× 1.5) 
- Fig. 2: *Acervulina inhaerens* attached to branches of *Corallina officinalis* (× 38)  1964.10.13.122
- Fig. 3: *Rosalina bradyi* attached to branch of *C. officinalis* (× 35)  1964.10.13.123
- Fig. 4: *Discorbis dimidiatus* attached to branch of *C. officinalis* (× 36)  1964.10.13.124
- Fig. 5: *Tolypamma* sp. attached to branch of *C. officinalis* (× 75)  1964.10.13.125

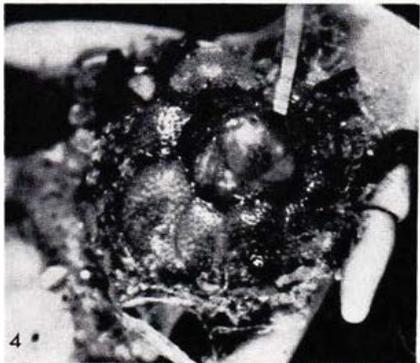
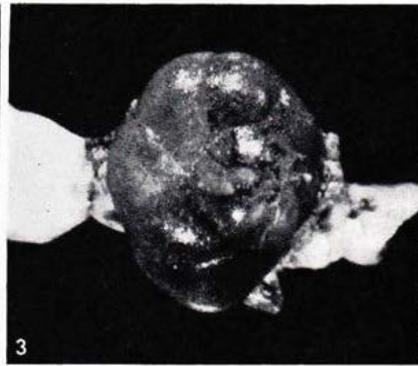
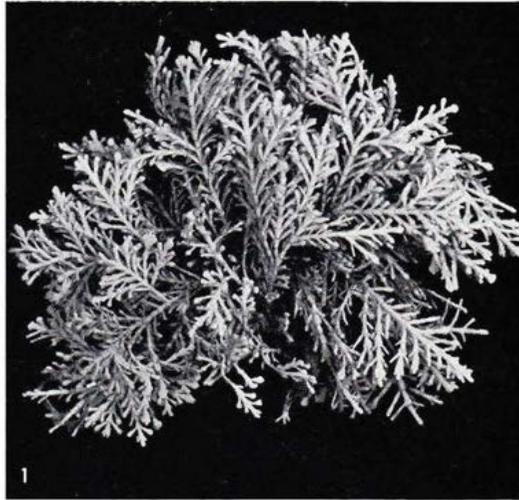


PLATE 2.

Fig. 1: Bi-lobed specimens of *Gromia oviformis* taken from a holdfast of *Macrocystis pyrifera* at Point Gordon, Wellington ($\times 20$).

Fig. 2: *Gromia oviformis* with pseudopodia extruded and attached to the substratum. This specimen was collected from Point Gordon, Wellington, and fixed in warm Bouin's fluid after the pseudopodia were extended ($\times 21$). From Hedley (1962a).

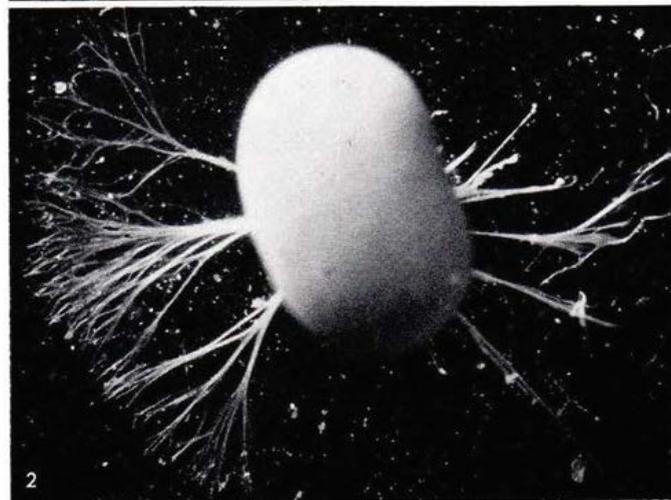
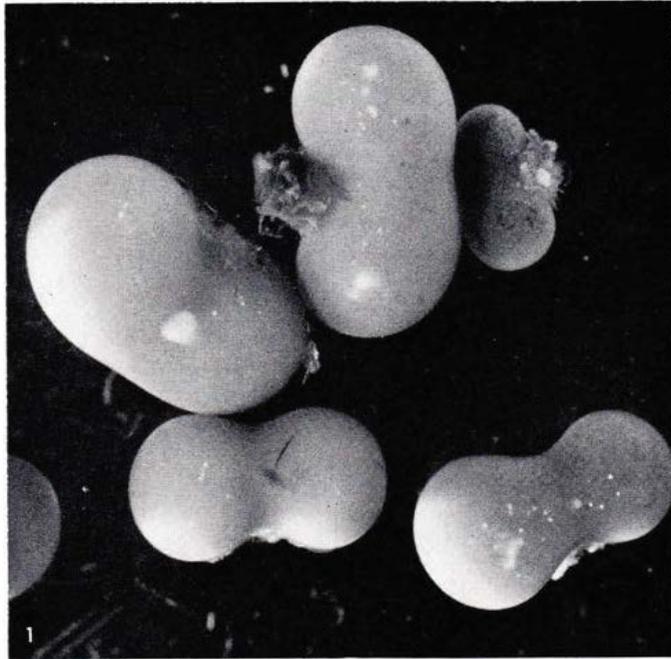


PLATE 3.

Living *Shepherdella taeniformis* from Christchurch photographed in culture dishes; the elongate worm-like form (B) with two oral regions, one at each end, changed to form (A) with four oral regions, from which pseudopodia were extruded, in 50 minutes ($\times 25$). From Hedley (1964).

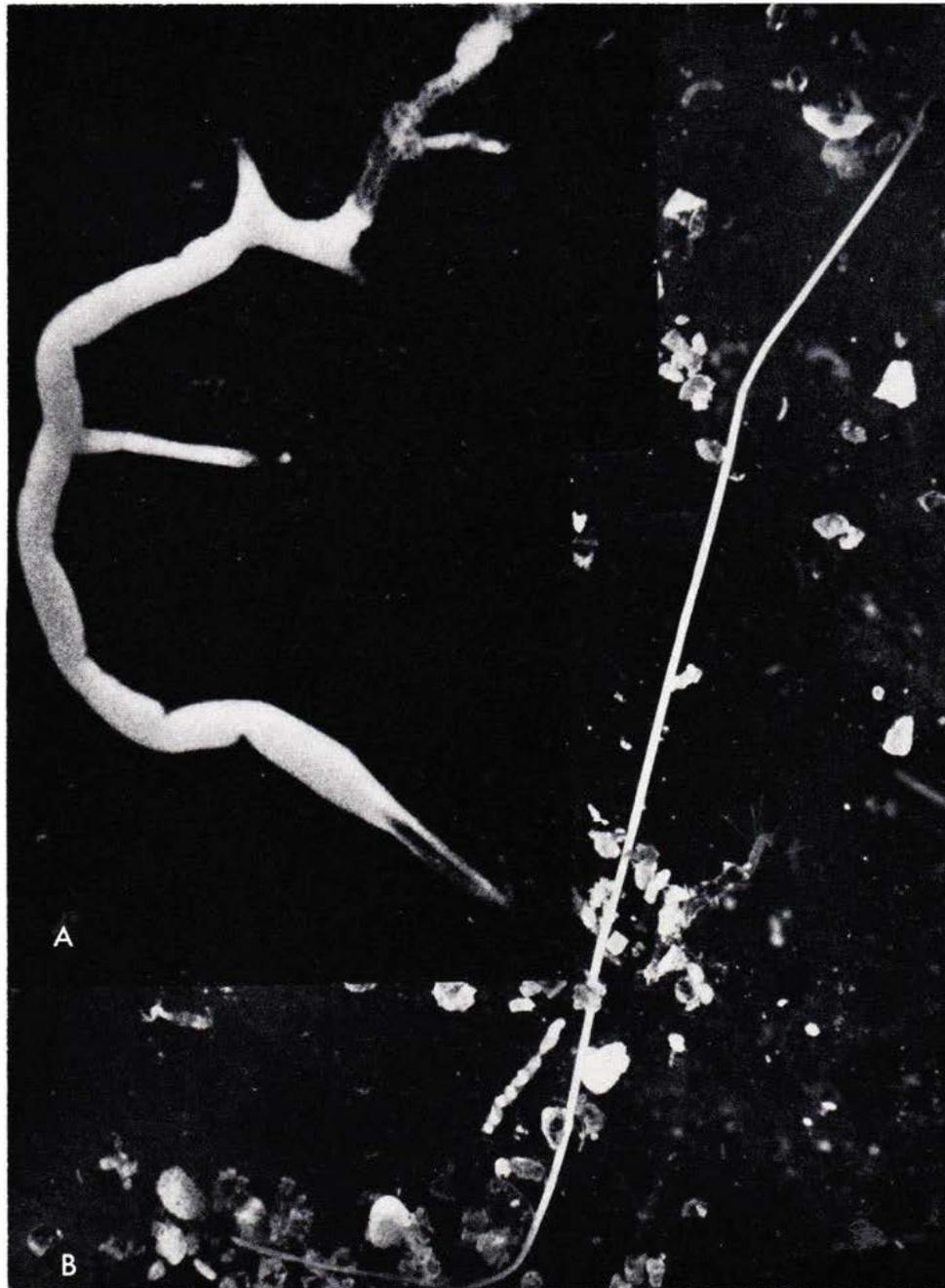


PLATE 4.

Living *Saccammina alba*, A—photographed with reflected light (\times 173),
B—photographed with transmitted light (\times 197). From Hedley (1962b).

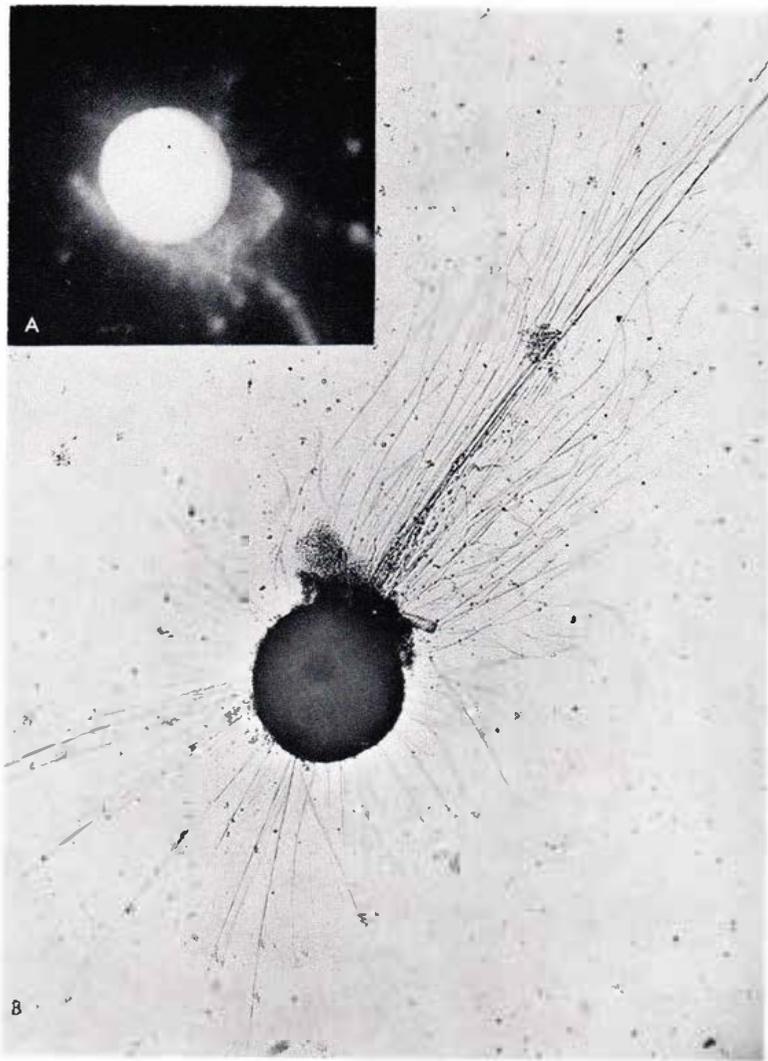


PLATE 5.

B.M. (N.H.) Reg. No.

- Fig. 1: Hemisphaerammina depressa* (Heron-Allen and Earland). Upper surface of a specimen attached to a small stone, a portion of which is shown ($\times 155$). From N.Z.O.I. Sta. B 374, Wellington 1964.10.13.3
- Fig. 2: Iridia diaphana* Heron-Allen and Earland.
A: lower surface of test of a specimen detached from *Corallina*, showing the contracted protoplasm ($\times 95$); B: upper surface, showing slit-like aperture ($\times 100$). From N.Z.O.I. Sta. B 405, Portobello 1964.10.13.1
- Fig. 3: Tolypammina* sp.
View of a specimen attached to *Corallina* ($\times 100$). From N.Z.O.I. Sta. B 420, Whangaparoa Peninsula 1964.10.13.4
- Fig. 4: Haplophragmoides canariense* (d'Orbigny).
A: peripheral view ($\times 80$); B: apertural view, showing the interio-areal aperture ($\times 80$). From N.Z.O.I. Sta. B 439, New Plymouth 1964.10.13.7
- Fig. 5: Ammobaculites exiguus* Cushman and Bronnimann.
A: peripheral view ($\times 102$); B: apertural view ($\times 104$). From N.Z.O.I. Sta. B 388, Porirua 1964.10.13.8
- Fig. 6: Textularia proxispira* Vella.
A: peripheral view; the initial portion of the specimen is damaged ($\times 87$); B: apertural view ($\times 93$). From N.Z.O.I. Sta. B 439, New Plymouth 1964.10.13.9
- Fig. 7: Textularia torquata* Parker.
A: peripheral view, showing oblique sutures and occasional larger sand grains embedded in test wall ($\times 156$); B: apertural view, showing slit-like aperture ($\times 166$). From N.Z.O.I. Sta. B 405, Portobello 1964.10.13.10
- Fig. 8: Siphotextularia mestayerae* Vella.
A: peripheral view ($\times 93$); B: apertural view ($\times 93$). From N.Z.O.I. Sta. B 439, New Plymouth 1964.10.13.11

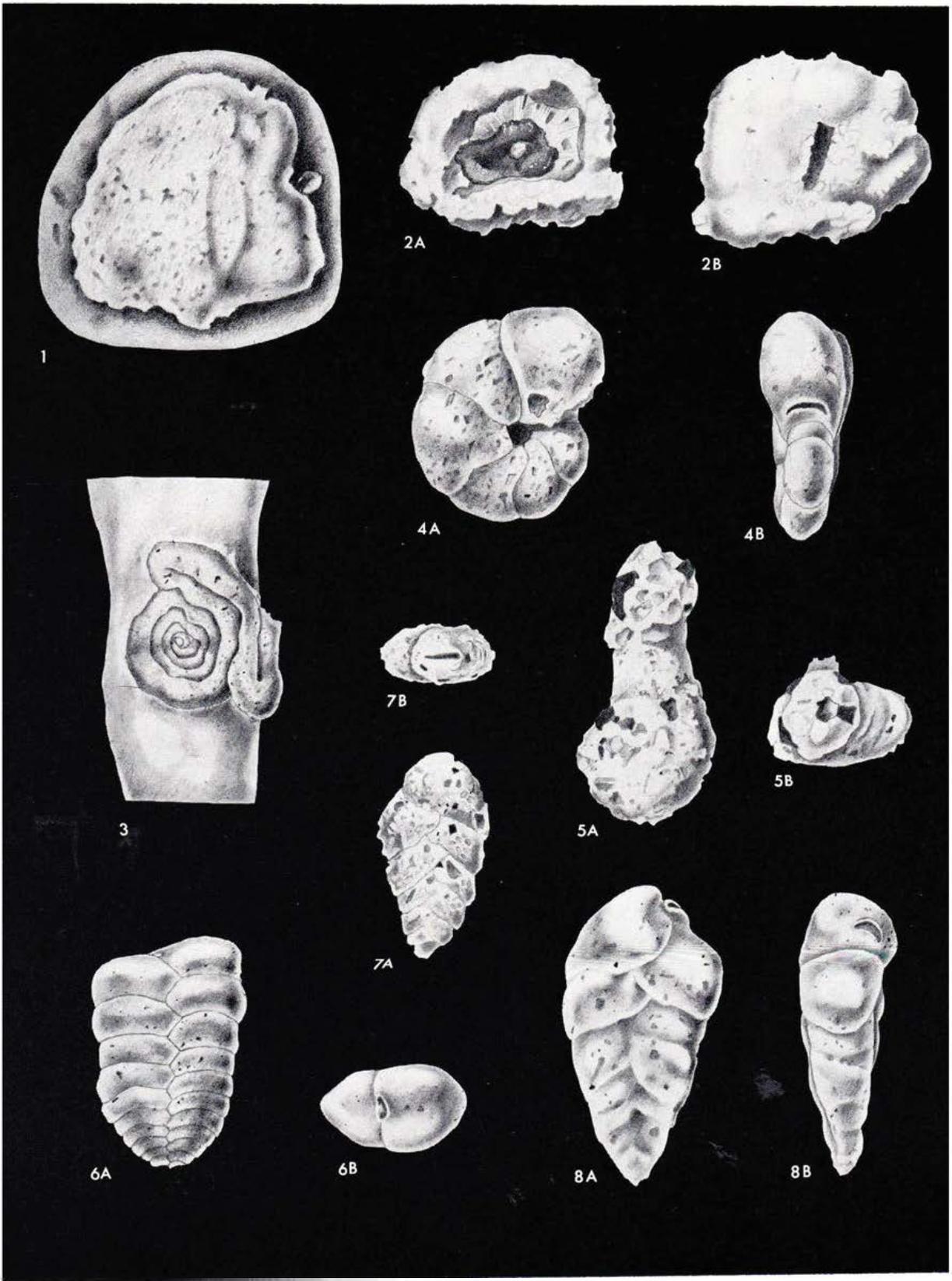


PLATE 6.

- Fig. 1: Trochammina adaperata* (Rhumbler). B.M. (N.H.) Reg. No.
 A: spiral view (\times 282); B: umbilical view, showing lobulate terminal chamber, with excavated umbilicus exposing the initial coils. The extra-umbilical aperture extends from the umbilicus along the base of the terminal chamber (\times 282); C: side view (\times 278). From N.Z.O.I. Sta. B 405, Portobello 1964.10.13.12
- Fig. 2: Trochammina bartrami* sp. nov.
 A: spiral view of holotype, showing strongly curved sutures and darkly coloured initial coils (\times 233); B: side view, showing low dorsal spire of test (\times 230); C: umbilical view, showing sigmoid-shaped sutures and stellate umbilicus, the points of which coincide with the sutures. The aperture extends from the umbilicus along the base of the terminal chamber (\times 233). From N.Z.O.I. Sta. B 434, Mount Maunganui 1964.10.13.14
- Fig. 3: Trochammina inflata* (Montagu).
 A: spiral view (\times 92); B: umbilical view (\times 90); C: side view (\times 90). From N.Z.O.I. Sta. B 388, Porirua 1964.10.13.31
- Fig. 4: Trochammina sorosa* Parr.
 A: spiral view (\times 162); B: umbilical view (\times 162); C: side view (\times 160). From N.Z.O.I. Sta. B 405, Portobello 1964.10.13.32
- Fig. 5: Gaudryina convexa* (Karrer).
 A: peripheral view (\times 48); B: apertural view (\times 46). From Hedley, Hornibrook, Hurdle and Burdett (1963). From N.Z.O.I. Sta. B 374, Wellington 1963.6.28.4

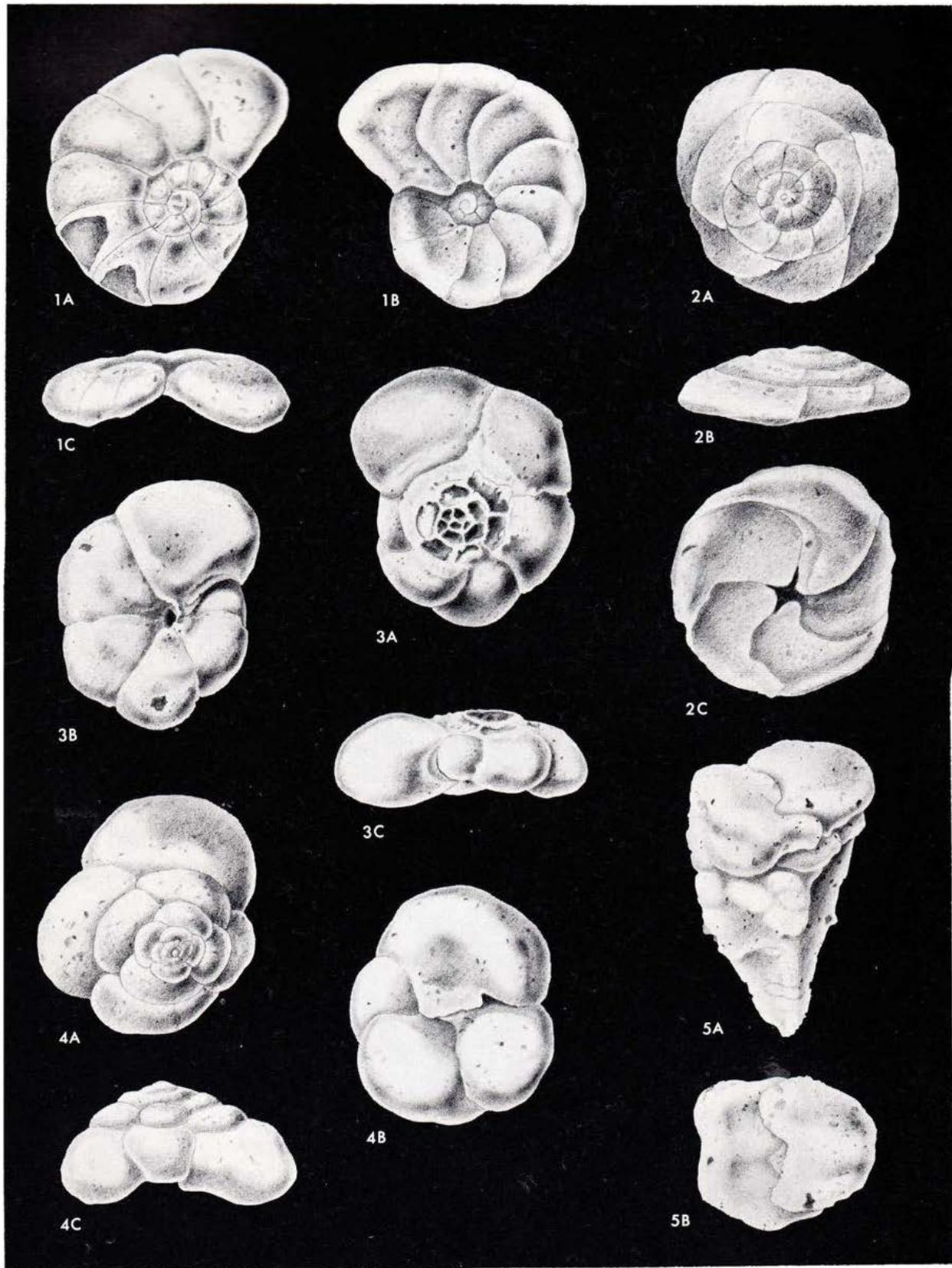


PLATE 7.

A culture of *Calcituba polymorpha* established in New Zealand in 1961 and flourishing at the time of writing – August 1964. A: (\times 48); B: (\times 80); and C: (\times 90).

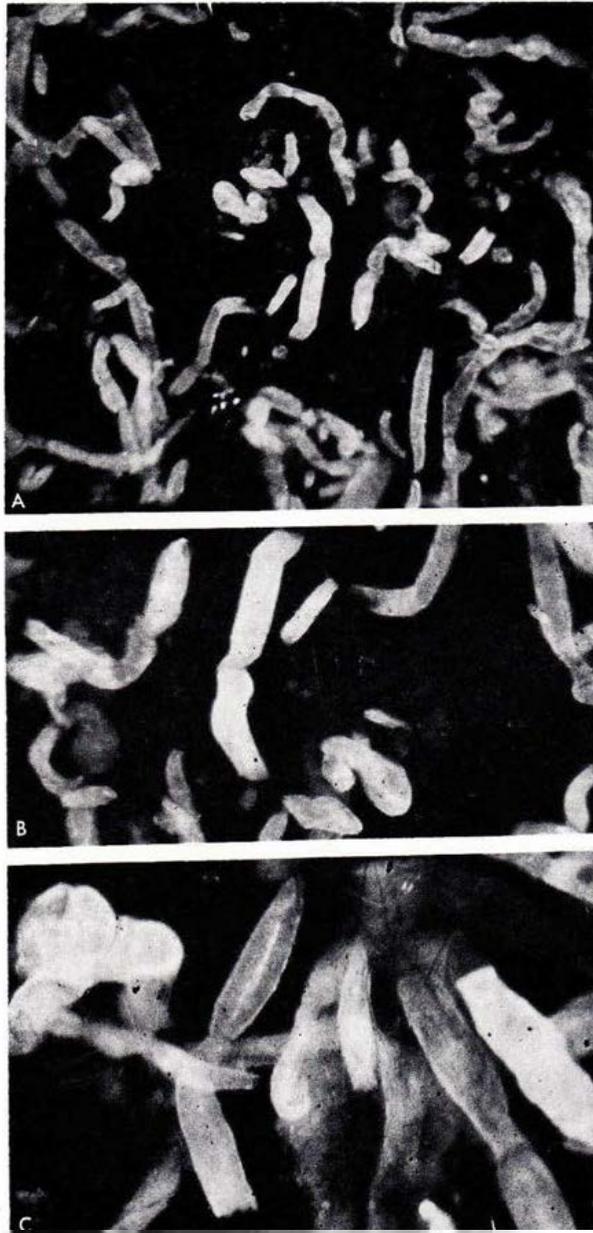


PLATE 8.

- Fig. 1: Massilina brodiei* sp. nov. B.M. (N.H.) Reg. No.
 A, B: opposite peripheral views of holotype ($\times 92$); C: apertural view, showing the bifid tooth. The shape of the bifid tooth is very variable, and is more pronounced in certain paratypes ($\times 92$). From N.Z.O.I. Sta. B 374, Wellington 1964.10.13.42
- Fig 2: Miliolinella labiosa* (d'Orbigny).
 A, B: opposite peripheral views ($\times 90$); C: apertural view showing broad, plate-like tooth ($\times 93$). From N.Z.O.I. Sta. B 388, Porirua 1964.10.13.58
- Fig. 3: Miliolinella labiosa* var. *schauinslandi* (Rhumbler).
 A: peripheral view ($\times 31$); B: apertural view ($\times 35$). From N.Z.O.I. Sta. B 400, Christchurch 1964.10.13.59
- Fig 4: Pateoris hauerinoides* (Rhumbler).
 A, B: opposite peripheral views ($\times 80$); C: apertural view ($\times 84$). From N.Z.O.I. Sta. B 368, Wellington 1964.10.13.57
- Fig. 5: Quinqueloculina auberiana* d'Orbigny.
 A, B: opposite peripheral views ($\times 65$); C: apertural view ($\times 65$). From N.Z.O.I. Sta. B 439, New Plymouth 1964.10.13.39
- Fig. 6: Quinqueloculina patagonica* d'Orbigny.
 A, C: opposite peripheral views ($\times 67$); B: apertural view ($\times 70$). From N.Z.O.I. Sta. B 388, Porirua 1964.10.13.40

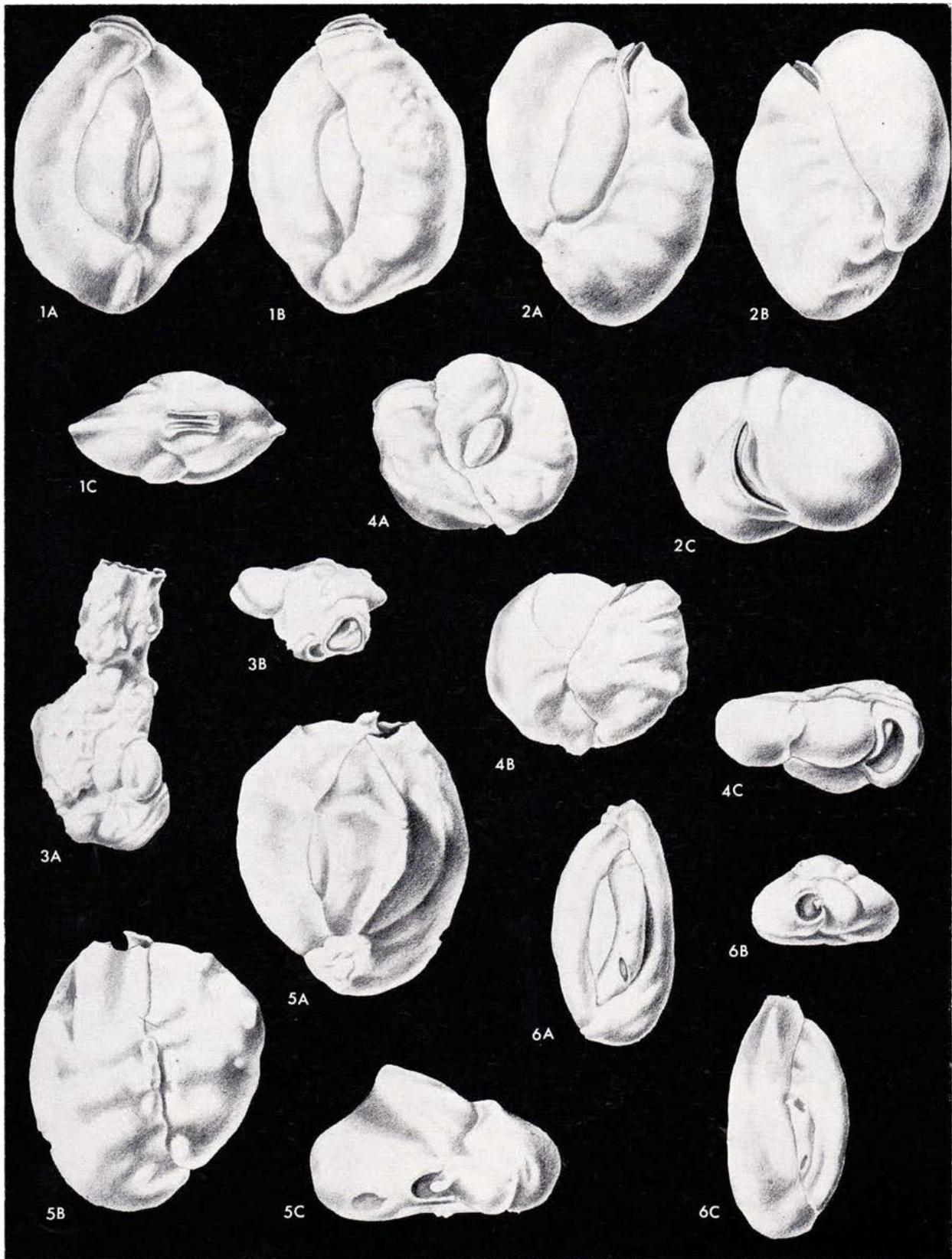


PLATE 9.

- Fig. 1: Quinqueloculina tenagos* Parker. B.M. (N.H.) Reg. No.
 A, B: opposite peripheral views (\times 92); C: apertural view
 (\times 92). From N.Z.O.I. Sta. B 388, Porirua 1964.10.13.41
- Fig. 2: Brizalina cacozela* Vella.
 A: peripheral view (\times 126); B: apertural view (\times 126).
 From N.Z.O.I. Sta. B 439, New Plymouth 1964.10.13.60
- Fig. 3: Bolivina compacta* Sidebottom.
 A: peripheral view of lectotype, showing curved depressed sutures
 and slightly lobulate chambers (\times 103); B: apertural view,
 showing aperture bordered by a lip (\times 103). From 8-14 fm,
 off the coast of the Island of Delos 1964.10.13.61
- Fig. 4: Bolivina pseudoplicata* Heron-Allen and Earland.
 A: peripheral view (\times 122); B: apertural view (\times 122).
 From N.Z.O.I. Sta. B 405, Portobello 1964.10.13.70
- Fig. 5: Virgulopsis turris* (Heron-Allen and Earland).
 A: peripheral view (\times 150); B: apertural view (\times 150).
 From N.Z.O.I. Sta. B 439, Mount Manuganui ... 1964.10.13.72
- Fig. 6: Rosalina* sp.
 A: peripheral view (\times 92); B: view of float chamber
 (\times 92); C: spiral view (\times 92). From N.Z.O.I. Sta. B 439,
 New Plymouth 1964.10.13.110
- Fig. 7: Patellinella inconspicua* (Brady).
 A: peripheral view (\times 100); B: spiral view (\times 92); C:
 apertural view (\times 92). From N.Z.O.I. Sta. B 434, Mount
 Maunganui 1964.10.13.101

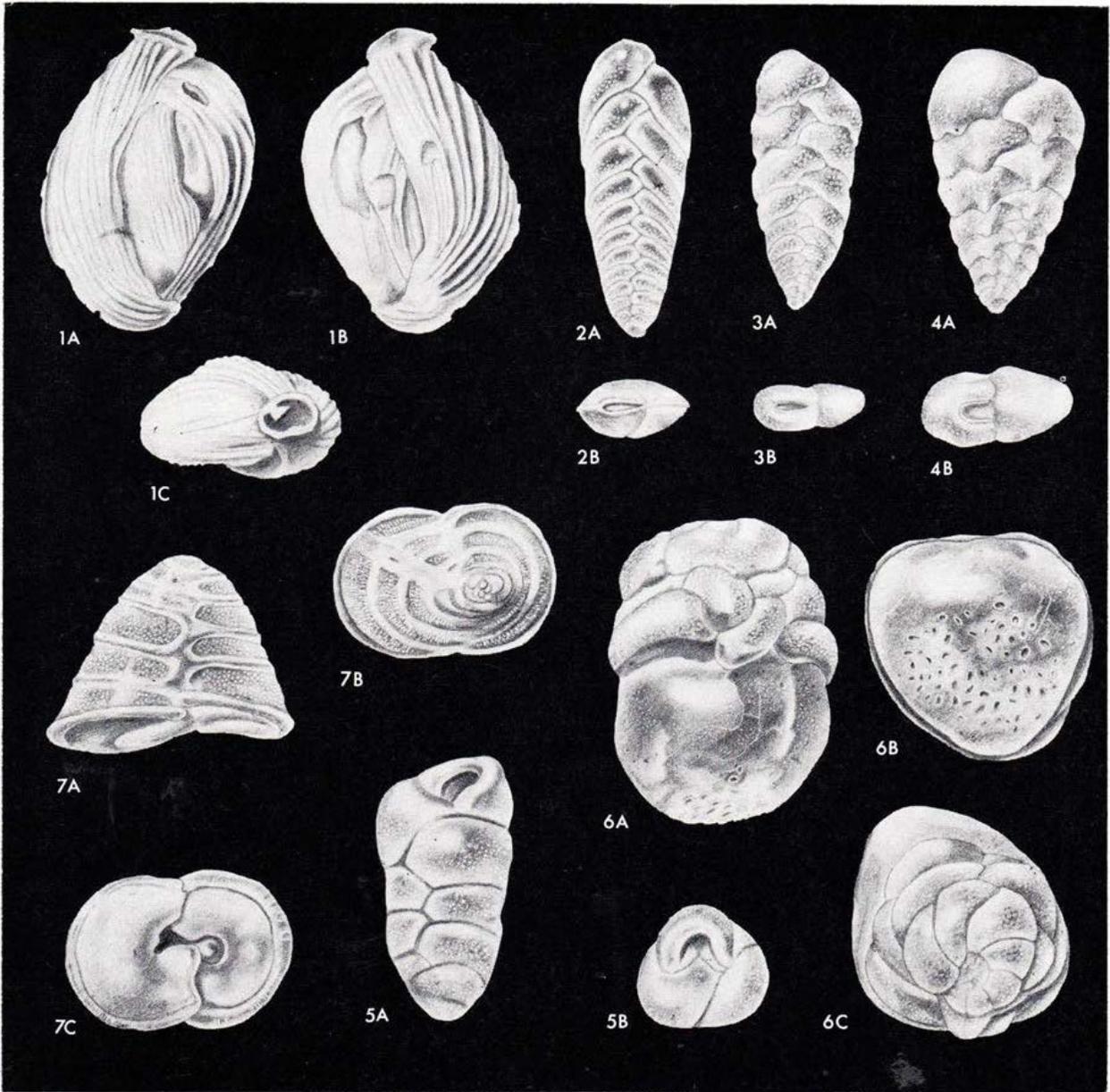


PLATE 10

- Fig. 1: Discorbis dimidiatus* (Parker and Jones). B.M. (N.H.) Reg. No.
- A: spiral view of paralectotype selected by A. R. Loeblich, jun., from the original material of Parker and Jones. The initial coils of the paratype are partially evolute ($\times 38$); B: side view ($\times 36$); C: umbilical view showing flattened surface and irregular umbilical plates ($\times 36$). From sponge sand, Melbourne, Australia 1964.10.13.73
- Fig. 2: Discorbis dimidiatus* (Parker and Jones).
- A: spiral view, showing evolute coils of test ($\times 40$); B: side view, showing raised evolute chambers of initial whorls ($\times 38$); C: umbilical view, showing short thickened umbilical plates, which are bordered by deep clefts ($\times 41$). From N.Z.O.I. Sta. B 374, Wellington 1964.10.13.74
- Fig. 3: Discorbis dimidiatus* (Parker and Jones).
- A: spiral view, showing completely evolute test; this variant of *D. dimidiatus* was originally described by Parr as *D. dimidiatus* var. *acervulinoides* ($\times 38$); B: side view, showing dome-shaped evolute test ($\times 40$); C: umbilical view, showing thickened umbilical plates, bordered by deep clefts ($\times 40$). From shore sand, Gulf St. Vincent, S. Australia 1964.10.13.75
- Fig. 4: Discorbis vesicularis* (Lamarck).
- A: spiral view of topotype, showing low evolute spire ($\times 38$); B: side view ($\times 38$); C: umbilical view showing thickened umbilical plates bordered by deep clefts ($\times 40$). From Lutetian of Grignon, Paris Basin 1964.10.13.76

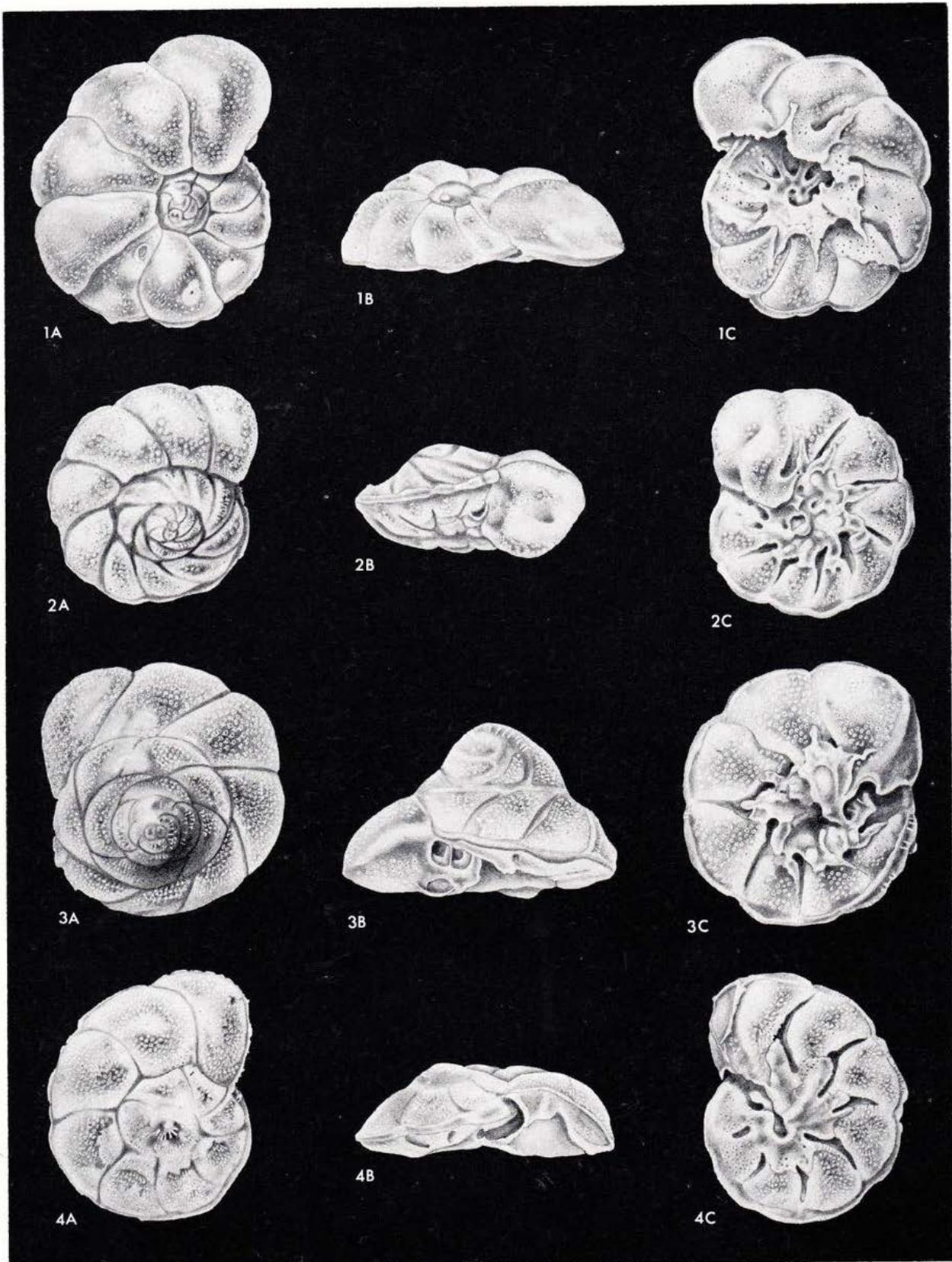


PLATE 11.

- Fig. 1: Planulinoides norcotti* sp. nov. B.M. (N.H.) Reg. No.
 A: spiral view of holotype, showing slightly inflated chambers and thickened, recurved sutures (\times 94); B: side view, showing peripheral aperture at base of last chamber and sutures bordering the periphery as a thickened flange (\times 94); C: umbilical view, showing excavated umbilicus and plate-like extensions of the chambers (\times 94). From N.Z.O.I. Sta. B 400, Christchurch — 1964.10.13.99
- Fig. 2: Rosalina bradyi* (Cushman).
 A: spiral view, showing inflated, densely perforate chambers (\times 62); B: side view (\times 60); C: umbilical view, showing excavated umbilicus bordered by thickened shelly patches (\times 60). From N.Z.O.I. Sta. B 439, New Plymouth --- 1964.10.13.102
- Fig. 3: Rosalina irregularis* (Rhumbler).
 A: spiral view, showing irregular arrangement of later chambers (\times 90); B: umbilical view, showing excavated umbilicus (\times 90). From N.Z.O.I. Sta. C 621, Chatham Islands — 1964.10.13.109
- Fig. 4: Ammonia aoteanus* (Finlay).
 A: spiral view (\times 72); B: side view (\times 68); C: umbilical view, showing open umbilical fissures bordered by slightly thickened areas of clear calcareous material. There is no umbilical plug, and there are no beads of calcareous material along the sutures (\times 70). From N.Z.O.I. Sta. B 388, Porirua --- 1964.10.13.111

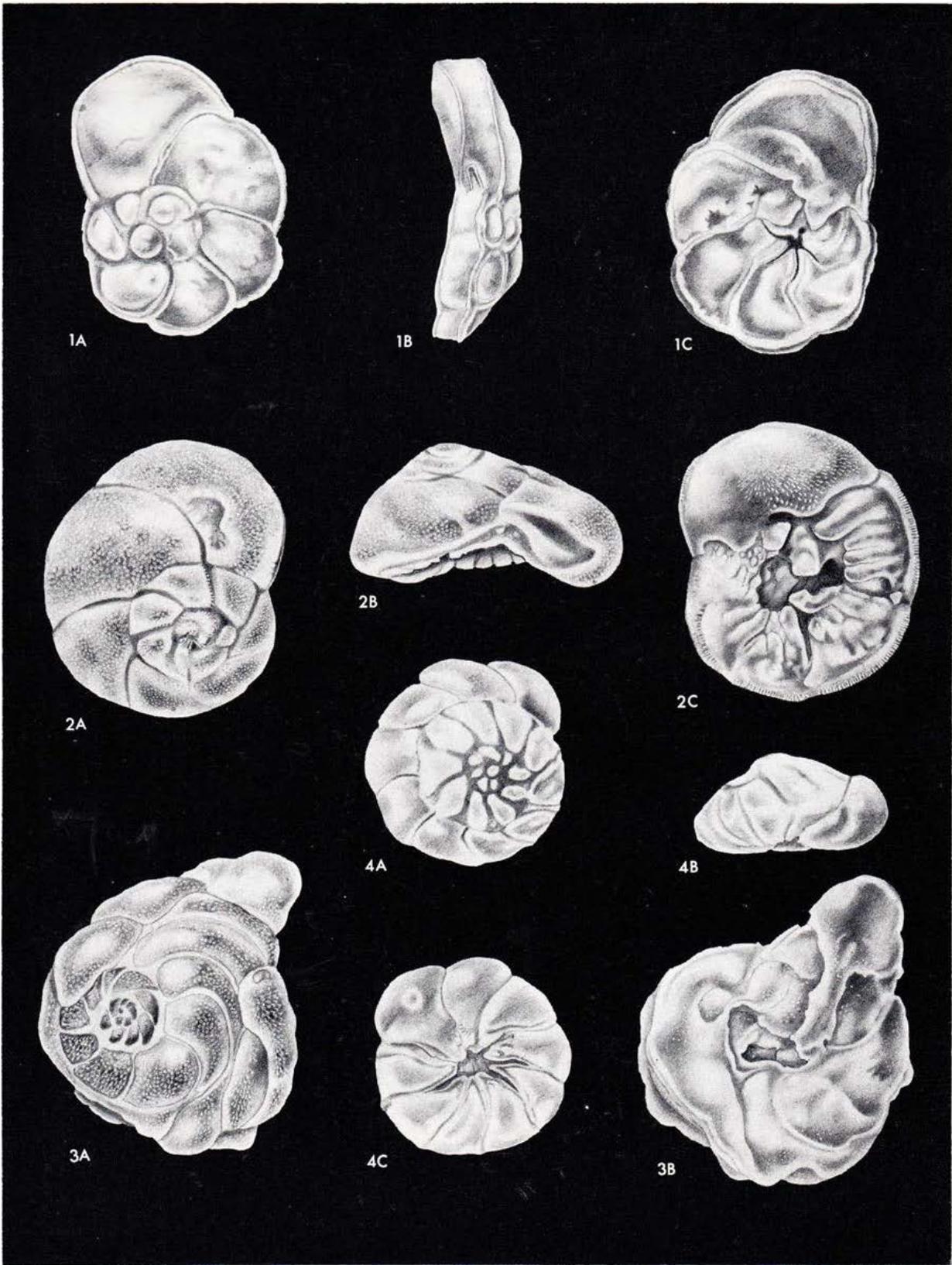


PLATE 12

B.M. (N.H.) Reg. No.

Fig. 1: *Criboelphidium simplex* (Cushman).

A: peripheral view, showing slightly curved sutures, with a limited number of sutural pores and the umbilical region filled with a granular calcareous mass ($\times 71$); B: apertural view, showing apertural pores at base of terminal chamber. *Criboelphidium* Cushman and Bronnimann, 1948, has been reinstated by Loeblich and Tappan (1964) to include species formerly included under *Elphidiononion* Hofker, 1951 ($\times 70$). From N.Z.O.I. Sta. B 405, Portobello

1964.10.13.120

Fig. 2: *Criboelphidium argenteum* (Parr).

A: peripheral view ($\times 130$); B: apertural view ($\times 130$). From N.Z.O.I. Sta. B 439, New Plymouth.

1964.10.13.118

Fig. 3: *Criboelphidium charlottensis* (Vella).

A: peripheral view ($\times 103$); B: apertural view ($\times 103$). From N.Z.O.I. Sta. B 420, Whangaparoa

1964.10.13.119

Fig. 4: *Elphidium novozealandicum* Cushman.

A: peripheral view ($\times 100$); B: apertural view ($\times 100$). From N.Z.O.I. Sta. B 405, Portobello

1964.10.13.117

Fig. 5: *Cassidulinoides orientalis* (Cushman).

A: peripheral view ($\times 111$); B: apertural view ($\times 111$). From N.Z.O.I. Sta. B 374, Wellington

1964.10.13.71

Fig. 6: *Cassidulina neocarinata* Thalmann.

A: peripheral view ($\times 129$); B: apertural view ($\times 125$). From N.Z.O.I. Sta. B 439, New Plymouth

1964.10.13.121



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33	In press	The Submarine Geology of Foveaux Strait. By D. J. CULLEN. <i>N.Z. Dep. sci. industr. Res. Bull.</i>	37	In press	The Marine Fauna of New Zealand: Porifera, Demospongiae. Part I. Tetractinomorpha and Lithistida. By PATRICIA M. BERGQUIST. <i>N.Z. Dep. sci. industr. Res. Bull.</i>
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