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**A Preliminary Account of the
Distribution of Recent Foraminifera
on Part of the N.W.
Australian Continental Shelf**



by

A.D. Albani and R. Geyskes

The information contained in this report has been obtained by the Department of National Development as part of the policy of the Commonwealth Government to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement without the permission in writing of the Director, Bureau of Mineral Resources, Geology & Geophysics.



A PRELIMINARY ACCOUNT OF THE DISTRIBUTION OF RECENT
FORAMINIFERA ON PART OF THE N.W. AUSTRALIAN CONTINENTAL SHELF

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Table: Numbers and percentages of foraminifera.

Plate: A general bathymetric chart of the area showing positions of sample stations along the traverses.

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SUMMARY

In 1967 samples were obtained from part of the N.W. Australian continental shelf suitable for an investigation of the ecology of Recent foraminifera. This paper gives the results of the examination of samples from three traverses across the shelf.

Only living foraminifera were considered. In all three traverses the arenaceous forms show an increase in percentages of the total population both towards shallower and deeper water while the calcareous porcellaneous forms are abundant in shallower water only. The calcareous hyaline forms appear to be much more sensitive to small changes in ecological parameters, although they too show a definite distribution pattern.

INTRODUCTION

In September 1967 the Marine Geology sub-section of B.M.R. resumed the survey of the N.W. Australian continental shelf, started in 1960 with the investigation of the Timor Sea (Veevers & van Andel, 1967). From September to December 1967 the S.S. Kos II was chartered and a survey was made of the area from Seringapatam Reef southward to the Rowley Shoals. This report deals with the preliminary results of an investigation of the ecology of Recent foraminifera in that region. R. Geyskes (BMR) took part in the cruise and was responsible for sample treatment, selection of the living forams, and to some extent their sorting. Identifications and frequency distributions were the work of A.D. Albani (University of New South Wales).

Several general accounts have been published of foraminifera of both Indian Ocean and West Pacific by various authors but to the present author's knowledge no published research has dealt in detail with the microfauna of the N.W. Australian continental shelf.

THE AREA

The area sampled is situated between $123^{\circ}40'E$ $13^{\circ}S$, $125^{\circ}E$ $14^{\circ}30'S$; $121^{\circ}30'E$ $18^{\circ}30'S$ and $119^{\circ}E$ $18^{\circ}30'S$ (Plate 1). Although morphological details are scarce it is known that a number of gulleys and a few deep channels run across it. In many places strong bottom currents have been detected, and well defined deep scattering layers were noted in a number of places seaward of the shelf edge.

Most of the area is covered by unconsolidated sediments of unknown thickness, ranging in composition from soft green silty clay to reasonably well sorted calcareous arenites.

A remarkable feature was the relative scarcity of molluscs larger than half an inch greatest dimension throughout the region.

METHODS

Either a small grab or a dredge were used in obtaining bottom samples at each station. As a preservative 95 percent alcohol was used; this gave satisfactory results when added to the wet sample in about half the volume to that of the sample. To stain the live foraminifera, 1 c.c. Rose of Bengal per gallon was added to the alcohol. The samples were kept cooled during storage.

Preparation for microscopical examination consisted of washing 8c.c. of wet material through a set of sieves with mesh openings of 0.0166, 0.0099, 0.0060 and 0.0030 inches respectively (BSS Nos. 36, 60, 100, 200). The four fractions thus obtained were examined in wet condition and all live forams picked.

DISTRIBUTION OF FORAMINIFERA

In order to get a rough idea in an early stage of the investigations of composition and distribution of the fauna, three traverses have been selected and examined (Plate 1). In all, 101 species have been identified. The percentages in which they occur at each station are plotted in Table I from which data Figures 1, 2 and 3 are compiled. Only significant genera have been used, and in a few instances single species are considered. The authors realise that by doing so not more than a general picture could be obtained, but the poor knowledge of the bottom topography as well as of the hydrological conditions would in any case make a more detailed analysis difficult. The impossibility of repeating the sampling at regular time intervals prevented any studies of seasonal fluctuations.

However, some conclusions can be drawn from Figures 1, 2 and 3. Along all three traverses the arenaceous forms increase in abundance both towards shallower and deeper water showing moderate numbers in between. The genera Textularia and Reophax are among the most common, the first one in shallow waters (less than 150 metres), the latter in deeper parts (over 250 metres) except at station 138 (90 metres) (Traverse I) where its abnormal peak may be due to local anomalous conditions.

An interesting situation appears to exist along Traverse 2 at the edge of the slope (station 209, 95 metres) where the arenaceous forms are exceptionally abundant. This suggests a local absence or substantial decrease in bottom currents. A similar situation has been found at shallower depths along the continental shelf off eastern Australia (Albani 1969, in press).

The calcareous porcellaneous forms follow the well known trend of being typical of shallow water. Quinqueloculina seminula and Q. pseudoreticulata are among the predominant species.

A discussion on the occurrence of calcareous hyaline forms presents many more difficulties. It is interesting however, to note how small differences in ecological parameters cause a marked shift in the distribution of many genera. The genus Cibicides is particularly abundant between 100 and 300 metres, while Hoeglundina and Lenticulina are found at slightly greater depths (150 to 350 metres). Brizalina, and especially Siphonina reticulata, seem to prefer deeper waters still, and are most abundant in depths exceeding 300 metres. On the other hand Rosalina bertheloti is restricted to waters shallower than 150 metres, and in all three traverses is most abundant at a depth of about 75 metres.

The authors feel that a greater amount of data than are available from the region under consideration are essential for a full ecological interpretation. In particular the lack of information on temperature ranges, salinity and, most important, bottom currents is felt badly and prevents the drawing of definite conclusions. Nevertheless the present preliminary survey has shown a constant and definite pattern in foraminiferal distribution which, when related to information on sediment distribution and bottom topography, will certainly prove to be of great value for further studies.

Systematic notes

The classification by Loeblich & Tappan (1964) has been adopted here, full references to all synonyms may be found in the Bibliography.

Order Foraminifera

Suborder Textulariina

Genus Technitella Norman, 1878.

TECHNITELLA LEGUMEN Norman, 1878

Technitella legumen - Norman, 1878. Ann. Mag. Nat. Hist.,
ser. 2, vol. 1. p. 279, Pl. 16, figs. 3,4;

Technitella legumen Norman - Brady, 1884. p. 246, Pl. 25,
figs. 8-12;

Technitella legumen Norman - Cushman, 1910. p. 48, fig. 53;

Technitella legumen Norman - Cushman, 1921. p. 50

Very few and generally small specimens occur at a few
stations.

Genus Ammodiscus Reuss, 1861

AMMODISCUS INCERTUS (d'Orbigny) 1839

Operculina incerta - d'Orbigny, 1839a. p. 49, Pl. 6,
figs. 16, 17;

Ammodiscus incertus (d'Orbigny) - Brady, 1884. p. 330,
Pl. 38, figs. 1-3;

Ammodiscus incertus (d'Orbigny) - Cushman, 1910. p. 73,
figs. 95, 96;

Ammodiscus incertus (d'Orbigny) - Cushman, 1921. p. 62,
Pl. 5, figs. 1, 2.

Very few specimens occur at a depth of 90 - 100 metres.

Genus Reophax Montfort, 1808

REOPHAX COMPRESSUS (Cushman & McCulloch) 1939

Ammofrondicularia compressa - Cushman & McCulloch, 1939
p. 68, Pl. 4, figs. 7-13.

The tests are very compressed and coarsely arenaceous.

The genus Ammofrondicularia has been placed among the
synonyms of Reophax by Loeblich & Tappan (1964, p. C216)

REOPHAX CYLINDRICUS Brady, 1884

Reophax cylindrica - Brady, 1884. p. 299, Pl. 32, figs. 7-9

Reophax cylindricus Brady - Cushman, 1921. p. 70, Pl. 13, fig. 1.

This species is restricted with very few individuals at
a depth of 300 metres.

REOPHAX DENTALINIFORMIS Brady, 1881

- Reophax dentaliniformis - Brady, 1881. p. 49
Reophax dentaliniformis Brady - Cushman, 1910. p.87, fig. 121;
Reophax dentaliniformis Brady - Cushman, 1921. p. 68, Pl.12, fig. 4;
Reophax dentaliniformis Brady-Barker, 1960. p. 62, Pl. 30,
figs. 21, 22.

Quite abundant only at station 226 (350 metres), very rare to absent elsewhere.

REOPHAX HORRIDUS Cushman, 1912

- Reophax horrida - Cushman, 1912. Proc. U.S. Nat. Mus.,
vol. 42. p. 229, Pl. 28, figs. 3, 4;
Reophax horridus Cushman - Cushman, 1921. p. 73, Pl. 13,
fig. 3; Pl. 18, figs. 3, 4.

The test is elongate with several chambers. The arenaceous wall shows the typical composition with an abundance of sponge spicules. Present only at station 226 (350 metres)

REOPHAX SCORPIURUS Montfort, 1808

- Reophax scorpiurus - Montfort, 1808. Conch. Syst., vol. 1.
p. 330, 83rd genus;
Reophax scorpiurus Montfort - Brady, 1884. p. 291
Pl. 30, figs. 12-17;
Reophax scorpiurus Montfort - Cushman, 1910. p. 83,
figs. 114-116;
Reophax scorpiurus Montfort - Cushman, 1921. p. 65 Pl. 6
fig. 6.

This typical species occurs abundantly along traverse 2 and only in the deepest section of traverse 3.

REOPHAX SCORPIURUS TESTACEA Wiesner, 1931

- Reophax scorpiurus Montfort, var. testacea - Wiesner,
1931. p. 89, Pl. 8, fig. 100
Reophax scorpiurus Montfort, var. testacea Wiesner - Parr,
1950. p. 269, Pl. 4, fig. 19.

Although generally associated with R. scorpiurus this species has been found along traverse 1. Sometimes it is difficult to clearly differentiate the two species because the foraminiferal tests, of which the wall of this variety is composed, may vary considerably in number.

REOPHAX SPICULIFER Brady, 1879

- Reophax spiculifera - Brady, 1879. p. 54;
Reophax spiculifera Brady - Brady, 1884 p. 295, Pl. 31,
figs. 16, 17;
Reophax spiculifer Brady - Cushman, 1910. p. 92,
figs. 132, 133.

One specimen only has been found, at station 226 (350 metres)

Genus Haplophragmoides Cushman, 1910

HAPLOPHRAGMOIDES CANARIENSIS (d'Orbigny) 1839

- Nonionina canariensis - d'Orbigny, 1839a. p. 128, Pl. 2,
figs. 33, 34;
Haplophragmium canariensis (d'Orbigny) - Brady, 1884.
p. 310, Pl. 35, figs. 1-5;
Haplophragmoides canariensis (d'Orbigny) - Cushman, 1910.
p. 101, fig. 149;
Haplophragmoides canariensis (d'Orbigny) - Cushman,
1921. p. 79.

Very few specimens.

Genus Textularia DeFrance, 1824

TEXTULARIA CANDEIANA d'Orbigny, 1839

- Textularia candeiana - d'Orbigny, 1839a. p. 143, Pl. 1,
figs. 25-27;
Textularia candeiana d'Orbigny - Cushman, 1911 (1910 etc.)
p. 12, figs. 14-17.

This species is normally found in the shallow section
of each traverse.

TEXTULARIA CONICA d'Orbigny, 1839

- Textularia conica - d'Orbigny, 1839a. p. 143, Pl. 1, figs. 19, 20;
Textularia conica d'Orbigny - Cushman, 1921. p. 123, Pl. 25,
fig. 2;
Textularia conica d'Orbigny - Barker, 1960. p. 88,
Pl. 43, figs. 13, 14.

Only two specimens have been found at station 137.
(115 metres)

TEXTULARIA FOLIACEA Heron-Allen & Earland, 1915

- Textularia foliacea - Heron-Allen & Earland, 1915 (1914 etc.)
p. 628, Pl. 47, figs. 17-20;
Textularia foliacea Heron-Allen & Earland - Cushman, 1921.
p. 117, Pl. 19, fig. 7.

This species appears to be the most common along traverse 3.

TEXTULARIA GRAMEN d'Orbigny, 1846

- Textularia gramen - d'Orbigny, 1846. p. 248, Pl. 15, figs.
4-6.
Textularia gramen d'Orbigny - Cushman, 1911 (1910 etc.).
p. 8, figs. 6-8.

Very few specimens

TEXTULARIA PSEUDOCARINATA Cushman, 1921

Textularia carinata d'Orbigny - Brady, 1884. p. 360, Pl. 42,
figs. 15, 16;

Textularia carinata d'Orbigny - Cushman, 1911 (1910 etc.),
p. 17, figs. 26, 27;

Textularia pseudocarinata - Cushman, 1921. p. 121, Pl. 22,
fig. 5.

Abundant at a few stations.

TEXTULARIA RAMOSA Lalicker & McCulloch, 1940

Textularia ramosa - Lalicker & McCulloch, 1940. p. 138, Pl. 15,
fig. 20.

Very rare.

TEXTULARIA SIPHONIFERA Brady, 1881

Textularia siphonifera - Brady, 1881. p. 53;

Textularia siphonifera Brady - Brady, 1884. p. 362, Pl. 42,
figs. 25-29;

Textularia siphonifera Brady - Cushman, 1911 (1910 etc.)
p. 17, figs. 28, 29;

Textularia siphonifera Brady - Albani, 1968. p. 96

A few specimens; all showing the apertural projections
typical of the species.

TEXTULARIA sp.

Textularia sp. nov. - Barker, 1960. p. 88, Pl. 43,
figs. 15, 16, 18.

A few specimens occur in shallow waters. The tests are
identical with the figure of T. trochus in Brady (1884,
Pl. 43, figs. 15, 16, 18).

Many more specimens are needed, however, before a precise
diagnostic description of the average specimen can be
made; therefore the views by Barker (1960) are here
accepted and the specimens are referred to T. sp. nov.

Genus Trochammina Parker & Jones, 1859

TROCHAMMINA INFLATA, (Montagu) 1808

Nautilus inflatus - Montagu, 1808. Test. Brit., Supp.,
p. 81, fig. 3;

Trochammina inflata (Montagu) - Brady, 1884. p. 338,
Pl. 41, fig. 4;

Trochammina inflata (Montagu) - Cushman, 1910 p. 121

Only one specimen has been found alive at station 210
(88 metres)

Genus Rotaliammina Cushman, 1924

ROTALIAMMINA MAYORI Cushman, 1924

Rotaliammina mayori - Cushman, 1924. Carnegie Inst. Washington, Publ., 342. p. 11, Pl. 1, figs. 4, 5;

Rotaliammina mayori Cushman - Loeblich & Tappan, 1955.
p. 20, Pl. 3, fig. 4.

Several specimens occur along traverses 2 and 3.

Genus Tritaxis Schubert, 1920

TRITAXIS CONICA (Parker & Jones) 1865

Valvulina triangularis d'Orbigny, var. conica - Parker & Jones, 1865. Philos. Trans. Roy. Soc., vol. 155. p. 406, Pl. 15, fig. 27;

Tritaxis conica (Parker & Jones) - Barker, 1960. p. 100,
Pl. 49, fig. 15.

Only one specimen from station 226 (350 metres)

Genus Gaudryina d'Orbigny, 1839

GAUDRYINA PAUPERCULA Cushman, 1911

Gaudryina paupercula - Cushman, 1911 (1910 etc.)
p. 66, figs. 106;

Gaudryina paupercula Cushman - Cushman, 1921 p. 148,
Pl. 29, figs. 4, 5.

Very rare and only at station 227. (330 metres)

GAUDRYINA QUADRANGULARIS Bagg, 1908

Gaudryina quadrangularis - Bagg, 1908. Proc. U.S. Nat. Mus.,
vol. 34. p. 133, Pl. 5, fig. 1;

Gaudryina quadrangularis Bagg - Cushman, 1911 (1910 etc.)
p. 64, fig. 103;

Gaudryina quadrangularis Bagg - Cushman, 1921. p. 147,
Pl. 29, fig. 2.

Very rare.

GAUDRYINA TRANSVERSARIA (Brady) 1884

Textularia transversaria - Brady, 1884. p. 359, Pl. 113,
figs. 3-5;

Gaudryina (siphogaudryina) transversaria (Brady) - Said,
1949. p. 8, Pl. 1, fig. 12;

Gaudryina (Siphogaudryina) transversaria (Brady) - Barker,
1960. p. 232, Pl. 113, figs. 3-5.

This species has been found abundant in the shallow section
of each traverse.

Genus Dorothia Plummer, 1931

DOROTHIA ARENATA Cushman, 1936

Dorothia arenata - Cushman, 1936 - Cushman Lab. Foram. Res.,
Spec. Publ. 6; p. 32, Pl. 5, fig. 11;

Dorothia arenata - Cushman, 1937a. p. 101, Pl. 11, fig. 9.

Only one specimen at station 137 (115 metres)

Genus Clavulina d'Orbigny, 1826

CLAVULINA PACIFICA Cushman, 1924

Clavulina angularis (d'Orbigny) - Brady, 1884. p. 396.
Pl. 48, figs. 22-24;

Clavulina pacifica - Cushman, 1924. Carnegie Inst.
Washington Publ. 342. p. 22, Pl. 6,
figs. 7-11;

Clavulina pacifica Cushman - Cushman, 1932. p. 16, Pl. 4,
figs. 4, 7, 9

Very few specimens occur in shallow water along traverse 1.

Genus Cylindroclavulina Bermudes & Key 1952

CYLINDROCLAVULINA BRADYI (Cushman) 1911

Clavulina cylindrica Hantken - Brady, 1884. p. 396, Pl. 48,
figs. 32-38;

Clavulina bradyi - Cushman, 1911 (1910 etc.). p. 73, figs.
118, 119.

Cylindroclavulina bradyi (Cushman) - Barker, 1960. p. 98,
Pl. 48, figs. 32-38.

Only two specimens have been found at 120 metres and
200 metres along traverse 2.

Suborder Miliolina

Genus Spiroloculina d'Orbigny, 1826

SPIROLOCULINA COMMUNIS Cushman & Todd, 1944

Spiroloculina grateloupi d'Orbigny - Cushman, 1917 (1910 etc.).
p. 31, Pl. 4, figs. 4, 5;

Spiroloculina grateloupi d'Orbigny - Cushman, 1921. p. 396,
Pl. 78, fig. 4; Pl. 100, fig. 3;

Spiroloculina communis - Cushman & Todd, 1944. p. 62, Pl. 8,
figs. 26-28;

Spiroloculina communis Cushman & Todd - Barker, 1960. p. 20,
Pl. 9, figs. 3, 4;

Spiroloculina communis Cushman & Todd - Albani, 1965. p. 61,
Pl. 6, fig. 6

This typical species occurs abundantly in shallow waters
along all three traverses.

SPIROLOCULINA DISPARILIS Terquem, 1878

- Spiroloculina disparilis - Terquem Mém. Soc. géol. France,
ser. 3, vol. 1. p. 55, Pl. 5, fig. 12;
Spiroloculina acutimargo Brady - Brady, 1884 p. 154,
Pl. 10, fig. 12;
Spiroloculina disparilis Terquem - Cushman & Todd, 1944.
p. 35, Pl. 5, figs. 22-31.

Only a few specimens at 90 metres.

Genus Quinqueloculina d'Orbigny, 1826

QUINQUELOCULINA AGGLUTINANS d'Orbigny, 1839.

- Quinqueloculina agglutinans - d'Orbigny, 1839a. p. 168,
Pl. 12, figs. 11-13;
Quinqueloculina agglutinans d'Orbigny - Cushman, 1921.
p. 441, Pl. 91, fig. 1.

This species seems to characterize very shallow waters;
it has been found in great abundance only at station
235 (55 metres).

QUINQUELOCULINA ANGUINA ARENATA Said, 1949

- Quinqueloculina anguina (Terquem) var. agglutinans (Wiesner)
-Cushman, 1932. p.18, Pl.5, fig. 1;
Quinqueloculina anguina (Terquem) var. arenata - Said, 1949.
p. 9, Pl. 1, fig. 25;
Quinqueloculina anguina arenata Said - Collins, 1958. p. 358

Together with Q. agglutinans, this species, found only in
waters less than 90 metres deep, is characteristic of the
shallow section of the traverses 1 and 3.

QUINQUELOCULINA LAMARCKIANA d'Orbigny, 1839

- Quinqueloculina lamarckiana - d'Orbigny, 1839a. p. 189,
Pl. 11, figs. 14, 15;
Quinqueloculina lamarckiana - d'Orbigny - Cushman,
1921. p. 418, Pl. 87, figs. 2, 3.

Among the miliolids, Q. lamarckiana is by far the most
abundant and with Q. pseudoreticulate it constitutes up
to 80 percent of the porcellaneous species.

QUINQUELOCULINA PSEUDORETICULATA Parr, 1941

- Miliolina reticulata (d'Orbigny) - Brady, 1884. p. 177,
Pl. 9, figs. 2, 3.
Quinqueloculina reticulata (d'Orbigny) - Cushman, 1917
(1910 etc.) p. 55, Pl. 16, figs. 1-3;
Quinqueloculina reticulata (d'Orbigny) - Cushman, 1921.
p. 434;
Quinqueloculina pseudoreticulata - Parr, 1941. p. 305.
Quinqueloculina pseudoreticulata - Parr - Barker, 1960.
p. 18, Pl. 9, figs. 2, 3.
Quinqueloculina pseudoreticulata Parr - Albani, 1968.
p. 98, Pl. 7, figs. 18-20.

Many large specimens, showing clearly the reticulated ornamentation, are present in all three traverses. The tests are identical with Brady's figures (1884) except for the tooth which is simple. Only in a few cases the tooth may be considered slightly bifid; in this respect they resemble the specimens from the eastern coast of Australia. (Albani, 1968)

QUINQUELOCULINA SEMINULA (Linné) 1767

- Serpula seminulum - Linné, 1767. Syst. Nat., ed. 12, p. 1264,
No. 791;
Quinqueloculina seminulum (Linné) - Cushman, 1917
(1910 etc.) p. 44, Pl. 11, fig. 2;
Quinqueloculina seminulum (Linné) - Cushman, 1921. p. 416,
Pl. 88, fig. 4.

Only a few specimens.

Genus Flintina Cushman, 1921

FLINTINA TRIQUETRA (Brady) 1879

- Miliolina triquetra - Brady, 1879. p. 54;
Miliolina triquetra Brady - Brady, 1884. p. 181, Pl. 8,
figs. 8-10;
Flintina triquetra (Brady) - Cushman, 1921. p. 466, Pl. 94,
fig. 1.

Very rare.

Genus Pyrgo DeFrance, 1824

PYRGO SARSII (Schlumberger) 1881

- Biloculina sarsii - Schlumberger, 1881. Mém. Soc. Zool.
France, vol. 4, p. 166, Pl. 9, figs.
55-59;
Biloculina sarsii Schlumberger - Cushman, 1917 (1910 etc).
p. 76, Pl. 30, fig. 2;
Biloculina sarsii Schlumberger - Cushman, 1921. p. 471,
Pl. 97, fig. 1.

Only a few specimens in deep waters.

Genus Sigmoilopsis Finlay, 1947

SIGMOILOPSIS SCHLUMBERGERI (Silvestei) 1904

- Planispirina celata (costa) - Brady, 1884 p. 197, Pl. 8,
figs. 1-4;
Sigmoilina schlumbergeri - Silvestei, 1904. Mem. Pont. Nuovi.
Lincei., vol. 22, p. 267;
Sigmoilina celata (costa) - Cushman, 1917 (1910 etc.) p. 61,
Pl. 24, fig. 1;
Sigmoilopsis schlumbergeri (Silvestri) - Barker, 1960.
p. 16, Pl. 8, figs. 1-4.

Very rare.

Genus Triloculina d'Orbigny 1826

TRILOCULINA RUPERTIANA (Brady) 1879

- Miliolina rupertiana - Brady, 1879. p. 46;
Miliolina rupertiana Brady - Brady, 1884. p. 178, Pl. 7,
fig. 7-12;
Triloculina rupertiana (Brady) - Cushman, 1921. p. 464,
Pl. 93, fig. 2;

Two specimens only and from very shallow water.

TRILOCULINA TRICARINATA d'Orbigny, 1826

- Triloculina tricarinata - d'Orbigny, 1826. p. 299, no. 7;
Triloculina tricarinata d'Orbigny - Cushman, 1917 (1910 etc.)
p. 66, Pl. 25, figs. 1,2;
Triloculina tricarinata d'Orbigny - Cushman, 1921. p. 454.

One specimen only.

Genus Miliolinella Wiesner, 1931

MILIOLINELLA SUBROTUNDA (Montagu) 1803

- Vermiculum subrotundum - Montagu, 1803. Test. Brit., p. 521;
Miliolina circularis (Bornemann) - Brady, 1884. p. 169,
Pl. 4, fig. 3;
Triloculina circularis Bornemann - Cushman, 1917 (1910 etc.)
p. 67, Pl. 25, fig. 4; Pl. 26, fig. 1;
Triloculina circularis Bornemann - Cushman, 1921 p. 462, Pl. 92,
figs. 1, 2;
Miliolinella subrotunda (Montagu) - Barker, 1960. p. 8,
Pl. 4, fig. 3.

A few specimens have been found at 170 metres (station 270).

Genus Sorites Ehrenberg, 1840

SORITES MARGINALIS (Lamarck) 1816

Orbulites marginalis - Lamarck, 1816. Syst. Anim. sans.
Vert., vol. 2. p. 196, no. 1;

Orbitolites marginalis (Lamarck) - Cushman, 1917 (1910
etc.). p. 92, Pl. 38, figs. 1, 2;

Orbitolites marginalis (Lamarck) - Cushman, 1921. p. 484.

Only one specimen at 55 metres (station 235)

Suborder Rotaliina

Genus Amphicoryna Schlumberger, 1881

AMPHICORYNA SCALARIS (Batsch) 1791

Nautilus (Orthoceras) scalaris - Batsch, 1791. Conchylien
des Seesandes, No. 4, Pl. 2, figs. a, c.

Amphicoryna scalaris (Batsch) - Barker, 1960. p. 134,
Pl. 63, figs 28-31;

Amphicoryna scalaris (Batsch) - Albani, 1968. p. 102,
Pl. 8, figs. 2, 3.

Several specimens along traverse 3. For a complete
discussion of this species see Albani (1968)

Genus Dentalina d'Orbigny, 1826

DENTALINA COMMUNIS d'Orbigny, 1826

Nodosaria (Dentalina) communis - d'Orbigny, 1826. p. 254,
No. 35;

Dentalina communis - d'Orbigny, 1840. Mém. Soc. Géol. France,
vol. 4. p. 13 Pl. 1, fig. 4;

Nodosaria communis d'Orbigny - Cushman, 1913 (1910 etc.).
p. 54, Pl. 28, figs. 1, 2;

Dentalina communis d'Orbigny - Barker, 1960. p. 130,
Pl. 62, figs. 21, 22.

Very few specimens occur in fairly deep waters along traverses
2 and 3.

DENTALINA JAPONICA (Cushman) 1913

Nodosaria japonica - Cushman, 1913 (1910 etc.) p. 57, Pl. 28, fig. 4;

The tests are elongate and consist of many cylindrical
chambers. The sutures, composed of clear shell material,
are quite visible although not depressed.

Only one complete specimen has been found at station 136
(90 metres).

DENTALINA MILLETTII Cushman, 1917

- Nodosaria scalaris, var. separans (Brady) - Millett, 1902.
Journ. Roy. Micr. Soc., p. 520, Pl. 11,
figs. 11, 12;
Nodosaria millettii - Cushman, 1917. Proc. U.S. Nat. Mus.,
vol. 51; p. 654;
Nodosaria millettii Cushman - Cushman, 1921. p. 202, Pl. 36, fig. 5
One specimen only at station 201 (265 metres)

DENTALINA VERTEBRALIS (Batsch) 1791

- Nautilus (Orthoceras) vertebralis - Batsch, 1791. p. 3,
No. 6, Pl. 2, fig. 6;
Nodosaria vertebralis (Batsch) - Brady, 1884. p. 514, Pl. 64,
figs. 11-14;
Nodosaria vertebralis (Batsch) - Cushman, 1913 (1910 etc.)
p. 60, Pl. 32, fig. 1;
Nodosaria vertebralis (Batsch) - Cushman, 1921. p. 211,
Pl. 38, figs. 2, 3; Pl. 40,
fig. 2;
Nodosaria vertebralis, var. albatrossi - Cushman, 1923
(1918 etc). p. 87, Pl. 15, fig. 1;
Nodosaria albatrossi Cushman - Barker, 1960. p. 134,
Pl. 64, figs. 11-14.
Dentalina vertebralis (Batsch) - Hedley, Hurdle & Burdett,
1965. p. 19, Pl. 6,

The views of Hedley, Hurdle & Burdett are here followed.
The specimens show the typical longitudinal costae
and the sutures are visible although not depressed.

Genus Lenticulina Lamarch 1804

LENTICULINA COSTATA (Fichtel & Moll) 1798

- Nautilus costatus - Fichtel & Moll, 1798 p. 47, Pl. 4,
figs. g-i;
Lenticulina costata (Fichtel & Moll) - Hedley, Hurdle &
Burdett, 1965. p. 14, Pl. 4, figs. 14a,b

The test is large and compressed with limbate sutures.
The chambers are ornamented with independent sets of
raised costae parallel to the periphery.
One specimen only at station 133 (300 metres)

LENTICULINA ECHINATA (d'Orbigny) 1846

- Robulina echinata - d'Orbigny, 1846. p. 100, Pl. 4, figs. 21, 22;
Cristellaria echinata (d'Orbigny) - Cushman, 1913 (1910
etc.). p. 73, Pl. 34, fig. 5;
Lenticulina papillosoechinata (Fornasini) - Barker, 1960
p. 148 Pl. 71, fig. 1.

The tests are biconvex and composed of few chambers. The sutures are limbate and, in the early part of the test, break up to form series of rounded and raised bosses of different sizes. The largest being near the umbo. The last formed sutures do not show such bosses and form a continuous raised ridge. Acicular spines are present along the periphery. Few specimens occur at stations 133 (300 metres), 135 (190 metres) 227 (330 metres) and 248 (200 metres).

LENTICULINA LIMBOSA (Reuss) 1863

- Robulina limbosa - Reuss, 1863. Sitz. Akad. Wiss. Wien,
vol. 48, pt. 1. p. 55, Pl. 6, fig. 69;
Robulus limbosus (Reuss) - Cushman & McCulloch, 1950. p. 297,
Pl. 39, figs. 1, 2.

The tests are close coiled and strongly biconvex. The chambers are uniform in shape with the umbilical area occupied by a large, not raised boss. The periphery is ornamented by a small rounded keel. This species is the most abundant of the genus and occurs along all three traverses.

LENTICULINA ORBICULARIS (d'Orbigny) 1826

- Robulina orbicularis - d'Orbigny, 1826 p. 288, Pl. 15, figs. 8, 9;
Cristellaria orbicularis (d'Orbigny) - Cushman, 1913 (1910 etc.)
p. 67, Pl. 36, figs. 4, 5;
Cristellaria orbicularis (d'Orbigny) - Cushman, 1921. p. 224.

Only one specimen from station 201 (265 metres) with the characteristic keel well pronounced.

LENTICULINA PEREGRINA (Schwager) 1866

- Cristellaria peregrina - Schwager, 1866 Novara - Exped., Geol.
Theil., vol. 2, p. 245, Pl. 7, fig. 89;
Cristellaria variabilis Reuss - Brady, 1884. p. 541,
Pl. 68, figs. 11-16;
Cristellaria peregrina Schwager - Cushman, 1923 (1918 etc.).
p. 113, Pl. 30, figs. 3, 4;
Lenticulina peregrina (Schwager) - Barker, 1960. p. 144,
Pl. 68, figs. 11-16.

The tests are small, compressed and formed by a few chambers; only three in the last-formed whorl. A very small keel marks the periphery and the aperture is slightly produced.

LENTICULINA SUBGIBBA Parr, 1950

Lenticulina subgibba - Parr, 1950. p. 321, Pl. 11, figs. 1, 2

Lenticulina subgibba Parr - Hedley, Hurdle & Burdett, 1960
p.16, Pl. 3, fig. 12; text fig. 2.

One specimen only from station 226 (350 metres)

LENTICULINA VORTEX (Fichtel & Moll) 1803

Nautilus vortex - Fichtel & Moll, 1803. Test. Micr., p. 33,
Pl. 2, figs. d-i;

Cristellaria vortex (Fichtel & Moll) - Brady, 1884. p.548,
Pl. 69, figs. 14-16;

Cristellaria vortex (Fichtel & Moll) - Cushman, 1913 (1910
etc.). p. 68, Pl. 32, fig. 3;

Cristellaria vortex (Fichtel & Moll) - Cushman, 1921. p. 227

This typical species occurs with a few specimens at stations
270, (170 metres) 227 (330 metres) and 247 (128 metres).

Genus Lagena Walker & Jacob, 1798

LAGENA PLIOCENICA TIMMSANA Cushman & Gray, 1946

Lagena pliocenica Cushman & Gray, var. timmsana - Cushman
& Gray, 1946. Contr. Cushman Lab. Foram.
Res., vol. 22, p. 68, Pl. 12, figs. 15-17;

Lagena pliocenica Cushman & Gray, var. timmsana Cushman
& Gray-Cushman & McCulloch, 1950. p. 345,
Pl. 46, fig. 10

The tests are globular with smooth wall. At the base a few
plate-like raised costae are produced outwards. The neck
is long and ornamented by a spiral costa.

LAGENA SULCATA (Walker & Jacob) 1798

Serpula (Lagena) sulcata - Walker & Jacob, 1798. In Adam's
Essays, Kanmacher's ed., p. 634, Pl. 14, fig. 5;

Lagena sulcata (Walker & Jacob) - Brady, 1884 p. 462, Pl. 57,
figs. 22, 26, 33, 34;

Lagena sulcata (Walker & Jacob) - Cushman, 1913 (1910 etc.).
p. 22, Pl. 9, fig. 2;

Lagena sulcata (Walker & Jacob) - Cushman, 1921. p. 179

Only one specimen at station 140 (57 metres)

Genus Pseudonodosaria Boomgaart, 1949

PSEUDONODOSARIA TORRIDA (Cushman) 1923

- Nodosaria (Glandulina) laevigata d'Orbigny - Brady, 1884.
p. 490, Pl. 61, figs. 20-22;
Nodosaria (Glandulina) laevigata d'Orbigny - Cushman,
1913 (1910 etc.) p.47, Pl.24, figs. 1,2;
Nodosaria (Glandulina) laevigata d'Orbigny - Cushman, 1921 p. 185,
Pl. 33, fig. 1;
Nodosaria (Glandulina) laevigata d'Orbigny, var. torrida -
Cushman, 1923 (1918 etc.) p.65, Pl.12, fig.10;
Rectoglandulina torrida (Cushman) - Barker, 1960. p. 128,
Pl. 61, figs. 20-22.

Only one specimen at station 226 (350 metres)

Genus Saracenaria DeFrance, 1824

SARACENARIA ITALICA DeFrance, 1824

- Saracenaria italica - DeFrance, 1824. Dist.Sci.Nat., vol.32.
Cristellaria italica (DeFrance) - Barker, 1960. p. 144,
Pl. 68, figs. 17, 18. 20-23.

Only one specimen of this well known species has been
found at station 227 (330 metres)

Genus Guttulina d'Orbigny, 1839

GUTTULINA PROBLEMA d'Orbigny, 1826

- Guttulina problema - d'Orbigny, 1826. p. 266, No. 14;
Polymorphina problema (d'Orbigny) - Brady, 1884. p. 568,
Pl. 72, fig. 20;
Guttulina problema d'Orbigny - Cushman & Ozawa, 1930. p. 19,
Pl. 2, figs. 1-6.

Very few specimens are present and without a specific
pattern of distribution.

Genus Nummulites Lamarck 1801

NUMMULITES AMMONOIDES (Gronovius) 1781

- Nautilus ammonoides - Gronovius, 1781. Zooph. Gron.,
p.282, Pl. 19, figs. 5,6;
Operculina ammonoides (Gronovius) - Cushman, 1914 (1910 etc).
p. 37, Pl. 14, fig. 7.
Operculina ammonoides (Gronovius) - Cushman, 1921. p. 382;
Operculina ammonoides (Gronovius) - Barker, 1960. p. 230,
Pl. 112, figs. 3-9, 11-13.

This species is unusually common at station 235
(55 metres). Except a few records it is a species of deep
cold waters and this finding confirms the author's views
that more detailed and complete records of the hydro-
logical parameters are essential.

Genus Eponides Montfort, 1808

EPONIDES BERTHELONIANUS (d'Orbigny)

Eponides berthelonianus (d'Orbigny) - Barker, 1960. p. 218,
Pl. 106, fig. 1.

Several specimens have been found mainly along traverse 1.

Genus Amphistegina d'Orbigny, 1826

AMPHISTEGINA LESSONII d'Orbigny, 1826

Amphistegina lessonii - d'Orbigny, 1826 p. 304, No.3, Pl.17,
figs. 1-4;

Amphistegina lessoni d'Orbigny - Cushman, 1914 (1910 etc). p.35;

Amphistegina lessoni d'Orbigny - Barker, 1960. p. 230,
Pl. 111, figs. 5, 6.

This species occurs abundantly in the shallow section of
traverse 3.

Genus Hyalinea Hofher, 1951

HYALINEA BALTHICA (Schroeter) 1783

Nautilus balthicus - Schroeter, 1783. Einleitung, vol. 1,
p. 20, Pl. 1, fig. 2;

Operculina ammonoides Parker & Jones - Brady, 1884, p. 745,
Pl. 92, figs. 1;2;

Anomalina balthica (Schroeter) - Cushman, 1931 (1913 etc.)
p. 108, Pl. 19, fig. 3;

Hyalinea balthica (Schroeter) - Barker, 1960, p.230, Pl.112,
figs. 1, 2.

One specimen only at station 236 (104 metres)

Genus Cibicides Montfort, 1808

CIBICIDES MARGARITIFERUS (Brady) 1881

Truncatulina margaritifera - Brady, 1881. p. 66;

Truncatulina margaritifera Brady - Brady, 1884 p. 667, Pl.
96, fig. 2;

Truncatulina margaritifera Brady - Cushman, 1915 (1910 etc.)
p. 40, Pl. 17, fig. 1; text.fig.43;

Cibicides margaritiferus (Brady) - Barker, 1960 p. 198,
Pl. 96, fig. 2.

This species is quite abundant along traverse 1.

CIBICIDES PRAECINCTUS (Karrer) 1868

- Rotalia praecincta - Karrer, 1868. Sitz. Akad. Wiss. Wien.
vol. 58, p. 189, Pl. 5, fig. 7;
Truncatulina praecincta (Karrer) - Brady, 1884. p. 667
Pl. 95, figs 1-3;
Truncatulina praecincta (Karrer) - Cushman, 1915 (1910 etc.)
p. 39, Pl. 26; fig. 2;
Truncatulina praecincta (Karrer) - Cushman, 1921. p. 318;
Cibicides praecinctus (Karrer) - Barker, 1960 p. 196, Pl. 95,
figs. 1-3.

Several specimens have been found along traverse 2.

CIBICIDES REFULGENS Montfort, 1808

- Cibicides refulgens - Montfort, 1808. p. 122
Truncatulina refulgens (Montfort) - Cushman, 1921.
p. 312, Pl. 63, fig. 1.
Cibicides refulgens Montfort - Barker, 1960 . p. 190,
Pl. 92, fig. 7.

This species is the most abundant of the genus reaching the 30 percent at a few stations. The specimens are very often small and variable and they are present to a depth of 300 metres which seems to be the lower limit in the area studied.

Genus Planorbulinella Cushman, 1927

PLANORBULINELLA LARVATA (Parker & Jones) 1860

- Planorbulina vulgaris d'Orbigny, var. larvata - Parker & Jones, 1860. Ann. Mag. Nat. Hist.,
ser. 3, vol. 5; p. 294.
Planorbulina larvata Parker & Jones - Cushman, 1915 (1910 etc.).
p. 27, Pl. 8, fig. 2.
Planorbulina larvata Parker & Jones - Cushman, 1921. p. 310.
Planorbulinella larvata (Parker & Jones) - Barker, 1960
p. 190, Pl. 92, figs. 5, 6.

Several specimens occur along traverses 2 and 3.

Genus Sigmoidella Cushman & Orawa, 1928.

SIGMOIDELLA ELEGANTISSIMA (Parker & Jones) 1865

- Polymorphina elegantissima - Parker & Jones, 1865. Philos.
Trans. vol., 155, p. 438, Pl. 10;
Polymorphina elegantissima Parker & Jones - Cushman, 1913
(1910 etc.) p. 90, Pl. 38, fig. 1;
Sigmoidella elegantissima (Parker & Jones) - Cushman and
Orawa, 1930 p. 140, Pl. 39, fig. 1

This species is abundant at several stations.

Genus Fissurina Reuss, 1850

FISSURINA MARGINATO-PERFORATA (Seguenza) 1880

- Lagena marginato-perforata-Seguenza, 1880. Atti. Accad. Lincei, ser. 3, vol.6, p. 332, Pl.17, fig.34;
Lagena marginato-perforato seguenza - Cushman, 1923 (1918 etc.)
p. 37, Pl. 7, fig. 4.

One specimen at station 249 (320 metres)

FISSURINA ORBIGNYANA Seguenza, 1862

- Fissurina orbignyana - Seguenza, 1862. Foram. monotal. Mioc. Messina. p. 66, Pl. 2, figs. 24, 26;
Lagena orbignyana (Seguenza) - Brady, 1884. p. 484, Pl. 59,
figs. 1, 18, 24, 26;
Lagena orbignyana (Seguenza) - Cushman, 1913 (1910 etc.).
p. 42, Pl. 19, fig. 1.

Present at stations 209 (95 metres) and 226 (350 metres)

Genus Brizalina Costa, 1856

BRIZALINA ALATA (Seguenza) 1862

- Valvulina alata - Seguenza, 1862. Atti. Accad. Gioenia Sci.Nat.
ser. 2, vol. 18. p. 115, Pl. 2, figs.5,5a;
Bolivina alata (Seguenza) - Cushman, 1937 p. 106, Pl. 13,
figs. 4, 10.

One specimen at station 134 (200 metres) along traverse 1.

BRIZALINA EARLANDI (Parr) 1950

- Bolivina earlandi - Parr, 1950. p. 339, Pl. 12, fig. 16;
Bolivina earlandi Parr - Barker, 1960. p. 106, Pl. 52, figs.
18, 19.

The tests are elongate and oval in transverse section.
The chambers are distinct with strongly curved sutures.
The wall is smooth and translucent; the aperture consists
of a narrow comma-shaped slit.
This species is rare; very few specimens have been found
at stations 136 (90 metres) and 157 (75 metres)

BRIZALINA SCHWAGERIANA (Brady) 1881

- Bolivina schwageriana - Brady, 1881. p. 28;
Bolivina schwageriana Brady - Brady, 1884. p. 425, Pl. 53,
figs. 24, 25;
Bolivina schwageriana Brady - Cushman, 1911 (1910 etc.).
p. 38, fig. 63;
Bolivina schwageriana Brady - Cushman, 1937. p. 130, Pl. 16,
figs. 22-24.

The test is very compressed and nearly as broad as long. The periphery is carinate and the few chambers are broader than high. The sutures are limbate with raised beads in the central portion of the test. This species is the most abundant of the genus in our material.

BRIZALINA SEMINUDA (Cushman) 1911

- Bolivina seminuda - Cushman, 1911 (1910 etc.) p. 34, fig. 55;
Bolivina seminuda Cushman - Parr, 1950. p. 339, Pl. 12, fig. 17

Together with B. schwageriana this species forms up to 90 percent of the total population of the genus and is present in many stations in the three traverses.

BRIZALINA SPATHULATA (Williamson) 1858

- Textularia variabilis var. spathulata - Williamson, 1858.
Recent British Foram. p. 76, Pl. 6, figs. 164, 165;
Bolivina dilatata Reuss - Brady, 1884. p. 418, Pl. 52, figs.
20, 21;
Bolivina dilatata Reuss - Cushman, 1911 (1910 etc.). p. 33,
fig. 54;
Bolivina dilatata Reuss - Cushman, 1921. p. 128, Pl. 26,
fig. 6;
Brizalina spathulata (Williamson) - Hedley, Hurdle &
Burdett, 1965. p. 21, Pl. 6, fig. 23;
Text-fig. 6.

Very few specimens occur at stations 270 (170 metres) and 209 (95 metres)

Genus Rectobolivina Cushman, 1927

RECTOBOLIVINA COLUMELLARIS (Brady) 1881

- Sagrina columellaris - Brady, 1881. p. 64;
Siphogenerina columellaris (Brady) - Cushman, 1913
(1910 etc.) p. 104, Pl. 47, figs. 2, 3;
Siphogenerina columellaris (Brady) - Cushman, 1921 p. 276,
Pl. 56, fig. 1;
Rectobolivina columellaris (Brady) - Barker, 1960. p. 156,
Pl. 75, figs. 15-17.

The test is elongate and cylindrical. The chambers of the uni-serial portion are rounded but not inflated with distinct

sutures. The aperture is large and terminal.
This species is abundant only at stations 270 (170 metres)
and 247 (128 metres) and present at station 209 (95 metres)

RECTOBOLIVINA RAPHANA (Parker & Jones) 1865

Uvigerina (Sagrina) raphanus - Parker & Jones, 1865. Philos.
Trans. vol. 155; p. 346, Pl. 18,
figs. 16, 17;

Sagrina raphanus Parker & Jones - Brady, 1884. p. 585
Pl. 75, figs. 21-24;

Siphogenerina raphanus (Parker & Jones) - Cushman, 1913 (1910 etc.).
p. 108, Pl. 46, figs. 1-5.

Only a few specimens at station 135 (190 metres) and 247 (128
metres)

Genus Bulimina d'Orbigny, 1826

BULIMINA MARGINATA d'Orbigny, 1826

Bulimina marginata - d'Orbigny, 1826 No. 4, Pl. 12, figs.
10-12;

Bulimina marginata d'Orbigny - Brady, 1884. p. 405, Pl. 51
figs. 3-5;

Bulimina marginata d'Orbigny - Cushman, 1911 (1910 etc.)
p. 83, fig. 136;

Bulimina marginata d'Orbigny - Cushman, 1921. p. 159.

Very few specimens occur.

Genus Reussella Galloway, 1933.

REUSSELLA SPINULOSA (Reuss) 1850

Verneuilina spinulosa - Reuss, 1850 Denkschr. Akad. Wiss. Wien.
vol. 1. p. 374, Pl. 47, fig. 12;

Verneuilina spinulosa Reuss - Cushman, 1911 (1910 etc.).
p. 55, fig. 88;

Verneuilina spinulosa Reuss - Cushman, 1921, p. 141, Pl. 27,
fig. 5;

Reussella spinulosa (Reuss) - Albani, 1968, p. 107, Pl. 8,
figs. 12, 13.

The few specimens present are all of the type a (Albani,
1968).

Genus Uvigerina d'Orbigny, 1826

UVIGERINA ASPERULA Czjzek, 1848

- Uvigerina asperula - Czjzek, 1848. Haidinger's Nat. Abh. 2.
p.146, Pl. 13, figs. 14, 15;
Uvigerina asperula Czjzek - Brady, 1884. p. 578, Pl. 75,
figs. 6-8;
Uvigerina asperula Czjzek - Cushman, 1913 (1910 etc). p.101,
Pl. 43, fig. 1;
Uvigerina asperula Czjzek - Cushman, 1921. p. 274, Pl. 54,
fig. 5.

One specimen at station 209 (95 metres)

UVIGERINA PEREGRINA Cushman, 1923

- Uvigerina pygmaea d'Orbigny - Brady, 1884. p. 575, Pl. 74,
figs. 11, 12;
Uvigerina pygmaea d'Orbigny - Cushman, 1913 (1910 etc).
p. 96, Pl. 42, fig. 1;
Uvigerina peregrina - Cushman, 1923 (1918 etc.). p. 166,
Pl. 42, figs. 7-10.
Euvigerina peregrina (Cushman) - Barker, 1960. p. 154, Pl.74,
figs. 11, 12.

Very few specimens occur at several stations

UVIGERINA PROBOSCIDEA Schwager, 1866

- Uvigerina proboscidea - Schwager, 1866. Novara Exped., Geol.
Theil., vol. 2. p.250, Pl.7, fig. 96.
Uvigerina proboscidea Schwager - Cushman, 1913 (1910 etc).
p. 94, Pl. 42, fig. 2.
Uvigerina proboscidea Schwager - Cushman, 1942 (1932 etc).
p. 49, Pl. 14, figs. 1-4.

The tests are short and fusiform, the later chambers tend to become uniserial. The inflated chambers are ornamented with numerous short spines. The aperture is at the end of a short neck. Although not present in all the stations, this species is the most abundant of the genus.

Genus Siphouvigerina Parr, 1950

SIPHOUVIGERINA PORRECTA (Brady) 1879

- Uvigerina porrecta - Brady, 1879. p. 60, Pl.8, figs. 15, 16;
Uvigerina porrecta Brady - Brady, 1884 p. 577, Pl. 74, figs. 21-23;
Uvigerina porrecta Brady - Cushman, 1913 (1910 etc) p. 99,
Pl. 44, fig. 2;
Siphouvigerina porrecta (Brady) - Albani, 1968. p. 108, Pl.8, fig.11.

This species is quite abundant along traverse 2 but is totally absent along the other two traverses.

Genus Trifarina Cushman, 1923

TRIFARINA BRADYI Cushman, 1923

- Rhabdogonium tricarinatum (d'Orbigny) - Brady, 1884. p. 525,
Pl. 67, figs. 1-3;
Triplasia tricarinata (d'Orbigny) - Cushman, 1913 (1910 etc.)
p. 62, Pl. 39, fig. 2;
Triplasia tricarinata (d'Orbigny) - Cushman, 1921. p. 219;
Trifarina bradyi - Cushman, 1923 (1918 etc). p. 99, Pl. 22,
figs. 3-9;
Trifarina bradyi Cushman - Barker, 1960. p. 140, Pl. 67, figs.
1-3.

Very few specimens occur sparsely in all three traverses.

Genus Discorbinella Cushman & Martin, 1935

DISCORBINELLA SUBBERTHELOTI (Cushman) 1924

- Discorbis subbertheloti - Cushman, 1924. p. 33,
Discopulvinulina subbertheloti (Cushman) - Barker, 1960.
p. 184, Pl. 89, fig. 10.

Very few specimens.

Genus Neoconorbina Hofker, 1951

NEOCONORBINA TERQUEMI (Rzehak) 1888

- Rosalina orbicularis - Terquem, 1876 Anim. sur. la Plage de
Dunkerque. p. 75, Pl. 9, figs. 4;
Discorbina orbicularis (Terquem) - Brady, 1884. p. 647,
Pl. 88, figs. 4-8;
Discorbis orbicularis (Terquem) - Cushman, 1915 (1910 etc.)
p. 16, Pl. 11, fig. 1;
Discorbis orbicularis (Terquem) - Cushman, 1921. p. 305;
Neoconorbina terquemi (Rzehak) - Barker, 1960. p. 182, Pl. 88,
figs. 4-8.

A few specimens occur at stations 270 (170 metres) and 247
(128 metres)

Genus Rosalina d'Orbigny, 1826

ROSALINA BERTHELOTI d'Orbigny, 1839

- Rosalina bertheloti - d'Orbigny, 1839b.p.135,Pl.1,figs.28-30;
Discorbina bertheloti (d'Orbigny) - Brady, 1884. p. 650,
Pl. 89, figs. 10-12;
Rosalina bertheloti d'Orbigny - Albani, 1968, p. 109,
Pl. 8, figs. 19, 20, 25, 26.

This species is abundant at many stations, particularly
in the shallow section of each traverse.

Genus Canceris Montfort, 1808

CANCERIS OBLONGUS (Williamson) 1858

Rotalina oblonga - Williamson, 1858. Recent British Foram.,
p. 51, Pl. 4, figs. 98-100;

Canceris oblongus (Williamson) Cushman & Todd, 1942. p. 80,
Pl. 20, fig. 4;

Canceris oblongus (Williamson) - Barker, 1960. p. 218, Pl. 106,
fig. 4.

Several specimens, some reaching large dimensions for the
species, occur along traverse 1.

Genus Baggina Cushman, 1926

BAGGINA PHILIPPINENSIS (Cushman) 1921

Pulvinulina philippinensis - Cushman, 1921. p. 331, Pl. 58
fig. 2;

Baggina philippinensis (Cushman) - Barker, 1960. p. 218,
Pl. 106, fig. 7.

Very few specimens have been found in the shallow section
of traverse 3.

Genus Siphonina Reuss, 1850

SIPHONINA TUBULOSA Cushman, 1924.

Truncatulina reticulata (Czjzek) - Brady, 1884. p. 669, Pl. 96,
figs. 5-7;

Siphonina reticulata (Czjzek) - Cushman, 1915 (1910 etc.) p. 43,
Pl. 16, fig. 4;

Siphonina tubulosa - Cushman, 1924. p. 40, Pl. 13, figs. 1,2;

Siphonina tubulosa Cushman - Barker, 1960. p. 198, Pl. 96,
figs. 5-7;

Present in deep water, particularly below 350 metres.

Genus Carpenteria Gray, 1858

CARPENTERIA PROTEIFORMIS Goës, 1882

Carpenteria balaniformis, var proteiformis - Goës, 1882.
Kongl. Svensk. Vet. Akad. Handl.,
vol. 19, p.94, Pl.6, figs.208-214;
Pl. 7, figs. 215-219;

Carpenteria proteiformis Goës - Brady, 1884. p. 679, Pl. 97,
figs. 8-14;

Carpenteria proteiformis Goës - Cushman, 1915 (1910 etc.),
p. 49, Pl. 20, fig. 2, Pl. 21, fig. 2;

Carpenteria proteiformis Goës - Cushman, 1921. p. 361, Pl. 73,
figs. 2, 3.

Although considered by Cushman (1921) a characteristic species of the coral reef regions, it is very rare in the material studied.

Genus Loxostomum Ehrenberg, 1854

LOXOSTOMUM AMYGDALAEFORMIS (Brady) 1881

Bolivina amygdalaeformis - Brady, 1881. p. 59;

Bolivina amygdalaeformis Brady - Cushman, 1911 (1910 etc.)
p. 42, fig. 69;

Loxostoma amygdalaeformis (Brady) - Cushman, 1937. p. 183,
Pl. 21, figs. 21-23;

Loxostomum amygdalaeformis (Brady) - Barker, 1960. p. 110
Pl. 53, figs. 28, 29.

The test is fusiform and slightly compressed with rounded periphery. The chambers are obscured by the ornamentation which consists of numerous anastomosing raised costae. The aperture is terminal and elliptical in shape. This species is present at many stations but is abundant at station 136 (90 metres) only.

Genus Cassidulina d'Orbigny, 1826

CASSIDULINA PACIFICA Cushman, 1925

Cassidulina pacifica - Cushman, 1925. Contr. Cushman Lab.
Foram. Res., vol. 1, pt. 3. p.24;

Cassidulina pacifica Cushman - Barker, 1960 p. 232, Pl. 113, fig. 8.

Several specimens occur at stations 270 (170 metres) and 227 (330 metres)

Genus Chilostomella Reuss in Czjzek, 1849

CHILOSTOMELLA OOLINA Schwager, 1878

Chilostomella oolina - Schwager, 1878. Boll. Uff. Geol.
Ital. Roma. p. 527, Pl. 1, fig. 16;

Chilostomella ovoidea Reuss - Brady, 1884, p. 436, Pl. 55,
figs. 12-23;

Chilostomella oolina Schwager - Barker, 1960. p. 112, Pl. 55,
figs. 12-14, 17, 18.

This typical species is very abundant at station 136 (90 metres) where it is one of the three most common species.

Genus Nonion Montfort, 1808

NONION PACIFICUM (Cushman) 1924

Nonionina umbilicatula (Montagu) var. pacifica - Cushman, 1924. Carnegie Inst. Washington, Pub. 342, p. 48, Pl. 16, fig. 3;

Nonion pacificum (Cushman) - Cushman, 1939. p. 25, Pl. 6, fig. 25.

Four specimens only have been found at station 226 (350 metres)

Genus Nonionella Cushman 1926

NONIONELLA TURGIDA (Williamson) 1858

Rotalina turgida - Williamson, 1858. Rec. Foram. Great Britain. p. 50, Pl. 4, figs. 95-97;

Nonionina turgida (Williamson) - Brady, 1884 p. 731, Pl. 109, figs. 17-19;

Nonionina turgida (Williamson) - Cushman, 1914 (1910 etc.) p. 29, Pl. 15, fig. 3.

Several specimens occur sparsely in the material studied.

Genus Anomalina d'Orbigny, 1826

ANOMALINA CORONATA Parker & Jones, 1857

Anomalina coronata - Parker & Jones, 1857. Ann. Mag. Nat. Hist., ser. 2, vol. 19. p. 294, Pl. 10, figs. 15, 16;

Anomalina coronata Parker & Jones - Cushman, 1915 (1910 etc.) p. 47, Pl. 18, fig. 5;

Anomalina coronata Parker & Jones - Cushman, 1921. p. 326, Pl. 61, fig. 2.

Very few specimens at station 227 (330 metres)

ANOMALINA NONIONOIDES Parr, 1932.

Anomalina nonionoides - Parr, 1932, pt. 2. p. 231, Pl. 22, fig. 38

Anomalina nonionoides Parr - Albani, 1968, p. 117 Pl. 10, fig. 11.

The few specimens found appear to be the most equatorial record of this species.

ANOMALINA POLYMORPHA Costa, 1856

- Anomalina polymorpha - Costa, 1856. Atti. Accad. Pont., vol. 7.
p. 252, Pl. 21, figs. 7, 9;
Anomalina polymorpha Costa - Cushman, 1915 (1910 etc.) p. 47,
Pl. 19, figs. 3, 4;
Anomalina polymorpha Costa - Cushman, 1921. p. 324, Pl. 61,
fig. 3.

Very few specimens at station 227 (330 metres)

Genus Hoeglundina Brotzen, 1948

HOEGLUNDINA ELEGANS (d'Orbigny) 1826

- Rotalia elegans - d'Orbigny, 1826 p. 276, No. 54;
Pulvinulina elegans (d'Orbigny) - Brady, 1884. p. 699,
Pl. 105, figs. 4-6;
Pulvinulina elegans (d'Orbigny) - Cushman, 1915 (1910 etc.)
p. 63, Pl. 26, fig. 3;
Hoeglundina elegans (d'Orbigny) - Barker, 1960. p. 216,
Pl. 105, figs. 4-6.

The tests are generally large, biconvex and with rounded periphery. The many chambers show clearly the typical ornamentation which consists of an irregular pattern of lines, dots and zones of clear calcite against a background of opaque shell material. The aperture is a slit on the umbilical end of the apertural face.

This species is widely recorded from the tropical Pacific and it is quite common in this material especially in deep waters where it reaches some 30 percent of the total population.

Genus Spirillina Ehrenberg, 1843

SPIRILLINA VIVIPARA Ehrenberg, 1841.

- Spirillina vivipara - Ehrenberg, 1841. Abh. Akad. Wiss. Berlin.
p. 442, Pl. 3, fig. 41.
Spirillina vivipara Ehrenberg - Cushman, 1915 (1910 etc.).
p. 3, Pl. 1, figs. 1, 2.

Very few specimens only.

Genus Asterorotalia Hofker, 1950

ASTEROROTALIA INFLATA (Millet) 1904

Rotalia schroeteriana, var. inflata - Millet, 1904. Journ. Roy. Micr. Soc., p. 504, Pl. 10, fig. 5;
Asterorotalia inflata (Millet) - Albani, 1965, p. 63, Pl. 6, figs. 8-10.

This typical species occurs in our material in fairly shallow water along traverse 1.

Genus Elphidium Montfort, 1808

ELPHIDIUM CRATICULATUM (Fichtel & Moll) 1798

Nautilus craticulatus - Fichtel & Moll, 1798. Test. Micr., p. 51, Pl. 5, figs. h-k;
Elphidium craticulatum (Fichtel & Moll) - Cushman, 1939. p. 56, Pl. 15, figs. 14-17.
Elphidium craticulatum (Fichtel & Moll) - Albani, 1968. p. 111, Pl. 9, figs. 19, 20.

Present in shallow waters.

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Fig. 1

TRAVERSE I

(Stns. 133-140)

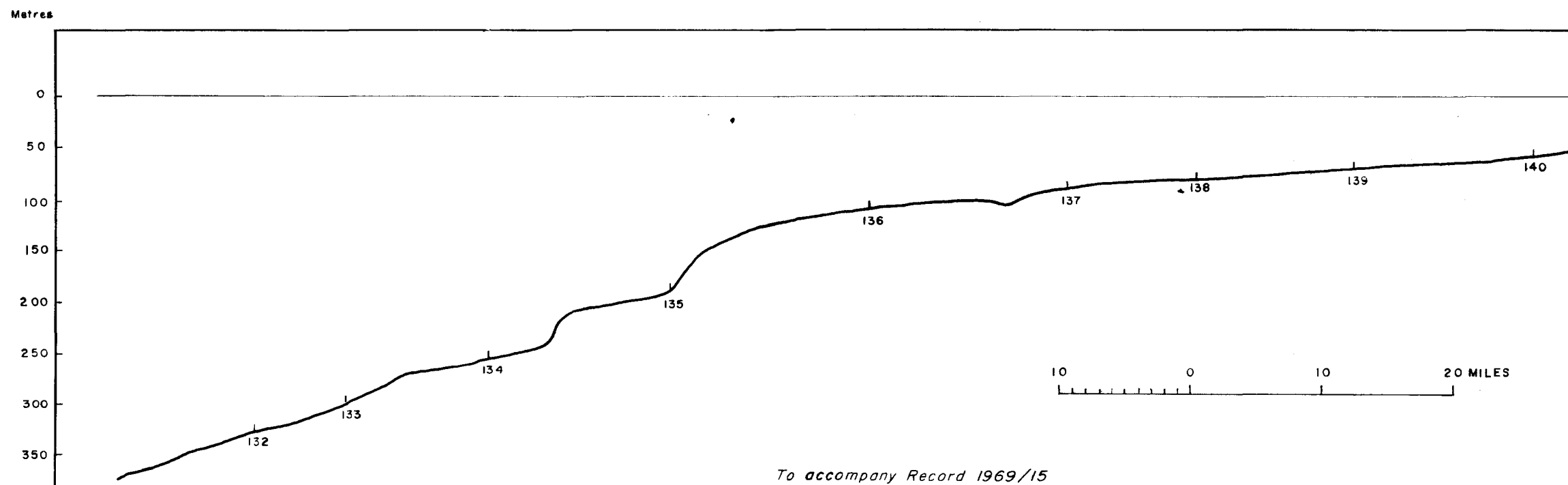
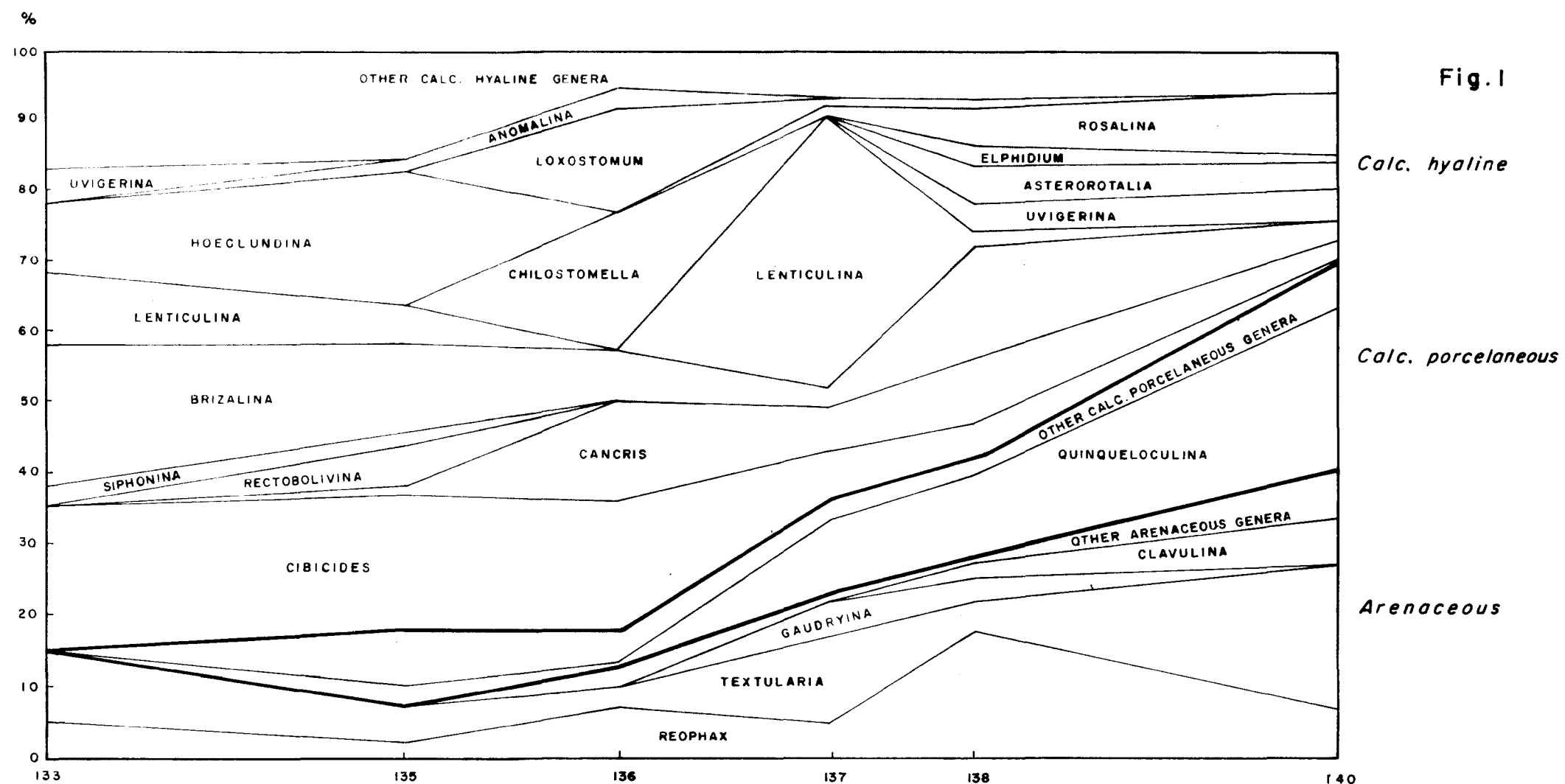
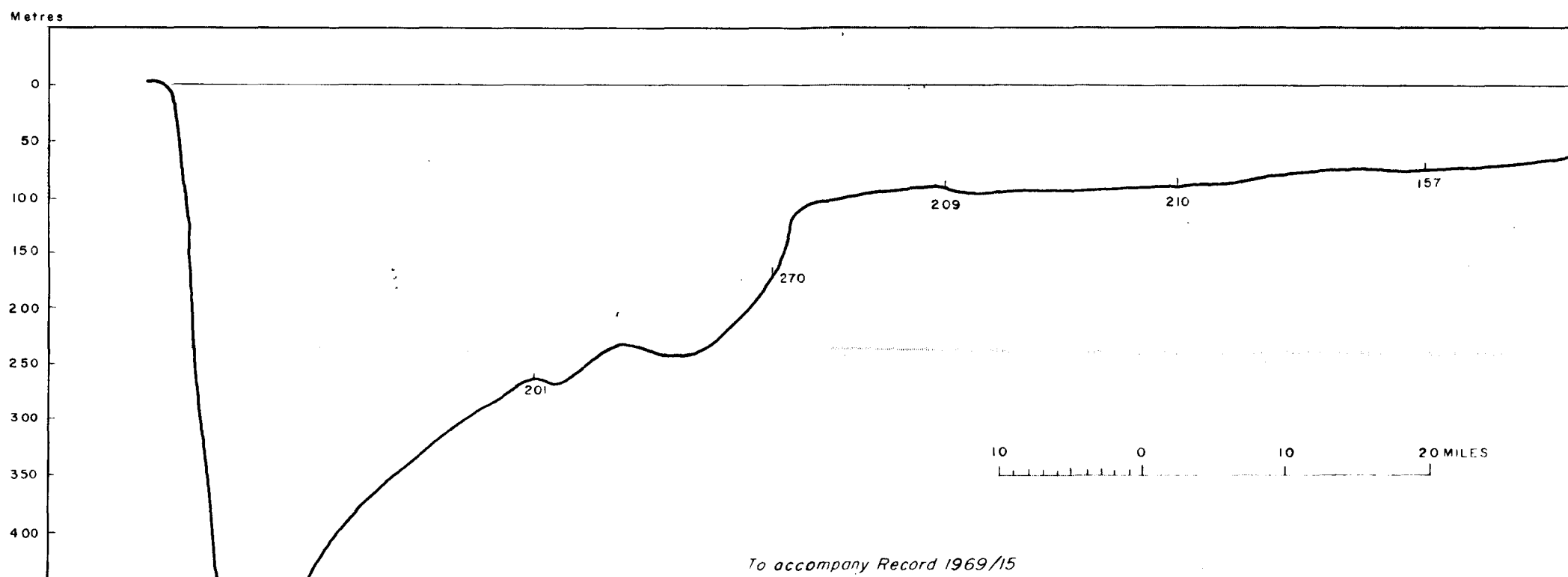
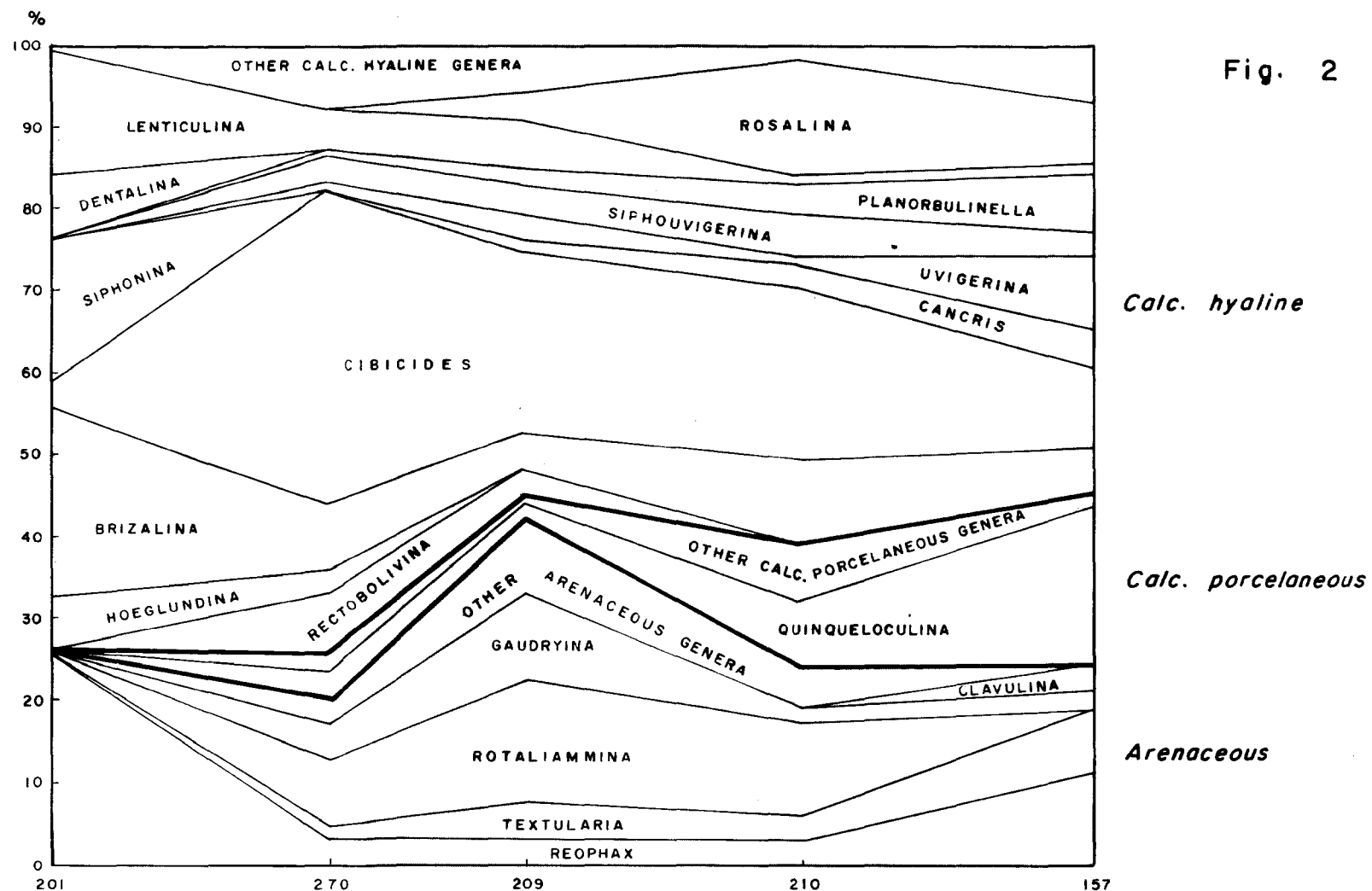


Fig. 2

TRAVERSE 2

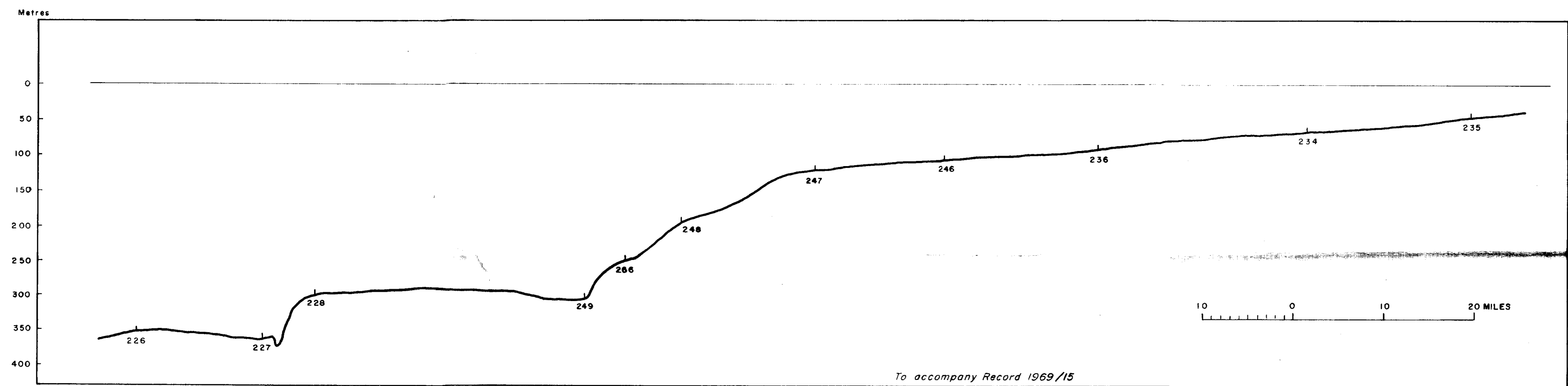
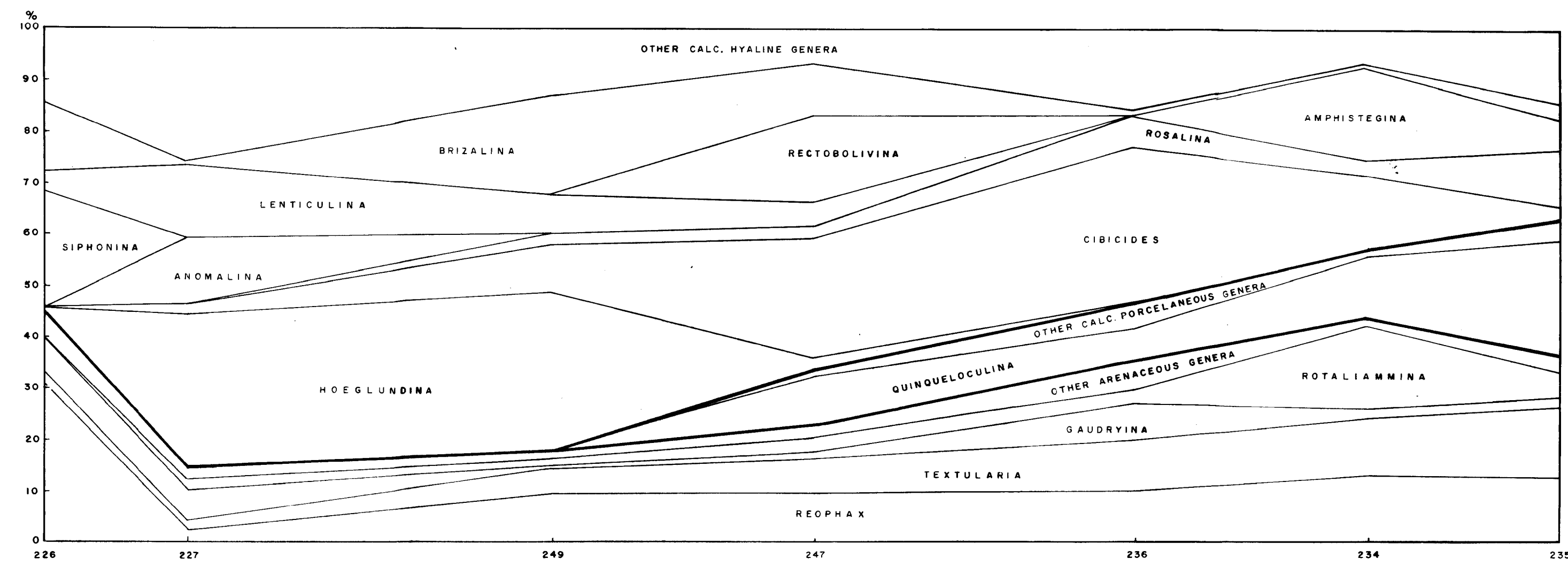
(Stns. 201 - 157)



To accompany Record 1969/15

Fig. 3

TRAVERSE 3
(Stns. 226-235)



BATHYMETRIC CHART

OF PART OF THE

N.W. AUSTRALIAN CONTINENTAL SHELF AND UPPER CONTINENTAL SLOPE

SHOWING POSITIONS OF TRAVERSES AND SAMPLE STATIONS

MERCATOR PROJECTION

SCALE 1:1,000,000 AT 33° LATITUDE

Coastline taken from R.A.N. Oceanic Soundings Sheets 318,319, 350

Bathymetry from published and unpublished data supplied by the
Hydrographer, RAN, and from the B.M.R. marine geological survey, 1967

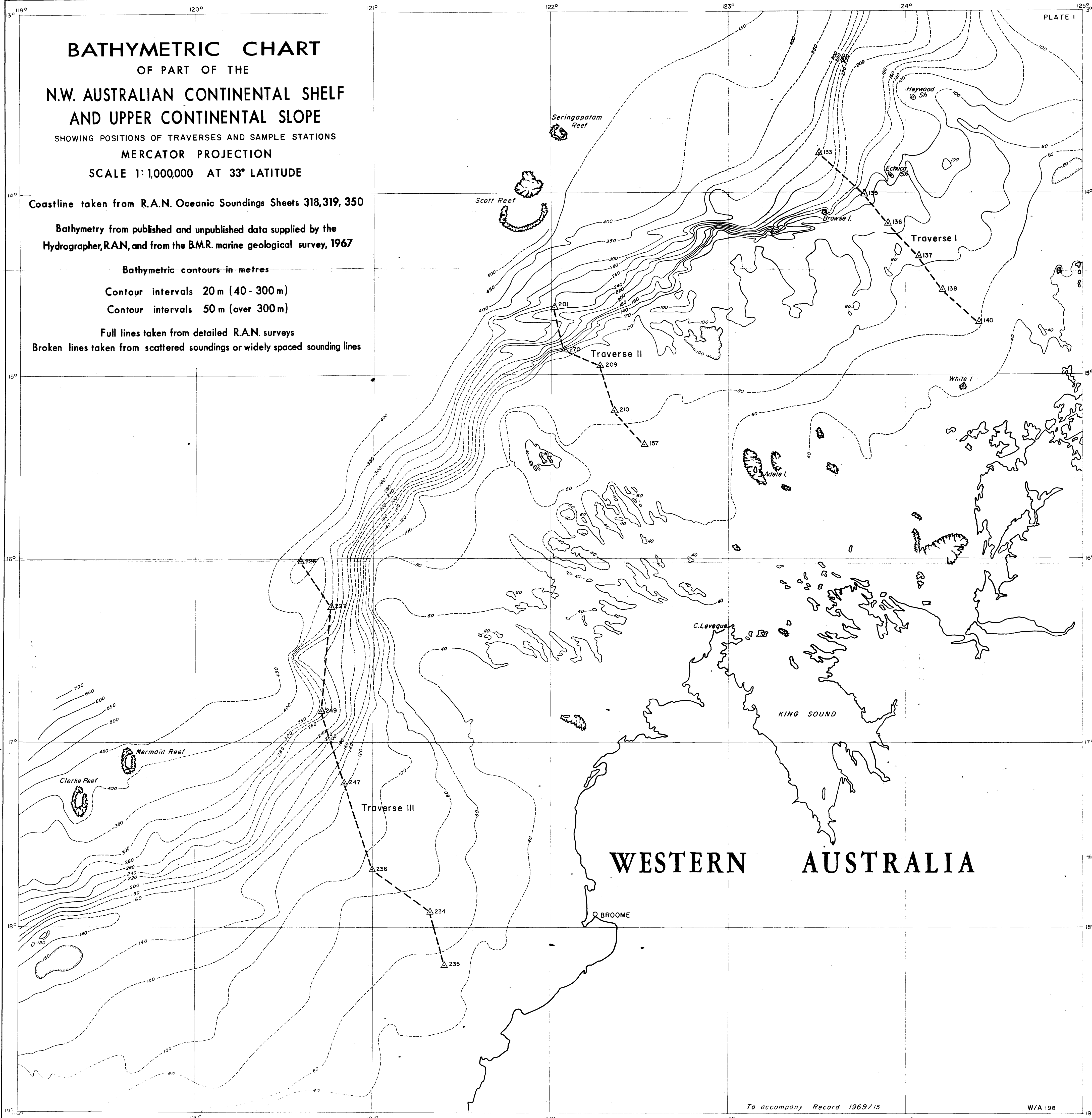
Bathymetric contours in metres

Contour intervals 20 m (40 - 300 m)

Contour intervals 50 m (over 300 m)

Full lines taken from detailed R.A.N. surveys

Broken lines taken from scattered soundings or widely spaced sounding lines



WESTERN AUSTRALIA

Rec. 1969/15.		TRAVERSE 1.						TRAVERSE 2.						TRAVERSE 3.						
Nos. - Number of specimens	% - per cent	133 T.P. 40 Nos. %	135 T.P. 54 Nos. %	136 T.P. 57 Nos. %	137 T.P. 66 Nos. %	138 T.P. 115 Nos. %	140 T.P. 83 Nos. %	201 T.P. 31 Nos. %	270 T.P. 351 Nos. %	209 T.P. 110 Nos. %	210 T.P. 86 Nos. %	157 T.P. 97 Nos. %	226 T.P. 104 Nos. %	227 T.P. 50 Nos. %	249 T.P. 131 Nos. %	247 T.P. 193 Nos. %	236 T.P. 165 Nos. %	234 T.P. 190 Nos. %	235 T.P. 267 Nos. %	
T.P. - Total population.																				
Suborder TEXTULARIINA																				
1. <i>Technitella legumen</i> Norman, 1878						1 0.9	5 6.			5 4.6	3 3.5		8 1.8							1
2. <i>Ammodiscus incertus</i> (d'Orbigny) 1839			1 1.8							3 2.7										2
3. <i>Reophax compressus</i> (Cushman & McCulloch, 1939)								2 6.5			1 1.2				2 1.5			6 2.3		3
4. <i>Reophax cylindricus</i> Brady, 1884	2 5.0																			4
5. <i>Reophax dentaliniformis</i> Brady, 1881						4 3.5							17 16.2	1 2.0	5 3.8					5
6. <i>Reophax horridus</i> Cushman, 1912													2 1.9							6
7. <i>Reophax scorpiurus</i> Montfort, 1808								5 16.0	10 2.9	1 0.9	2 2.3	7 7.3				8 4.2	7 4.3		9 3.4	7
8. <i>Reophax scorpiurus testacea</i> Wiesner, 1931		1 1.8	4 7.0	3 4.6	17 14.8	6 7.2	1 3.2	1 0.3	4 3.6			4 4.1	11 10.8		2 1.5	9 4.7	8 4.8	26 13.6	20 7.5	8
9. <i>Reophax spiculifer</i> Brady, 1881													1 0.9							9
10. <i>Haplophragmoides canariensis</i> (d'Orbigny) 1839					2 3.0				9 2.6				3 2.9	1 2.0	2 1.5	2 1.0	9 5.5	1 0.5	4 1.5	10
11. <i>Textularia candelana</i> d'Orbigny, 1839	2 5.0		1 1.8				1 1.2											7 3.7	6 2.3	11
12. <i>Textularia conica</i> d'Orbigny, 1839					2 3.0															12
13. <i>Textularia foliacea</i> Heron-Allen & Earland, 1915							7 8.4									2 1.0	2 1.2	12 6.3	23 9.5	13
14. <i>Textularia gramen</i> d'Orbigny, 1846	2 5.0											2 2.0	1 0.9		2 1.5	2 1.0			4 1.5	14
15. <i>Textularia pseudocarinata</i> Cushman, 1921.		1 1.8			4 6.1	4 3.5	4 4.8						2 1.9		3 2.3	5 2.6	9 5.5			15
16. <i>Textularia ramosa</i> Lallier & McCulloch, 1940		2 3.7	1 1.8			1 0.9			4 1.1					1 2.0	1 0.8	1 0.5				16
17. <i>Textularia siphonifera</i> Brady, 1881										5 4.6	1 1.2	2 2.0				4 2.1	3 1.8			17
18. <i>Textularia</i> sp.							5 6.0				1 1.2	2 2.0					1 0.6	2 1.0	3 1.1	18
19. <i>Trochammina inflata</i> (Montagu)											1 1.2									19
20. <i>Rotallammina mayori</i> Cushman, 1924									26 7.4	17 15.4	10 11.6			1 2.0	2 1.5	6 3.1	6 3.7	31 16.5	15 5.6	20
21. <i>Tritaxis conica</i> (Parker & Jones) 1865													1 0.9							21
22. <i>Gaudryina paupercula</i> Cushman, 1911.														2 4.0						22
23. <i>Gaudryina quadrangularis</i> Bagg, 1908.																		2 1.0		23
24. <i>Gaudryina transversaria</i> (Brady) 1884					3 4.6	4 3.5		15 4.3	12 11.0	1 1.2	2 2.0					2 1.0	12 7.3	2 1.0	6 2.3	24
25. <i>Dorothyia arenata</i> Cushman, 1936.					1 1.5															25
26. <i>Clavulina pacifica</i> Cushman, 1924						2 1.8	5 6.0					3 3.1				1 0.5				26
27. <i>Cylindrocylavulina bradyi</i> (Cushman) 1911																1 0.5				27
Suborder MILIOLINA																				
28. <i>Spiroloculina communis</i> Cushman & Todd 1944			1 1.8			3 2.6	4 4.8					1 1.2	1 1.0				5 3.0	2 1.0	8 3.0	28
29. <i>Spiroloculina disparilis</i> Terquem, 1878												5 5.7								29
30. <i>Quinqueloculina agglutinans</i> d'Orbigny, 1839																		2 1.0	19 7.2	30
31. <i>Quinqueloculina angulata arenata</i> Sald., 1949					1 1.5		7 8.4												10 3.7	31
32. <i>Quinqueloculina lamarkiana</i> d'Orbigny 1839	2 3.7				4 6.1	8 7.0	5 6.0		2 0.6			5 5.7	13 13.5			12 6.5	2 1.7	11 5.3	20 7.5	32
33. <i>Quinqueloculina pseudoreticulata</i> Sald., 1949					2 3.0	5 4.4	7 8.4		4 1.1	2 1.8		6 6.2				7 3.8	3 1.8	12 6.3	13 5.0	33
34. <i>Quinqueloculina seminula</i> (Linnaeus) 1767									3 0.9	1 0.9							5 3.0			34
35. <i>Filintina triquetra</i> (Brady) 1879			1 1.8																	35
36. <i>Pyrgo sarsii</i> (Schlumberger) 1881		1 1.8												2 1.0						36
37. <i>Stenoloplosia schlumbergeri</i> (Silvestri) 1904		3 5.5			2 3.0											2 1.0				37
38. <i>Triloculina rupertiana</i> (Brady) 1879							1 1.2												1 0.3	38
39. <i>Triloculina tricarinata</i> d'Orbigny, 1826			1 1.8														3 1.8			39
40. <i>Miliolinella subrotunda</i> (Montagu) 1803									9 2.6											40
41. <i>Sorites marginalis</i> (Lamarck) 1816																			1 0.3	41
Suborder ROTALINA																				
42. <i>Amphicoryna scalaris</i> (Batsch) 1792														2 4.0			1 0.6			42
43. <i>Dentalina communis</i> d'Orbigny, 1826								1 3.2	1 0.3						1 0.8					43
44. <i>Dentalina japonica</i> (Cushman) 1913			1 1.8										1 0.9							44
45. <i>Dentalina millettii</i> Cushman, 1917								1 3.2												45
46. <i>Dentalina vertebalis</i> (Batsch) 1791								1 3.2						2 4.0						46
47. <i>Lenticulina costata</i> (Fichtel & Moll) 1798	1 2.5																			47
48. <i>Lenticulina echinata</i> (d'Orbigny) 1846	1 2.5	3 5.5												1 2.0						48
49. <i>Lenticulina limbosa</i> (Reuss) 1863	2 5.0				25 38.0	2 1.8		4 13.0	5 1.4	6 5.5		1 1.0	1 0.9	5 10.0	8 6.1	6 3.1				49
50. <i>Lenticulina orbicularis</i> (d'Orbigny) 1826								1 3.2												50
51. <i>Lenticulina peregrina</i> (Schwager) 1866													2 1.9							51
52. <i>Lenticulina subglobba</i> Parr, 1950													1 0.9							52
53. <i>Lenticulina vortex</i> (Fichtel & Moll) 1803									9 2.6					1 2.0		2 1.0				53
54. <i>Lagena pilocenica - himmiana</i> Cushman & Gray, 1946						2 1.8				1 0.9										54
55. <i>Lagena sulcata</i> (Walker & Jacob) 1798							1 1.2													55
56. <i>Pseudonodosaria torrida</i> (Cushman) 1923													1 0.9							56
57. <i>Saracenaria italica</i> DeFrance, 1924.														1 2.0						57
58. <i>Guttulina problema</i> d'Orbigny, 1826		1 1.8															1 0.6		6 2.3	58
59. <i>Stenodella elegantissima</i> (Parker & Jones) 1865		2 3.7			2 3.0				3 0.9	3 2.7	1 1.2					1 0.5	3 1.8	2 1.0	2 9.7	59
60. <i>Fissurina marginato-perforata</i> (Sequenza) 1880															1 0.8					60
61. <i>Fissurina orbignyana</i> Sequenza 1862										1 0.9			3 2.9							61
62. <i>Brizalina euglandi</i> (Parr) 1950			3 5.2									2 2.0								62
63. <i>Brizalina schwageriana</i> (Brady) 1881	5 12.5	7 13.0	1 1.8	2 3.0	13 11.3		6 19.6	22 6.3	3 2.7	5 5.7	3 3.1	13 12.6			21 16.0	20 10.4	1 0.6		7 2.6	63
64. <i>Brizalina seminuda</i> (Cushman) 1911	3 7.5				5 4.4	2 2.4	1 3.2				4 4.5	1 1.0	1 0.9							64
65. <i>Brizalina spatulata</i> (Williamson) 1858								4 1.7	2 1.8											65
66. <i>Rectobolivina columellaris</i> (Brady) 1881								22 6.3	4 3.6							22 11.5	10 5.5			66
67. <i>Rectobolivina raphana</i> (Parker & Jones) 1865		3 5.5					1 1.2						1 0.9		1 0.8					67
68. <i>Bulinina marginata</i> d'Orbigny, 1826										1 0.9										68
69. <i>Reussella spinulosa</i> (Reuss) 1850					2 1.8					1 0.9						7 3.8		1 0.5		69
70. <i>Uvigerina asperula</i> Cizek, 1848										1 0.9										70
71. <i>Uvigerina peregrina</i> Cushman, 1923	1 2.5												1 0.9	1 2.0	3 2.3					71
72. <i>Uvigerina proboscidea</i> Schwager, 1866	1 2.5				4 3.5	4 4.8		2 0.6	2 1.8		8 8.3									72
73. <i>Siphonuvigerina porrecta</i> (Brady) 1881								12 3.4	4 3.6	4 4.5	3 3.1									73
74. <i>Trifarina bradyi</i> Cushman, 1923					2 1.8				2 0.6		1 1.2			1 2.0	2 1.5					74
75. <i>Discorbinella subbertheloti</i> (Cushman), 1924	1 2.5	1 1.8													1 0.8		1 9.6			75
76. <i>Neonorbinella terqueni</i> (Rehder) 1838									8 2.3							2 1.0				76
77. <i>Rosalina bertheloti</i> d'Orbigny, 1839	1 2.5				1 1.5	6 5.2	7 8.4		4 3.6	12 14.0	7 7.3			2 1.5	5 2.6	10 6.0	5 3.0	39 14.2		77
78. <i>Cancris oblongus</i> (Williamson) 1858		1 1.8	8 14.0	4 6.1	11 9.5	2 2.4			1 0.9	3 3.5	4 4.1					5 3.0				78
79. <i>Baggina philippinensis</i> (Cushman) 1921																	7 4.3	1 0.5	5 1.9	79
80. <i>Siphonina tubulosa</i> Cushman, 1924	1 2.5	1 1.8						5 16.0					24 23.5		1 0.8	2 1.0	1 0.6			80
81. <i>Carpenteria protiformis</i> Gies, 1882									1 0.3								1 0.6			81
82. <i>Loxostomum amygdalaeformis</i> (Brady) 1881			8 14.0	1 1.5	1 0.9						1 1.2					1 0.5				82
83. <i>Cassidulina pacifica</i> Cushman 1925									6 1.7					4 8.0		1 0.5				83
84. <i>Chilostomella oolina</i> Schwager, 1878			11 19.4																	