

NEW ZEALAND  
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN 163

**A Foraminiferal Fauna from the Western  
Continental Shelf, North Island,  
New Zealand**

by

R. H. HEDLEY

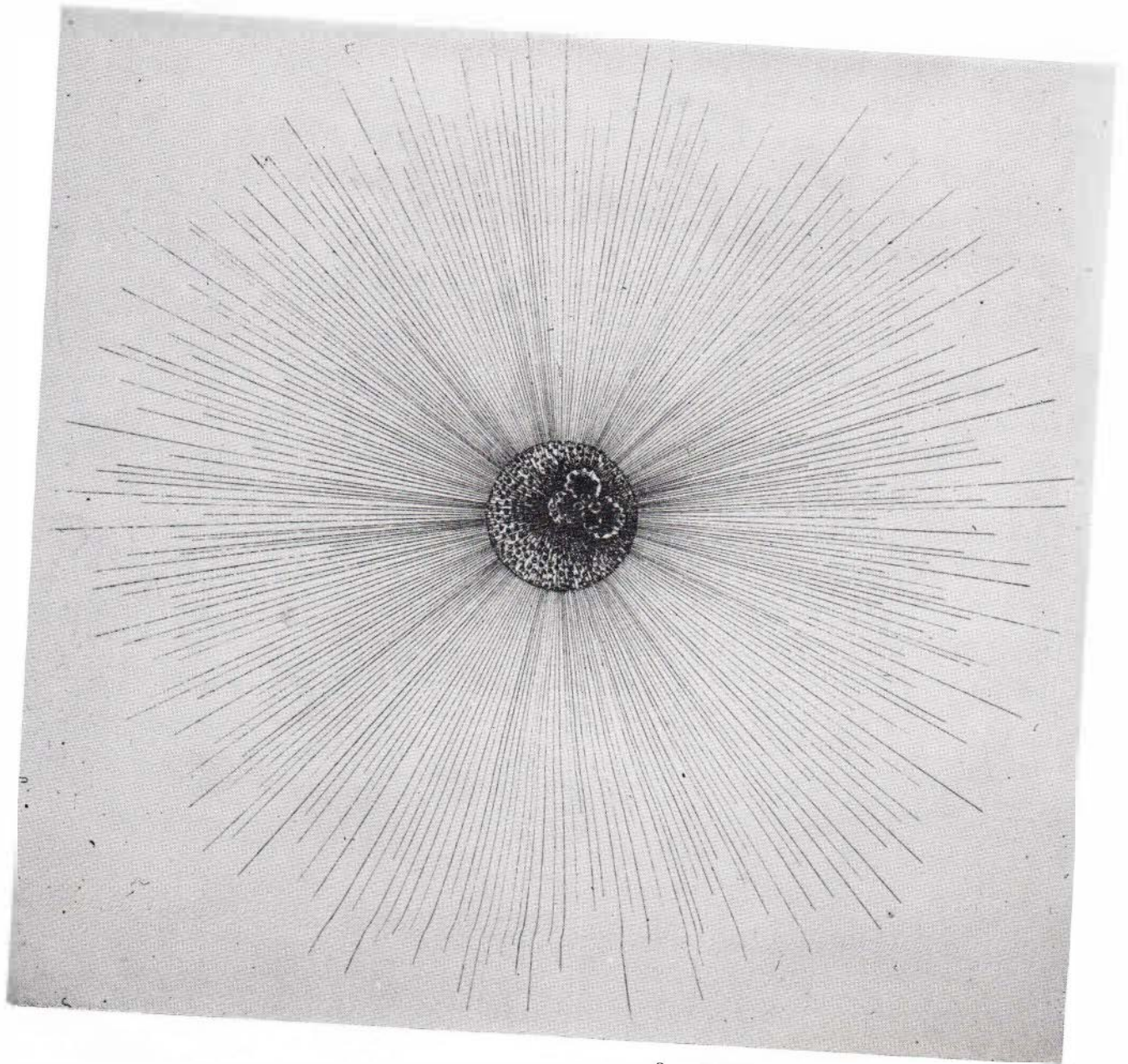
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**New Zealand Oceanographic Institute  
Memoir No. 25**

1965

A FORAMINIFERAL FAUNA FROM THE WESTERN CONTINENTAL  
SHELF, NORTH ISLAND, NEW ZEALAND



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*Orbulina universa* d'Orbigny. Surface specimen, immediately after being taken from the sea; drawn by Mr Wild.

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## FOREWORD

OVER the last few years there has been an increasing interest in New Zealand in the Recent Foraminifera of the region. It is therefore particularly appropriate that the present study by Dr Hedley and his colleagues should have been made, providing as it does a revision of the taxonomy and systematics of a substantial element of the planktonic and the benthic shelf fauna.

The literature on Recent Foraminifera up to the present has been sparse and the present work is a significant addition to the available information. The illustrations, of species not figured or not adequately figured previously, are the work of Mr I. D. J. Burdett.

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

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# A Foraminiferal Fauna from the Western Continental Shelf, North Island, New Zealand

## Abstract

FIFTY-THREE species of benthic and planktonic Foraminifera are reported from the west coast of New Zealand from RRS *Discovery II* Station 939 at a depth of 87 m; 28 of these are illustrated. This study of the Foraminiferal fauna of the shelf off the west coast of New Zealand and examination of earlier New Zealand collections deposited in the British Museum (Natural History) has enabled substantial clarification of the systematic positions of the species concerned. Numerous nomenclatural changes and misidentifications are discussed.

## INTRODUCTION

A single, alcohol-preserved, sediment sample taken by RRS *Discovery II*, in 1932, from a depth of 87 m off the west coast of North Island, New Zealand ( $35^{\circ} 49.6'S$ ,  $173^{\circ} 27'E$ ; Station D 939), was obtained from the U.K. National Institute of Oceanography collections and is gratefully acknowledged. Although few specimens appeared to have been alive at the time of collection the sample was sufficiently rich in specimens to warrant further examination of the species from a systematic point of view, for the specimens represent a substantial portion of the known benthic foraminiferal fauna from the continental shelf of the west coast of the North Island, New Zealand. This examination seemed to be particularly desirable for, until recently, when Vella (1957) published his *Studies in New Zealand Foraminifera* little was known of the Recent Foraminifera from the area. Most of that which was known, for example, Brady (1884), Cushman (1919), Chapman (1906, 1909), and Heron-Allen and Earland (1922), was published prior to more recent nomenclatural revisions and changes in taxonomic conceptions. Consequently we have felt it would be useful to give an account of the Foraminifera in the *Discovery* collection, after comparing them with those from New Zealand localities deposited in the British Museum (Natural History) and reported on by Brady (1884) and Heron-Allen and Earland (1922). In addition we have examined the types of Williamson, and of Parker and Jones whenever applicable, as well as certain topotypic specimens of Cushman, all of which are de-

posited in the British Museum (Natural History). Furthermore, one of us (R.H.H.) has had a recent opportunity to discuss the provisional identifications with Dr P. Vella (Victoria University, Wellington) and Dr S. Kustanowich (New Zealand Oceanographic Institute, Wellington). We are grateful for their comments which in some instances have modified our opinions and identifications.

Illustration of species is restricted to those either not previously figured in works dealing with New Zealand Foraminifera or which, in our opinion, have been inadequately illustrated.

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. When there are records from New Zealand which do not fulfil these requirements, they are noted in the remarks section.

Microradiographs have been prepared when it was considered necessary and practical. When these have been photographed and included in the account, the radiographic factors are given in the corresponding legend. The method and equipment are the same as that described by Hedley (1957).

One set of specimens, including those figured, and the microradiographs are deposited in the British Museum (Natural History) and another set of specimens has been deposited in the New Zealand Geological Survey.

## ACKNOWLEDGMENTS

One of us (R.H.H.) is indebted to Mr J. W. Brodie of the New Zealand Oceanographic Institute and to Mr N. de B. Hornibrook of the New Zealand 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.

Our colleague, Dr C. G. Adams, has kindly discussed many problems during the period of study.

## LIST OF SPECIES

*Alveolophragmium zealandicum* Vella.  
*Ammobaculites agglutinans* (d'Orbigny).  
*Astronianian novo-zealandicum* Cushman and Edwards.  
*Biloculinella depressa* (d'Orbigny).  
*Bolivina robusta* Brady.  
*Brizalina spathulata* (Williamson).  
*Bulimina marginata* d'Orbigny.  
*Cibicides lobatulus* (Walker and Jacob).  
*Cibicides marlboroughensis* Vella.  
*Cornuspirella diffusa* (Heron-Allen and Earland).  
*Dentalina emaciata* Reuss.  
*Dentalina filiformis* (d'Orbigny).  
*Dentalina vertebralis* (Batsch).  
*Discorbinella bertheloti* (d'Orbigny).  
*Dyocibicides biserialis* Cushman and Valentine.  
*Eponides tenera* (Brady).  
*Gavelinopsis lobatulus* (Parr).  
*Globigerina bulloides* d'Orbigny.  
*Globigerina inflata* d'Orbigny.  
*Globobulimina turgida* (Bailey).  
*Globorotalia truncatulinoides* (d'Orbigny).  
*Hastigerina (Hastigerina) siphonifera* (d'Orbigny).  
*Lagena sulcata* (Walker and Jacob).  
*Lenticulina costatus* (Fichtel and Moll).  
*Lenticulina cultratus* (Montfort).  
*Lenticulina gibba* (d'Orbigny).  
*Lenticulina subgibba* Parr.

*Lenticulina suborbicularis* Parr.  
*Lenticulina tasmanica* Parr.  
*Loxostomum karrerianum* (Brady).  
*Loxostomum lobatum* (Brady).  
*Miliolinella vigilax* Vella.  
*Orbulina universona* d'Orbigny.  
*Planularia tricarinnella* (Reuss).  
*Planularia tricarinnella* var. *spinipes* Cushman.  
*Polystomellina finlayi* (Vella).  
*Polystomellina zelandica* (Finlay).  
*Psammosphaera fusca* Schulze.  
*Pseudopolymorphina tortuosa* Vella.  
*Pyrgo pisum* (Schlumberger).  
*Quinqueloculina agglutinans* d'Orbigny.  
*Quinqueloculina colleenae* Vella.  
*Quinqueloculina seminulum* (Linnaeus).  
*Reophax scorpiurus* Montfort.  
*Saracenaria latifrons* (Brady).  
*Sigmoidella elegantissima* (Parker and Jones).  
*Siphotextularia concava* (Karrer).  
*Sphaeroidina bulloides* d'Orbigny.  
*Spiroloculina communis* Cushman and Todd.  
*Textularia goesii* Cushman.  
*Textularia* sp. aff. *T. gramen* d'Orbigny.  
*Triloculina insignis* (Brady).  
*Uvigerina peregrina* Cushman.

TABLE 1: STATION LIST

Ship	Station	Date	Position		Depth	Temperature		Gear	Nature of Sediment
			Lat°	Long°		Surface	Bottom		
<i>Discovery II</i>	939	18/8/1932	35° 49' 6" S	173° 27' E to	87m	Surface	Bottom	Cone dredge 1558–1604 Otter dredge 1623–1723 Net attached to back of trawl Mesh. 7mm. Net attached to back of trawl Mesh. 4mm.	
			35° 51' 6" S	173° 28' 9" E		..	..		
<i>Challenger</i> ..	166	23/6/1874	38° 50' S	169° 20' E	275fm	58·5°F	50·5°F	Trawl. Some sediment recovered on sounding tube	Globigerina ooze.
	166a	23/6/1874	..	..	350fm	..	..	..	"
	166b	23/6/1874	39° 8' S	170° 43' E	400fm	58·5°F	..	..	"
	166c	23/6/1874	39° 21' S	171° 28' E	400fm	58·0°F	..	..	"
	167	24/6/1874	39° 32' S	171° 48' E	145–150fm	58·5°F	..	..	Blue Mud.
	167a	25/6/1874	Off D'Urville Island	..	32–52fm	..	..	..	"
<i>Terra Nova</i> ..	168	8/7/1874	40° 28' S	177° 43' E	1100fm	57·2°F	37·2°F	..	"
	*	August 1911	Off Three Kings Island	..	90–120fm	..	..	Recovered on sounding lead	Shell sand and coarse debris of Polyzoa.
	90	25/7/1911	From Summit of Great King (Three Kings Islands) S 14° W, 8 miles	..	100fm	..	..	..	Coarse sand and shell, polyzoan and coral debris (3 samples).
	91	26/7/1911	From Summit of Great King (Three Kings Islands) S 10° W, 25 miles	..	300fm	..	..	..	Stones, corals, and sand with polyzoan and sponge debris (2 samples).
	96	3/8/1911	7 miles E of North Cape	..	70fm	..	..	..	Sand, shell debris, and white-grey limestone (5 samples).
	134	31/8/1911	Spirits Bay, near North Cape	..	11–20fm	..	..	..	Sand, shell fragments, and other organic debris.
144	13/9/1911	From Cape Maria van Diemen, W by S, 7 miles	..	35–40fm	..	..	..	Organic debris and sand.	

\*No number





## SYSTEMATIC NOTES

Genus **Psammosphaera** Schulze, 1875

**Psammosphaera fusca** Schulze.

*Psammosphaera fusca* Schulze, 1875, p. 113, pl. 2, fig. 8a–f.  
*Psammosphaera fusca*, Heron-Allen and Earland, 1922, p. 83,  
pl. 1, fig. 18.

MATERIAL: 4 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919)  
and Heron-Allen and Earland (1922).

### Remarks

Heron-Allen and Earland (1913: 16–18, pl. 2, figs. 3–16)  
discuss the variation found in *Psammosphaera fusca* and  
the significance of a spicule in the test of *Psammosphaera*  
*fusca* var. *parva* (Flint).

Genus **Reophax** Montfort, 1808

**Reophax scorpiurus** Montfort (pl. 1, fig. 1).

*Reophax scorpiurus* Montfort, 1808, p. 331, text fig. p. 330.  
*Reophax scorpiurus*, Heron-Allen and Earland, 1922, p. 93.

MATERIAL: 5 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919,  
doubtful record); Heron-Allen and Earland (1922); Vella  
(1957), and Kustanowich (1965).

### Remarks

Our specimens are identical with those from *Terra Nova*  
Stations 91 and 96 (Heron-Allen and Earland, 1922).

Genus **Ammobaculites** Cushman, 1910

**Ammobaculites agglutinans** (d'Orbigny) (pl. 1, figs. 2, 3).

*Spirolina agglutinans* d'Orbigny, 1846, p. 137, pl. 7, figs. 10–12.  
*Ammobaculites agglutinans*, Cushman, 1910, p. 600.  
*Haplophragmium agglutinans*, Heron-Allen and Earland, 1922,  
p. 97, pl. 3, fig. 15.

MATERIAL: 16 specimens (9 adults, 7 young forms).

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman  
(1910); Heron-Allen and Earland (1922).

### Remarks

Cushman (1910) notes that the coiled portion of *Ammo-*  
*baculites agglutinans* from the New Zealand area is not  
very distinct from the uncoiled portion. This also applies  
to our specimens when viewed externally (pl. 1, fig. 2),  
but the initial coiling is seen in radiographs (pl. 1, fig. 3).

Heron-Allen and Earland (1922) figured an unusual  
form (pl. 3, fig. 15) which is not typical of most of the  
New Zealand specimens they assigned to *Ammobaculites*  
*agglutinans*. Our specimens are identical with those of  
Heron-Allen and Earland (1922) recorded from Station 96.

For further useful information see Cushman (1920, 1921).

Genus **Alveolophragmium** Stschedrina, 1936

**Alveolophragmium zealandicum** Vella (pl. 1, fig. 4a–c).

*Alveolophragmium zealandicum* Vella, 1957, p. 15, pl. 3, figs. 44,  
45.  
*Haplophragmium latidorsatum*, Heron-Allen and Earland, 1922,  
p. 99.

MATERIAL: 5 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Haplo-*  
*phragmium latidorsatum* by Heron-Allen and Earland (1922)  
and as *Alveolophragmium zealandicum* by Vella (1957).

### Remarks

Our specimens are identical with those of Heron-Allen  
and Earland from Station 96 and with the holotype of  
*Alveolophragmium zealandicum* Vella (1957). Unfortunately  
all our large specimens which were compared with those of  
Heron-Allen and Earland and of Vella have been lost.  
Because of this we have illustrated a specimen from the  
New Zealand Station 96 (Heron-Allen and Earland 1922).

Genus **Textularia** Defrance, 1824

**Textularia goesii** Cushman

*Textularia goesii* Cushman, 1911, p. 15, fig. 24 (after Brady)  
in text.  
*Textularia trochus*, Heron-Allen and Earland (part), 1922, p. 121.

MATERIAL: 13 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman  
(1911) and as part of *Textularia trochus* by Heron-Allen  
and Earland (1922, Station 96).

### Remarks

Cushman (1911) placed the *Textularia trochus* illustrated  
by Brady (1884: pl. 44, figs. 1–3) in the synonymy of his  
*Textularia goesii*. We have examined Brady's specimens  
and observe that those illustrated on pl. 44, figs. 1 and 2  
closely resemble specimens identified by Cushman as  
*Textularia goesii* from *Albatross* Station D 5110 which  
are deposited in the British Museum (Natural History).  
The only detectable difference is in the size of the aperture  
which is smaller in Brady's specimens. The longitudinal  
section illustrated by Brady (1884: pl. 44, fig. 3) shows a  
labyrinthic arrangement of chambers which is not  
characteristic of *Textularia goesii*.

**Textularia** sp. aff. **T. gramen** d'Orbigny (pl. 1, fig. 5a, b).

MATERIAL: 22 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922).

#### Remarks

Our specimens are identical with some of *Textularia gramen* recorded by Heron-Allen and Earland. None of these, however, are identical with d'Orbigny's type figure (1846: pl. 15, figs. 4–6) and they differ in having (1) more chambers, (2) sutures generally horizontal, and (3) terminal chambers less inflated.

The wide range of variation thought to be shown by *Textularia gramen* is illustrated by Todd and Bronnimann (1957: pl. 2, figs. 15–18) and Boltovskoy (1957: pl. 2, figs. 1–9; 1959a: pl. 1, fig. 10). Our specimens fit into this range and we are not following Chapman and Parr (1937) in the use of their *Textularia pseudogramen*.

It is worthy of mention that we find intermediate specimens which seem to link *Textularia gramen*, *Textularia conica*, and *Textularia agglutinans*, a point raised earlier by Heron-Allen and Earland (1922: 121).

### Genus **Siphotextularia** Finlay, 1939

**Siphotextularia concava** (Karrer) (pl. 1, fig. 6a, b).

*Plecanium concavum* Karrer, 1868, p. 129, pl. 1, fig. 3.  
*Textularia concava*, Brady (part), 1884, p. 360, pl. 42, figs. 13, 14.  
*Textularia concava*, Heron-Allen and Earland (part), 1922, p. 117.

MATERIAL: 5 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As part of *Textularia concava* by Heron-Allen and Earland (1922).

#### Remarks

Our specimens are also identical with some of those recorded by Heron-Allen and Earland and with the *Textularia concava* of Brady (1884) from *Challenger* Station 219A, Admiralty Islands (pl. 42, fig. 13) and Station 308, west of Patagonia (pl. 42, fig. 14).

It is noted that Vella (1957: 17) indicates the close affinity of his *Siphotextularia blacki* with *Siphotextularia concava* (Karrer). We feel that the close agreement of our specimens with the type figure of *Plecanium concavum* compels us to allocate our specimens to *Siphotextularia concava*. Marks (1951: 37) mentions that this species has been recorded living in the Atlantic Ocean. See also Bermudez (1949: 66, pl. 2, figs. 72–74), and Said (1950: 5, pl. 1, fig. 3).

### Genus **Cornuspirella** Cushman, 1928

**Cornuspirella diffusa** (Heron-Allen and Earland).

*Cornuspira diffusa* Heron-Allen and Earland, 1913, p. 272, pl. 12, text fig. 37.  
*Cornuspira foliacea*, Brady (part), 1884, p. 199, pl. 11, fig. 7.  
*Cornuspira diffusa*, Heron-Allen and Earland, 1922, p. 74.  
*Cornuspirella diffusa*, Cushman, 1928, p. 4, pl. 1, fig. 14.

MATERIAL: 6 incomplete specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922).

#### Remarks

The lectotype and paro-lectotypes, designated by Loeblich and Tappan (1964) from the North Sea were examined and compared with the specimens recorded from New Zealand by Heron-Allen and Earland (1922, Station 96). It is noted that the striae of the New Zealand specimens are thicker and slightly more incised than the type specimens.

Our specimens are identical with those from New Zealand Station 96 (Heron-Allen and Earland, 1922) except that no individual was found to have the initial spiral coil. The rarity of specimens with an initial coil in any sample has been commented on by Heron-Allen and Earland (1913, p. 273).

Specimens reported from RRS *Discovery* Stations in the South Orkneys, South Sandwich Islands, and South Georgia are smaller than ours, smooth and translucent, but undoubtedly belong to the same species (Earland, 1933: 51, pl. 1, figs. 5–7; 1934: 52).

### Genus **Miliolinella** Wiesner, 1931

**Miliolinella vigilax** Vella.

*Miliolinella vigilax* Vella, 1957, p. 21, pl. 7, figs. 124–126.

MATERIAL: 14 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957); Kustanowich (1965).

#### Remarks

Of the 14 specimens examined, seven are identical with *Miliolinella vigilax* Vella, while seven although similar in appearance and triloculine, are without teeth. These toothless specimens resemble *Miliolina rosea* (d'Orbigny) of Heron-Allen and Earland (1932: 318, pl. 6, figs. 16–18) but unfortunately there are only three specimens of *M. rosea* in the collections of the British Museum (Natural History) and further study of them is not contemplated at this stage. Boltovskoy (1954: 130, pl. 2, fig. 8; 1959a: 53, pl. 4, fig. 19) records *Triloculina rosea* but his figured specimens do not appear to be similar to ours.

Vella (1957: 21) in his discussion of *Miliolinella vigilax* comments on previous records of *Miliolina circularis* of Heron-Allen and Earland (1922, 1932) and of Earland (1934), and notes that Parr (1950) considered these records to be incorrect. We are unable to clarify this point because of the small number of specimens and the very small size and irregular shapes of those which are available. The one point on which we are sure concerns two specimens of *Miliolina circularis* recorded by Earland (1933: 49) from South Georgia. These are identical with *Miliolinella vigilax* but are not typical of the rest of *Miliolina circularis* of either Earland or Heron-Allen and Earland.

### Genus **Quinqueloculina** d'Orbigny, 1826

**Quinqueloculina agglutinans** d'Orbigny (pl. 2, fig. 7a, b).

*Quinqueloculina agglutinans* d'Orbigny, 1839a, p. 195, pl. 12, figs. 11–13.  
*Miliolina agglutinans*, Heron-Allen and Earland, 1922, p. 69.

MATERIAL: 15 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Miliolina agglutinans* by Heron-Allen and Earland (1922; Stations 91 and 96).



### Remarks

Bermudez (1935: 161) has transferred *Quinqueloculina agglutinans* d'Orbigny to *Dentostomina* Carman (1933: 31), a genus erected to include arenaceous quinqueloculine miliolids which possess a bifid tooth and have the apertural rim covered in tooth-like projections. D'Orbigny's type figure does not show a bifid tooth, but does have the teeth-like projections. We have examined material from La Chorrera, Havana, Cuba, donated to the British Museum (Natural History) by Bermudez, and found several arenaceous *Quinqueloculina* with a bifid tooth but no serrate aperture. We have followed Todd and Bronnimann (1957: 27, pl. 3, fig. 4), Todd (1957: 286, pl. 85, fig. 6), Graham and Militante (1959: 41, pl. 4, fig. 10) in the use of *Quinqueloculina*, rather than *Dentostomina*.

### *Quinqueloculina colleenae* Vella.

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

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

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

MATERIAL: 10 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) and by Vella.

### Remarks

Heron-Allen and Earland (1922) stated that *Miliolina ferussacii* occurs at all inshore New Zealand stations and displays a wide range of variation. Re-examination of this material indicates that the following records of *Miliolina ferussacii* can be assigned to *Quinqueloculina colleenae*: Sounding 0, 4 specimens; Station 90, 4 specimens; Station 134, 1 specimen; Station 144, 1 specimen. *Miliolina ferussacii* was apparently a misidentification by Heron-Allen and Earland as the figured specimen by d'Orbigny has a pronounced neck and several costae running the length of the chambers. We have also examined Brady's specimens (1884), a very elongate form, but these are not similar to our own.

Loeblich and Tappan (1964) have suppressed *Lachanella* as a synonym of *Quinqueloculina*.

Further examination of specimens listed as *Miliolina contorta* (d'Orbigny) from Station 96 by Heron-Allen and Earland (1922) shows that some of these are identical with *Quinqueloculina colleenae*. This is also true of 10 specimens of *Miliolina contorta* reported from the Falkland Islands Station W.S. 71 (Heron-Allen and Earland, 1932).

### *Quinqueloculina seminulum* (Linnaeus) (pl. 2, fig. 8a, b).

*Serpula seminulum* Linnaeus, 1758, p. 786, p. 1264.

*Miliolina seminulum*, Brady, 1884, p. 157, pl. 5, fig. 6.

*Miliolina seminulum*, Heron-Allen and Earland (part), 1922, p. 67.

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

MATERIAL: 8 specimens.

### Remarks

Our specimens are identical with those recorded as *Quinqueloculina* (*Quinqueloculina*) *triangularis* by Vella

(1957) and as *Quinqueloculina seminulum* by Brady (1884: pl. 5, fig. 6) and by Heron-Allen and Earland (1922, part). *Quinqueloculina seminulum* is generally recognised as variable (Heron-Allen and Earland, 1932, pl. 6, figs. 25–40) and as having a world-wide distribution. Because of the inadequate type figure, many different forms have been recorded under this species from widely different localities and depths. Loeblich and Tappan (1964, p. C458) have figured and described a neotype of *Q. seminulum*, from the type locality, "Recent shore sand, Rimini". We have examined specimens of *Miliolina seminulum*, identified by Parker and Jones from the type locality. These specimens include forms very similar to the neotype of Loeblich and Tappan.

In a study of some New Zealand intertidal foraminifera (Hedley, Hurdle and Burdett, in press), specimens of *Q. seminulum* were found to include forms closely resembling the neotype and also forms with a more broadly rounded periphery. This latter variant of the species is represented in the present material (pl. 2, fig. 8a, b).

Vella (1957) considers that this species is not known in New Zealand. Specimens of *Quinqueloculina* (*Quinqueloculina*) *triangularis* fall within the range of variation of *Q. seminulum* in New Zealand material examined by us. *Q. triangularis* d'Orbigny was described from the Tertiary of the Vienna Basin, and is placed in the synonym of *Q. akneriana* d'Orbigny by Marks (1951, p. 38).

### Genus *Spiroloculina* d'Orbigny, 1826

#### *Spiroloculina communis* Cushman and Todd (pl. 2, fig. 9a–c).

*Spiroloculina communis* Cushman and Todd, 1944, pp. 63–64, pl. 9, figs. 4, 5, 7, 8.

*Spiroloculina excavata*, Brady, 1884, p. 151, pl. 9, figs. 5, 6.

*Spiroloculina excavata*, Heron-Allen and Earland (part), 1922, p. 63.

*Spiroloculina grateloupi*, Cushman, 1919, p. 634.

MATERIAL: 2 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Spiroloculina grateloupi* by Cushman (1919) and as *Spiroloculina excavata* by Heron-Allen and Earland (1922; Station 96).

### Remarks

We have examined the three *Terra Nova* specimens and recognise them as *Spiroloculina communis*, a species erected by Cushman and Todd (1944) with *Spiroloculina grateloupi* as a synonym. Microradiographs of our specimens and those of Heron-Allen and Earland show that they are all megalospheric forms whereas microradiographs of two specimens of Brady's *Spiroloculina excavata*, including the one figured by him in 1884 (pl. 9, fig. 5) which has been placed in the synonymy of *Spiroloculina communis* by Cushman and Todd, show that they are both microspheric forms. We have also prepared microradiographs of three specimens of Brady's *Spiroloculina impressa*

including those he figured in 1884 (pl. 10, fig. 3, 4) but, because of infilling, the initial chambers are obscure. For this reason we are unable to make any further comment on Cushman and Todd's (1944) decision to place *Spiroloculina impressa* of Brady in the synonymy of *Spiroloculina communis*.

For further useful information and figures see Asano (1956) and Graham and Militante (1959).

#### Genus *Triloculina* d'Orbigny, 1826

##### *Triloculina insignis* (Brady) (pl. 3, fig. 10a-c).

*Miliolina insignis* Brady, 1881, p. 45.  
*Miliolina insignis*, Brady, 1884, p. 165, pl. 4, fig. 8.  
*Miliolina insignis*, Heron-Allen and Earland, 1922, p. 65.

MATERIAL: 9 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Miliolina insignis* by Heron-Allen and Earland (1922: Station 96) and as *Triloculina* cf. *insignis* by Vella (1957).

##### Remarks

Specimens identified and donated by Dr P. Vella, as well as our own, compare closely with those of Brady (1884: pl. 4, fig. 8) from *Challenger* Station 24 off Culebra Island, West Indies, except that they have less strongly marked longitudinal ribs.

#### Genus *Pyrgo* DeFrance, 1824

##### *Pyrgo pisum* (Schlumberger)

*Biloculina pisum* Schlumberger, 1891, p. 569, pl. 11, figs. 81-83, text fig. 31.  
*Biloculina pisum*, Chapman, 1906, p. 80.  
*Biloculina ringens*, Heron-Allen and Earland (part), 1922, p. 61.  
*Biloculina pisum*, Vella, 1957, p. 29, pl. 7, figs. 130, 131.

MATERIAL: 9 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Recorded by Chapman (1906), Cushman (1919) and Vella (1957) as *Biloculina pisum* and by Heron-Allen and Earland (1922) as *Biloculina ringens*.

##### Remarks

Heron-Allen and Earland noted that many large and typical specimens (*Biloculina ringens*) were found at Station 96. Re-examination of this material has shown that 21 specimens from this locality can be assigned to *Pyrgo pisum*.

We include under this species specimens from *Discovery* Station D 939 which grade into the *Biloculina anomala* type. None of our specimens can be confidently assigned to *Biloculina anomala* Schlumberger. The same difficulty seemed to be encountered by Heron-Allen and Earland (1922) who included a similar range to ours under the name *Biloculina ringens*.

*Biloculina* d'Orbigny is placed in the synonymy of *Pyrgo* by Loeblich and Tappan (1964, p. C465), and the genus includes a species possessing apertures with bifid teeth. According to Loeblich and Tappan, *Pyrgo* differs from *Biloculinella* in the character of the aperture, which in *Biloculinella* is broad and flap-like.

#### Genus *Biloculinella* Wiesner, 1931

##### *Biloculinella depressa* (d'Orbigny).

*Biloculina depressa* d'Orbigny, 1826, p. 298.  
*Biloculina depressa*, Schlumberger, 1891, pp. 160-163, figs. 1-5, pl. 9, figs. 48-49.  
*Biloculina depressa*, Heron-Allen and Earland, 1922, p. 62.  
*Pyrgo depressa*, Vella, 1957, p. 29, pl. 7, figs. 137, 140.

MATERIAL: 7 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Biloculina depressa*, by Heron-Allen and Earland (1922; Sounding 0. Stations 90, 91, 96, 144) and as *Pyrgo depressa*, by Chapman and Parr (1937), Vella (1957), and Hornibrook (1961).

##### Remarks

Our specimens are identical with those reported by Heron-Allen and Earland (1922) and Vella (1957: pl. 7, figs. 137, 140).

See remarks on *Pyrgo pisum*.

#### Genus *Lenticulina* Lamarck, 1804

##### *Lenticulina costatus* (Fichtel and Moll) (pl. 4, fig. 14a, b; text fig. 1a-e).

*Nautilus costatus* Fichtel and Moll, 1798, p. 47, pl. 4, figs. g-i.  
*Cristellaria costata*, Heron-Allen and Earland, 1922, p. 180.

MATERIAL: 65 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: *Cristellaria costata* by Heron-Allen and Earland (1922) whose specimens are identical with ours.

##### Remarks

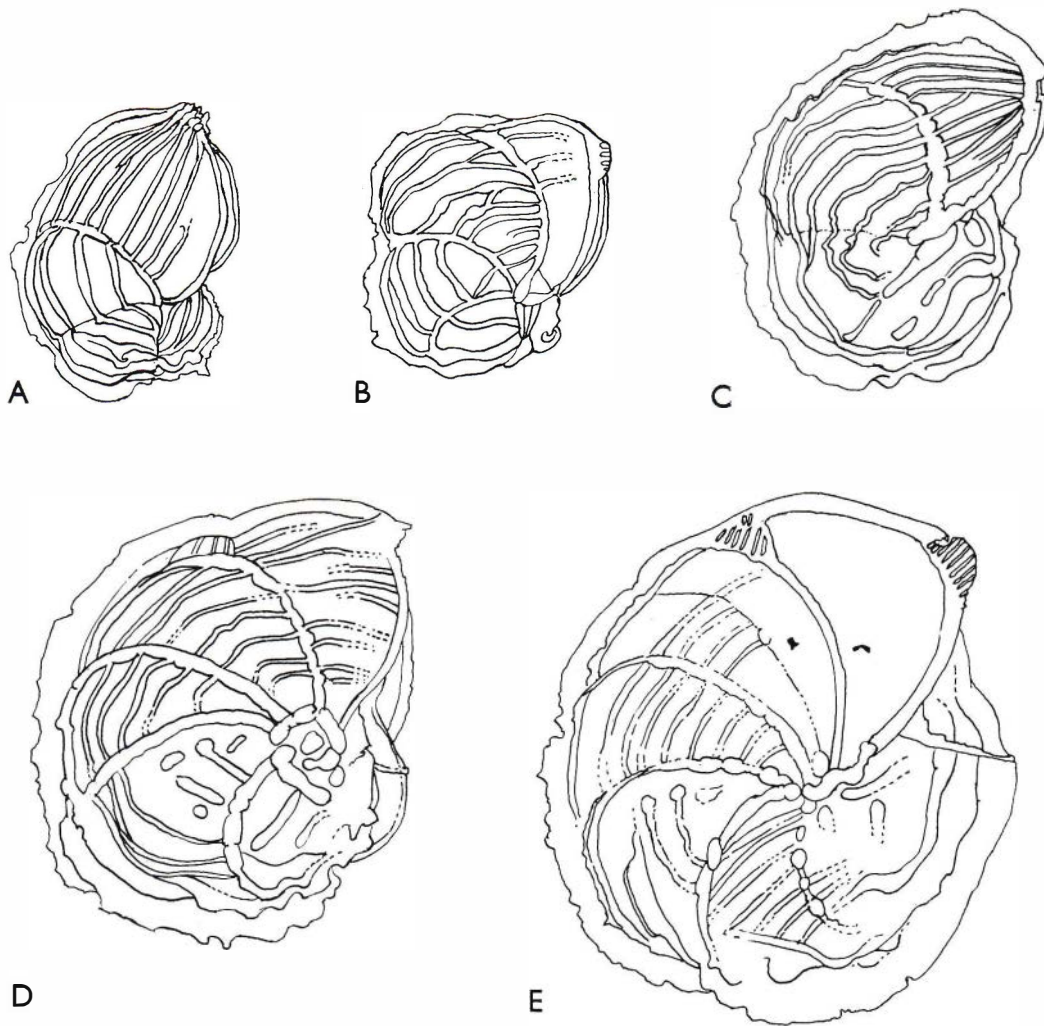
Loeblich and Tappan (1964, p. C518-520) have given an extensive synonymy of the genus *Lenticulina*. Listed among the numerous synonyms are such forms as *Robulus* and *Darbyella*, as well as many older genera. The subfamily Nodosariinae is classified chiefly on the apertural characteristics and on the arrangement of the chambers. The considerable variation in the shape of the aperture, especially the length of the apertural slits, and also in the degree of chamber coiling, has prompted the revision by Loeblich and Tappan.

Of our 65 specimens which show a wide range of variation, 10 were sectioned (selected throughout the range). All of these appeared to be megalospheric forms. The maximum diameter and thickness of the smallest and largest specimens are as follows:

	Smallest	Largest
Maximum diameter in mm	1.72	4.00
Maximum thickness in mm	0.72	1.5

The variation shown by our specimens is related mainly to the degree of development, inter-relationship and distribution of the sutures, costae, keel, and raised bosses. In general, the larger, older, specimens have lost their costae, but are more heavily calcified with raised bosses along the sutures and in the umbilical region, and have much enlarged discontinuous ribs towards the periphery of the test. The smaller, younger, specimens are more regular. The relationship of these structures and the general ornamentation of the test has been described by Cushman (1948, p. 21).





Text fig. 1: *Lenticulina costatus* (Fichtel and Moll.) A-E, outline drawings to illustrate variation in form and ornamentation. B.M. (N.H.) 1962-5-20-23-27.  $\times$  45, 40, 29, 27, 23 respectively.

***Lenticulina cultratus*** (Montfort) (pl. 4, fig. 15a, b).

*Robulus cultratus* Montfort, 1808, p. 214.  
*Cristellaria cultrata*, Heron-Allen and Earland (part), 1922, p. 180.

MATERIAL: 10 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Cristellaria cultrata* by Chapman (1909), Cushman (1919), and Heron-Allen and Earland (1922) and as *Robulus cultratus* by Hornibrook (1961).

**Remarks**

The genus *Robulus*, the type species of which is *R. cultratus*, is placed in the synonymy of *Lenticulina* by Loeblich and Tappan (1964) – see remarks on *R. costatus*.

From Hornibrook's illustration (pl. 4, fig. 62) it appears that the sutures are straighter and there are fewer chambers than in our specimens.

For further useful information and illustrations see Cushman and McCulloch (1950).

***Lenticulina gibba*** (d'Orbigny) (pl. 3, fig. 1 la, b).

*Cristellaria gibba* d'Orbigny, 1839a, p. 40, pl. 7, figs. 20, 21.  
*Cristellaria articulata*, Heron-Allen and Earland (part), 1922, p. 179.

MATERIAL: 17 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Hornibrook (1961) and Kustanowich (in press); and as part of *Cristellaria articulata* by Heron-Allen and Earland (1922; Station 96).

**Remarks**

Our specimens show a close resemblance to d'Orbigny's type-figure and description of *Cristellaria gibba* and to the figure by Cushman (1923: pl. 25, fig. 4). Furthermore none of our specimens possess the "robuline" aperture which distinguishes this species from *Lenticulina* (*Robulus*) *antarctica* Parr (1950: 323, pl. 11, figs. 1 la, b).



***Lenticulina subgibba* Parr (pl. 3, fig. 12a, b; text fig. 2 a–d).**

*Lenticulina subgibba* Parr, 1950, p. 321, pl. 11, figs. 1, 2a, b.  
*Cristellaria gibba*, Heron-Allen and Earland (part), 1922, p. 179.

MATERIAL: 24 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957); and as part of *Cristellaria gibba* by Heron-Allen and Earland (1922).

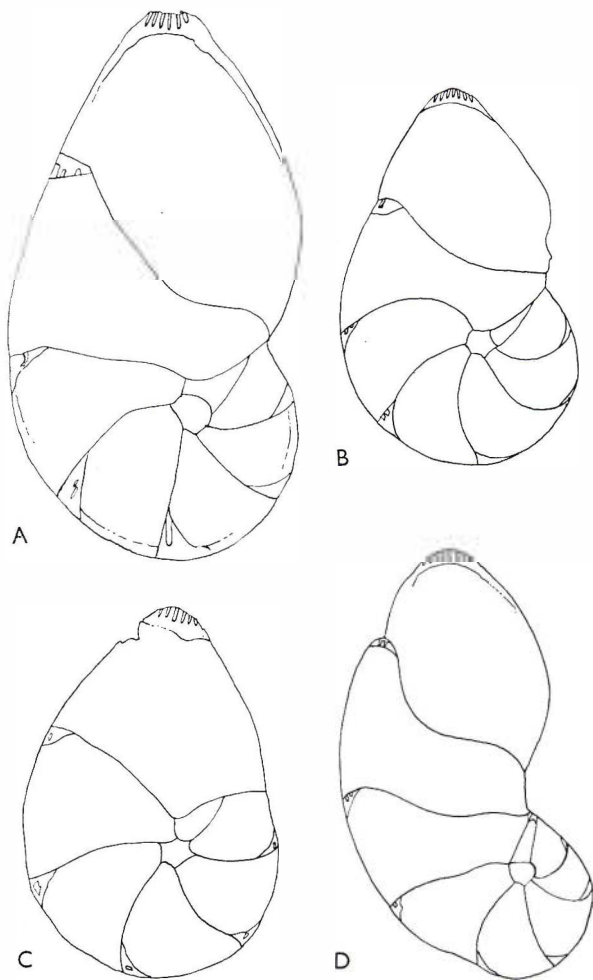
**Remarks**

The specimens of Heron-Allen and Earland from Station 96 are identical with our material.

The maximum length and thickness of our smallest and largest specimens from *Discovery* Station 939 are as follows:

	Smallest	Largest
Maximum length in mm ..	0.79	1.40
Maximum thickness in mm ..	0.31	0.33

Our specimens are variable and range from “typical” close-coiled forms to a loosely-coiled form in which the terminal chambers become uniserial (text fig. 1). The most distinctive character of *Lenticulina subgibba* is the enveloping of the early chambers by the terminal chamber. The majority of our specimens show this clearly.



Text fig. 2: *Lenticulina subgibba* Parr. Outline drawings illustrating closely-coiled and loosely-coiled forms,  $\times 47$ . B.M. (N.H.) Reg. Nos. 1962.5.20.13–16.

***Lenticulina suborbicularis* Parr (pl. 5, fig. 16a, b).**

*Lenticulina (Robulus) suborbicularis* Parr, 1950, pp. 321, 322, pl. 11, figs. 5, 6.  
*Cristellaria orbicularis*, Heron-Allen and Earland (part), 1922, p. 179.

MATERIAL: 11 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Robulus suborbicularis* by Vella (1957) and Kustanowich (in press) and as part of *Cristellaria orbicularis* by Heron-Allen and Earland (1922).

**Remarks**

Our specimens are similar to those figured by Parr (1950) and to some from off Little Barrier and Great Barrier Islands, New Zealand, identified and provided by Mr N. de B. Hornibrook and the late Mr S. Hulme of the New Zealand Geological Survey.

***Lenticulina tasmanica* Parr (pl. 5, fig. 17a, b).**

*Lenticulina (Robulus) tasmanica* Parr, 1950, p. 321, pl. 11, figs. 3, 4.  
*Cristellaria articulata*, Heron-Allen and Earland (part), 1922, p. 179.

MATERIAL: 3 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957) and as part of *Cristellaria articulata* by Heron-Allen and Earland (1922).

**Remarks**

*Lenticulina tasmanica* (Parr, 1950: pl. 11, fig. 3, 4) apparently differs from *Cristellaria articulata* Reuss only in the length of the “robuline” slit which, in *Lenticulina tasmanica*, reaches to the base of the apertural face and is bounded by marginal flanges.

The maximum diameter and maximum thickness of our smallest and largest specimens are as follows:

	Smallest	Largest
Maximum diameter in mm ..	1.45	1.5
Maximum thickness in mm ..	0.75	0.77

After examining Brady’s specimens (1884: pl. 69, figs. 10–12) of *Cristellaria articulata* Reuss, we consider two forms can be distinguished; Brady’s figure 10, possesses a radiate typically “lenticuline” aperture, whereas his figures 11, 12 have radiate aperture with a “robuline” slit extending approximately halfway down the apertural face. The slits are bordered by marginal flanges. All Brady’s specimens (pl. 69, figs. 10–12) have been placed in the synonymy of *Cristellaria lucida* by Cushman (1923) but they differ from Cushman’s figure (pl. 30, fig. 2) in lacking a well-developed keel. Thalmann (1937: 341) has pointed out that *Cristellaria lucida* is preoccupied by *Robulina lucida* Silvestri and a new name is required. The name *Robulus atlanticus* nom. nov. is proposed by Barker (1960).

TABLE 2: DIFFERENCES BETWEEN *Planularia tricarinella* (REUSS), 1863 AND *Planularia tricarinella* var. *spinipes* CUSHMAN, 1913

Characters	<i>Planularia tricarinella</i> (Reuss), 1863	<i>Planularia tricarinella</i> var. <i>spinipes</i> Cushman, 1913
Initial coiling	Close coiled	Close coiled.
Size of proloculus	Small (0.03–0.04 mm)	Large (0.05–0.08 mm)
Shape of test	Generally closely coiled, chambers retain breadth without obvious tapering	Generally loosely coiled, terminal chambers tend to become tapered.
Sutures	Slightly depressed and thickened	Slightly depressed and thickened.
Chambers	Very slightly inflated	Very slightly inflated.
Keel	Smooth	Smooth, giving rise to spines at apical end of test.
Spines	Nil	Number variable, 1–4.
Number of chambers	In complete specimens varying between 12–16 chambers	In complete specimens varying between 15–18 chambers. Larger specimens broken.
Number of specimens	7	38

Genus *Planularia* Defrance, 1824

***Planularia tricarinella* (Reuss) (pl. 4, fig. 13a, b; text fig. 3a–c).**

*Cristellaria (Cristellaria) tricarinella* Reuss, 1863, p. 68, pl. 7, fig. 9a, b.  
*Cristellaria tricarinella*, Brady, 1884, pp. 540–541, pl. 68, figs. 3, 4.  
*Cristellaria tricarinella*, Cushman, 1919, p. 615.  
*Cristellaria tricarinella*, Heron-Allen and Earland (part), 1922, p. 177.

MATERIAL: 7 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Cristellaria tricarinella* by Brady (1884), Cushman (1919), and by Heron-Allen and Earland (1922).

Remarks

The report by Heron-Allen and Earland included two forms under the name *Cristellaria tricarinella*, one being typical of *Cristellaria tricarinella* Reuss (1863: pl. 7, fig. 9a b), and the other of *Cristellaria tricarinella* var. *spinipes* Cushman (1913: 72, pl. 33, fig. 2a, b). Both of these forms are present in the *Discovery* Station D 939 sample. Only the spineless forms will be remarked on in this section. The form with spines is considered under the next name *Planularia tricarinella* var. *spinipes*. Table 2 lists the differences between the two forms.

Our spineless forms are identical with those figured by Brady (1884: pl. 68, figs. 3, 4) which were collected off the Philippines and the west coast of New Zealand and which Barker (1960) records as a variety of *Planularia australis* Chapman. This latter species was described by Chapman (1941: 158, pl. 9, fig. 1) who placed *Cristellaria tricarinella* of Chapman (1915) in the synonymy and indicated that Brady's specimens appear to be intermediate between *Planularia australis* and *Planularia tricarinella* (Reuss) since they showed some carination of dorsal borders. *Planularia australis* differs from *Cristellaria complanata* and *Cristellaria tricarinella* in having flush sutures. In our opinion, both Brady's specimens and our own have slightly inflated chambers and in consequence the sutures appear depressed. We are not following Chapman in the use of *Planularia australis*.

***Planularia tricarinella* (Reuss) var. *spinipes* Cushman (pl. 4, fig. 13c, d; text fig. 3d–g).**

*Cristellaria tricarinella* var. *spinipes* Cushman, 1913, p. 72, pl. 33, fig. 2.  
*Cristellaria tricarinella* var. *spinipes* Cushman, 1919, p. 616.  
*Cristellaria tricarinella*, Heron-Allen and Earland (part), 1922, p. 177.

MATERIAL: 38 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919) and as part of *Cristellaria tricarinella* by Heron-Allen and Earland (1922).

Remarks

Cushman (1913: pl. 33, fig. 2) first described the variety from off the coast of Japan, his figured specimen having one spine. Later, Cushman (1919) described the variety from New Zealand and stated that it differed from the typical form in both the nature of coiling and number of spines. In 1921, Cushman illustrated *Cristellaria tricarinella* (pl. 50, fig. 3a, b) with a spine and bulbous appearance of the initial coiling which would indicate that this form should be placed with the other spiny forms under the name *Planularia tricarinella* var. *spinipes*.

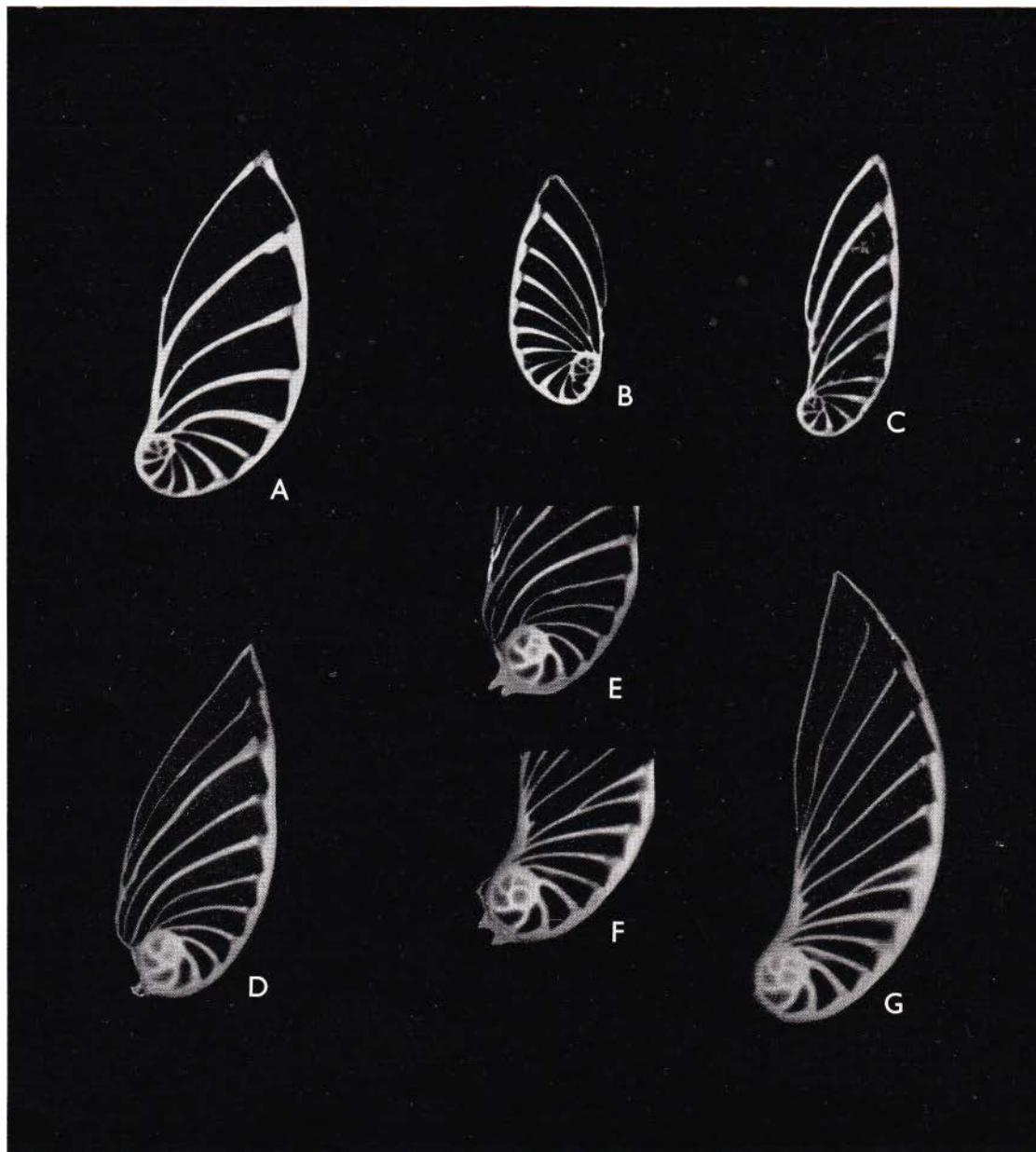
Table 2 lists the differences between *Planularia tricarinella* and *Planularia tricarinella* var. *spinipes*. We consider that the two forms may represent stages in the development of the same species the variety *spinipes* being the megalospheric form. If this should prove to be so it should be noted that the megalospheric form in this species possesses more chambers than the microspheric, a reverse of the situation one normally encounters in the Foraminifera.

Genus *Saracenaria* Defrance, 1824

***Saracenaria latifrons* (Brady).**

*Cristellaria latifrons* Brady, 1884, p. 544, pl. 68, fig. 19, pl. 113, fig. 11.  
*Cristellaria latifrons*, Heron-Allen and Earland, 1922, p. 178.

MATERIAL: 3 specimens.



Text fig. 3 A-C: *Planularia tricarinella* (Reuss). Radiographs, 30 kv 10 ma 15 cm 15 min. A, from *Discovery* Sta. D 939,  $\times 35$ ; B, from Heron-Allen and Earland's (1922) New Zealand Sta. 96,  $\times 33$ . C, from Brady's (1884) *Challenger* Sta. 167, west coast of New Zealand,  $\times 32$ . B.M. (N.H.) Reg. Nos. 1962-5-20-18, 50, and 51 respectively. Text fig. 2D-G. *Planularia tricarinella* (Reuss) var. *spinipes* Cushman. Radiographs, 30 kv 10 ma 15 cm 15 min. E, is the same radiograph as D after having been retouched to illustrate the spines; similarly F, is the same as G. Both D, E and F, G are from *Discovery* Sta. D 939. B.M. (N.H.) Reg. Nos. 1962-5-20-20 and 21 respectively.

PREVIOUS RECORDS FROM NEW ZEALAND: Kustanowich (1965); and as *Cristellaria latifrons* by Brady (1884), Cushman (1919), and Heron-Allen and Earland (1922; Station 96).

*Remarks*

We have examined the three specimens (syntypes) in Brady's collection from *Challenger* Stations 166 and 167, off the west coast of New Zealand as well as those of Heron-Allen and Earland. The range of variation is comparable with that shown in our specimens.

For further information and illustrations see Parr (1950) and Asano (1956).

Genus *Dentalina* Risso, 1826

*Dentalina emaciata* Reuss (pl. 6, fig. 18).

*Dentalina emaciata* Reuss, 1851, p. 63, pl. 3, fig. 9.  
*Nodosaria consobrina* var. *emaciata*, Heron-Allen and Earland, 1922, p. 170.

MATERIAL: 9 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957) and Kustanowich (1965); and as *Nodosaria consobrina*



var. *emaciata* by Cushman (1919) and Heron-Allen and Earland (1922).

*Remarks*

Our specimens are very similar to those of Brady (1884: 502, pl. 62, figs. 25–26), Cushman (1913: 56, pl. 27, fig. 9; 1923: 78, pl. 13, figs. 3–5), Heron-Allen and Earland (1922: 170) but differ chiefly from them in the addition of a spine at the apical end of the test, as shown in the type figure of Reuss (1851). Some of the specimens figured by Asano (1938, 1956) possess a spine and are very similar to our specimens.

From the information given by Parr (1950: 329, pl. 12, fig. 1) we find it difficult to distinguish *Dentalina subemaciata* Parr from *Dentalina emaciata* although it is noted that in the holotype of *D. subemaciata* the sutures appear straighter and the chambers less inflated.

***Dentalina filiformis* (d'Orbigny)**

*Nodosaria filiformis* d'Orbigny, 1826, p. 253.

*Nodosaria filiformis*, Heron-Allen and Earland, 1922, p. 169.

MATERIAL: 1 specimen.

*Remarks*

Our specimen is identical with those recorded as *Nodosaria filiformis* by Heron-Allen and Earland (1922; Station 96) but apparently not very similar to Hornibrook's figure of *Nodosaria filiformis* (1961: 47, pl. 6, fig. 92).

The only other record from New Zealand is that of Cushman (1919), which is also under *Nodosaria filiformis*.

***Dentalina vertebralis* (Batsch) (pl. 6, fig. 19; text-fig. 4a–c).**

*Nautilus (Orthoceras) vertebralis* Batsch, 1791, p. 3, No. 6, pl. 2, fig. 6a, b.

*Nodosaria vertebralis*, Brady, 1884, p. 514, pl. 63, fig. 35; pl. 64, figs. 11–14.

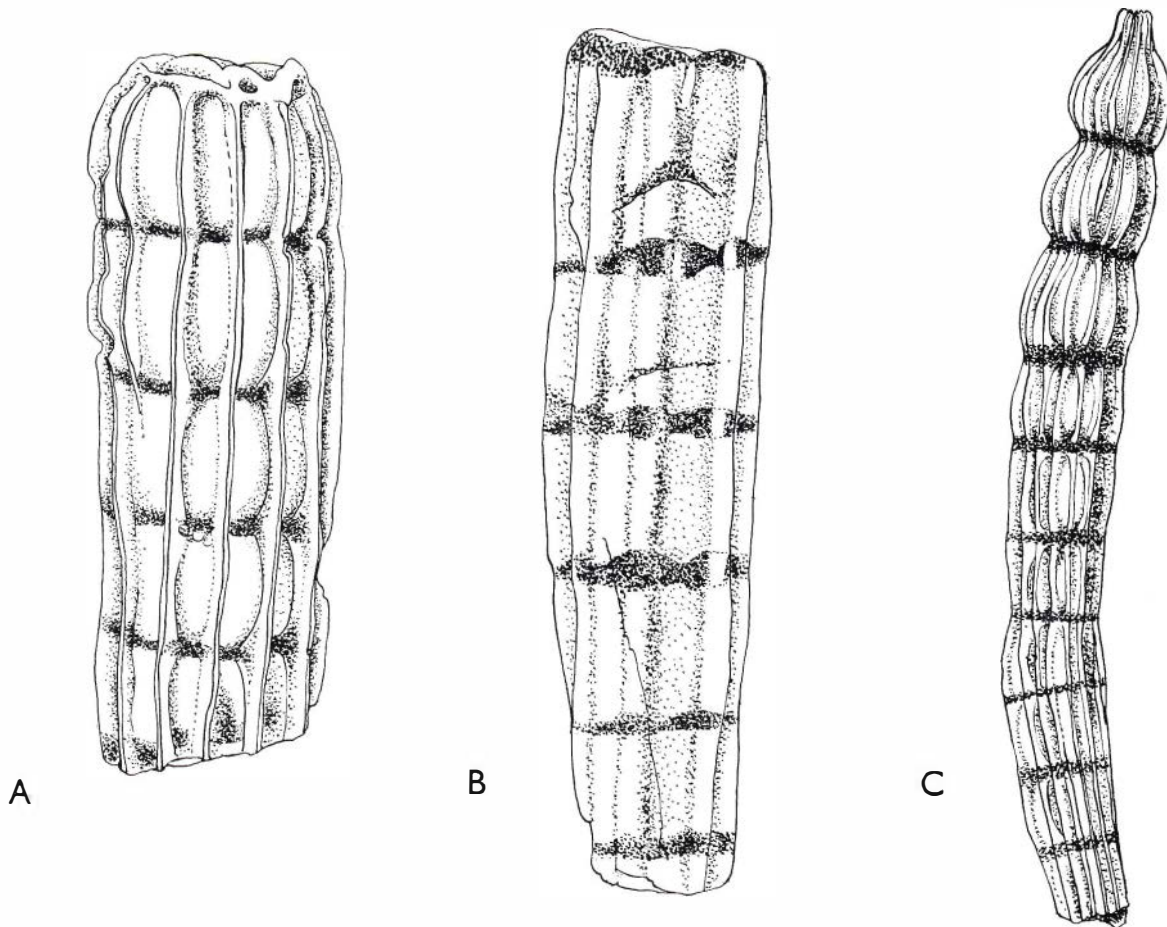
*Nodosaria vertebralis*, Heron-Allen and Earland, 1922, p. 172.

*Nodosaria vertebralis* var. *albatrossi* Cushman, 1923, p. 87, pl. 15, fig. 1.

*Nodosaria vertebralis*, Cushman, 1931b, p. 66.

MATERIAL: 3 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922; Station 96).



Text fig. 4: Outline drawings of *Dentalina vertebralis* (Batsch) from Rimini in the Parker and Jones collection B.M. (N.H.), showing the variation in breadth of the sutures and in thickness of the (Longitudinal) costae,  $\times 62$ . B.M. (N.H.) Reg. Nos. 1962-5-20-32-33; C, outline drawings of a topotypic specimen of *D. vertebralis* var. *albatrossi* (ex-Cushman collection) showing the close similarity to the specimens of Parker and Jones, B.M. (N.H.) Reg. No. 1961-1-9-222.

### Remarks

Loeblich and Tappan (1964) have restricted the genus *Nodosaria* to include species possessing symmetrical, rectilinear, tests; asymmetrical forms are placed in the genus *Dentalina*.

Heron-Allen and Earland's specimens are identical with our own. Cushman (1923: 87, pl. 15, fig. 1) erected the new variety *Nodosaria vertebralis* (Batsch) var. *albatrossi* and placed *Nodosaria vertebralis* of Brady in synonymy (Brady, 1884: pl. 63, fig. 35; pl. 64, figs. 11–14). We have examined Brady's specimens alongside topotypic specimens of Cushman (*Albatross Station D2377*). The two species are very similar. We have also examined *Nodosaria vertebralis* identified by Parker and Jones from shore sand of Rimini, probably the type locality of *Nodosaria vertebralis* (Batsch) – see Cushman (1931b: 62). None of these specimens is entire (text fig. 4a, b) but they are very similar to the figure given by Batsch (1791: pl. 2, fig. 6a) and are identical with Cushman's topotypic specimens of *Nodosaria vertebralis* var. *albatrossi* (text fig. 4c).

Brady's, Cushman's, and Parker and Jones's specimens show a comparable range of variation, particularly with regard to the sutures: some are broad and translucent, others less clear and opaque.

According to Barker (1960), those specimens figured by Brady (1884: pl. 64, figs. 11–14) are *Nodosaria albatrossi* whilst the specimen figured in Brady (pl. 63, fig. 35) is a new unnamed subspecies. On present evidence we contend that all these, as well as Cushman's *Nodosaria vertebralis* var. *albatrossi*, are referable to *Nodosaria vertebralis* (Batsch). Hornibrook (1961) has recorded *Dentalina albatrossi* (Cushman) from New Zealand. However, there are no accompanying remarks or illustrations to allow further comment.

It is noted that the species figured by Loeblich and Tappan (1964, p. C515, fig. 403: 3) as *Dentalina cuvieri*, described by d'Orbigny from the Adriatic, closely resembles the present species.

### Genus *Lagena* Walker and Jacob, 1798

#### *Lagena sulcata* (Walker and Jacob).

*Serpula* (*Lagena*) *sulcata* Walker and Jacob, 1798, p. 634, pl. 14, fig. 5.

*Lagena sulcata*, Heron-Allen and Earland (part), 1922, p. 146.

MATERIAL: 4 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919), Heron-Allen and Earland (1922), Vella (1957), and Hornibrook (1961).

### Remarks

Specimens identified from *Terra Nova* Stations by Heron-Allen and Earland (1922) show a wide range of variation.

### Genus *Pseudopolymorphina* Cushman and Ozawa, 1928

#### *Pseudopolymorphina tortuosa* Vella.

*Pseudopolymorphina tortuosa* Vella, 1957, p. 30, pl. 8, figs. 152, 153.

MATERIAL: 2 specimens.

### Genus *Sigmoidella* Cushman and Ozawa, 1928

#### *Sigmoidella elegantissima* (Parker and Jones) (pl. 6, fig. 20).

*Polymorphina elegantissima* Parker and Jones, 1865, p. 438.

*Polymorphina elegantissima*, Brady, Parker and Jones, 1870, p. 231, pl. 40, fig. 15b, c.

*Polymorphina elegantissima*, Heron-Allen and Earland (part), 1922, p. 182.

MATERIAL: 4 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Sigmoidella elegantissima* by Vella (1957) and Hornibrook (1961), and as *Polymorphina elegantissima* by Cushman (1919) and Heron-Allen and Earland (1922).

### Remarks

Our specimens were compared with those of Parker and Jones (1864) from Melbourne and with those of Brady. Parker and Jones (1870: pl. 40, fig. 15a, b, c), from Storm Bay, Tasmania. The specimen illustrated in their pl. 40, fig. 15a is exceptionally large and badly damaged, but other specimens of Brady, Parker and Jones compare well with ours.

Compared with Brady's specimens (1884: pl. 72, fig. 12–15), ours closely resemble the one on pl. 72, fig. 12. According to Barker (1960) this was referred to a new variety (unnamed) by Thalmann (1932: 306) whilst the specimen figured in pl. 72, fig. 13, is referred to *Sigmoidella elegantissima*. A scarcity of specimens does not allow further comment at this stage.

Heron-Allen and Earland's specimens show a range of variation comparable with that of Brady's, while some of their New Zealand specimens are identical with ours.

### Genus *Bulimina* d'Orbigny, 1826

#### *Bulimina marginata* d'Orbigny (pl. 6, fig. 21; text fig. 5a–d).

*Bulimina marginata* d'Orbigny, 1826, p. 269, pl. 12, figs. 10–12.

*Bulimina marginata*, Heron-Allen and Earland, 1922, p. 128.

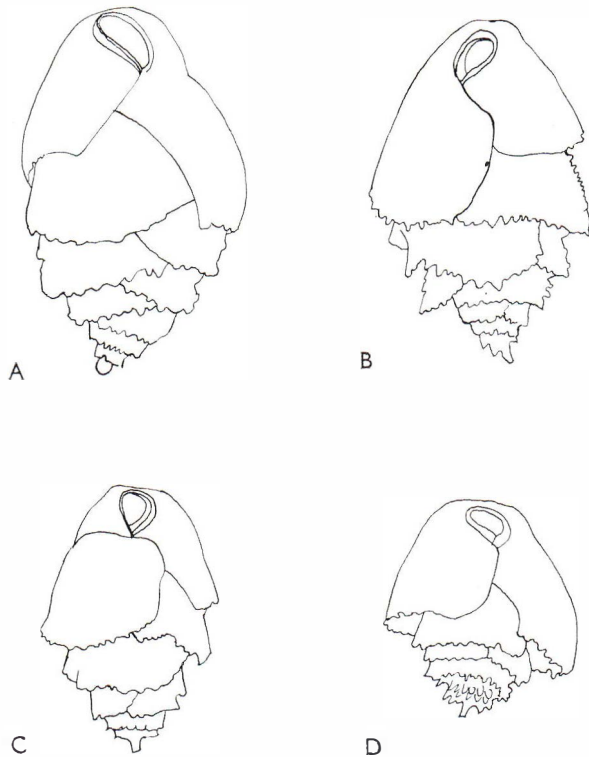
MATERIAL: 30 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919), Heron-Allen and Earland (1922), and Kustanowich (in press) and possibly as *Bulimina submarginata* by Vella (1957).

### Remarks

After examination of specimens identified as *Bulimina marginata* by Parker and Jones (Rimini shore sand, Adriatic) and Brady (*Porcupine Station 11*, North Atlantic; Storm Bay, Tasmania; and *Challenger Station 232*, South of Japan) we have reached the following conclusions: (1) our specimens are smaller than those of Parker and Jones; nevertheless, they are similar to those figured by d'Orbigny. (2) Brady's North Atlantic specimens are identical with ours and show a comparable range of variation; Brady's specimens from south of Japan show an affinity with *Bulimina marginata* as illustrated by Asano (1958: 4, pl. 1, figs. 5, 9, 10, 11). (3) Brady's specimens of *Bulimina marginata* from Storm Bay, Tasmania, closely resemble the type figure of *Bulimina submarginata* Parr (Parr, 1950: 336, pl. 12, fig. 13) from the east coast of Tasmania. In our





Text fig. 5: Outline drawings of *Bulimina marginata* d'Orbigny from *Discovery* Sta. D 939.  $\times$  114, 104, 108, 114, respectively. B.M. (N.H.) Reg. Nos. 1962.5.20.36-39.

opinion *Bulimina submarginata* may be nothing more than a local variety of *B. marginata*.

For further information and illustrations see Cushman and Parker (1938, 1947) and Höglund (1947).

#### Genus *Bolivina* d'Orbigny, 1839

*Bolivina robusta* Brady (pl. 6, fig. 22a, b).

*Bolivina robusta* Brady, 1881, p. 57.  
*Bolivina robusta*, Brady, 1884, p. 421, pl. 53, figs. 7-9.  
*Bolivina robusta*, Heron-Allen and Earland, 1922, p. 136.

MATERIAL: 2 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) and Vella (1957).

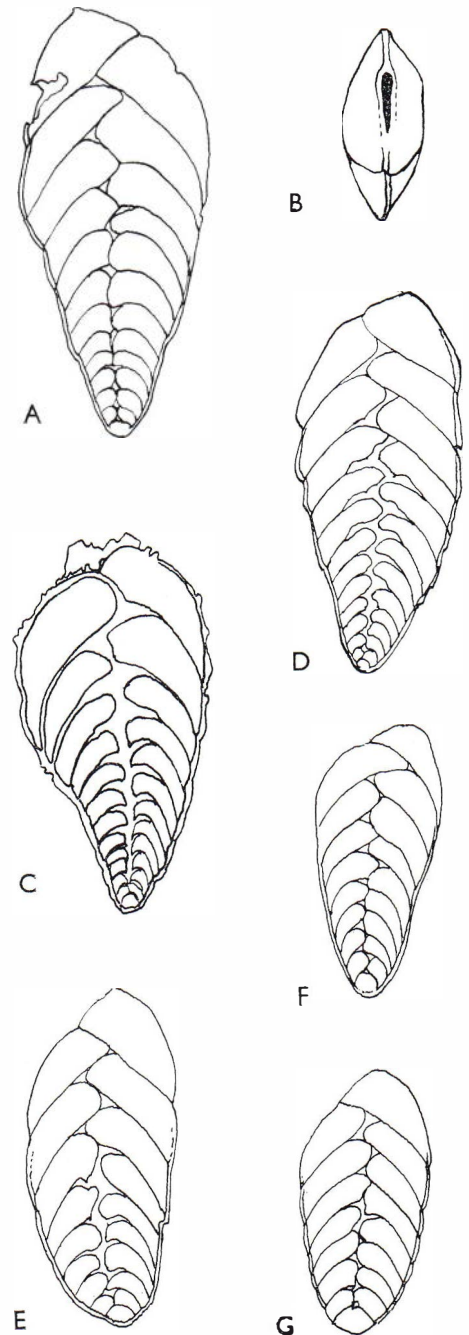
#### Remarks

Compared with Brady's syntypes our specimens are smaller and without a spine at the apical end of the shell; they show greater resemblance to Brady's specimens from *Challenger* Station 191A, off the Ki Islands. Some of the *Bolivina robusta* recorded by Heron-Allen and Earland (1922) possess an apical spine.

#### Genus *Brizalina* Costa, 1856

*Brizalina spathulata* (Williamson) (pl. 6, fig. 23a, b; text fig. 6a-g).

*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*, Heron-Allen and Earland (part). 1922, p. 134.  
*Bolivina numerosa* Vella, 1957, p. 33, pl. 8, figs. 160, 161.



Text fig. 6: Outline drawings of six syntypes of *Brizalina spathulata* (Williamson). It has proved impossible to determine which of the syntypes is Williamson's figured specimen. Text fig. 6A, B is the specimen closest to, if not identical with, the one illustrated by Williamson. None of the syntypes is as flat as that shown by Williamson (1858, fig. 165).  $\times$  116, 116, 114, 116, 113, 116, 121, respectively. B.M. (N.H.) Reg. No. 96.8.13.42.

MATERIAL: 4 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As part of *Bolivina dilatata* by Heron-Allen and Earland (1922) and as *Bolivina numerosa* by Vella (1957).

#### Remarks

This species is assigned to the genus *Brizalina*, as emended by Loeblich and Tappan (1964, p. C552), which includes species possessing a compressed test, often carinate, with limbate sutures. The genus differs from *Bolivina* in lacking retral chamber processes or crenulations which lie along the basal margin of the chambers.

We have compared our specimens with Williamson's figured specimens and syntypes (12 in number) and consider them identical. Some specimens identified by Heron-Allen and Earland (1922) from New Zealand stations as *Bolivina dilatata* are identical with our *Brizalina spathulata*.

The variation shown by Williamson's specimens is in our opinion sufficient to account for those differences which according to Vella (1957, p. 33, pl. 8, figs. 160, 161) distinguish *Bolivina spathulata* and *Bolivina numerosa*.

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

#### **Loxostomum karrerianum** (Brady)

- 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.

MATERIAL: 15 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Bolivina karreriana* by Cushman (1919) and Heron-Allen and Earland (1922) and as *Loxostomum karrerianum* by Vella (1957) and Kustanowich (1965).

#### Remarks

Our specimens are identical with those of Brady (1884), Heron-Allen and Earland (1922), and Vella (1957).

For further information and illustrations see Cushman (1937) and Asano (1958).

#### **Loxostomum lobatum** (Brady) (pl. 6, fig. 24a, b).

- Bolivina lobata* Brady, 1881, p. 58.
- Bolivina lobata*, Brady, 1884, p. 425, pl. 53, figs. 22, 23.
- Bolivina lobata*, Heron-Allen and Earland, 1922, p. 134.

MATERIAL: 6 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) as *Bolivina lobata* whose specimens are identical with ours.

#### Remarks

We have compared our specimens with Brady's syntypes and find that ours are identical with some specimens mounted on a slide labelled – *Bolivina lobata* Brady (scarcely typical), from *Challenger* Station 185, off Raine Island, Torres Strait. These latter specimens differ from those figured in being less translucent and in having a less acute periphery.

Genus **Uvigerina** d'Orbigny, 1826

#### **Uvigerina peregrina** Cushman.

- Uvigerina peregrina* Cushman, 1923, p. 166, pl. 42, fig. 7–10.
- Uvigerina pygmaea*, Heron-Allen and Earland (part), 1922, p. 183.

MATERIAL: 10 specimens.

PREVIOUS RECORD FROM NEW ZEALAND: As *Uvigerina pygmaea* by Heron-Allen and Earland (1922).

#### Remarks

Heron-Allen and Earland's specimens from Station 96 are identical with ours. Furthermore our specimens are identical with *Uvigerina peregrina*, in the British Museum (Natural History) collections, identified by Cushman from *Albatross* Station D 2706. Kustanowich records *Uvigerina* cf. *peregrina* from Milford Sound.

Höglund (1947: 279–83) illustrates the range of variation and apertural structure of *Uvigerina peregrina* but according to Hofker (1951: 219–25), who has classified the Uvigerinae on the basis of toothplate arrangements, these specimens of Höglund belong to *Aluvigerina pygmaea*.

The *Aluvigerina* has been suppressed as a synonym of *Uvigerina* by Loeblich and Tappan (1964, p. C565).

Hofker (1951: 219–25; 1956: 76, 82–4) identifies *Uvigerina peregrina* Cushman, by the form of the toothplate, as *Euvigerina peregrina*. Parker (1954: 519) questions Hofker's subdivision of the genus and retains *Uvigerina*.

Vella (1961, p. 473) provisionally included *U. peregrina* in the genus *Hofkeruva* Vella, but later (Vella, 1963, p. 10) designated it as the type species of a new genus *Noviuva*. *Hofkeruva*, together with a number of subgenera described by Vella, has been placed in the synonymy of *Euvigerina* by Loeblich and Tappan (1964, p. C566). The latter authors do not recognise the validity of ornamentation as a feature of generic value in the classification of uvigerine foraminifera. As the tooth-plates of *Noviuva* are identical with those of *Euvigerina* and *Hofkeruva* (Vella, 1963, p. 10), we are not following Vella in the use of *Noviuva*, which apparently differs from other uvigerine genera only in surface ornamentation.

Genus **Sphaeroidina** d'Orbigny, 1826

#### **Sphaeroidina bulloides** d'Orbigny.

- Sphaeroidina bulloides* d'Orbigny, 1826, p. 267, modèles No. 65.
- Sphaeroidina bulloides*, Heron-Allen and Earland, 1922, p. 194.

MATERIAL: 14 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919), Heron-Allen and Earland (1922), Vella (1957), Hornibrook (1961), and Kustanowich (1965).

#### Remarks

D'Orbigny described *Sphaeroidina bulloides* from both fossil and Recent deposits, the latter from Rimini on the Adriatic coast. We have examined two specimens of *Sphaeroidina bulloides* from Rimini shore sand, identified by Parker and Jones; these are (1) larger than ours and (2) more opaque, with thicker walls. Brady's (1884) specimens have also been examined: (1) the majority are similar to those of Parker and Jones but (2) those from *Challenger* Station 279A off Tahiti, at 420 fathoms (pl. 84, figs. 3, 4) are similar to ours, although more translucent (in this characteristic they resemble Earland's (1933) specimens).

Our specimens appear to agree with the figures of *Sphaeroidina bulloides* given by Cushman and Todd (1949: 13, pl. 3, figs. 8–11) in that (1) they have a general cubic shape and (2) the terminal chamber forms half of the test. Our smaller specimens differ from Cushman and Todd's



description in having (1) slightly curved sutures and (2) a moderately translucent wall. These latter features indicate an affinity to *Sphaeroidina compressa* Cushman and Todd.

For further information and illustrations see Parker (1954: 539, pl. 11, fig. 18) and Todd and Bronnimann (1957: 40, pl. 11, fig. 14).

#### Genus *Orbulina* d'Orbigny, 1839a

##### *Orbulina universa* d'Orbigny.

*Orbulina universa* d'Orbigny, 1839a, p. 3, pl. 1, fig. 1.  
*Orbulina universa*, Heron-Allen and Earland, 1922, p. 193.

MATERIAL: 11 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919), Heron-Allen and Earland (1922; Sounding O; Stations 90, 91, 96, 134, 144); Vella (1957), Hornibrook (1961), and Kustanowich (1965).

##### Remarks

For further useful information and figures see Blow (1956) and Bolli, Loeblich and Tappan (1957).

#### Genus *Globigerina* d'Orbigny, 1826

##### *Globigerina bulloides* d'Orbigny.

*Globigerina bulloides* d'Orbigny, 1826, p. 277.  
*Globigerina bulloides*, Heron-Allen and Earland, 1922, p. 187.

MATERIAL: 6 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Cushman (1919), Heron-Allen and Earland (1922), Vella (1957), Hornibrook (1961), and Kustanowich (1965).

##### Remarks

Our specimens are identical with the *Globigerina bulloides* of Heron-Allen and Earland (1922) from the following New Zealand localities; Sounding O; Stations 90, 91, 96, 134 and 144.

For further useful information and figures see Brady (1884), Bolli, Loeblich and Tappan (1957), and Banner and Blow (1960).

##### *Globigerina inflata* d'Orbigny (pl. 7, fig. 25a–c.)

*Globigerina inflata* d'Orbigny, 1839b, p. 134, pl. 2, figs. 7–9.  
*Globigerina inflata*, Brady, 1884, p. 601, pl. 79, figs. 8–10.  
*Globigerina inflata*, Chapman, 1909, pp. 350–351.  
*Globigerina inflata*, Heron-Allen and Earland, 1922, p. 188.

MATERIAL: 15 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Brady (1884), Chapman (1909), Heron-Allen and Earland (1922; Sounding O, Stations 90, 91, 96, 134, 144) and Kustanowich (1965).

##### Remarks

Our specimens are identical with those of Heron-Allen and Earland.

For further information and figures see Bradshaw (1959).

#### Genus *Globobulimina* Cushman, 1927

##### *Globobulimina turgida* (Bailey) (pl. 7, fig. 26a, b).

*Bulimina turgida* Bailey, 1851, p. 12, figs. 28–31.  
*Bulimina pyrula*, Heron-Allen and Earland, 1922, p. 127.

MATERIAL: 12 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Heron-Allen and Earland (1922) and Kustanowich (1965).

##### Remarks

Our specimens are identical with those from New Zealand assigned to *Bulimina pyrula* d'Orbigny by Heron-Allen and Earland (1922). None of these specimens is like *Bulimina pyrula* figured by d'Orbigny (1846: 184, pl. 11, figs. 9, 10) or by Cushman and Parker (1937: pl. 6, fig. 1). The 12 specimens we have examined have the spines and show the variation of *Bulimina (Desinobulimina) turgida* Bailey, as illustrated by Cushman and Parker (1947: pl. 29, figs. 26–27). A similar range of variation to that which we have found for *Globobulimina turgida* is illustrated by Asano (1958: pl. 2, figs. 7, 8, 9).

#### Genus *Globorotalia* Cushman, 1927

##### *Globorotalia truncatulinoides* (d'Orbigny) (pl. 7, fig. 27a–c).

*Rotalina truncatulinoides* d'Orbigny, 1839b, p. 132, pl. 2, figs. 25–27.  
*Pulvinulina truncatulinoides*, Heron-Allen and Earland, 1922, p. 216.

MATERIAL: 7 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Kustanowich (1965); and as *Pulvinulina truncatulinoides* (d'Orbigny) by Cushman (1919) and Heron-Allen and Earland (1922; Sounding O, Stations 90, 96, 144). Our specimens are identical with those recorded by Heron-Allen and Earland.

##### Remarks

For further useful information and figures see Cushman (1927, 1931a), Earland (1934), Cushman and Bermudez (1949), and Bradshaw (1959).

#### Genus *Hastigerina* Thomson, 1876

##### *Hastigerina (Hastigerina) siphonifera* (d'Orbigny).

*Globigerina siphonifera* d'Orbigny, 1839a, p. 83, pl. 4, figs. 15–18.  
*Globigerina aequilateralis* Brady, 1879, p. 285.  
*Globigerina aequilateralis*, Brady, 1884, p. 605, pl. 80, figs. 18–21.  
*Globigerina aequilateralis*, Heron-Allen and Earland, 1922, p. 192.  
*Globigerinella aequilateralis*, Vella, 1957, pp. 11, 14 (list).

MATERIAL: 9 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Globigerina aequilateralis* by Heron-Allen and Earland (1922) and as *Globigerinella aequilateralis* by Vella (1957) and Kustanowich (1965).

##### Remarks

Our specimens are identical with those of Heron-Allen and Earland (1922), with those of Brady (1884: figs. 18–21) and with the lectotype selected by Banner and Blow (1960b: 22, text fig. 3a, b).

Banner and Blow (1960b: 22) have selected lectotypes of *Globigerina siphonifera* d'Orbigny and *Globigerina aequilateralis* Brady, and consider the two names to be synonymous. They also regard *Globigerinella* Cushman (1927) as a junior synonym of *Hastigerina* Thomson (1876). This view is endorsed by Loeblich and Tappan (1964).

Genus *Astrononion* Cushman and Edwards, 1937

*Astrononion novo-zealandicum* Cushman and Edwards (pl. 7, fig. 28a, b).

*Astrononion novo-zealandicum* Cushman and Edwards, 1937, p. 35, pl. 3, figs. 18a, b.  
*Nonionina umbilicatula*, Heron-Allen and Earland (part), 1922, p. 227.

MATERIAL: 6 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957) and Kustanowich (1965), and as part of *Nonionina umbilicatula* by Heron-Allen and Earland (1922).

Remarks

Although the number of chambers in our specimens is similar to that given in the type description, the diameter of the shells (ranging from 0.31–0.48 mm) is smaller than that recorded by Cushman and Edwards (1937).

Vella (1962, p. 289) designated *A. novo-zealandicum* as the type species of a new genus, *Pacinonion*. Hornibrook (1964) considers *Pacinonion* to be a synonym of *Astrononion*.

Genus *Discorbinella* Cushman and Martin, 1935

*Discorbinella bertheloti* (d'Orbigny).

*Rosalina bertheloti* d'Orbigny, 1839b, p. 135, pl. 1, figs. 28–30.  
*Rosalina* emended Brotzen, 1948, p. 72, text fig. 19.  
*Discorbina bertheloti*, Heron-Allen and Earland, 1922, p. 202.  
*Discopulvinulina bertheloti*, Vella, 1957, p. 10.  
*Discopulvinulina bertheloti*, Hornibrook, 1961, p. 106, pl. 14, fig. 286.

MATERIAL: 12 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Discorbina bertheloti* by Heron-Allen and Earland (1922) and as *Discopulvinulina bertheloti* by Vella (1957) and Hornibrook (1961).

Remarks

Hofker (1951, p. 359) designated *Rosalina bertheloti* as the type species of *Discopulvinulina*, a genus which included many species previously assigned to several distinct genera, including *Discorbis*, *Discorbina* and *Rosalina*.

Parker (1954, p. 523) has pointed out that *Discopulvinulina* Hofker has become a synonym of *Rosalina*, because Hofker (1951) placed *Rosalina globularis*, designated the type species of *Rosalina* by Galloway and Wissler (1927, p. 62), under *Discopulvinulina*. Hornibrook and Vella (1954, p. 26) have discussed *Rosalina* and *Discopulvinulina*, and have recommended that the latter genus should be restricted to the “*bertheloti* group”.

As pointed out by Loeblich and Tappan (1964, p. C575) Hofker's genus *Discopulvinulina* would be preoccupied by several other generic names, in addition to *Rosalina*, if the variety of species included by Hofker under *Discopulvinulina* were congeneric. Loeblich and Tappan (1964) have suppressed *Discopulvinulina* as a junior synonym of *Discorbinella*.

One of Brady's specimens of *Rosalina bertheloti* (1884: pl. 89, fig. 10a–c) from *Challenger* Station 209, Philippine Islands, 95 fathoms, has been placed by Cushman (1924, p. 33, pl. 10, fig. 1) in the synonymy of his species, *Discorbis subbertheloti* (now *Discopulvinulina subbertheloti* – see

Barker (1960: 184)). We have examined Brady's specimen and include it under *Rosalina bertheloti* for the following reasons:

(1) It has a keel on the convex side which is partially broken on the terminal chamber, but not shown in the figure (10b), whereas according to Cushman, *Discorbis subbertheloti* is not keeled on the convex face.

(2) It has a fairly large proloculus and is probably a megalospheric form of *Rosalina bertheloti*.

Genus *Gavelinopsis* Hofker, 1951

*Gavelinopsis lobatulus* (Parr).

*Discorbis lobatulus* Parr, 1950, p. 354, pl. 13, figs. 23–25.  
*Gavelinopsis lobatulus*, Vella, 1957, pp. 10, 36.

MATERIAL: 6 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Gavelinopsis lobatulus* by Vella (1957), whose specimens are identical with our own, and possibly as *Discorbina rugosa* (d'Orbigny) by Heron-Allen and Earland (1922).

Remarks

Parr (1950) considers *Discorbina isabelleana* (d'Orbigny) of Brady (1884: 646, pl. 88, fig. 1) a synonym of *D. lobatulus*; we have examined both of Brady's specimens and do not include them in the synonymy here because they are more finely perforate and have a more acute periphery than our specimens. A comparative table has been compiled from observations on our specimens and those of Brady (1884), and also from the information given in Parr's (1950) type description of *Discorbis lobatulus*:

TABLE 3: MEASUREMENTS OF *Gavelinopsis lobatulus*

	Number of Chambers		Size (in mm)
	Dorsal	Ventral	
Specimens from <i>Discovery II</i> Sta. D 939	11–15 (26 in a microspheric specimen)	6	Diameter = 0.29–0.37 (0.41 in the microspheric specimen) Height = 0.14–0.18
Brady (1884)	11 and 14	Both 6	Diameter = 0.36 (both) Height = 0.15 (both)
Parr (1950) (pl. 13, figs. 23–25)	21	6	Diameter = 0.33 Height = 0.2

Genus *Eponides* Montfort, 1808

*Eponides tenera* (Brady)

*Truncatulina tenera* Brady, 1884, p. 665, pl. 95, fig. 11a–c.  
*Truncatulina tenera*, Heron-Allen and Earland, 1922, p. 211.

MATERIAL: 5 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Truncatulina tenera* by Heron-Allen and Earland (1922) and as *Eponides tenera* by Vella (1957).

Remarks

Our specimens are identical with Brady's syntypes from *Challenger* Station 305, west coast of Patagonia.

Genus **Polystomellina** Yabe and Hanzawa, 1923

**Polystomellina finlayi** (Vella).

*Notorotalia finlayi* Vella, 1957, p. 49, pl. 1, figs. 4, 5, 9, 10.  
*Rotalia clathrata*, Heron-Allen and Earland (part), 1922, p. 220.

MATERIAL: 4 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957), Hornibrook (1961), and as part of *Rotalia clathrata* by Heron-Allen and Earland (1922; Station 96).

**Remarks**

The maximum height and diameter of our specimens was measured; the dimensions of three topotypic specimens, kindly donated by Dr P. Vella, were also recorded:

	Our Specimens	Topotypic Specimens	Dimensions of Holotype (Vella)
Maximum height in mm	0·12–0·17	0·21–0·28	0·21
Maximum diameter in mm	0·27–0·33	0·58–0·63	0·63

It will be seen that our specimens are smaller than both the topotypic specimens and the holotype.

Loeblich and Tappan (1964) have suppressed *Notorotalia* as a junior synonym of *Polystomellina*.

**Polystomellina zelandica** (Finlay).

*Notorotalia zelandica* Finlay, 1939, p. 518.  
*Rotalia clathrata*, Heron-Allen and Earland (part), 1922, p. 220.  
*Notorotalia zelandica zelandica*, Vella, 1957, p. 55, pl. 2, figs. 31, 33, 34, text fig. 2a–e.

MATERIAL: 7 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957), Hornibrook (1961), and Kustanowich (1965), and as part of *Rotalia clathrata* by Heron-Allen and Earland (1922).

**Remarks**

Some of Heron-Allen and Earland's specimens from Station 96 are identical with our own.

See remarks on *Polystomellina finlayi*.

Genus **Cibicides** Montfort, 1808

**Cibicides lobatulus** (Walker and Jacob).

"*Nautilus spiralis lobatus*" Walker and Boys, 1784, p. 20.  
*Nautilus lobatulus* Walker and Jacob, 1798, p. 642.  
*Truncatulina lobatula*, Heron-Allen and Earland (part), 1922, p. 208.

MATERIAL: 4 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: As *Truncatulina lobatula* by Cushman (1919) and Heron-Allen and Earland

(1922, part). Some of the latter author's specimens, especially those from Station 96, are identical with ours.

For further information and illustrations see Brady (1884) and Nyholm (1961).

**Cibicides marlboroughensis** Vella

*Cibicides marlboroughensis* Vella, 1957, p. 40, pl. 9, figs. 201–203.

MATERIAL: 250 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957) and Kustanowich (1965).

**Remarks**

Our 250 specimens show a wide size range. The height of the shell is apparently directly related to the form of coiling, so that in the loosely coiled forms the height is small. Most of the specimens show dextral coiling. Histograms prepared by plotting numbers of specimens against both diameter and height measurements suggest a continuous range between the smallest and largest specimens and, consequently, indicate a single species.

	Largest	Smallest
Diameter in mm	0·84	0·26
Height in mm	0·38	0·14

The diameter range the greatest number of specimens is 0·65–0·69 mm; the height range the greatest number of specimens is 0·26–0·27 mm.

Genus **Dyocibicides** Cushman and Valentine, 1930

**Dyocibicides biserialis** Cushman and Valentine.

*Dyocibicides biserialis* Cushman and Valentine, 1930, p. 31, pl. 10, figs. 1, 2a, b.  
*Truncatulina variabilis*, Heron-Allen and Earland (part), 1922, p. 208.  
*Dyocibicides biserialis*, Vella, 1957, p. 41.

MATERIAL: 17 specimens.

PREVIOUS RECORDS FROM NEW ZEALAND: Vella (1957) and as *Truncatulina variabilis* by Heron-Allen and Earland (1922; Station 96).

**Remarks**

Our specimens are identical with those of Heron-Allen and Earland and do not agree with d'Orbigny's illustrations of his *Truncatulina variabilis* (1826: 279).

In a study of the biology of *Cibicides lobatulus*, Nyholm (1961) found a series of schizonts resembling the genera *Dyocibicides*, *Cyclocibicides*, *Stichocibicides*, and *Rectocibicides* and noted that the form of the test was related to the nature of the substratum. A similar opinion was held by Heron-Allen and Earland (1932: 420) in discussing *Truncatulina variabilis*.



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# PLATES





## LEGENDS TO PLATES

### PLATE 1

- Fig. 1: Reophax scorpiurus* Montfort.  $\times 45$ . B.M. (N.H.) Reg. No. 1962·5·20·1.
- Fig. 2: Ammobaculites agglutinans* (d'Orbigny).  $\times 58$ . B.M. (N.H.) Reg. No. 1962·5·20·2.
- Fig. 3: Radiograph of Ammobaculites agglutinans* (d'Orbigny) showing the coiling of the chambers in the older part of the test (= bottom of photograph).  $\times 33$ ; 35 kv 10 ma 15 cm 15 min. B.M. (N.H.) Reg. No. 1962·5·20·47.
- Fig. 4: Alveolophragmium zealandicum* Vella. A, peripheral view,  $\times 27$ ; B, apertural view,  $\times 27$ ; C, portion of wall to show alveolar structure,  $\times 25$ . A and B are of a specimen from Station 96 (Heron-Allen and Earland, 1922), C is a fragment of a damaged specimen from *Discovery* Station D 939. B.M. (N.H.) Reg. Nos. 1962·5·20·3-4.
- Fig. 5: Textularia* sp. aff. *T. gramen* d'Orbigny. A, peripheral view,  $\times 66$ ; B, apertural view,  $\times 66$ . B.M. (N.H.) Reg. No. 1962·5·20·5.
- Fig. 6: Siphotextularia concava* (Karrer). A, peripheral view,  $\times 58$ ; B, view showing the unusual double aperture; this is not normal,  $\times 58$ . B.M. (N.H.) Reg. No. 1962·5·20·6.

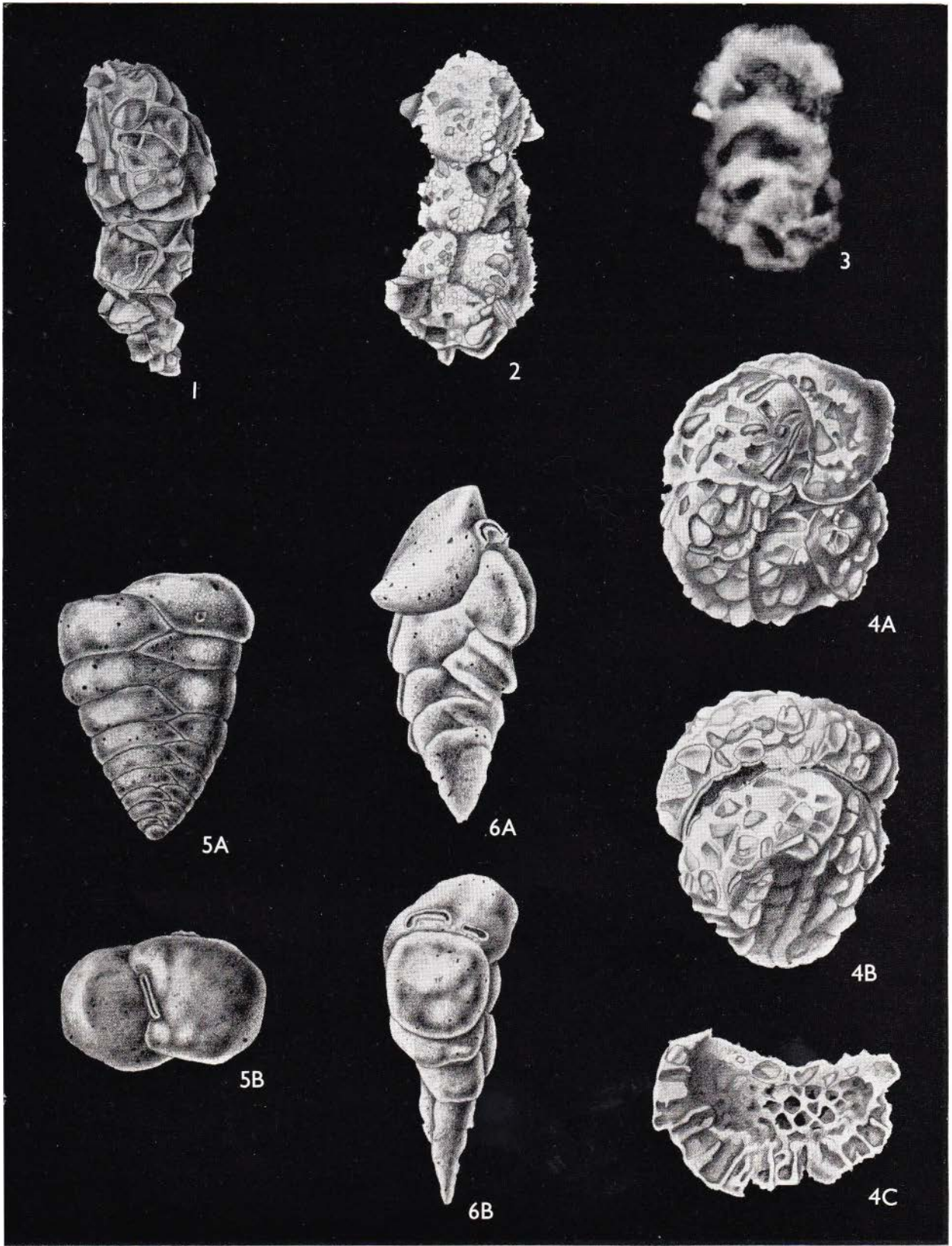


PLATE 1

PLATE 2

- Fig. 7: Quinqueloculina agglutinans* d'Orbigny. A, peripheral view,  $\times$  52; B, apertural view,  $\times$  72. B.M. (N.H.) Reg. No. 1962·5·20·7.
- Fig. 8: Quinqueloculina seminulum* (Linnaeus). A, peripheral view,  $\times$  53; B, apertural view,  $\times$  58. B.M. (N.H.) Reg. No. 1962·5·20·8.
- Fig. 9: Spiroloculina communis* Cushman and Todd. A, peripheral view,  $\times$  59; B, radiograph of one of Heron-Allen and Earland's (1922) specimens, megalospheric form,  $\times$  63; C, radiograph of Brady's (1884) *S. excavata* (= microspheric form of *S. communis*),  $\times$  40. Factors for both radiographs 25 kv 10 ma 15 cm 15 min. B.M. (N.H.) Reg. Nos. 1962·5·20·9, 48, 49 for A, B, and C, respectively.



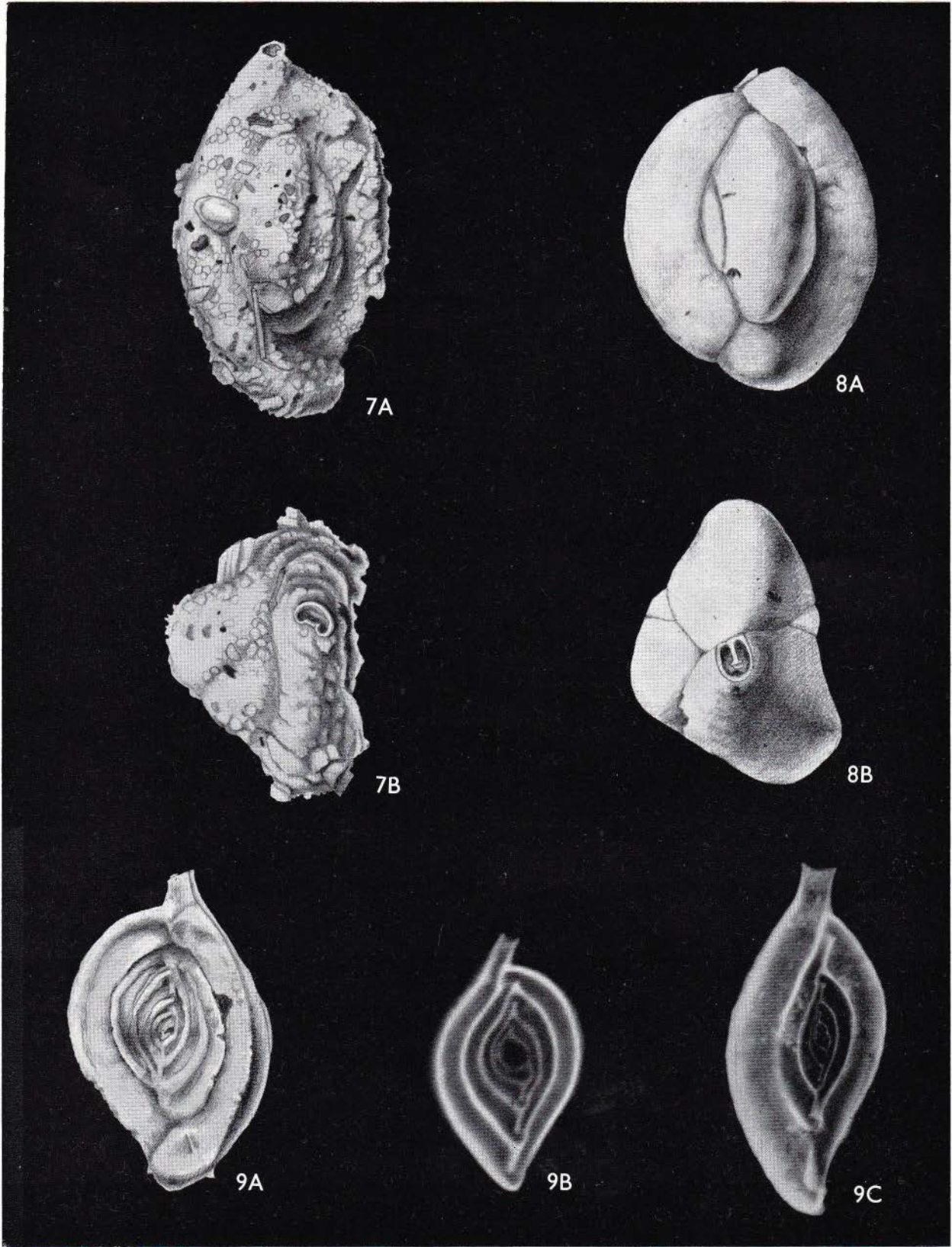


PLATE 2

PLATE 3

*Fig. 10: Triloculina insignis* (Brady). A, and C, peripheral views,  $\times 23$ ; B, apertural view,  $\times 27$ . B.M. (N.H.) Reg. No. 1962·5·20·10.

*Fig. 11: Lenticulina gibba* (d'Orbigny). A, peripheral view,  $\times 48$ ; B, apertural view,  $\times 48$ . B.M. (N.H.) Reg. No. 1962·5·20·11.

*Fig. 12: Lenticulina subgibba* Parr. A, peripheral view,  $\times 47$ ; B, apertural view,  $\times 47$ . B.M. (N.H.) Reg. No. 1962·5·20·12.



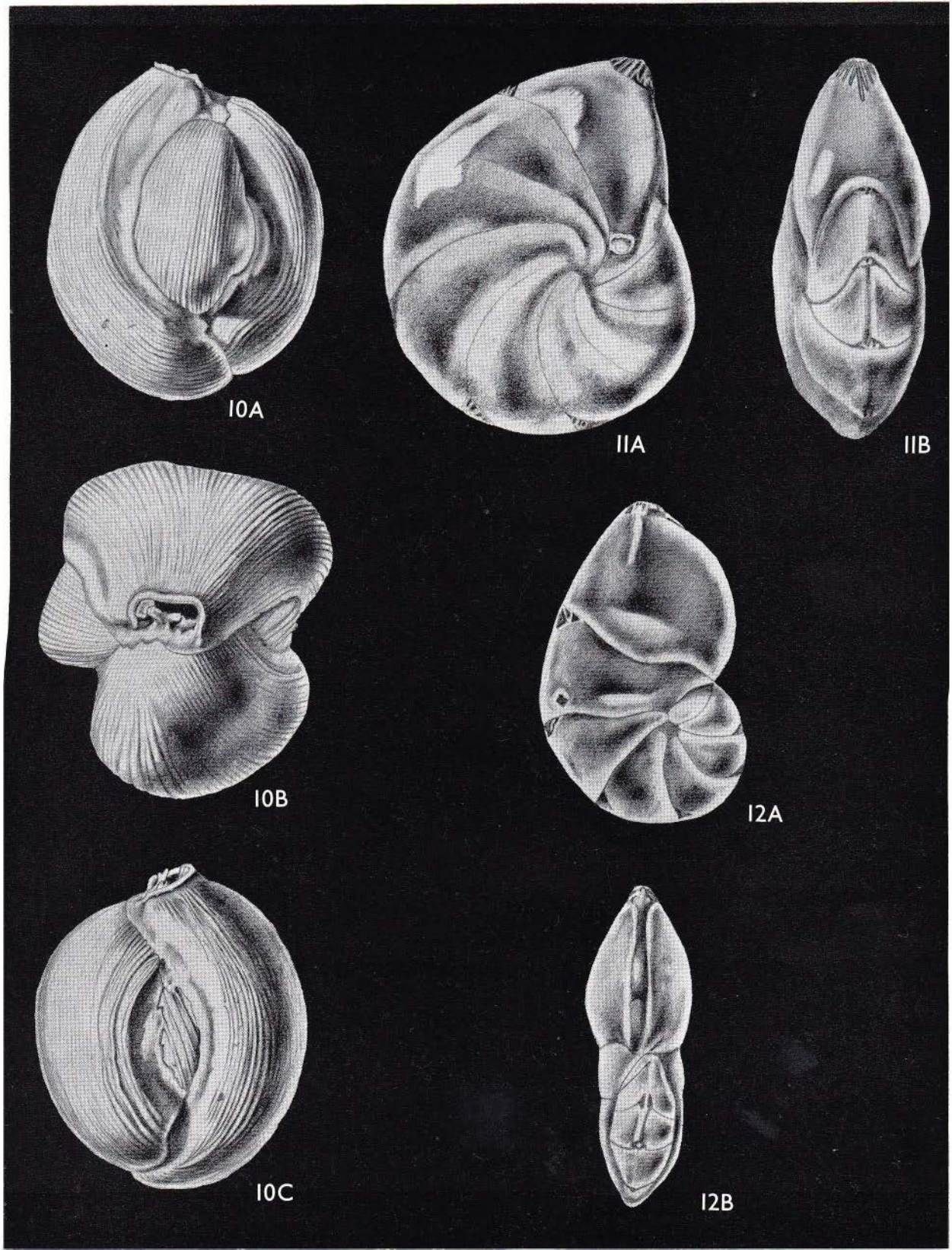


PLATE 3



PLATE 4

- Fig. 13a, b: *Planularia tricarinella* (Reuss). A, peripheral view,  $\times 51$ ; B, apertural view,  $\times 51$ . B.M. (N.H.) Reg. No. 1962-5-20-17. Fig. 13c, d, *Planularia tricarinella* (Reuss) var. *spinipes* Cushman. C, peripheral view,  $\times 51$ ; D, apertural view,  $\times 51$ . B. M. (N.H.) Reg. No. 1962-5-20-19.
- Fig. 14: *Lenticulina costatus* (Fichtel and Moll). A, peripheral view,  $\times 25$ ; B, apertural view,  $\times 25$ . B.M. (N.H.) Reg. No. 1962-5-20-22.
- Fig. 15: *Lenticulina cultratus* Montfort. A, peripheral view,  $\times 34$ ; B, apertural view,  $\times 34$ . B.M. (N.H.) Reg. No. 1962-5-20-28.

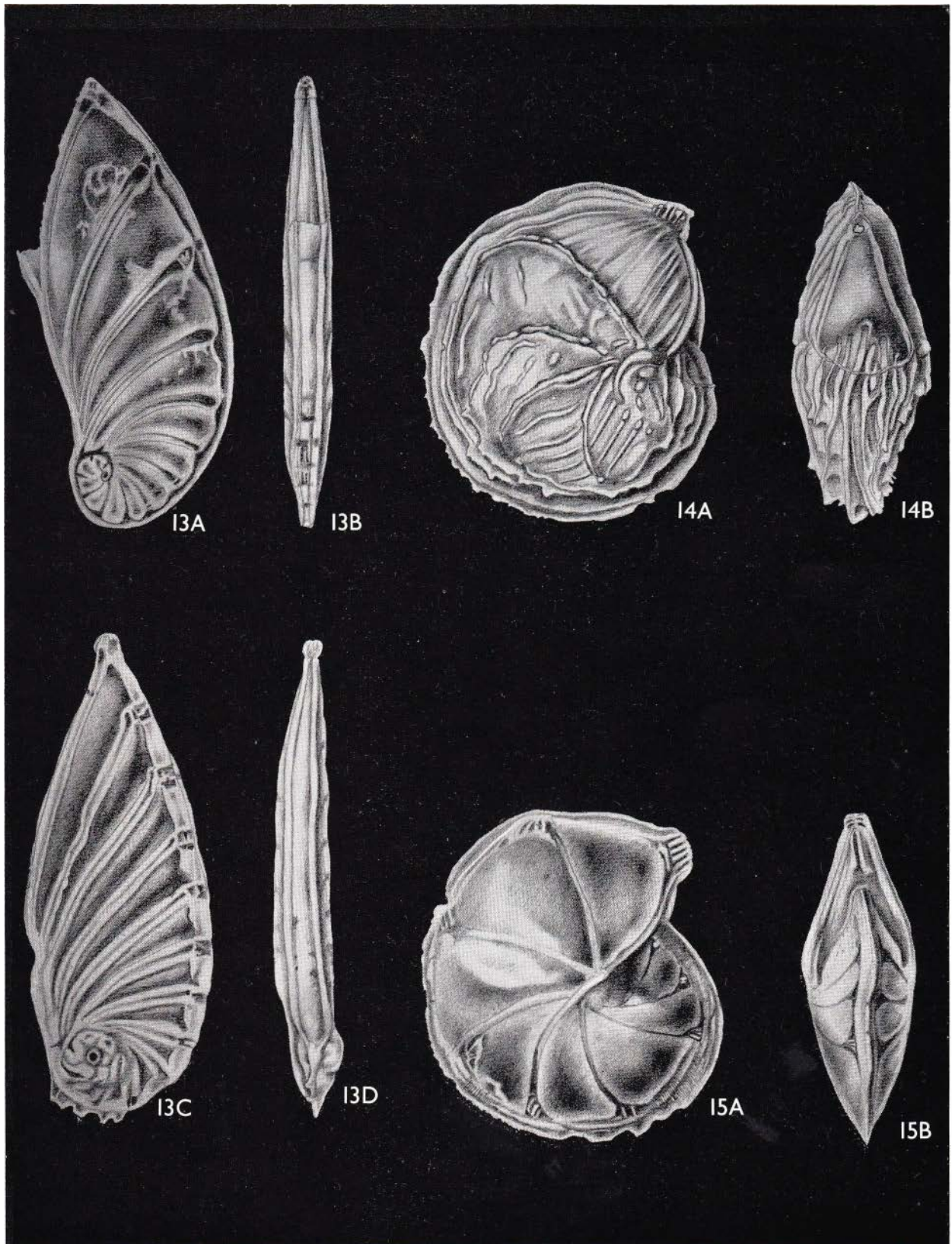


PLATE 4

PLATE 5

*Fig. 16: Lenticulina suborbicularis* (Parr). A, peripheral view,  $\times 68$ ; B, apertural view,  $\times 68$ .  
B.M. (N.H.) Reg. No. 1962·5·20·52.

*Fig. 17: Lenticulina tasmanica* (Parr). A, peripheral view,  $\times 55$ ; B, apertural view,  $\times 55$ . B.M.  
(N.H.) Reg. No. 1962·5·20·29.



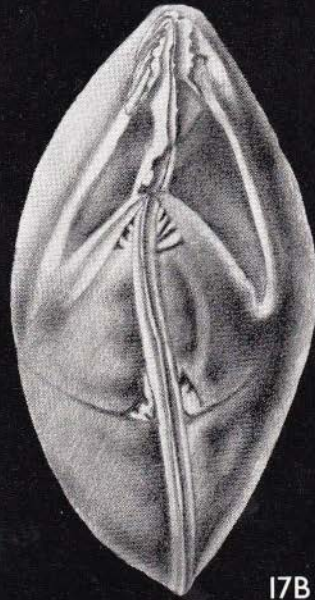
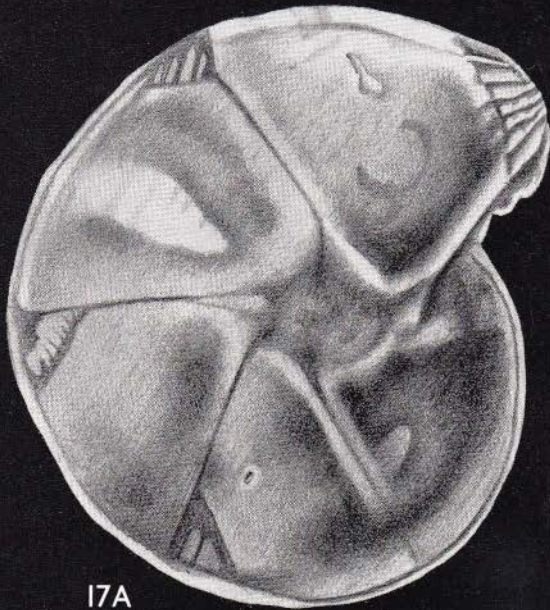


PLATE 5

PLATE 6

- Fig. 18:* Peripheral view of *Dentalina emaciata* Reuss, × 27. B.M. (N.H.) Reg. No. 1962·5·20·30.
- Fig. 19:* Peripheral view of *Dentalina vertebralis* (Batsch), × 19; B.M. (N.H.) Reg. No. 1962·5·20·31.
- Fig. 20:* *Sigmoidella elegantissima* (Parker and Jones), × 48. B.M. (N.H.) Reg. No. 1962·5·20·34.
- Fig. 21:* *Bulimina marginata* d'Orbigny, × 100. B.M. (N.H.) Reg. No. 1962·5·20·35.
- Fig. 22:* *Bolivina robusta* Brady. A, peripheral view, × 137; B, apertural view, × 137. B.M. (N.H.) Reg. No. 1962·5·20·40.
- Fig. 23:* *Brizalina spathulata* (Williamson). A, peripheral view, × 100; B, apertural view, × 100. B.M. (N.H.) Reg. No. 1962·5·20·41.
- Fig. 24:* *Loxostomum lobatum* (Brady). A, peripheral view, × 145; B, apertural view, × 145. B.M. (N.H.) Reg. No. 1962·5·20·42.



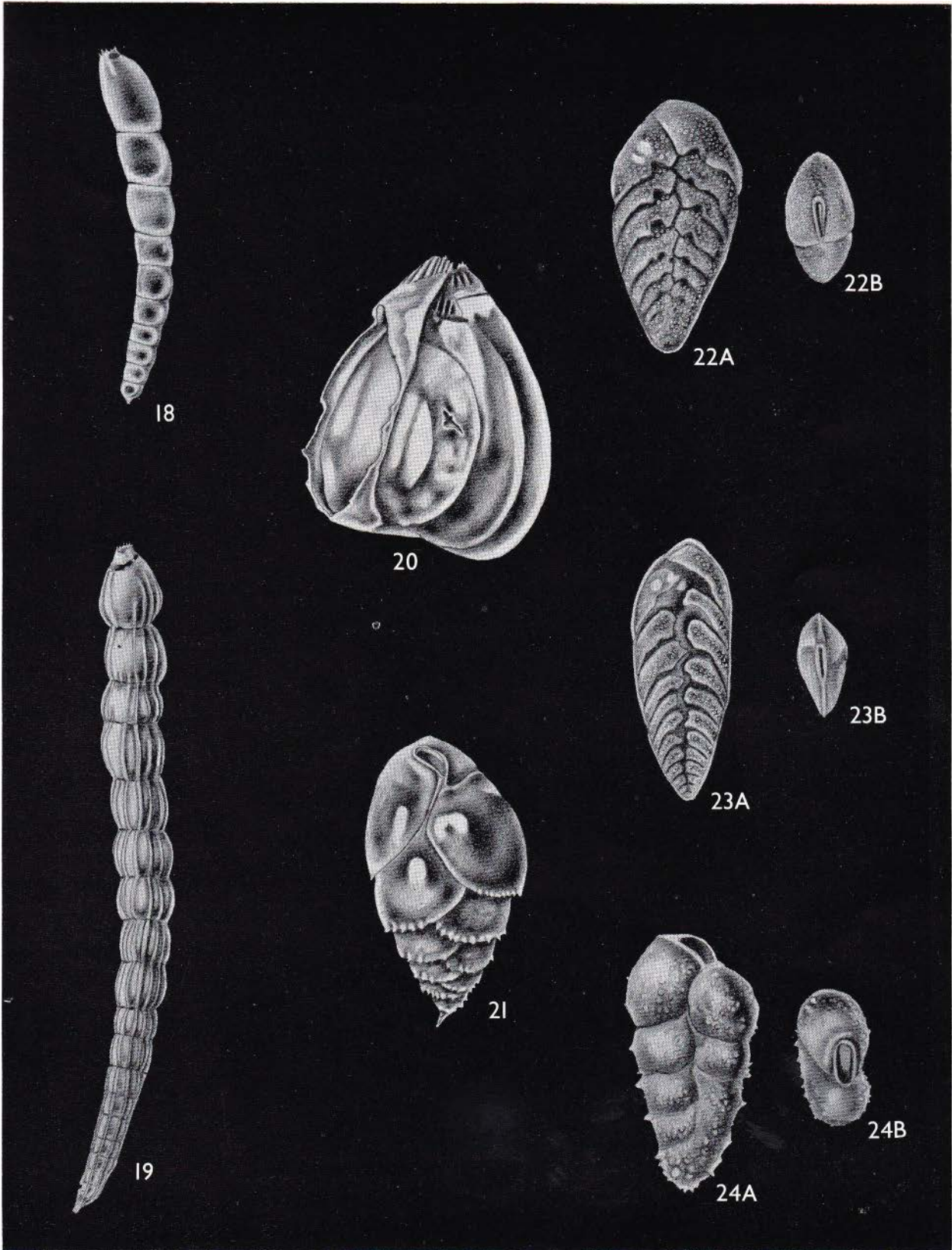


PLATE 6



PLATE 7

*Fig. 25: Globigerina inflata* d'Orbigny. A, "ventral" view,  $\times 96$ ; B, apertural view,  $\times 96$ ; C, "dorsal" view,  $\times 96$ . B.M. (N.H.) 1962·5·20·43.

*Fig. 26: Globobulimina turgida* (Bailey). A, peripheral view,  $\times 81$ ; B, apertural view,  $\times 81$ . B.M. (N.H.) Reg. No. 1962·5·20·44.

*Fig. 27: Globorotalia truncatulinoides* (d'Orbigny). A,  $\times 75$ ; B,  $\times 75$ ; C,  $\times 75$ . B.M. (N.H.) Reg. No. 1962·5·20·45.

*Fig. 28: Astrononion novo-zealandicum* Cushman and Edwards, A,  $\times 93$ ; B,  $\times 93$ . B.M. (N.H.) Reg. No. 1962·5·20·46.

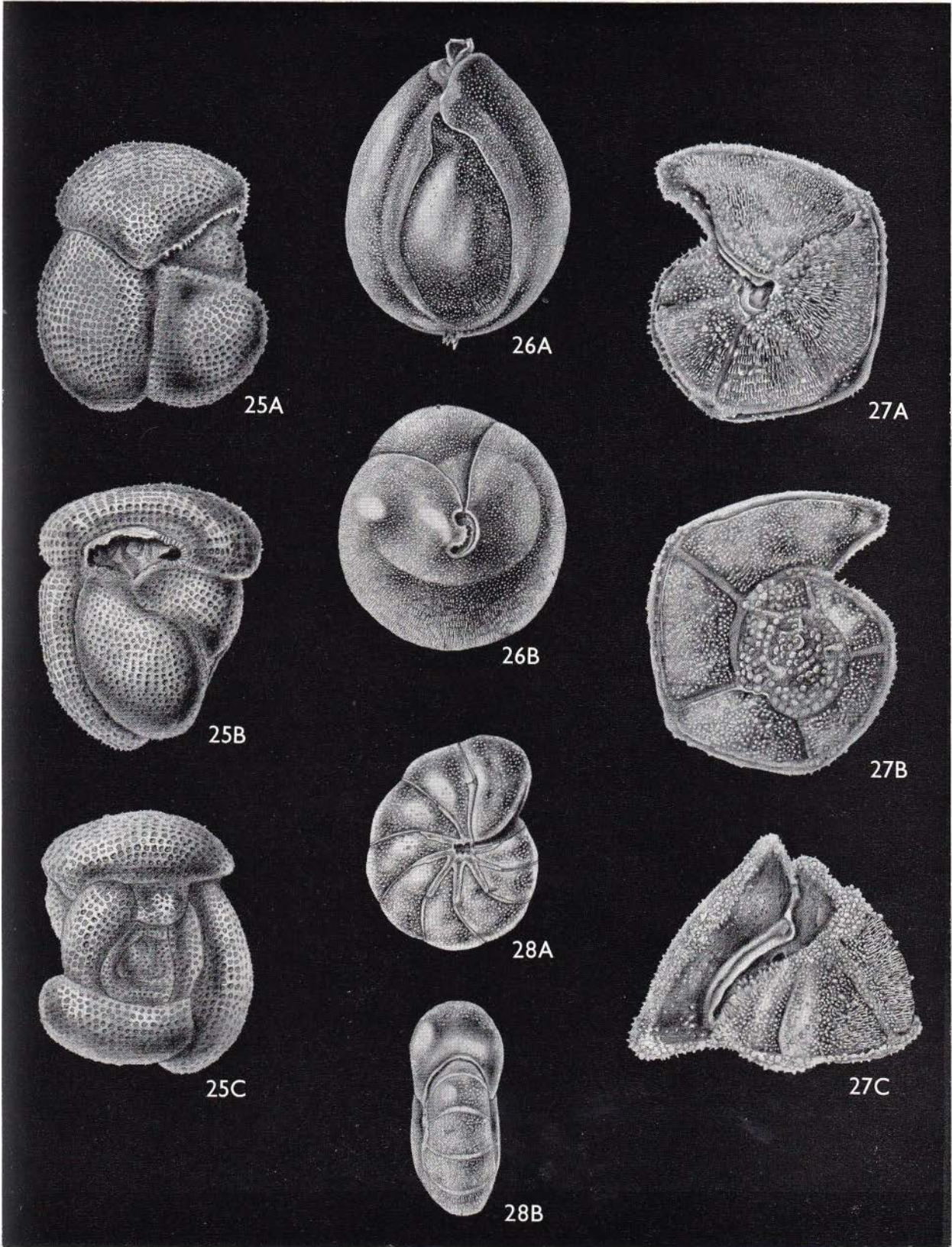


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