Lower Scotian Slope Benthic Foraminifera—Their Taxonomy and Occurrences

F.C. Thomas

Atlantic Geoscience Centre
Geological Survey of Canada
Department of Energy, Mines and Resources

Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

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LOWER SCOTIAN SLOPE BENTHIC FORAMINIFERA - THEIR TAXONOMY AND OCCURRENCES

by

F.C. Thomas

Eastern Petroleum Geology Subdivision
Atlantic Geoscience Centre
Geological Survey of Canada
Department of Energy, Mines and Resources

Bedford Institute of Oceanography

P.O. Box 1006

Dartmouth, Nova Scotia

Canada B2Y 4A2

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ABSTRACT

Thomas, F.C., 1987. Lower Scotian Slope Benthic Foraminifera - their taxonomy and occurrences. Canadian Technical Report of Hydrography and Ocean Sciences No. 80: iii + 68 p.

One hundred and fifty-one species of benthic Foraminifera and one extinct Mesozoic planktic species were identified in 24 samples of surficial sediments from the lower Scotian Slope and Rise, and over 100 samples from two cores from a water depth of 4046 m in the same area. The surficial samples came from water depths ranging from 2000-4925 m. The classification, taxonomy, and some remarks concerning the distribution of these species are presented.

SOMMAIRE

Thomas, F.C., 1987. Lower Scotian Slope Benthic Foraminifera - their taxonomy and occurrences. Canadian Technical Report of Hydrography and Ocean Sciences No. 80: iii + 68 p.

On a identifié 151 espèces de foraminifères benthiques et une espèce planctonique fossile due Mésozoïque dans 24 échantillons de sédiments de surface provenant du glacis et de la pente du plateau Scotian inférieur et dans plus de 100 échantillons provenant de deux carottes prélevées dans la même région à 4046 m de profondeur. Les échantillons de surface ont été prélevées à une profondeur variant de 2000 à 4925 m. On donne des renseignements sur la classification, la taxonomie et la répartition de ces espèces.

Introduction

This paper outlines the taxonomy of all those benthic foraminifera encountered in a study of 24 samples of surficial sediments taken from depths ranging from 2000 m to 4925 m on the lower Scotian Slope and rise, along with the benthic species seen in an 11-metre piston core and accompanying 1.5 m gravity trigger weight core from 4046 m in the same area (Fig. 1).

Table 1 gives sample numbers, locations, water depths, and type of equipment used.

All samples were prepared similarly (washed through a 63 μ sieve), with the exception that the box core samples were stained with Rose Bengal (Walton, 1952) to differentiate living and dead specimens shortly after collection, and were subsequently stored and examined in a buffered formalin solution.

The text of the taxonomy used here is extracted almost verbatim from a previous work by the author (Thomas, 1985, unpublished manuscript) but has been recompiled in the present format to make it more widely available to other workers interested in deep-water benthic foraminifera in general and western Atlantic continental margin faunas in particular. A more detailed taxonomic examination of many of the agglutinated species listed in the present publication can be found in Schröder (1986).

An overview of the foraminiferal assemblages in the samples, the deep water hydrodynamic regime of the area, and other pertinent data from the study can be found in the above-mentioned manuscript, and may also appear in a future publication.

The suprageneric classification used in this outline is that of Loeblich and Tappan (1964), which, although it may not be the most recent, is at least widely recognized and is readily available to most researchers in the field.

No attempt is made to supply a complete listing of synonyms, but texts dealing with nearby geographic areas and/or faunas of similar depth ranges were consulted whenever possible. Such local literature is more likely to contain accurate descriptions and illustrations

of the species, especially in those forms where ecophenotypic variation may occur.

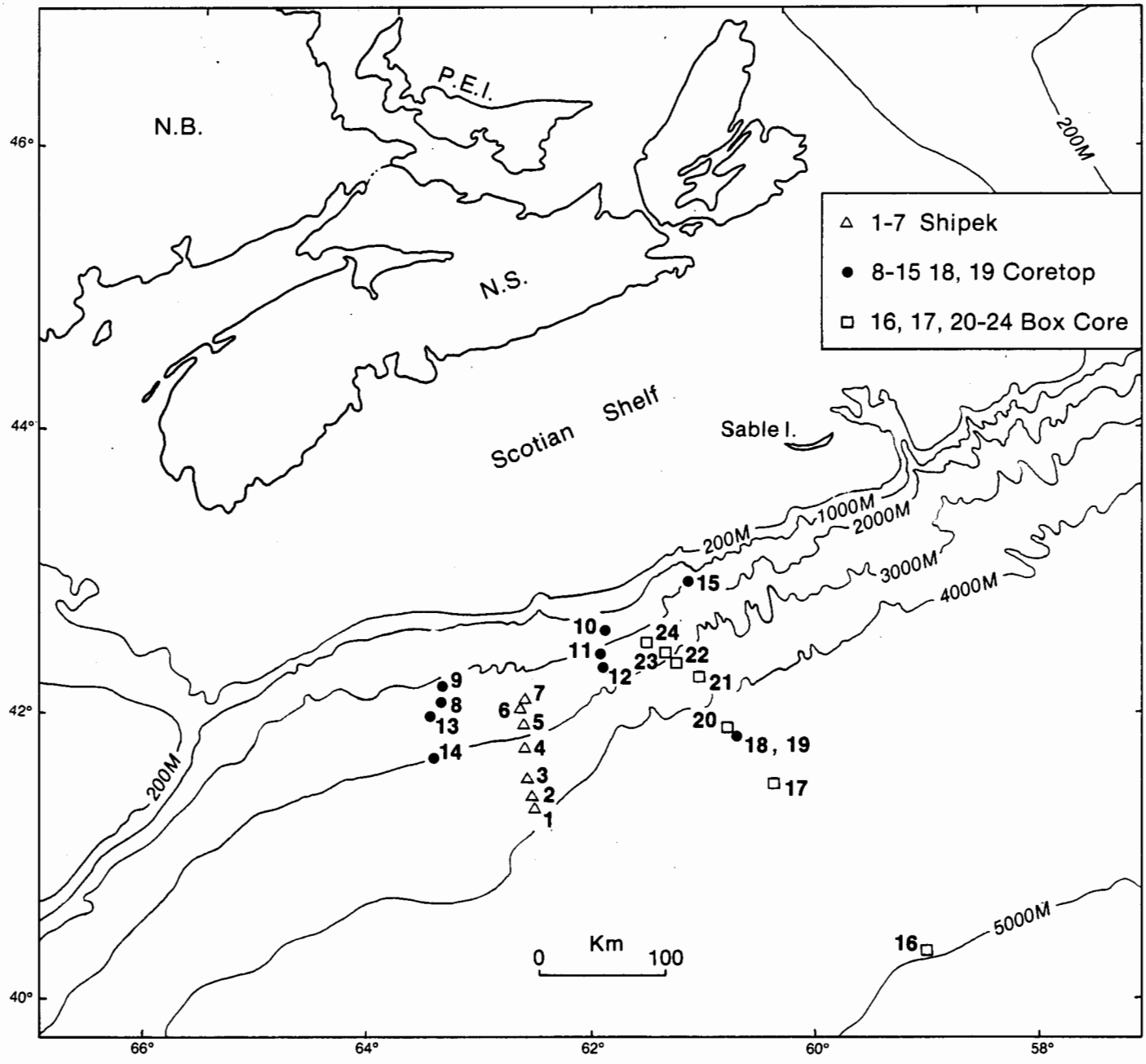

Figure 1. Location and type of samples used.

Table 1

No.	Sample	Location		Water Depth (m)	Type of Sample
		Latitude	Longitude		
1	81-016-01	41°27.0'	62°32.0'	3985	ShipekGrab
2	81-016-02	41°32.0'	62°33.0'	3880	Shipek Grab
3	81-016-03	41°43.0'	62°37.0'	3500	Shipek Grab
4	81-016-04	41°53.0'	62°37.5'	3247	Shipek Grab
5	81-016-05	42°02.6'	62°38.0'	2995	Shipek Grab
6	81-016-06	42°09.8'	62°39.0'	2750	Shipek Grab
7	81-016-07	42°14.5'	62°37.5'	2500	Shipek Grab
8	79-002-12	42°13.5'	63°25.0'	2200	Core Top
9	79-002-13	42°19.9'	63°25.0'	2000	Core Top
10	79-002-50	42°34.2'	61°53.5'	2000	Core Top
11	79-002-51	42°32.2'	61°54.0'	2200	Core Top
12	79-002-52	42°29.8'	61°54.0'	2400	Core Top
13	80-004-13	42°05.0'	63°30.3'	2500	Core Top
14	80-004-14	41°48.5'	63°28.7'	3050	Core Top
15	80-004-65	43°02.3'	61°05.8'	2120	Core Top
16	82-022-76	40°23.9'	58°58.1'	4925	Box Core
17	82-022-77	41°38.0'	60°19.5'	4495	Box Core
18	82-022-78G	41°57.4'	60°39.9'	4046	Core Top
19	82-022-78P	41°57.4'	60°39.9'	4046	Core Top
20	82-022-79	41°58.6'	60°41.9'	4030	Box Core
21	82-022-80	42°22.9'	60°59.6'	3543	Box Core
22	82-022-82	42°29.7'	61°13.8'	2996	Box Core
23	82-022-83	42°31.8'	61°17.3'	2750	Box Core
24	82-022-84	42°37.0'	61°30.4'	2487	Box Core

1. Sample numbers, locations, water depths, and method of sample. 82-022-78G is the gravity core, and 82-022-78P represents the piston core.

An effort was made to give full reference (name of journal or book,and volume number) to each original designation of the species included. This facilitates further taxonomic study by the reader.

Finally, included in this paper is one planktic form, an extinct Maastrichtian species (*Heterohelix* cf. *americana* (Ehrenberg)). This form is included in the present study for reasons elaborated below.

Acknowledgements

Many thanks to F. Cole (Atlantic Geoscience Centre) and Dr. F.S. Medioli (Dalhousie University) whose painstaking critical reviews greatly improved this manuscript. G. Cook (AGC) drafted the location map. D. Anderson, C. Archibald, and S. Hiltz (all of BIO) typed the many revisions of this paper.

Order FORAMINIFERIDA Eichwald, 1860

Suborder Allogromiina Loeblich and Tappan, 1961

Superfamily Lagynacea Schultze, 1854

Family Allogromiidae Rhumbler, 1904

Genus *Placopsilinella* Earland, 1934

Placopsilinella aurantica Earland

Placopsilinella aurantica Earland, 1934. Discovery Reports, vol. 10, p. 95, pl. 3, fig. 18; Echols, 1971, pl. 1, fig. 1; Cole, 1981, p. 3, pl. 16, fig. 1; Kaminski, 1983, p. 5, pl. 11, fig. 8.

Remarks. This attached form is easily recognized by its biserial, reddish chitinous test. For some reason it appears to favor relatively flat surfaces such as the test of *Globorotalia menardii*, a planktonic form fairly common in Lower Scotian Slope surficial sediments.
Distribution. This species occurs in approximately half the surface samples between 2200 and 4046 m depth. In samples from 2995 - 3500 m it reaches its greatest abundance (1 - 3%). Its appearance in the cores is limited to a few specimens at various levels in the top 130 cm of both cores.

Suborder Textulariina Delage and Hérouard, 1896

Superfamily Ammodiscacea Reuss, 1862

Family Astrorhizidae Brady, 1881

Subfamily Astrorhizinae Brady, 1881

Genus *Astrammina* Rhumbler *in* Weisner, 1931

Astrammina sp.

Remarks. This form is composed of relatively large (up to 1.0 mm) coarsely agglutinated spherical bodies with one or more radial arms which may represent single broken chambers of larger forms. This classification as *Astrammina* sp. is very tentative.
Distribution. This form occurs in several surface samples, from 2500 to 4046 m, and reaching its greatest numbers (> 2% of total benthics) at 4046 m. It is not seen in core samples.

Genus *Astrorhiza* Sandahl, 1858

Astrorhiza cf. *crassatina* Brady

Astrorhiza crassatina Brady, 1881. Quart. J. Micr. Sci. vol. 21, p. 47.

Remarks. This form is represented by relatively large (up to 2.0 mm) loosely agglutinated roughly oval bodies with many broken areas which may indicate the former presence of radial arms. Its identity as *A. crassatina* is somewhat tentative.

Distribution. Occurs in small numbers in most samples from below 3000 m depth. It is present only in the top 10 cm of the gravity core.

Genus *Rhabdammina* M. Sars in Carpenter, 1869

Rhabdammina cf. *irregularis* Carpenter

Rhabdammina irregularis Carpenter, 1869. Proc. Roy. Soc. London, vol. 18, no. 114, p. 60.

Distribution: This form appears only as single specimens in a very few core samples, thus its identity is somewhat tentative.

Rhabdammina linearis Brady

Rhabdammina linearis Brady, 1879 Quart. J. Micr. Sci., vol. 19, p. 37; LeRoy and Hodgkinson, 1975, pl. 1, fig. 12; Ingle et al. 1980, p. 144; Cole, 1981, p. 5, pl. 1, fig. 1; Milam and Anderson, 1981, pl. 1, fig. 2.
Rhabdammina cf. *linearis* Brady, Anderson, 1975, pl. 1, fig. 2.

Remarks. This large form is usually seen as a single fairly straight tube, with somewhat thinner walls than *Hyperammina*, which it superficially resembles.
Distribution. In surface samples this species is found at depths between 2200 and 3985 m in small numbers. *R. linearis* occurs only in the gravity core as a single individual at 123 - 125 cm.

Rhabdammina scabra Höglund

Rhabdammina scabra Höglund, 1947, Zool. Bidr. Uppsala, Bd. 26, p. 28, pl. 1, figs. 3,4; Cole, 1981, p. 5, pl. 2, fig. 8.

Remarks. *R. scabra* is usually seen as a tube entirely covered in the tests of planktonic foraminifera.
Distribution. *R. scabra* occurs in almost all surface samples including shallowest and deepest, but is most common between 2750 and 4495 m. At 3050 m it exceeds 10% of the total benthics. It does not appear at all in core samples.

Subfamily Rhizamminae Rhumbler, 1895

Genus *Rhizammina* Brady, 1879

Rhizammina cf. *algaeformis* Brady

Rhizammina algaeformis Brady, 1879, Quart. J. Micr. Sci. vol. 19, p. 39, pl. 4, figs. 16,17; Cushman, 1918, pl. 11, figs. 2,3; Barker, 1960, p. 58, pl. 28, figs. 1-11; Cole, 1981, p. 6, pl. 1, fig. 9.

Remarks. *R. algaeformis* appears in these samples as a very thin-walled, crooked tube composed largely of a latticework of loosely bound needle-like fragments which appear to be sponge spicules.

Distribution. This rare form occurs in very small numbers in only 2 surface samples, at 2995 m and 4046 m. In both cores it occurs only as 1 or 2 specimens in a few samples from the top 130 cm.

Rhizammina indivisa Brady

Rhizammina indivisa Brady, 1884 Rep. Voy. Challenger Zoology, vol. 9, p. 277, pl. 29, figs. 5-7; Cushman, 1918, pl. 12, figs. 7-10; Cole, 1981, p. 6, pl. 2, fig. 16; Kaminski, 1983, p. 6, pl. 1, fig. 6.

Remarks. This species is encountered as fairly straight tubes of agglutinated material, usually branching, and often with one or two tests of planktonic foraminifera attached.
Distribution. One of the more common agglutinated forms in surface samples, *R. indivisa* occurs in varying abundances in almost all samples. It is oddly absent in three samples from around 4000 m but is most common (24.3% of total benthics) at 4925 m. It is absent from the cores.

Subfamily Hippocrepininae Rhumbler, 1895

Genus *Hyperammina* Brady, 1878

Hyperammina elongata Brady

Hyperammina elongata Brady, 1878 Ann. Mag. Nat. Hist. ser. 5, vol. 1, p. 433, pl. 20, figs. 2a,b; Barker, 1960, p. 46, pl. 23, fig. 8; Vilks, 1969, p. 43, pl. 1, fig. 4; Cole and Ferguson, 1975, pl. 1, fig. 2; Cole, 1981, p. 9, pl. 2, fig. 2; Kaminski, 1983, p. 7-8, pl. 2, fig. 3. Williamson, 1983, p. 204-205, pl. 1, fig. 1.

Remarks. This species can be distinguished froom other tubular forms by its thicker, more robust wall (usually of a yellowish-orange colour) and in some specimens by the presence of a bulbous proloculus.
Distribution. The single most common agglutinated form in surface samples, *H. elongata* exceeds 25% of the total benthics at 2995 m and at 3500 m but seems somewhat less common deeper, and is absent from several samples between 2000 and 2500 m. It is common in the uppermost 20 cm of both cores, and again fairly common at 120-150 cm of the short core but is otherwise not represented.

Genus *Saccorhiza* Eimer and Fickert, 1899

Saccorhiza ramosa (Brady)

Hyperammina ramosa Brady, 1879. Quart. J. Micr. Sci. vol. 19, p. 33, figs. 14,15.
Saccorhiza ramosa (Brady) Barker, 1960, p. 46, pl. 23, figs. 15-19; Vilks, 1969, p. 43, pl. 1, fig. 5; Anderson, 1975, pl. 1, fig. 4; Cole, 1981, p. 11, pl. 1, fig. 5; Kaminski, 1983, p. 9, pl. 2, fig. 7.

Remarks. This rare form closely resembles Brady's (1879) illustrated specimens, with a dense covering of fine spicules, perhaps from sponges.
Distribution. This species occurs only in limited members at 2205 m and 2995 m, never exceeding 1% of the total. It is not encountered in the core samples.

Subfamily Dendrophyrinae Haeckel, 1894

Genus *Dendrophyra* Wright, 1861

Dendrophyra arborescens (Norman)

Psammatodendron arborescens Norman, 1881. Norpod. - Exped. in der Jahren 1872-1874, vol. 13, p. 98; Barker, 1960, p. 58, pl. 28, figs. 12,13.
Dendrophyra arborescens (Norman) Cole, 1981, p. 12, pl. 1, fig. 10. Kaminski, 1983, p. 8.

Remarks. *D. arborescens* appears as a small, very thin tube of brownish appearance. The tube is always somewhat curved or bent, sometimes with abrupt changes of direction.
Distribution. This form enjoys a scattered and somewhat odd distribution, appearing in small numbers in a few samples from all depth ranges, exceeding 5% of Σ at 2487 m and at 4925 m. A lone individual was found at 123 - 125 cm in the gravity core, but otherwise was not seen in subsurface samples.

Family Saccaminidae Brady, 1884

Subfamily Psammosphaerinae Haeckel, 1894

Genus *Psammosphaera* Schulze, 1875

Psammosphaera parva Flint

Psammosphaera parva Flint, 1899. Ann. Rep. U.S. Nat. Mus., 1897, pt. 1, p. 268, pl. 9, fig. 1; Barker, 1960, p. 36, pl. 18, figs. 2-4; Mendelson, 1982, pls. 2,3; Kaminski, 1983, p. 9, pl. 3, fig. 3.

Remarks. This very small, partially chitinous form usually stains strongly because of its composition.
Distributin. *P. parva* occurs as only one specimen at 3985 m in surface samples and is absent from the cores.

Subfamily Saccamininae Brady, 1884

Genus *Saccammina* M. Sars in Carpenter, 1869

Saccammina difflugiformis (Brady)

Reophax difflugiformis Brady, 1879. Quart. J. Micr. Sci. vol. 19, p. 51, pl. 4, figs. 3a-b; Barker, 1960, p. 62, pl. 30, figs. 1-4; Anderson, 1975, pl. 1, fig. 16; Cole, 1981, p. 23-24, pl. 4, fig. 6.
Reophax sp. 1 Kaminski, 1983, p. 16, pl. 7, figs. 4-5.
Saccamina difflugiformis (Brady) Poag et al., 1980, pl. 1, figs. 1-4. Williamson, 1983, p. 205, pl. 1, fig. 3.

Remarks. This flask-shaped species normally stains pink in samples treated with Rose Bengal because of its pseudochitinous inner lining. For this and other reasons Cole (1981) indicates the species may actually belong in *Proteonina*. Williamson's (1983) description of the form as *Saccamina difflugiformis* may also be accurate, and I have chosen to retain this

designation because of the close relationship between Williamson's (1983) paper and the present study.
Distribution. *S. difflugiformis* is widespread in surface samples, composing up to 2.6% of the total benthics in most, but is oddly absent at 4030 m and 4046 m. At 4495 m and 4925 m, however, this form comprises 26.5% and 28.6%, respectively, of the assemblages. This species is quite common in most of the gravity core, and the upper 80 cm of the piston core, although it is seen only in small numbers in the uppermost 20 cm of both cores. From 260 - 262 cm to 687 - 689 cm in the piston core *S. difflugiformis* is present in smaller numbers, and is absent below this.

Genus *Technitella* Norman, 1878

Technitella legumen Norman

Technitella legumen Norman, 1878, Ann. Mag. Nat. Hist. ser. 5, vol. 1, p. 274; Barker, 1960, p. 50, pl. 25, figs. 8-12; Cole and Ferguson, 1975, pl. 1, fig. 3.

Remarks. The one specimen of *T. legumen* found in this survey is an elongated oval shape, covered with longitudinally oriented fine spines.
Distribution. *T. legumen* occurs as only a single well-preserved specimen at 4925 m in surface samples, not at all in the cores.

Family Ammodiscidae Reuss, 1862

Subfamily Ammodiscinae Reuss, 1862

Genus *Glomospira* Rzehak, 1885

Glomospira charoides (Jones and Parker)

Trochammina squamata charoides Jones and Parker, 1860, Geol. Soc. London, Quart. J. vol. 16, p. 304.
Glomospira charoides (Jones and Parker) Barker, 1960, p. 78, pl. 38, figs. 10-16; Anderson, 1975, pl. 1, figs. 10a,b. LeRoy and Hodgkinson, 1975, pl. 2, figs. 1,2; Ingle et al. 1980, p. 136, pl. 9, fig. 6, Cole, 1981, p. 19-20, pl. 4, fig. 2; Poag, 1981, pl. 7, fig. 4; Kaminski, 1983, p. 11, pl. 5, fig. 6.

Remarks. This tightly-coiled form closely resembles most published illustrations of it, and is usually a yellowish-brown colour, often with some dark mineralization in the sutures.
Distribution. This species occurs in very small numbers (< 1% of total benthics) in most samples from between 2000 m and 3985 m. One specimen appears at 105 - 107 cm in the gravity core.

Subfamily Tolypammininae Cushman, 1928

Genus *Tolypammina* Rhumbler, 1895

Tolypammina vagans (Brady)

Hyperammina vagans Brady, 1879. Quart. J. Micr. Sci. vol. 19, p. 33, pl. 3, fig. 5.

Tolypammina vagans *(Brady)* Rhumbler, 1895. Nachs. K. Ges. Wiss. Gottingen, p. 83; Barker, 1960, p. 48, pl. 24, figs. 1-5; LeRoy and Hodgkinson, 1975, pl. 2, fig. 3; Cole, 1981, p. 20-21, pl. 4, fig. 3.

Remarks. *T. vagans* appeared in these samples in two forms, usually as a single yellowish-brown tube attached to an meandering over tests of other foraminifera, and very occasionally as a small tube with a few other tests attached to it.
Distribution. The form occurs in small numbers in most surface samples between 2200 m and 3500 m, exceeding 6% of the total benthic assemblage at 3050 m. It appears again in very small numbers (< 1%) at 4040 m and is also seen occasionally in small numbers in the upper metre or so of both cores.

Superfamily Lituolacea de Blainville, 1825

Family Hormosinidae Haeckel, 1894

Subfamily Hormosininae Haeckel, 1894

Genus *Hormosina* Brady, 1879

Hormosina globulifera, Brady

Hormosina globulifera Brady, 1879. Quart. J. Micr. Sci. vol. 19, p. 60, pl. 4, figs. 4,5; Barker, 1960, p. 80, pl. 39, figs. 1-6; LeRoy and Hodgkinson, 1975, pl. 3, figs. 1-2; Ingle et al., 1980, p. 138, pl. 7, fig. 7; Cole, 1981, p. 27, pl. 4, fig. 7; Mendelson, 1982, pl. 4; Kaminski, 1983, p. 13, pl. 5, fig. 7.

Remarks. This spherical agglutinated form is quite distinctive and difficult to confuse with anything else.
Distribution. *H. globulifera* is found in some surface samples from between 2487 m and 3543 m, exceeding 1% of the total benthics only at 2750 m, but is totally absent from the cores.

Genus *Reophax* de Montfort, 1808

Reophax bacillaris Brady

Reophax bacillaris Brady, 1881 - Quart. J. Micr. Sci. vol. 21, p. 49; Barker, 1960, p. 62, pl. 30, figs. 23,24; Cole, 1981, pl. 2, fig. 12; Kaminski, 1983, p. 15, pl. 6, fig. 4.

Remarks. This large (up to 5.0 mm) form is well illustrated in the literature, and because of its size is quite distinct. Some specimens were observed by the author in apparent life position on the sediment-water interface of some box cores as they were landed.
Distribution. In surface samples this form is absent above 2500 m depth. It is most common (3%) at 2996 m disappearing again at 4046 m. *R. bacillaris* also occurs in small numbers in the upper metre or so of both cores.

Reophax dentaliniformis (Brady)

Lituola (Reophax) dentaliniformis Brady, 1881. Quart. J. Micr. Sci. vol. 21, p. 49.

Reophax dentaliniformis Brady. Barker, 1960, pl. 30, fig. 31; Anderson, 1975, pl. 1, fig. 15; Cole and Ferguson, 1975, pl. 1, fig. 10; Ingle et al. 1980, p. 144; Cole, 1981, p. 23, pl. 16, fig. 23; Kaminski, 1983, p. 15, pl. 6, figs. 9,10.

Remarks. This species is well illustrated in the literature, and the specimens encountered in this study conform quite closely to published descriptions.
Distribution. *R. dentaliniformis* appears in only 5 surface samples (always less than 1.0% of the benthic total) ranging in depth from 2000 m to 3500 m. It is seen as single specimens in only two core samples.

Reophax fusiformis (Williamson)

Proteonina fusiformis Williamson, 1858. Rec. Foram. Great Britain p. 1, pl. 1, fig. 1.
Reophax fusiformis (Williamson) Brady, 1884. Rep. Voy. Challenger, Zool., vol. 9, p. 290, pl. 30, figs. 7-11; Barker, 1960, p. 62, pl. 30, figs. 7-11; Vilks, 1969, p. 44, pl. 1, figs. 8a-b; Cole and Ferguson, 1975, pl. 1, fig. 15; Ingle et al., 1980, p. 144; Milam and Anderson, 1981, pl. 2, fig. 1.
Reophax curtus Cushman, 1920. U.S. Nat. Mus. Bull. 104, (2), p. 8, pl. 2, figs. 2,3.
Reophax subfusiformis Earland, 1933, Discovery Repts. vol. 7, p. 74, pl. 2, figs. 16-19.

Remarks. This species as it appears in the study area closely resembles the published illustrations and descriptions.
Distribution. This rare form appears in very small numbers in several surface samples from between 2000 m and 4046 m depth, and is not seen in any subsurface core samples.

Reophax guttifer (Brady)

Lituola (Reophax) guttifer Brady, 1881. Quart. J. Micr. Sci. vol. 21, p. 49.
Reophax guttifer (Brady) Barker, 1960, pl. 31, figs. 10-15; Anderson, 1975, pl. 1, figs. 18a-b; Ingle et al. 1980, p. 144.
Reophax guttifera (Brady) Brady, 1884. Rep. Voy. Challenger, Zool. vol. 9, p. 295, pl. 31, figs. 10-15; Vilks, 1969, p. 44, pl. 1, fig. 10; Cole, 1981, p. 25, pl. 2, fig. 11; Williamson, 1983, p. 207, pl. 1, fig. 10.
?*Hormosina guttifer* (Brady) Kaminski, 1983, p. 17, pl. 7, fig. 7.

Remarks. This small, fragile form is easy to distinguish by its thin 'waist' between chambers.
Distribution. *R. guttifer* is a rare form, occurring in only 5 surface samples (2120 m - 4046 m) and is most common (1.19% of total benthics) at 2120 m. It appears in only one core sample.

Reophax spp. fragments

Remarks. These vaguely circular or oval agglutinated forms usually consist of a single chamber, sometimes two. A few may actually represent *Saccamina* spp. but it was found most convenient to simply assign them all to this designation.
Distribution. Found in samples from a wide depth range and in cores from the upper two metres.

Family Lituolidae de Blainville, 1825

Subfamily Haplophragmoidinae Maync, 1952

Genus *Haplophragmoides* Cushman, 1910

Haplophragmoides bradyi (Robertson)

Trochammina bradyi Robertson, 1891. Ann. Mag. Nat. Hist. ser. 6, vol. 7, p. 388.
Haplophragmoides bradyi (Robertson) Phleger and Parker, 1951. Geol. Surv. Amer. Mem. 46, pt. II, pl. 1, fig. 10; Anderson, 1975, pl. 2, figs. 8a,b; Cole, 1981, p. 28-29, pl. 4, fig. 10.

Remarks. This small, nearly planispiral form is similar to other illustrations given for it.
Distribution. This species appears in only 4 surface samples from depths ranging from 2995 - 3985 m. It never exceeds 1% of the total benthic assemblage. It is present in one core sample (747 - 749 cm) as a single specimen.

Haplophragmoides sphaeroloculum Cushman, 1910

Haplophragmoides sphaeroloculum Cushman, 1910. U.S. Nat. Mus. Bull., no. 71, p. 107.

Remarks. This form is usually rather small and can be distinguished from certain other low trochospiral agglutinated species by its nearly spherical chambers and almost planispiral chamber arrangement.
Distribution. *H. sphaeroloculum* is present in small numbers in most surface samples from between 2120 m and 4046 m, and is most common (5% of benthic total) at 3543 m. Also present in some core samples from various depths, never in large numbers.

Genus *Adercotryma* Loeblich and Tappan, 1952

Adercotryma glomerata (Brady)

Lituola glomerata Brady, 1878. Ann. Mag. Nat. Hist. ser. 5, vol. 1, p. 433, pl. 20, fig. 1.
Adercotryma glomerata (Brady). Barker, 1960, pl. 34, figs. 15-18. Barbieri and Medioli, 1969, p. 853-854; Vilks, 1969, p. 44, pl. 1, fig. 15; Anderson, 1975, pl. 2, figs. 4a-b; Cole and Ferguson, 1975, pl. 3, figs. 12,13; Ingle et al., 1980, p. 128; Cole, 1981, p. 29-30, pl. 4, fig. 8; Milam and Anderson, 1981, pl. 2, fig. 3; Kaminski, 1983, p. 17, pl. 7, figs. 9,10; Williamson, 1983, p. 208, pl. 1, fig. 16.

Remarks. In this study, *A. glomerata* was found to closely resemble published illustrations and descriptions given for it.
Distribution. This species appears in only 3 surface samples at 3247 m, 4030 m and 4925 m; its maximum abundance is in the last, at 2.14% of the total. In both cores the form is much more common sometimes exceeding 5% of the benthics.

Genus *Cribrostomoides* Cushman, 1910

Cribrostomoides scitulum (Brady)

Lituola (Haplophragmium) scitulum Brady, 1881. Quart. J. Micr. Sci. vol. 21, p. 50.
Alveophragmium scitulum (Brady) Barker, 1960, p. 70, pl. 34, figs. 11-13. Ingle et al., 1980, p. 128; Williamson, 1983, p. 210, pl. 2, fig. 6.

Cribrostomoides scitulum (Brady) Poag, 1981, pl. 11-12, fig. 4; Kaminski, 1983, p. 17-18, pl. 2, figs. 2a-b.
Cribrostomoides scitulus (Brady) Loeblich and Tappan, 1964, (2) vol. 1, p. C225; LeRoy and Hodgkinson, 1975, pl. 4, figs. 5,6; Cole, 1981, p. 30-31, pl. 4, fig. 12.

Remarks. This involute, quite attractive species is often a bright yellow or yellowish-orange in colour, and usually closely resembles figured specimens.
Distribution. *C. scitulum* appears intermittently in surface samples from almost all depths. It is somewhat more common in the deeper half of the range, but never exceeds 1% of the benthic total. It is absent from subsurface core samples.

Cribrostomoides subglobosa (G.O. Sars)

Lituola subglobosa G.O. Sars, 1872. For. Vid. Selsk. Christiana, p. 253.
Cribrostomoides subglobosum (G.O. Sars) Poag, 1981, pl. 11-12, fig. 2; Cole, 1981, p. 31, pl. 4, fig. 13; Milam and Anderson, 1981, pl. 3, fig. 1; Williamson, 1983, p. 210, pl. 1, fig. 15.
Alveophragmium subglobosum (G.O. Sars) Barker, 1960, p. 70, pl. 34, figs. 7,8,10,14; Ingle et al., 1980, p. 130, pl. 3, fig. 10.
Cribrostomoides subglobosus (Cushman) Vilks, 1969, p. 45, pl. 1, figs. 18a,b.
Cribrostomoides subglobosus (Sars) Anderson, 1975, pl. 2, fig. 7; LeRoy and Hodgkinson, 1975, pl. 4, figs. 2-4.

Remarks. Although variable in size (150 µm - 500 µm) this form is easily recognized by its involute construction and globular chambers.
Distribution. This species is present in surface samples from 2000 m down to 4046 m and is most common (2% of the total benthics) at 2995 m. It is present only occasionally in core samples.

Cribrostomoides weisneri (Parr)

Labrospira weisneri Parr, 1950. Brit. Austr. N. Zeal. Antarctic Res. Exped. 1929-31 Rep. ser. B (Zool.) vol. 5, pt. 6, p. 272, p. 4, figs. 25,26.
Cribrostomoides weisneri (Parr) Leblich and Tappan, 1964. (2) vol. 1, p. C225; LeRoy and Hodgkinson, 1975, pl. 3, figs. 16,17; Cole, 1981, p. 31, pl. 4, fig. 11; Milam and Anderson, 1981, pl. 2, fig. 6.
Alveophragmium weisneri (Parr). Barker, 1960, p. 82, pl. 40, figs. 14, 15. Anderson, 1975, pl. 2, figs. 11a,b.

Remarks. This small, laterally compressed, nearly planispiral form is easily distinguished by its smooth, shiny wall and is yellowish-brown in colour.
Distribution. *C. weisneri* is present in surface samples only deeper than 2995 m and is most common (2% of the total benthics) at 3985 m. Very rare in core material, seen as only a few scattered individuals.

Genus *Recurvoides* Earland, 1934

Recurvoides contortus Earland

Recurvoides contortus Earland, 1934. Discovery Reports, vol. 10, p. 91, pl. 10, figs. 7-19; Cole and Ferguson, 1975, pl. 3, figs. 4-5; LeRoy and Hodgkinson, 1975, p.

436, pl. 3, figs. 20-21; Cole, 1981, p. 31-32, pl. 5, fig. 1; Milam and Anderson, 1981, pl. 3, fig. 2; Resig, 1981, pl. 10, fig. 12; Kaminski, 1983, p. 18, figs, 5a-c.

Remarks. This species superficially resembles *Cribrostomoides subglobosum*, but is irregularly coiled, not planispiral.
Distribution. *R. contortus* is present in most surface samples, occasionally accounting for over 30% of the benthic total, as at 2995 m and 3543 m, but is very rare in core material.

Subfamily Cyclamminae Marie, 1941

Genus *Cyclammina* Brady, 1879

Cyclammina cancellata Brady

Cyclammina cancellata Brady, 1879. Quart. J. Micr. Sci., vol. 19, p. 62; Barker, 1960, p. 76, pl. 37, figs. 8-16; Anderson, 1975, pl. 2, figs. 12a-b; LeRoy and Hodgkinson, 1975, pl. 4, figs. 15-17; Ingle et al., 1980, p. 132, pl. 2, fig. 1; Cole, 1981, p. 32, pl. 5, fig. 2; Kaminski, 1983, p. 20, pl. 10, figs. 1a-b, 2-3; Williamson, 1983, p. 210, pl. 2, fig. 10.

Remarks. This large species is quite distinct in appearance, and is often encrusted with dark mineral matter.
Distribution. Very rare in both surface and core material, occurring in only a few samples as lone individuals.

Genus *Alveophragmium* Shchedrina, 1936

Alveophragmium ringens (Brady)

Trochammina ringens Brady, 1879. Quart. J. Micr. Sci. vol. 19, p. 57, pl. 5, figs. 12a-b.
Alveophragmium ringens (Brady) Parker, 1954, p. 487; Barker, 1960, p. 82, pl. 40, figs. 17a-b, 18a-b.
Cribrostomoides ringens (Brady) Loeblich and Tappan, 1964. (2) vol. 1, p. C225; LeRoy and Hodgkinson, 1975, pl. 4, fig. 1.
Cystaminella ringens (Brady) Lukina, 1980, fig. 48; Kaminski, 1983, p. 17, pl. 9, figs. 3a-b.

Remarks. This highly distinctive species conforms very closely to illustrations in the literature.
Distribution. An occasional find in surface samples from below 2750 m, *A. ringens* appears in a very few core samples.

Subfamily Lituolinae de Blainville, 1825

Genus *Ammobaculites* Cushman, 1910

Ammobaculites agglutinans (d'Orbigny)

Spirolina agglutinans d'Orbigny, 1846. Foram. Foss. Vienne, p. 137, pl. 7, figs. 10-12.

Ammobaculites agglutinans (d'Orbigny). Barker, 1960, p. 66, pl. 32, figs. 19-21, 24-26; Anderson, 1975, pl. 2, figs. 15a-b; Cole, 1981, p. 33, pl. 5, fig. 3; Resig, 1981, pl. 9, fig. 16; Kaminski, 1983, p. 19, pl. 9, fig. 4.

Distribution. This robust form is fairly common in surface samples, especially from 2750 m to 4046 m, occasionally composing 5% of the benthic total. It is quite rare in core material.

Genus *Ammomarginulina* Weisner, 1931

Ammomarginulina foliacea (Brady)

Lituola (Haplophragmium) foliaceum Brady, 1881. Quart. J. Micr. Sci., vol. 21, p. 50.
Ammomarginulina foliaceus (Brady). Barker, 1960, p. 68, pl. 33, figs. 20-25.
Ammomarginulina foliacea (Brady). Cushman, 1933a, pl. 10, figs. 6a,b. Cole, 1981, pl. 5, fig. 4; Kaminski, 1983, p. 20, pl. 9, fig. 6.

Remarks. This form is found in both morphotypes, the small discoid form, and, more rarely, with a rectilinear portion.
Distribution. *A. foliacea* occurs only in those samples taken from 2995 m or greater depth, and is most common (over 2%) at 4030 m. It is also found very rarely in the upper 2 metres of both cores.

Genus *Ammoscalaria* Høglund, 1947

Ammoscalaria tenuimargo (Brady)

Haplophragmium tenuimargo Brady, 1882. Proc. Roy. Soc. Edinburgh, vol. 11, p. 715.
Ammomarginulina tenuimargo (Brady) Cushman, 1910, p. 117, figs. 100-183. Cole, 1981, p. 34, pl. 5, fig. 5.
Ammoscalaria tenuimargo (Brady) Barker, 1960, p. 68, pl. 33, figs. 13-16. Blanc-Vernet, 1983, p. 504.

Remarks. This is a very fragile form which resembles loosely aggregated plates of thin mineral flakes.
Distribution. *A. tenuimargo* occurs only in surface samples as a single specimen from 2000 m.

Family Textulariidae Ehrenberg, 1838

Subfamily Spiroplectammininae Cushman, 1927

Genus *Spiroplectammina* Cushman, 1927

Spiroplectammina biformis (Parker and Jones)

Textularia agglutinans biformis Parker and Jones, 1865. Philos. Trans. Roy. Soc., vol. 155, p. 370, pl. 15, figs. 23-24.
Spiroplectammina biformis (Parker and Jones) LaCroix, 1932. Bull. Inst. Ocean. Monaco, vol. 591, p. 5, fig. 1; Barker, 1960, p. 92, pl. 45, figs. 25-27; Vilks, 1969, p. 45, pl. 1, figs. 20a-b; Cole and Ferguson, 1975, pl. 3, fig. 3; Ingle et al., 1980, p. 144, pl. 5, fig. 9; Cole, 1981, p. 34, pl. 6, fig. 3; Rodriguez and Hooper, 1982b, p. 348; Williamson, 1983, p. 211-212, pl. 2, fig. 5.

Remarks. In general this form closely resembles published figures and descriptions.
Distribution. In surface samples, a few specimens occur at 3247 m and at 3500 m. In core material, *S. biformis* is fairly common below 669 cm, constituting 31% of the foraminiferal assemblage at 708-710 cm. Above 669 cm, it is quite rare.

Subfamily Textulariinae Ehrenberg, 1838

Genus *Textularia* Defrance *in* de Blainville, 1825

Textularia gracillima Höglund

Textularia gracillima Höglund, 1947. Tod. Bidr. Uppsala, Bd. 26, p. 180, pl. 13, fig. 2; p. 173 text-fig. 15b.

Remarks. This is a small and very fragile form, easily broken by imprudent handling.
Distribution. Not present in any surface samples, and rare in a few core samples from between 290 cm and 749 cm.

Subfamily Pseudobolivininae Weisner, 1931

Genus *Siphotextularia* Finlay, 1939

Siphotextularia catenata (Cushman)

Textularia catenata Cushman, 1911, p. 23, figs. 39-40.
Siphotextularia rolshauseni Phleger and Parker, 1951. Geol. Soc. Amer. Mem. 46(2), p. 4, pl. 1, figs. 23-24; Cole, 1981, p. 36, pl. 5, fig. 7; Belanger and Streeter, 1980, p. 415.
Siphotextularia catenata (Cushman) Corliss, 1979, p. 5, pl. 1, figs. 1-2; Blanc-Vernet, 1983, p. 506.

Remarks. This species is usually of a distinctive white, "sugary" appearance.
Distribution. *S. catenata* appears in very small numbers in three surface samples, from 2996 m, 3247 m, and 3880 m. In core samples from between 270 cm and 440 cm this form is often found in small numbers, less commonly below this.

Family Trochamminidae Schwager, 1877

Subfamily Trochammininae, Schwager, 1877

Genus *Trochammina* Parker and Jones, 1859

Trochammina bullata Takayanagi

Trochammina bullata Takayanagi, 1960. Tohoku. Univ. Sci. Repts. Ser. 2, (Geol.) vol. 32, no. 1, p. 85, pl. 4, figs. 1a-c. Cole, 1981, p. 37, pl. 7, fig. 1.

Distribution. One specimen from a surface sample at 2995 m.

Trochammina globigeriniformis (Parker and Jones)

Lituola nautiloidea var. *globigeriniformis* Parker and Jones, 1865 Trans. Roy. Soc. London, vol. 155, p. 407, pl. 15, figs. 46, 47.
Ammoglobigerina globigeriniformis (Parker and Jones) Barker, 1960, p. 72, pl. 35, figs. 10,11.
Trochammina globigeriniformis (Parker and Jones) LeRoy and Hodgkinson, 1975, pl. 5, figs. 6,7; Ingle et al., 1980, p. 146, pl. 5, figs. 12; 13; Williamson, 1983, p. 213,pl. 2, fig. 14.

Distribution. This species occurs connomly in surface samples from 2400 m down, exceeding 4.0% of the total benthics at 4925 m. It is very rare in core material.

Trochammina ochracea (Williamson)

Rotalia ochracea Williamson, 1858. Rec. Foram. Great Brit., p. 55, pl. 4, fig. 112; pl. 5, fig. 113.
Trochammina ochracea (Williamson) Feyling-Hansen, 1964. Norges. Geol. Und. NR225, p. 220, pl. 13, figs. 11,12; Cole and Ferguson, 1975, pl. 4, figs. 9,10; Thomas, 1977, p. 48, pl. 1, figs. 11,12.

Remarks. This small nearly planispiral form is commonly associated with somewhat shallower nearshore conditions than is the case in the present study (Cole and Ferguson, 1975; Thomas, 1977).
Distribution. In surface samples this species is found only as a few specimens at 3247 m. In the cores *T. ochracea* occurs in small numbers in several samples, somewhat more frequently in the bottom three metres.

Trochammina pusilla Höglund

Trochammina pusilla Höglund, 1947. Univ. Zool. Bidr. Uppsala, Bd. 26, p. 201, pl. 17, fig. 4.

Remarks. This very small, high trochospiral form agrees very closely with Höglund's (1947) description and plates.
Distribution. *T. pusilla* occurs as only a few individuals from samples in various levels of the cores.

Trochammina squamata group Jones and Parker

Trochammina squamata Jones and Parker, 1860. Quart. J. Geol. Soc., vol. 16, p. 304; Cole and Ferguson, 1975, pl. 4, figs. 11-12; LeRoy and Hodgkinson, 1975, pl. 5, figs. 4-5; Ingle et al. 1980, p. 146; Cole, 1981, p. 39, pl. 6, figs. 10-11; Williamson, 1983, p. 213, pl. 2, figs. 8-9.
Tritaxis squamata (Jones and Parker) Anderson, 1975, pl. 4, figs. 2a-b.

Distribution. This somewhat variable group of forms enjoys a wide distribution in surface samples, found in most material from below 2400 m, and reaches nearly 3% of the total benthics at 4925 m. It is fairly common in core material from between 260 cm and 400 cm, less so in other levels.

Genus Cystammina Newmayr, 1899

Cystammina pauciloculata (Brady)

Trochammina pauciloculata Brady, 1879. Quart. J. Micr. Sci. vol. 19, p. 58, pl. 5, figs. 13,14.

Cystammina pauciloculata (Brady). Barker, 1960, p. 84, pl. 41, figs. 1-2. Anderson, 1975, pl. 4, figs. 1a-b; Ingle et al., 1980, p. 134, pl. 9, fig. 11; Cole, 1981, p. 39-40, pl. 5, fig. 8; Kaminski, 1983, p. 18, pl. 9, fig. 1.

Remarks. This distinctive and well-documented species often exhibits a very shiny, smooth surface.
Distribution. *C. pauciloculata* is present sporadically from 2120 m down to 4925 m, where it is most common (3%). Very rare, however, in subsurface material, present as only a single specimen at 123-125 cm.

Family Ataxophragmiidae Schwager, 1877

Subfamily Globotextulariinae Cushman, 1927

Genus *Eggerella* Cushman, 1933a

Eggerella bradyi (Cushman)

Verneuilina bradyi Cushman, 1911. U.S. Nat. Mus. Bull. 71, pt. 2, p. 54, text figs. 87a,b; pl. 6, fig. 4.
Eggerella bradyi (Cushman) Barker, 1960, pl. 47, figs. 4-7; LeRoy and Levinson, 1974, p. 5, pl. 1, fig. 14; Anderson, 1975, pl. 4, fig. 3; LeRoy and Hodgkinson, 1975, pl. 6, fig. 4; Corliss, 1979, p. 5, pl. 1, figs. 3,4; Boltovsky, 1980a, pl. 4, figs. 5a,b; Ingle et al., 1980, p. 134; Cole, 1981, p. 43, pl. 5, fig. 9; Blanc-Vernet, 1983, p. 504, pl. 1, fig. 12; Kaminski, 1983, pl. 11, fig. 5.

Remarks. This species may sometimes be confused with the calcareous *Tosaia hanzawai*, except that *E. bradyi* is normally an orange or brownish hue in these samples.
Distribution. This form is found in surface samples frm 2500 m, 2750 m and 2995 m, always in very small numbers. It is absent from core samples.

Eggerella propinqua (Brady)

Verneuilina propinqua Brady, 1884. Rep. Voy. Challenger, Zool. vol. 9, p. 387, pl. 47, figs. 8-12.
Eggerella propinqua (Brady) Barker, 1960, pl. 47, figs. 8-12; LeRoy and Hodgkinson, 1975, pl. 6, fig. 7f; Cole, 1981, p. 43, pl. 5, fig. 10; Kaminski, 1983, p. 22, pl. 11, fig. 6.

Distribution. This very rare form occurs in small numbers in only two surface samles (2750 m and 2995 m) and in no subsurface material.

Eggerella sp.

Remarks. Test is very small, fine-grained, 3 chambers per whorl in last stages. The initial end is very pointed, and the whole test is approximately 4 times longer than broad.

Distribution. This species of uncertain affinity is found only in small numbers in the upper metre or so of the cores, and is even scarcer further down. It is entirely absent from surface material.

Genus *Karreriella* Cushman, 1933

Karreriella apicularis (Cushman)

Gaudryina apicularis Cushman, 1911. U.S. Nat. Mus. Bull. 71, pt. 2, p. 69, figs. 110a-b.
Karrieriella apicularis (Cushman). Poag, 1981, pl. 15-16, fig. 5; Barker, 1960, p. 94, pl. 46, figs. 17-19; LeRoy and Hodgkinson, 1975, pl. 6, fig. 5; Ingle et al., 1980, p. 138; Cole, 1981, p. 43-44, pl. 8, fig. 1; Blanc-Vernet, 1983, p. 505, pl. 1, fig. 11; Kaminski, 1983, p. 22, pl. 1, fig. 7.

Remarks. In the present study this species is found to closely resemble the published descriptions and illustrations given for it.
Distribution. *K. apicularis* occurs in very small numbers in surface samples from 2750 m down, most commonly between 2996 m and 3500 m. It also occurs as a single specimen from 2120 m. In the cores, this species occurs in very small numbers in a few samples at various depths.

Karreriella bradyi (Cushman)

Gaudryina bradyi Cushman, 1911. U.S. Nat. Mus. Bull. 71, vol. 2, p. 67, text-fig. 107.
Karreriella bradyi (Cushman). Cushman, 1937. Cushman Lab. Foram. Res. Spec. Publ. 8, p. 135; Barker, 1960, p. 94, pl. 46, figs. 1-4; LeRoy and Levinson, 1974, p. 5-6, pl. 1, fig. 15; LeRoy and Hodgkinson, 1975, pl. 6, fig. 6; Corliss, 1979, p. 5, pl. 1, figs. 5-6; Ingle et al., 1980, p. 138; Cole, 1981, p. 44, pl. 6, fig. 5; Blanc-Vernet, 1983, p. 505, pl. 1, fig. 10; Williamson, 1983, p. 214, pl. 2, fig. 7.

Remarks. This large, distinctive species is easy to recognize by its inflated, rounded chambers and slit-like aperture.
Distribution. *K. bradyi* occurs in surface samples from 2750 m to 3985 m in small numbers, exceeding 1.0% of the total benthics only above 3050 m. Present in cores only in one sample, at 95 - 97 cm.

Karreriella novangliae (Cushman)

Gaudryina barcata novangliae Cushman, 1922a. U.S. Nat. Mus. Bull. 104, vol. 3, p. 76, pl. 13, fig. 4.
Karreriella novangliae (Cushman) Cushman, 1937. Cushman Lab. Foram. Res. Spec. Publ. 8, p. 136; Barker, 1960, p. 94, pl. 46, figs. 8-10; LeRoy and Levinson, 1974, p. 6, pl. 1, fig. 16; Ingle et al., 1980, p. 140; Cole, 1981, p. 44-45, pl. 8, fig. 2.

Remarks. This form can be distinguished from *K. bradyi* by its larger size and more "cubic" chambers.
Distribution. *K. novangliae* is found in only 2 surface samples, at 2750 m and 2995 m, in neither one exceeding 0.25% of the benthic total. It is also present, usually as single specimens, in three core samples.

Subfamily Valvulininae Berthelin, 1880

Genus *Martinottiella* Cushman, 1933

Martinottiella communis (d'Orbigny)

Clavulina communis d'Orbigny, 1846. Gide et Comp. p. 196, pl. 12, figs. 1,2.
Martinottiella communis (d'Orbigny) Cushmam, 1933c. Contr. Cushman Lab. Foram. Res., vol. 9, p. 37; Barker, 1960, p. 98, pl. 48, figs. 3,4,6-8; Ingle et al. 1980, p. 140. Blanc-Vernet, 1983, p. 505.

Distribution. This small form is very rare in the present survey samples, occurring in surface material only once, at 3500 m. Two other specimens were found in the piston core, at 290 - 292 cm and 420 - 422 cm.

Martinottiella nodulosa (Cushman)

Clavulina communis var. *nodulosa* Cushman, 1922a, U.S. Nat. Mus. Bull. 104, pt. 3, p. 85.
Martinottiella nodulosa (Cushman) Barker, 1960, p. 98, pl. 48, figs. 9-13.
Martinottiella nodulosus (Cushman) Miller and Lohmann, 1982, pl. 1, fig. 7.

Remarks. This form can be distinguished from the very similar *M. communis* by the slightly enlarged early multiserial portion of the test.
Distribution. This species occurs in only one surface sample, at 3880 m, and as single individuals in a few subsurface samples from various levels.

Suborder Miliolina Delage and Hérouard, 1896

Superfamily Miliolacea Ehrenberg, 1839

Family Nubeculariidae Jones, 1875

Subfamily Ophthalmidiinae Wiesner, 1920

Genus *Ophthalmidium* Kubler and Zwingli, 1870

Ophthalmidium pusillum (Earland)

Spiroloculina pusilla Earland, 1934. Discovery Reports, vol. 10, p. 47.
Spirophthalmidium pusillum (Earland) Barker, 1960, p. 20, pl. 10, figs. 9-10; Cole, 1981, p. 48, pl. 9, fig. 1.
Ophthalmidium pusillum (Earland) Loeblich and Tappan, 1964, p. C448; Corliss, 1979, p. 5-6, pl. 1, figs. 7-8.

Distribution. Absent from surface samples, but two single specimens were found at 51 - 53 cm and 61 - 63 cm in the gravity core.

Family Miliodae Ehrenberg, 1839

Subfamily Quinqueloculininae Cushman, 1917

Genus *Quinqueloculina* d'Orbigny, 1826

Quinqueloculina sp.

Remarks. Only two imperfectly preserved specimens were taken of this form, which somewhat resembles *Q. tropicalis* depicted by Barker (1960, p. 10, pl. 5, figs. 3a-c), but its exact identity is unknown.
Distribution. This species is represented by only a few specimens from 2 piston core samples at 802- 804 cm and 840 - 842 cm.

Genus *Pyrgo* De France, 1824

Pyrgo comata (Brady)

Biloculina comata Brady, 1884. Rep. Voy. Challenger, Zool. 9, p. 144, pl. 3, fig. 9.
Pyrgo comata (Brady) Cushman, 1929b. U.S. Nat. Mus. Bull. 104, vol. 6, p. 73, pl. 19, fig. 8; LeRoy and Levinson, 1974, p. 6, pl. 2, fig. 4; Cole and Ferguson, 1975, pl. 10, figs. 1-3; LeRoy and Hodgkinson, 1975, pl. 7, figs. 7-8; Blanc-Vernet, 1983, p. 506.

Distribution. Very rare in study area; found in only one surface sample, at 2750 m (one specimen), and one individual from 678 - 680 cm in the piston core.

Pyrgo murrhyna (Schwager)

Biloculina murrhyna Schwager, 1866. Novara-Exped. Geol. Thiel., vol. 2, p. 203, pl. 4, figs. 15a-c.
Pyrgo murrhyna (Schwager) Cushman, 1929b. U.S. Nat. Mus. Bull. 104, vol. 6, p. 71; Barker, 1960, p. 4, pl. 2, figs. 10-11, 15; Ingle et al., 1980, p. 142; Cole, 1981, p. 52-53, pl. 8, fig. 9.
Pyrgo murrhina (Schwager) LeRoy and Levinson, 1974, p. 6, pl. 2, fig. 5. LeRoy and Hodgkinson, 1975, pl. 7, figs. 4-5; Corliss, 1979, p. 6, pl. 1, figs. 15-18; Boltovskoy, 1980b, p. 354, pl. 2, fig. 6; Corliss and Honjo, 1981, p. 362, 364, pl. 9, figs. 1-12; Blanc-Vernet, 1983, p. 506.

Remarks. This distinctive form closely resembles the many published descriptions and illustrations given for it.
Distribution. One of the more widely distributed species encountered in this survey, *P. murrhyna* ranges the whole suite of surface samples, but appears most persistently below 2750 m, comprising over 7.0% of the total benthic fauna at 4495 m. It also occurs quite frequently in the upper 2 metres of both cores, but is much less common below.

Pyrgo subsphaerica (d'Orbigny)

Biloculina subsphaerica d'Orbigny, 1839. *In* de la Sagra, "Hist. Phys. Pol. Nat. Cuba", p. 162, pl. 8, figs. 25-27.
Pyrgo subsphaerica (d'Orbigny) Parker, 1952. Bull. Mus. Comp. Zool., vol. 106, no. 9, p. 405, pl. 3, fig. 17; Vilks, 1969, p. 46, pl. 2, figs. 7a,b; Cole, 1981, p. 53, 54, pl. 9, fig. 9.

Remarks. This species can readily be distinguished from *P. murrhyna* by its rotund, almost spherical shape.
Distribution. *P. subsphaerica* occurs in only 4 widely scattered surface samples, ranging in depth from 2400 m to 4046 m, always in very small numbers. It is also present, though rare, in a few core samples.

Genus *Sigmoilopsis* Finlay, 1947

Sigmoilopsis schlumbergeri (Silvestri)

Sigmoilina schlumbergeri Silvestri, 1904. Accad. Pont. Romana Nuovi Lincei, Mem. vol. 22, p. 267, 269.
Sigmoilopsis schlumbergeri (Silvestri) Finlay, 1947. Roy. Soc. New Zeal. Trans. vol. 28, no. 5 (B), p. 270; Barker, 1960, p. 16, pl. 8, figs. 1-4; LeRoy and Levinson, 1974, p. 6, pl. 2, fig. 13; Cole and Ferguson, 1975, pl. 12, figs. 1-2; LeRoy and Hodgkinson, 1975, pl. 7, fig. 15; Blanc-Vernet, 1983, p. 506; Williamson, 1983, p. 215-216, pl. 3, fig. 4.

Remarks. This species is readily recognizable by its flattened, lenticular shape and fine agglutinated coating.
Distribution. *S. schlumbergeri* is present in small numbers in most surface samples, being most common (5.3%) at 2750 m.

Genus *Triloculina* d'Orbigny, 1826

Triloculina oblonga (Montagu)

Vermiculum oblongum Montagu, 1803. Test. Brit., pt. 2, p. 522, pl. 14, fig. 9.
Triloculina oblonga (Montagu) d'Orbigny, 1826. Ann. Sci. Nat. Paris, ser. 1, vol. 7, p. 300, no. 16; mod. 95; Cole and Ferguson, 1975, pl. 11, fig. 10; Cole, 1981, p. 55, pl. 17, figs. 41-42.

Distribution. A very rare form. *T. oblongum* occurs as only a few specimens at 2996 m, and in very small numbers in various levels of the cores.

Triloculina tricarinata d'Orbigny

Triloculina tricarinata d'Orbigny, 1826. Ann. Sci. Nat. Paris, ser. 1, vol. 7, p. 299, no. 7, mod. 94; Barker, 1960, p. 6, pl. 3, figs. 17a-b; Cole and Ferguson, 1975, pl. 11, fig. 11; Cole, 1981, p. 55-56, pl. 10, fig. 2; Blanc-Vernet, 1983, p. 506.

Distribution. *T. tricarinata* occurs in most surface samples in this study, being most common (1.0-3.0% of the benthic total) between 2487 m and 2996 m. It appears in many subsurface samples, sometimes comprising over 10% of the fauna in the upper 1.5 metres.

Subfamily Miliolinae Ehrenberg, 1839

Genus *Miliola* Lamarck, 1804

Miliola sp.

Remarks. The exact affinities of this miliolid are unknown, but its overall form seems to place it in this genus.
Distribution. Found only as single specimens in two core samples, at 51 - 53 cm and 61 - 63 cm.

Suborder Rotaliina Delage and Hérouard, 1896

Superfamily Nodosariacea Ehrenberg, 1838

Family Nodosariidae Ehrenberg, 1838

Subfamily Nodosariinae Ehrenberg, 1838

Genus *Nodosaria* Lamarcke, 1812

Nodosaria albatrossi Cushman

Nodosaria albatrossi Cushman, 1923. U.S. Nat. Mus. Bull. 104, pt. 4, p. 87; Barker, 1960, p. 134, pl. 64, figs. 11-14.

Remarks. The distinctive appearance of this species makes it difficult to confuse with other nodosariids. In this form, both the initial and final chambers are of slightly greater diameter than the others.
Distribution. *N. albatrossi* appears in very small numbers in some surface samples from between 2000 m and 2750 m. One specimen was found in the piston core at 40 - 42 cm.

Genus *Astacolus* de Montfort, 1808

Astacolus crepidulus (Fichtel and Moll)

Nautilus crepidula Fichtel and Moll, 1798. Test. Micr. alia. min. gen. Argon et Naut. ad nat. picta et descri. (2nd ed., 1803) p. 107, pl. 19, figs. g-i.
Astacolus crepidulus (Fichtel and Moll) Barker, 1960, p. 142, pl. 67, fig. 20; pl. 68, figs. 1-2; Cole, 1981, p. 57-58, pl. 17, fig. 47.

Distribution. This is a very rare form in the study area, present as a single specimen in only one surface sample (3880 m), and in similar concentrations in various core samples.

Genus *Dentalina* Risso, 1826

Dentalina inornata (d'Orbigny) var. *bradyensis* (Dervieux)

Nodosaria inornata (d'Orbigny) *bradyensis* Dervieux, 1894. Boll. Soc. Geol. Ital. vol. 12, p. 610.
Dentalina inornata bradyensis (Dervieux) Barker, 1960, p. 130, pl. 62, figs. 19-20; Cole, 1981, p. 60, pl. 18, fig. 7.
Dentalina inornata (d'Orbigny) *bradyensis* (Dervieux) Blanc-Vernet, 1983, p. 504.

Remarks. This species occurs sporadically in surface samples from between 2200 m and 4046 m, and is most prevalent (1% of total) at 3247 m. It also occurs in small numbers in several core samples, though not below 783 cm.

Genus *Lagena* Walker and Jacobs in Kanmacher, 1798

Lagena distoma (Parker and Jones)

Lagena laevis var. *striata* Parker and Jones, 1857, Ann. Mag. Nat. Hist., ser. 2, vol. XIX, p. 278 pl. XI, fig. 24.
Lagena laevis (Montagu) var. *distoma* Silvestri, 1900, Accad. Pont. Nuevi Lincei Mem. Roma, vol. 17, p. 244.
Lagena distoma Parker and Jones. Barker, 1960, p. 119, pl. 58, figs. 11-15; Anderson, 1975, pl. 5, fig. 4; Ingle et al., 1980, p. 140, pl. 4, fig. 12.

Distribution. As single specimens in a few surface samples and some subsurface material.

Lagena elegantissima (Reuss)

Lagena acuticosta Reuss. 1867, Sitzungsb. d. k. Akad. Wiss. Wien, vol. XLIV, p. 385, pl. i, fig. 4; Brady, 1884, pl. LVII, figs. 31,32.
Ovulina elegantissima Borneman, 1855, Zeitscht. d. deutsch geol. Gesellsch. vol. VII, p. 316, pl. XII, fig. 1
Lagena elegantissima (Bornemann) Barker, 1960, p. 118, pl. 57, fig. 32.

Distribution. Very rare occurring as single individuals in one surface sample (3985 m) and in a few core samples.

Lagena gracilis Williamson

Lagena gracilis Williamson, 1848, Ann. & Mag. Nat. Hist., London, ser. 2, vol. 1, p. 13, pl. 1, fig. 5; Barker, 1960, p. 119, pl. 58, figs. 2-3, 7-10, 22-24; Vilks, 1969, p. 47, pl. 2, fig. 17; Anderson, 1975, pl. 5, fig. 7; Ingle et al., 1980, p. 140.

Distribution. This lagenid is found only as a few scattered individuals at various levels in the cores.

Lagena hispidula Cushman

Lagena hispidula Cushman, 1923. U.S. Nat. Mus. Bull., 104, pt. 4, p. 29. Barker, 1960, p. 114, pl. 56, figs. 10,11; Anderson, 1975, pl. 5, fig. 9; Ingle et al., 1980, p. 140.

Remarks. This species has a distinct "fuzzy" appearance caused by the numerous small spines or projections which give it its name.
Distribution. One of the more common Lagenids in surface material, this form occurs in 9 samples from between 2000 m to 3985 m, exceeding 1.0% f the total benthics only at 3050 m. Single specimens also occur in several core samples.

Lagena meridionalis Weisner

Lagena gracilis var. *meridionalis* Weisner, 1931, Foram. Deutsche Subpolar Exped. 1901-1903, p. 117.

Lagena meridionalis Weisner. Loeblich and Tappan, 1953, Smith. Misc. Coll. vol. 121, no. 7, p. 59; Barker, 1960, p. 119, pl. 58, fig. 19; Vilks, 1969, p. 47, pl. 2, fig. 19; Anderson, 1975, pl. 5, fig. 11; Cole and Ferguson, 1975, pl. 5, fig. 15.

Distribution. Occurs very rarely in the present study area, seen only in one surface sample from 3050 m, and as another single specimen in a core at 61-63 cm.

Lagena striata (d'Orbigny)

Oolina striata d'Orbigny, 1839, tome 5, pt. 5, p. 21, pl. 5, fig. 12.
Lagena striata (d'Orbigny) Barker, 1960, p. 118, pl. 57, figs. 19, 22, 24, 28; Ingle et al., 1980, p. 140, pl. 4, fig. 13.

Distribution. *L. striata* appears in one surface sample from 2750 m. Present as single specimens in three subsurface samples.

Lagena spp.

Remarks. This designation is applied to several small lagenid forms, usually poorly preserved or damaged, whose exact affinities are unknown.
Distribution. These forms occur as single individuals in one or two surface samples and a few core samples.

Genus *Lenticulina* Lamarck, 1804

Lenticulina angulata (Reuss)

Robulina angulata Reuss, 1851. Zeitschr. Deutsch. Geol. Ges., vol. 3, p. 54, pl. 8, fig. 6.
Lenticulina angulata (Reuss) Feyling-Hanssen, 1964. Norges. Geol. Unders. NR 225, p. 277, pl. 9, figs. 9,10. Cole, 1981, p. 67, pl. 13, fig. 12.

Remarks. The only species of *Lenticulina* found in the survey, this form is readily identifiable by its planispiral, lens-shaped test, with a somewhat angular polygonal outline.
Distribution. Occurs only in very small numbers in four samples from between 2205 - 2995 m.

Genus *Marginulina* d'Orbigny, 1826

Marginulina obesa Cushman

Marginulina obesa Cushman, 1923. U.S. Nat. Mus. Bull. 104, pt. 4, p. 128, pl. 37, fig. 1; Barker, 1960, p. 136, pl. 65, figs. 5,6; LeRoy and Levinson, 1974, p. 8, pl. 4, figs. 3,4; LeRoy and Hodgkinson, 1975, pl. 8, fig. 7; Cole, 1981, p. 68, pl. 13, fig. 14; Blanc-Vernet, 1983, p. 505.

Distribution. This form occurs in only one surface sample, at the top of the gravity core. It occurs in small numbers at various levels in both cores.

Genus *Pseudonodosaria* Boomgart, 1949

Pseudonodosaria cf. *torrida* (Cushman)

Nodosaria (Glandulina) laevigata var. *torrida* Cushman, 1923. U.S. Nat. Mus. Bull. 104, pt. 4, p. 65.
Rectoglandulina torrida (Cushman) Loeblich and Tappan, 1955. Smithson Misc. Coll., 126 (3) p. 6; Barker, 1960, p. 128, pl. 61, figs. 20-22; Anderson, 1975, pl. 5, fig. 16. Cole and Ferguson, 1975, pl. 12, figs. 8,9.
Pseudonodosaria torrida (Cushman) Loeblich and Tappan, 1964, (2), p. C522-C523; LeRoy and Hodgkinson, 1975, pl. 8, fig. 8; Boltovskoy, 1980b, p. 354; Cole, 1981, p. 70, pl. 18, fig. 32; Milam and Anderson, 1981, pl. 6, fig. 5.

Distribution. *P.* cf. *torrida* appears only once in surface samples at 3985 m, as a single specimen. Another specimen was taken from a core sample.

Family Polymorphinidae d'Orbigny, 1839

Subfamily Polymorphininae d'Orbigny, 1839

Genus *Pyrulina* d'Orbigny, *in* de la Sagra, 1839

Pyrulina cylindroides (Roemer)

Polymorphina cylindroides Roemer, 1838, p. 385, pl. 3, fig. 26.
Pyrulina cylindroides (Roemer) Barker, 1960, p. 150, pl. 72, figs. 5-6.

Distribution. *P. cylindroides* occurs in four surface samples from depths ranging from 2750 m - 3880 m, always in very small numbers. None were found in subsurface material.

Pyrulina fusiformis (Roemer)

Polymorphina fusiformis Roemer, 1838, p. 386, pl. 3, fig. 37.
Pyrulina fusiformis (Roemer) Barker, 1960, p. 148, pl. 71, figs. 17-19, pl. 72, fig. 4; Cole and Ferguson, 1975, pl. 12, fig. 4; Boltovskoy, 1980a, pl. 5, figs. 5a,b.

Distribution. Limited to one specimen found in a core sample from 7.5 - 9.5 cm.

Pyrulina praelonga (Egger)

Guttulina praelonga Egger, 1857, p. 287, pl. 13, figs. 25-27.
Pyrulina angusta (Egger) Barker, 1960, p. 150, pl. 72, figs. 1-3.

Distribution. This species occurs in very small numbers in several samples from between 2205 m and 3500 m, and a single specimen was also seen in a core sample from 123 - 125 cm.

Family Glandulinidae Reuss, 1860

Subfamily Glandulininae Reuss, 1860

Genus *Laryngosigma* Loeblich and Tappan, 1953

Laryngosigma hyalascidia Loeblich and Tappan

Laryngosigma hyalascidia Loeblich and Tappan 1953. Smithson. Misc. Coll., vol. 121, (7), p. 83-84, pl. 15, figs. 6-8; Cole, 1981, p. 73-74, pl. 19, fig. 3.

Remarks. The specimens of *L. hyalascidia* encountered in this survey were not transparent as Cole (1981) mentions, but this may be due to a difference in preservation. Also, it is possible these specimens may represent small *Pseudopolymorphina novangliae* (Cushman).
Distribution. Rare, two specimens were seen in surface samples,, one at 2487 m and the other at 2750 m. One or two specimens were also seen in the upper 1.5 m of the cores.

Subfamily *Oolininae* Loeblich and Tappan, 1961

Genus *Oolina* d'Orbigny, 1839

Oolina apiculata Reuss

Oolina apiculata Reuss, 1851, Naturw. Aph. Wien, Bd. 4, Abth. 1, p. 22, pl. 2, fig. 1; Barker, 1960, p. 116, pl. 56, figs. 15-16; Vilks, 1969, p. 48, pl. 2, figs. 26a-b; Anderson, 1975, pl. 7, fig. 10; Ingle et al., 1980, p. 142.

Distribution. *O. apiculata* appears in 3 surface samples, the highest at 3050 m, the lowest at 3985 m, always in very small numbers. It is absent from the cores.

Oolina caudigera (Weisner)

Lagena (Entosolenia) globosa var. *caudigera* Weisner, 1931. Deuts. Sudpolar Exped. 1901-1903, vol. 20, p. 119, pl. 18, fig. 214.
Oolina caudigera (Weisner) Loeblich and Tappan, 1953, p. 67, pl. 13, figs. 1-3; Cole, 1981, p. 75, pl. 19, fig. 7.

Distribution. Very rare, appearing as single specimens in 2 surface samples (2750 m and 3050 m), and in several core samples.

Oolina globosa (Montagu)

Vermiculum globosum Montagu, 1803, Test. Brit., p. 523.
Fissurina globosa Bornemann, 1855, Deutsche Geol. Ges. Zeits. Bd. 7, Heft. 2, p. 317, pl. 12, fig. 4a,b.
Oolina globosa (Montagu) Parr, 1950. Brit. Austral. New Zeal. Ant. Res. Exped., 1929 - 1931. Reports, Ser. B, vol. 5, p. 6, p. 302; Barker, 1960, p. 114, pl. 56, figs. 1-3; Vilks, 1969, p. 48, pl. 2, fig. 27a-b; Anderson, 1975, pl. 7, fig. 14; Ingle et al., 1980, p. 142.

Distribution. *O. globosa* appears in small numbers in several samples from 2205 m to 3543 m. It is absent from core material.

Oolina hexagona (Williamson)

Entosolenia squamosa (Montagu) var. *hexagona*. Williamson, 1848, Ann. & Mag. Nat. Hist. ser. 2, vol. 1, p. 20, pl. 2, fig. 23.

Oolina hexagona (Williamson) Parr, 1950. Brit. Austral., New Zeal. Ant. Res. Exped. 1929-31, Ser. B, Vol. 5, no. 6, p. 304; Barker, 1960, p. 120, pl. 58, figs. 32-33; Vilks, 1969, p. 48, pl. 2, fig. 28; Anderson, 1975, pl. 7, fig. 15; Lagoe, 1977, p. 122, pl. 2, fig. 13; Ingle et al., 1980, p. 142; Milam and Anderson, 1981, pl. 6, fig. 3.

Distribution. This distinctive Oolinid occurs in 3 surface samples from between 2750 m and 2050 m depth, always as lone individuals. There are no occurrences in the cores.

Oolina longispina (Brady)

Lagena longispina Brady, 1884, Rept. Voy. Chall. vol. 9, p. 454, pl. LIX, figs. 13, 14; pl. LVI, figs. 33, 36.

Oolina longispina (Brady) Barker, 1960, p. 116, pl. 56, fig. 36. LeRoy and Hodgkinson, 1975, pl. 8, fig. 11.

Distribution. Two specimens were seen in surface samples from 2500 m and 2750 m, and none were encountered in subsurface material.

Oolina spp.

Remarks. This designation includes a number of poorly preserved, anomalous, or indeterminate single-chambered forms which superficially resemble oolinids. It is possible that some may actually belong in *Fissurina* or *Lagena*.

Distribution. These forms occur in small numbers in most surface samples from depths between 2205 m and 3985 m.

Genus *Fissurina* Reuss, 1850

Fissurina alveolata (Brady)

Lagena alveolata Brady var. *substriata* Brady, 1884, Rept. Voy. Chall., vol. 9, pl. LX, figs. 30-32.

Fissurina alveolata (Brady) Barker, 1960, p. 126, pl. 60, figs. 30-32.

Distribution. This species is present in only two surface samples from 2995 m and 4925 m, as single specimens. Similar occurrences were seen in two core samples.

Fissurina annectens (Burrows and Holland)

Lagena annectens Burrows and Holland, 1895, Mono. Crag. Foram., pt. II, p. 203.

Fissurina annectens (Burrows and Holland) Barker, 1960, p. 122, pl. 59, fig. 7, 15; Anderson, 1975, pl. 6, fig. 2; Ingle et al., 1980, p. 134.

Distribution. *F. annectens* appears in some surface samples from depths between 2120 m and 3985 m, and single specimens are seen in three core samples.

Fissurina crebra (Mathes)

Lagena crebra Mathes, 1939, Paleontogr. vol. 90, Abt. A, p. 72.
Fissurina crebra (Mathes) Barker, 1960, p. 122, pl. 59, fig. 6; Anderson, 1975, pl. 6, fig. 5; Milam and Anderson, 1981, pl. 6, fig. 4.

Distribution. This species occurs in small numbers in some samples taken from between 2200 m and 3985 m, and one specimen was seen in a core sample.

Fissurina kerguelenensis Parr

Fissurina kerguelenesis Parr, 1950. Brit. Aust. New Zeal. Ant. Res. Exped., 1929-1931, Ser. B, vol. 5, no. 6, p. 305; Barker, 1960, p. 122, pl. 59, figs. 8-11; Anderson, 1975, pl. 6, fig. 8.

Distribution. This form appears in some samples from between 2000 m and 4046 m, never exceeding 1.0% of the total benthics. A few specimens were seen in the top 4 meters of the cores.

Fissurina orbignyana Seguenza

Fissurina orbignyana Seguenza, 1862, p. 66, pl. 2, figs. 25-26. Barker, 1960, p. 124, pl. 59, figs. 18, 20, 26; Ingle et al., 1980, p. 136.

Distribution. This species occurs in small numbers in most surface samples from between 2200 m and 3985 m, but seems present most consistently at around 2500 m to 2995 m. Two specimens were seen in core samples from the upper two metres.

Fissurina seguenziana (Fornasini)

Fissurina seguenziana Fornasini, 1886. Boll. Soc. Geol. Ital. vol. V, (1887), p. 350; Barker, 1960, p. 122, pl. 59, fig. 1.

Distribution. Very rare, a single specimen found in a surface sample from 3985 m, and one in the piston core at 802-804 cm.

Fissurina sulcata Seguenza

Fissurina sulcata Seguenza, 1862, p. 67, pl. 2, fig. 29.
Fissurina sulcata (Walker and Jacb) Barker, 1960, p. 127, pl. 60, figs. 35-37.

Distribution. This species is present in three surface samples from between 3880 m and 4046 m, always in very low concentrations. Four specimens were also seen in the uppermost metre of the cores.

Fissurina spp.

Remarks. This informal designation is given to a variety of indeterminate forms encountered in the study area which are too poorly preserved or too anmalous t be definitely assigned to one or another of the *Fissurina* species described above.
Distribution. Single specimens are seen in some surface samples and several core samples.

Genus *Parafissurina* Parr, 1947

Parafissurina tectulostoma Loeblich and Tappan

Parafissurina tectulostoma Loeblich and Tappan, 1953. Smithson, Mis. Coll. vol. 121, (7) p. 81, pl. 14, fig. 17; Vilks, 1969, p. 49, pl. 3, fig. 1a-b; Cole, 1981, p. 85, pl. 19, fig. 36.

Distribution. Small numbers of this species are seen in some samples from 2000 m to 3050 m, and a few specimens were seen in the upper 1.5 m of the cores.

Superfamily *Buliminacea* Jones, 1895

Family Turrilinidae Cushman, 1927

Subfamily Turrilininae Cushman, 1927

Genus *Buliminella* Cushman, 1911

Buliminella elegantissima (d'Orbigny)

Bulimina elegantissima d'Orbigny 1839. Voy. dans l'Amèr. Mérid. Foram. vol. 5 (5), p. 51, pl. 7, figs. 13-14.

Buliminella elegantissima (d'Orbigny) Cushman and Parker, 1931. Proc. U.S. Nat. Mus. vol. 80, p. 13, pl. 3, figs. 12-13; Barker, 1960, p. 104, pl. 50, figs. 20-22; Anderson, 1975, pl. 7, fig. 18; Cole and Ferguson, 1975, pl. 6, figs. 8-9; Ingle et al., 1980, p. 131; Cole, 1981, p. 85-86, pl. 10, fig. 6; Blanc-Vernet, 1983, p. 504.

Distribution. Very rare, scattered individuals occur in several surface samples from a variety of depths, and a few more specimens were seen in core material.

Genus *Tosaia* Takayanagi, 1953

Tosaia hanzawai Takayanagi

Tosaia hanzawai Takayanagi, 1953. Tohoku Univ. Inst. Geol. Paleon. Short Papers, no. 5, p. 30, pl. 40, fig. 7; Cole, 1981, p. 86-87, pl. 11, fig. 11.

Remarks. Except for its calcareous test, this species bears a very close resemblance to *Eggerella bradyi*, as previously noted. Well-preserved specimens exhibit a hyalinity which precludes mistaking them for the agglutinated form, but older, etched ones can be quite ambiguous.
Distribution. A fairly common form in the study material, *T. hanzawai* occurs in most surface samples down to 4046 m, sometime exceeding 1.0% of the benthic assemblage. It is also present in small numbers in the upper three metres of the cores.

Family Bolivinitidae Cushman, 1927

Genus *Bolivina* d'Orbigny, 1839

Bolivina aff. *earlandi* Parr

Bolivina earlandi Parr, 1950. Brit. Austral. New Zeal. Ant. Res. Exped. Ser. B, vol. 9, no. 6, p. 339; Barker, 1960, p. 106, pl. 52, figs. 18-19.

Remarks. This relatively small species bears a resemblance to *B. earlandi* as pictured by Barker (1960), though its exact identification is uncertain. It is possible that this form may in fact merely represent well-preserved specimens of *Bolivina pseudopunctata*, which it certainly closely resembles. Its test is so thin and fragile that chambers tend to break off even when handled with the utmost care.
Distribution. Present in only one surface sample from 2996 m, it is quite common in core material, often composing 10% or more of benthic foraminiferal assemblages. It is present in over 60% of all subsurface samples.

Bolivina cf. *inflata* Heron-Allen and Earland

Bolivina inflata Heron-Allen and Earland, 1913. Roy. Irish Acad. Proc. vol. 31 (3), p. 68, pl. 4, figs. 16-19; Cole, 1981, p. 87, pl. 11, fig. 14.

Distribution. This form is found only in small numbers in a few core samples.

Bolivina pseudoplicata Heron-Allen and Earland

Bolivina pseudoplicata Heron-Allen and Earland, 1930. Roy. Mic. Soc. London J., ser. 3, p. 81, pl. 3, figs. 36-40; Feyling-Hanssen et al., 1971, Bull. Geol. Soc. Denmark, vol. 21, (3), p. 243, pl. 7, fig. 16, pl. 18, fig. 11; Cole and Ferguson, 1975, pl. 6, fig. 5.

Remarks. This rugose form is very small, and can easily be missed in a rich sample.
Distribution. Very rare, occurring in 4 surface samples from various depths, and occasional specimens were seen in a few core samples.

Bolivina pseudopunctata Höglund

Bolivina pseudopunctata Höglund, 1947. Zool. Bidr. Uppsala, Bd. 26, p. 273, pl. 24, fig. 5; pl. 32, figs. 23-24, text-figs. 280-281, 287; Cole and Ferguson, 1975, pl. 6, fig. 6; Cole, 1981, p. 87-88, pl. 11, fig. 12.

Distribution. *B. pseudopunctata* is quite rare in surface material, occurring in small numbers in a few samples from 3542 m to 4046 m. It is a common constituent, however, of core material, sometimes comprising over 10% of benthic species and reaching 27% at 651 - 653 cm.

Bolivina pygmaea Brady

Bolivina pygmaea Brady, 1881. Deutsch. r.d.k. Adad. Wiss. Wien, vol. 43, p. 27; Barker, 1960, pl. 53, figs. 5-6; Ingle et al., 1980, p. 131; Cole, 1981, p. 88, pl. 19, fig. 37.

Distribution. Two specimens of this species were seen in a surface sample from 4046 m. It was not encountered in any subsurface material.

Bolivina striatula Cushman

Bolivina striatula Cushman, 1922c. Carnegie Inst. Washington Publ. 311, p. 27, pl. 3, fig. 10; Höglund, 1947, Zool. Bidr. Uppsala, Bd. 26, pl. 24, fig. 4; Cole, 1981, p. 88, pl. 19, fig. 38.

Distribution. This species is very rare in the study area, occurring in very small numbers in 2 surface samples at 2120 m and 2750 m. It also appears in 2 core samples both near 750 cm.

Bolivina subaenariensis Cushman

Bolivina subaenariensis Cushman 1937. Cushman Lab. Foram. Res. Spec. Publ. 9, p. 156; Barker, 1960, p. 110, pl. 53, figs. 10,11; Rodriguez and Hooper, 1982b, p. 343; Williamson, 1983, p. 218, pl. 3, fig. 11.
Brizalina subaenariensis (Cushman) Barbieri and Medioli, 1969, p. 856, pl. 62, fig. 2a,b.

Distribution. This bolivinid is present only in small numbers in the lower parts of the piston core.

Bolivina subspinescens Cushman

Bolivina subspinescens Cushman, 1922a. U.S. Nat. Mus. Bull. 104 (3), p. 48, pl. 7, fig. 5; Barker, 1960, p. 108, pl. 52, figs. 24-25; Ingle et al., 1980, p. 131; Cole, 1981, p. 88; Williamson, 1983, p. 218, pl. 3, fig. 10.

Distribution. *B. subspinescens* occurs in only two surface samples, at 2000 m and 2200 m, never exceeding 1.0% of the benthic total. A few specimens were also found in several core samples from below 250 cm.

Family Islandiellidae Loeblich and Tappan, 1964

Genus *Islandiella* Nørvang, 1959

Islandiella norcrossi (Cushman)

Cassidulina norcrossi Cushman, 1933b. Smiths, Misc. Coll. 89 (9), p. 7, pl. 3, fig. 7; Lagoe, 1977, p. 127, pl. 5, fig. 17.

Islandiella norcrossi (Cushman) Nørvang, 1959. Vid. Medd. Dansk. Nat. Foren. 14, p. 32, pl. 7, figs. 8-13; pl. 8, fig. 14. Vilks, 1969, p. 49, pl. 3, figs. 4a-b; Feyling-Hanssen et al., 1971, Bull. Geol. Soc. Denmark, vol. 21, pts. 2-3, p. 248, pl. 8, figs. 1-2. Cole and Ferguson, 1975, pl. 9, fig. 3; Belanger and Streeter, 1980, p. 416; Cole, 1981, p. 89, pl. 19, figs. 40-41; Feyling-Hanssen, 1981, pl. 1, figs. 25-26; Rodriguez and Hooper, 1982b, p. 348.

Distribution. This well-documented form is not seen in surface samples in the study area, but is fairly widespread in core material, though rarely exceeding 5.0% of the total benthic assemblage.

Family Eouvigerinidae Cushman, 1927

Genus *Stilostomella* Guppy, 1894

Stilostomella sp. cf. *antillea* (Cushman)

Nodosaria antillea Cushman, 1923. U.S. Nat. Mus. Bull. 104, pt. 4, p. 91.
Stilostomella antillea (Cushman) Barker, 1960, p. 158, pl. 76, figs. 9-10. LeRoy and Levinson, 1974, p. 9, pl. 5, fig. 5.

Remarks. This species appears to closely resemble *S. antillea* but not enough specimens were obtained to enable more specific identification.
Distribution. Only one specimen was collected from 400-402 cm in the piston core.

Family Buliminidae Jones, 1875

Subfamily Bulimininae Jones, 1875

Genus *Bulimina* d'Orbigny, 1826

Bulimina alazanensis Cushman

Bulimina alazanensis Cushman, 1927b. J. Paleo., vol. 1, (2), p. 161, pl. 25, fig. 4; Barker, 1960, p. 104, pl. 51, figs. 18,19; LeRoy and Hodgkinson, 1975, pl. 9, fig. 3; Cole, 1981, p. 89, pl. 19, fig. 42.

Distribution. Only two specimens of this type were seen, one in a surface sample from 2750 m, and the other from 20-22 cm in the piston core.

Bulimina gibba Fornasini

Bulimina gibba Fornasini, 1902. Mem. Reale Acc. Sci. Inst. Bologna, Sers. V, vol. 9, p. 377; Barker, 1960, p. 102, pl. 50, figs. 1-4; Anderson, 1975, pl. 7, fig. 23; Belanger and Streeter, 1980, p. 416-417; Feyling-Hanssen, 1981, pl. 1, figs. 13-16.

Distribution. *B. gibba* appears in very small numbers in two widely scattered surface samples, at 2120 m and 3500 m. It is very rare in subsurface material.

Bulimina notovata Chapman

Bulimina notovata Chapman, 1941. Trans. Roy. Soc. South Australia, vol. 65, p. 166; Barker, 1960, p. 102, pl. 50, fig. 13.

Distribution. Only two specimens of this type were encountered in the study area, one in a surface sample at 2200 m, the other in a core sample.

Bulimina striata d'Orbigny

Bulimina striata d'Orbigny, 1826, Ann. Sci. Nat. vol. 7, p. 269; Barker, 1960, p. 104, pl. 51, figs. 10-11; Williamson, 1983, p. 220-221, pl. 3, fig. 14.

Distribution. One of the more common species in the upper range of samples, this form is seen in all samples taken from between 2000 m and 2750 m, and never in deeper ones. At 2000 m it comprises 5.0% of the total foraminiferal assemblage, lessening to trace levels at 2750 m. It is very rare in subsurface samples.

Genus *Globobulimina* Cushman, 1927

Globobulimina auriculata (Bailey)

Bulimina auriculata Bailey, 1851, Smithson. Contr., vol. 2, p. 12, pl. 1, figs. 25-27; Ingle et al., 1980, p. 131.

Globobulimina auriculata (Bailey) Barbieri and Medioli, 1969, p. 857, pl. 64, figs. 1a-b; 2a-d; Rodriguez and Hooper, 1982b, p. 344; Williamson, 1983; p. 221, pl. 3, fig. 17.

Globobulimina sp. Miller and Lohmann, 1982, pl. 1, fig. 5 non fig. 8.

Remarks. This well-described species is unique enough in its appearance to make it difficult to confuse with any others. However, there have been several morphotypes of the species described, and for the purposes of this study, all have been included in this designation.
Distribution. The primary range of *G. auriculata* in surface samples is from 2000 m to 2995 m, where it sometimes comprises over 5% of the total benthic assemblage. Occasional appearances occur in lower depth ranges. The form appears in a few core samples, more commonly in the uppermost 1.5 m.

Genus *Stainforthia* Hofker, 1956

Stainforthia concava (Höglund)

Virgulina concava Höglund, 1947. Zool. Bidr. Uppsala, Bd. 26, p. 257, pl. 23, figs. 3-4; pl. 32, figs. 4-7; text-figs. 273-275.

Stainforthia concava (Höglund) Loeblich and Tappan, 1964, p. C561; Cole, 1981, p. 91, pl. 9, fig. 5; Williamson, 1983, p. 221-222, pl. 3, fig. 18.

Remarks. In the study area this important form conforms quite closely to the descriptions and illustrations given for it in the above cited literature.
Distribution. One of the most common species from surface samples, it is not seen deeper than 4046 m. It is most prevalent in the 2000-2500 m range, often exceeding 5% of the benthic total. At one of the 2500 m samples, it accounts for nearly 20% of the benthic total. Also common in core material, this form occasionally comprises 10% or more of assemblages, but is usually seen in somewhat smaller numbers. This species may be similar to *Fursenkoina. fusiformis* of other authors (i.e. Scott et al., 1984).

Family *Uvigerinidae* Haeckel, 1894

Genus *Uvigerina* d'Orbigny, 1826

Uvigerina asperula Czjzek

Uvigerina asperula Czjzek, 1848. Nat. Abh. Wien., Osterr. Bd. 2, Abth. 1, p. 146, pl. 13; figs. 14-15; Barker, 1960, p. 156, pl. 75, figs. 6-9; Anderson, 1975, pl. 7, fig. 24; pl. 8, fig. 2; Cole, 1981, p. 91, pl. 11, fig. 7; Blanc-Vernet, 1983, p. 506.

Uvigerina peregrina asperula (Cushman) Ingle et al., 1980, p. 146.

Remarks. *U. asperula* appears in the study area in two separate morphotypes, a small form (150 - 300 mμ in length with a somewhat hyaline appearance) and a larger type (400 - 800 mμ in length) with a relatively thicker and more rugged test. The two forms, possibly ecophenotypes, have somewhat different ranges of occurrence in the study area.
Distribution. The smaller form of *U. asperula* appears in a few surface samples at 2500 m and 3985 m and in somewhat larger numbers (nearly 4.0%) at 4046 m. In core material, the smaller type is fairly common, often exceeding 5% of the assemblage, occasionally reaching 20%. The larger form is not seen in surface samples, appearing in only small numbers in several core samples, almost invariably in company with *U. peregrina.*

Uvigerina peregrina Cushman

Uvigerina peregrina Cushman, 1923. U.S. Nat. Mus. Bull. 104 (4), p. 166, pl. 42, figs. 7-10; LeRoy and Levinson, 1974, p. 10, pl. 5, fig. 18; Lohmann, 1978, p. 26, pl. 4, figs. 14-15; Boltovskoy, 1980b, p. 355, pl. 2, figs. 31-32; Ingle et al., 1980, p. 146, pl. 3, fig. 6; pl. 5, figs. 14-15; Cole, 1981, p. 92, pl. 10, fig. 9; Feyling-Hanssen, 1981, pl. 1, figs. 7-8; Miller and Lohmann, 1982, pl. 1, figs. 11-12; Blanc-Vernet, 1983, p. 506, pl. 2, figs. 1-3; Williamson, 1983, p. 222, pl. 4, fig. 3.

Euuvigerina peregrina (Cushman) Barker, 1960, p. 154, pl. 74, figs. 11-12.

Remarks. As can be seen from the extensive reference list, this species is well known and has been described and depicted many times.
Distribution. *U. peregrina* occurs in only three samples of surface sediments in the study area, ranging from 2487 m to 4046 m depth. Its greatest concentration is at the upper level, where it exceeds 5% of the total benthic assemblage. In subsurface material this is one of the

more common species, in several cases accounting for more than 30% of the total benthic foraminifera, even in samples where the fauna is very sparse.

Uvigerina spinicostata Cushman & Jarvis

Uvigerina spinicostata Cushman and Jarvis, 1929. Cushman lab. Foram. Res. vol. 5 (1), no. 72, p. 12, pl. 3, figs. 9-10. LeRoy and Levinson, 1974, p. 10, pl. 5, fig. 14. LeRoy nd Hodgkinson, 1975, pl. 9, fig. 6; Cole, 1981, p. 92, pl. 19, fig. 45.

Remarks. This species somewhat resembles *U. peregrina* except that in the uppermost whorl(s) of chambers, the longitudinal costae are broken up into irregular rows of spines. There may well be a gradation between *U. spinicostata* and *U. peregrina* to which it is certainly closely related.
Distribution. *U. spinicostata* is one of the most common forms in surface samples from the 2000 m to 2487 m depth range, often accounting for over 20% of the total benthic assemblage, especially at 2200 m and above. From 2500 m to 2750 m it is limited to less than 5% of the benthic totals, and below that its appearance is sporadic and in small numbers. In core material this species is quite rare, occurring in small numbers in the upper 1.5 m, but only very occasionally below that.

Genus *Trifarina* Cushman, 1923

Trifarina angulosa (Williamson)

Uvigerina angulosa Williamson, 1858. Rec. Foram. Great Britain, p. 67, pl. 5, fig. 140.
Angulogerina angulosa (Williamson) Höglund, 1947. Zool. Bidr. Uppsala, Bd. 26, p. 283, pl. 23, fig. 8; text-figs. 305-308; Barker, 1960, p. 154, pl. 74, figs. 15-16; Feyling-Hanssen, 1981, pl. 1, fig. 10.
Trifarina angulosa (Williamson) Michelson, 1967. Meddr. Dansk. Geol. Foren. 17, p. 227, pl. 2, fig. 13; Barbieri and Medioli, 1969, p. 857-858, pl. 65, figs. 1-5; Anderson, 1975, pl. 8, fig. 4; Belanger and Streeter, 1980, p. 417; Ingle et al., 1980, p. 144, pl. 3, figs. 1,4; Cole, 1981, p. 92, pl. 19, fig. 46; Blanc-Vernet, 1983, p. 506; Williamson, 1983, p. 222, pl. 4, fig. 1.

Remarks. This well-known species has been amply described in the existing literature. It is possible in the present study that a few specimens of the closely-related *Trifarina fluens* (Todd) are included in this designation.
Distribution. *T. angulosa* occurs in most samples from depths less than 3050 m, but only in small numbers, usually less than 1.0% of the benthic total. In core material it is represented only by a few scattered specimens.

Superfamily Discorbacea Ehrenberg, 1838

Family Discorbidae Ehrenberg, 1838

Subfamily Discorbinae Ehrenberg, 1838

Genus *Buccella* Anderson, 1952

Buccella frigida (Cushman)

Pulvinulina frigida Cushman, 1922b. Contr. Can. Biol. no. 9, p. 12.
Eponides frigida (Cushman) Cushman, 1931. U.S. Nat. Mus. Bull. 104 (8), p. 45.
Buccella frigida (Cushman) Anderson, 1952. Washington Acad. Sci. J. vol. 42 (5), p. 144, text-figs. 4-6; Loeblich and Tappan, 1953, p. 115, pl. 22, figs. 2-3; Barker, 1960, p. 216, pl. 105, figs. 8-9; Vilks, 1969, p. 49, pl. 3, figs. 7a-b; Cole and Ferguson, 1975, pl. 8, figs. 8-9; Lagoe, 1977, p. 126, pl. 4, figs. 3-4; Cole, 1981, p. 94, pl. 10, fig. 10.

Distribution. In the present study, *B. frigida* was limited to occasional appearances in core material below 800 cm, being totally absent in surface samples.

Genus *Discopulvinulina* Hofker, 1951

Discopulvinulina bertheloti (d'Orbigny)

Rosalina bertheloti d'Orbigny, 1839. *In* de la Sagra, "Hist. Phys. Pol. Nat. Cuba", vol. 8, p-. 135, pl. 1, figs. 28-30.
Discorbis bertheloti (d'Orbigny) Cushman, 1931. U.S. Nat. Mus. Bull. vol. 8, p. 16, pl. 3, fig. 2.
Discopulvinulina bertheloti (d'Orbigny) Barker, 1960, p. 184, pl. 89, figs. 11-12.
Cibicides bertheloti (d'Orbigny) Feyling-Hanssen, 1964. Norges Geol. Unders. NR 225, p. 338, pl. 18, figs. 21-24; Cole, 1981, p. 103-104, pl. 12, fig. 7.

Distribution. This species was only encountered as single specimens in 4 core samples from various levels.

Genus *Epistominella* Husezima and Maruhasi 1944

Epistominella exigua (Brady)

Pulvinulina exigua Brady, 1884. Rep. Voy. Challenger, Zool. 9, p. 696, pl. 103, figs. 13-14.
Eponides exigua (Brady) Cushman, 1931. U.S. Nat. Mus. Bull. 104 (8), p. 44, pl. 10, figs. 1-2.
Epistominella exigua (Brady) Parker, 1954. Bull. Mus. Comp. Zool. vol. 111 (10), p. 533, pl. 10, figs. 22-23; Barker, 1960, p. 212, pl. 103, figs. 13-14; Anderson, 1975, pl. 8, figs. 9a-b; Corliss, 1979, p. 7, pl. 2, figs. 7-9; Belanger and Streeter, 1980, p. 417; Boltovskoy, 1980a, pl. 3, figs. 13a-b; Ingle et al., 1980, p. 134, pl. 2, fig. 4; Cole, 1981, p. 95, pl. 11, fig. 2; Blanc-Vernet, 1983, p. 504-505.

Remarks. This is a relatively small, hyaline species which often exhibits a star-shaped pattern in its sutures when viewed optically. It is possible in the present study that some specimens of *Epistominella vitrea*, Parker (figured in Cole, 1981, p. 95, pl. 11, figs. 3-4) a closely related or synonymous form, have been counted under this heading.
Distribution. In surface samples from less than 3000 m water depth, *E. exigua* appears sporadically in very small numbers, but below that it is present more consistently and in slightly higher concentrations, comprising over 9% of the total benthic assemblage at 3985 m. This form is present in small numbers in several parts of the cores, occasionally reaching 5% or more of the total, especially in levels below 750 cm.

Epistominella takayanagii Iwasa

Epistominella takayanagii Iwasa, 1955. J. Geol. Soc. Japan, vol. 61, p. 16, text-fig. 4.
Pseudoparrella takayanagii (Iwasa) Rodriguez and Hooper, 1982b, p. 348.

Distribution. The occurrence of this species in this survey is limited to core samples, where it occurs quite frequently, often composing 2-5% of the total benthic assemblage.

Epistominella umbonifera (Cushman)

Pulvinulinella umbonifera Cushman, 1933d, Contr. Cushman. Lab. Foram. Res. vol. 9, pt. 4, p. 90, pl. 9, fig. 9a-c.
Epistominella (?) *umbonifera* (Cushman) Phleger et al., 1953, pl. 9, figs. 33-34.
"Epistominella" umbonifera (Cushman) Lohmann, 1978, p. 2-6, pl. 3, figs. 1-6.
Nuttalides umbonifer (Cushman) Anderson, 1975, p. 88, pl. 8, fig. 14.
Epistominella umbonifera (Cushman) Corliss, 1979, p. 7, pl. 2, figs. 10-12. Corliss and Honjo, 1981, p. 359, pl. 3, figs. 1-15.

Remarks. This species, although known by many names, has been well documented and illustrated many times. In this study, the specimens of *E. umbonatus* encountered often exhibited a rough "sugary" appearance, making individual chambers difficult to distinguish. Its characteristic overall shape, however, makes it difficult to confuse with other forms.
Distribution. This form is absent from all surface samples taken from water dpeths less than 2750 m. Below that level, it becomes more and more common down to 3985 m where it constitutes more than 50% of the total benthic assemblage. Its numbers taper off again below this depth, falling to less than 20% of the benthic total at 4925 m.
This is also a principal component of core assemblages to 150 cm depth, and is often the only component of the very sparse samples down to 260 cm. Below this point, its occurrences are sporadic and limited to small numbers.

Genus *Stetsonia* Parker, 1954

Stetsonia minuta Parker

Stetsonia minuta F. Parker, 1954. Bull. Mus. Comp. Zool. vol. 111 (10), p. 534, pl. 10, figs. 27-29; Cole, 1981, p. 97, pl. 19, figs. 56-57.

Distribution. This tiny form appears only occasionally in surface samples, at 2500 m, 2995 m and 3985 m, always in numbers less than 1.0% of the benthic total. It is very rare in core material, seen only as single specimens in a few samples.

Subfamily Baggininae Cushman, 1927

Genus *Valvulineria* Cushman, 1926

Valvulinera sp. cf. *arctica* Green

Valvulineria arctica Green, 1958. U.S.A.F. Cambridge Res. Centre Geophysics Res. Paper 63, vol. 1, paper 6, p. 78, pl. 1, fig. 3; Vilks, 1969, p. 49, pl. 3, fig. 9a-c; Cole, 1981, p. 97-98, pl. 12, fig. 3.

Remarks. The form designated by this name in the present study is similar to *V. arctica* Green, but does not appear to be identical. However, it is obviously a closely related form and some specimens readily conform to that type.
Distribution. Absent in surface material, this species is very common in core samples below 260 cm, often exceeding 10% of the total benthic assemblages.

Superfamily Rotaliacea Ehrenberg, 1938

Family Elphidiidae Galloway, 1933

Subfamily Elphidiinae Galloway, 1933

Genus *Elphidium* de Montfort, 1808

Elphidium excavatum (Terquem) forma *clavata* Cushman

Elphidium excavatum (Terquem) forma *clavata* Cushman. Feyling-Hanssen, 1972, p. 339-340, pl. 1, figs. 1-9; pl. 2, figs. 1-9; Poag et al., 1980, pl. 1, fig. 12; Feyling-Hanssen, 1981, pl. 2, figs. 20-21; Miller et al., 1982, p. 124-128, pl. 1, figs. 5-8; pl. 2, figs. 3-8; pl. 3, figs. 3-8; pl. 4, figs. 1-6; pl. 5, figs. 4-8; pl. 6, figs. 1-5; Williamson, 1983, p. 224, pl. 5, fig. 9.

Remarks. This is an enigmatic species group, showing a great deal of ecophenotypic variation (Miller et al., 1982). The specimens encountered in this survey fall into two main ecophenotypes, one from the surface samples, the other from core material below the 250 cm level.
The "surface" form is larger, very white and quite opaque. According to Miller (pers. comm., 1985), it is a deep-water ecophenotype common on the Scotian Slope from 1000 m down.
The form found below 250 cm in the core is comparatively smaller, often translucent, and may exhibit a brownish stain. It appears to correspond very closely to the *Elphidium excavatum* forma *clavata* of late glacial faunas described by Vilks (1981).
Distribution. The larger 'deep-water" form is the dominant member of all surface samples from depths less than 2750 m, and comprises over 50% of the benthic totals at 2000 m, 2205 m, and 2500 m. Below 2750 m its appearance is occasional and rarely does it constitute more than 2.0% of a fauna. It is also fairly common in the upper 100 cm of the cores, but its appearance is much more sporadic below that.
The "late glacial" form is not encountered in surface samples, but is very common in core material below 250 cm, often exceeding 10% of total benthics, and even larger proportions in some samples which contain only a few foraminifera.

Superfamily Globigerinacea Carpenter, Parker and Jones, 1862

Family Heterohelicidae Cushman, 1927

Subfamily Heterohelicinae Cushman, 1927

Genus *Heterohelix* Ehrenberg, 1843

Heterohelix cf. *americana* (Ehrenberg)

Textularia americana Ehrenberg, 1843. Abh. K. Akad. Wiss. Berlin. Phys.-Math. Cl. Jahrg. 1841, pp. 336, 398, 429.

Heterohelix americana (Ehrenberg) Loeblich, 1951. Cushman Found. Foram. Res. Contr., vol. 2, pt. 3, p. 107; Loeblich and Tappan, 1964, fig. 523, 5a,b.

Remarks. Test very small, biserial, with 7-9 visible globular chambers. Last chamber somewhat inflated, and all densely covered with fine longitudinal costae which are usually only barely visible with a binocular microscope. Aperture is large, sutural and forms a semicircular arch. Microspheric forms are commonly planispiral in early stages.
Loeblich and Tappan (1964) give the stratigraphic range of this form as Maastrichtian, thus its appearance in this study material must be viewed as a result of reworking. It is included in the present study because it is the only Mesozoic reworked species to appear in these samples. Oddly, its preservation is usually quite good, and the form could easily be mistaken for juvenile specimens of some biserial benthic taxon.
Distribution. This species is present only below 290-292 cm in the piston core. It occurs in approximately 1/3 of all samples below this level, and sometimes comprises over 5% of the total assemblage, even in a few samples with very poor faunas.

Superfamily Orbitoidacea Schwager, 1876

Family Eponididae Hofker, 1951

Genus *Eponides* de Montfort, 1808

Eponides bradyi Earland

Eponides bradyi Earland, 1934. Discovery Rep. vol. 10, p. 187, pl. 8, figs. 36-38; Cole, 1981, p. 102, pl. 11, fig. 5; Boltovskoy, 1980a, pl. 3, figs. 3a-b.

Distribution. This small form occurs in several surface samples from between 2200 m and 3985 m. In two locales it exceeds 3.0% of the total. It is also fairly common in subsurface material, often making up 2-3% of the total benthic assemblage.

Family Cibicididae Cushman 1927

Subfamily Planulininae Bermudez 1952

Genus *Planulina* d'Orbigny, 1826

Planulina wuellerstorfi (Schwager)

Anomalina wuellerstorfi Schwager, 1866. Novara Exped., Geol. Theil., vol. 2, p. 258, pl. 7, figs. 105, 107.
Truncatulina wuellerstorfi (Schwager) Brady, 1884. Rep. Voyage Challenger, Zool. (9), p. 662, pl. 93, fig. 9.
Planulina wuellerstorfi (Schwager) Cushman, 1929a. Cushman Lab. Foram. Res. Contr. vol. 5, p. 104, pl. 15, figs. 1-2. Barker, 1960, p. 192, pl. 93, fig. 9; Lagoe, 1977, p. 127, pl. 5, figs. 1-2; Lohmann, 1978, p. 26, pl. 2, figs. 1-4; Corliss, 1979, p. 7-8, pl. 2, figs. 13-16; Ingle et al., 1980, p. 142; Corliss and Honjo, 1981, p. 362, pl. 8, figs. 1-16; Williamson, 1983, p. 225, pl. 4, figs. 8-9.
Cibicidoides wuellerstorfi (Schwager) LeRoy and Levinson, 1974, p. 16, pl. 7, figs. 1-3.
Cibicides wuellerstorfi (Schwager) Belanger and Streeter, 1980, p. 417. Boltovskoy, 1980a, pl. 2, figs. 5-7; Blanc-Vernet, 1983, p. 504, pl. 1, figs. 4-5.

Remarks. This well-known forms is represented by fairly typical specimens in this study. The brown staining reported by Cole (1981) was seen in only a very few individuals, the remainder being either perfectly white or, more rarely, translucent.
Distribution. This rather common form is found in most surface samples, but was most prevalent in depths between 2500 m and 4030 m. At 3880 m, *P. wuellerstorfi* makes up over 6.0% of the total benthic assemblage. In core material, however, it disappears rapidly with depth, and is absent below 150 cm.

Subfamily Cibicidinae Cushman, 1927

Genus *Cibicides* de Montfort, 1808

Cibicides lobatulus (Walker and Jacob)

Nautilus lobatulus Walker and Jacob, 1798. *In* Adam's "Essays on the microscope", p. 642, pl. 14, fig. 36.
Cibicides lobatulus (Walker and Jacob) Cushman, 1931. U.S. Nat. Mus. Bull. 104, vol. 8, p. 118K, pl. 21, fig. 3; Barker, 1960, p. 190, 192, pl. 92, fig. 10, pl. 93, figs. 1,4,5; Barbieri and Medioli, 1969, p. 860-861; Vilks, 1969, p. 50, pl. 3, figs. 17a-b; Anderson, 1975, pl. 10, fig. 4; Cole and Ferguson, 1975, pl. 8, figs. 5-6; Poag et al., 1980, pl. 1, figs. 10-11; Reyling-Hanssen, 1981, pl. 2, fig. 6; Miller and Lohmann, 1982, pl. 1, fig. 4; Rodriguez and Hooper, 1982b, p. 343; Blanc-Vernet, 1983, p. 504; Williamson, 1983, p. 226, pl. 4, figs. 10-11.
Cibicidoides lobatulus (Walker and Jacob) LeRoy and Hodgkinson, 1975, pl. 9, figs. 22-23; Corliss, 1979, p. 10, p. 3, figs. 7-9.
Cibicides cf. *lobatulus* (Walker and Jacob) Belanger and Streeter, 1980, p. 417; Milam and Anderson, 1981, pl. 9, fig. 4.
Cibicides sp. Cole, 1981, p. 105, pl. 11, figs. 9-10.

Remarks. One of the most well-known of all benthic foraminifera largely because of its nearly cosmopolitan abundance in shelf and nearshore areas, this form is nevertheless also an important component of the benthic assemblages of the present survey.
C. lobatulus appears in two fairly distinct morphotypes on the lower Scotian slope and rise; the "typical' fairly large form familiar to many workers, and a smaller, more irregular form similar or identical to Cole's (1981) "*Cibicides* sp." listed above. It is the author's opinion that the small form is more common in sediments which have few or no clastic particles large enough for this normally attached form to properly adhere to. Evidence for this contention comes from the observation that the spiral side of the small form is much less likely to be as smooth and regular as in the case of a "typical" larger specimen.
Distribution. The "small" form of *C. lobatulus* is found in small numbers in most surface samples. At 3880 m it comprises over 6.0% of the benthic total, and at 4046 m, 5.0%. It tends to be somewhat less widespread above 2750 m. In the cores the small form occurs in most levels in fairly small numbers.
The larger, "typical" form occurs in small numbers in a few surface samples from between 2995 m and 3985 m, and in only very small numbers in a few of the uppermost core samples.

Cibicides robertsonianus (Brady)

Planorbulina (Truncatulina) robertsoniana Brady, 1881. Quart. J. Micr. Sci. No. 8, vol. 21, p. 65.

Cibicides robertsonianius (Brady) Cushman, 1931. U.S. Nat. Mus. Bull. 104, vol. 8, p. 121, pl. 23, fig. 6; Barker, 1960, p. 196, pl. 95, fig. 4; Cole, 1981, p. 104-105, pl. 12, fig. 5; Blanc-Vernet, 1983, p. 504.

Cibicidoides robertsonianus (Brady) LeRoy and Levinson, 1974, p. 16, pl. 8, figs. 10-11; LeRoy and Hodgkinson, 1975, pl. 9, figs. 19-20; Ingle et al., 1980, p. 132, pl. 9, fig. 10.

Distribution. Found in most surface samples from the 2750 m to 4046 m depth range, this form is most common (3.5%) at 4030 m. Small numbers of this species also occur in a few near-surface core samples.

Superfamily Cassidulinacea d'Orbigny, 1839

Family Caucasinidae Bykova, 1959

Subfamily Fursenkoininae Loeblich and Tappan, 1961

Genus *Fursenkoina* Loeblich and Tappan, 1964

Fursenkoina fusiformis (Williamson)

Bulimina pupoides fusiformis Williamson, 1858. Rec. foram. Great Brit., p. 63, pl. 5, figs. 129-130.

Bulimina fusiformis Williamson Höglund, 1947. Zool. Bidr. Uppsala, Bd. 26, p. 232, pl. 20, fig. 3, text-figs. 219-233.

Fursenkoina fusiformis (Williamson) Loeblich and Tappan, 1964, p. C732-C733; Anderson, 1975, pl. 10, fig. 11; Poag et al., 1980, pl. 1, figs. 7-8; Cole, 1981, p. 105-106, pl. 14, fig. 1; Milam and Anderson, 1981, pl. 9, fig. 6; Williamson, 1983, p. 226-227, pl. 5, fig. 1.

Virgulina fusiformis (Williamson) Feyling-Hanssen, 1964, Norges. Geol. Unders., Nr. 225, p. 307, pl. 14, figs. 15-18.

Cassidella fusiformis (Williamson) Lagoe, 1977, p. 127, pl. 4, fig. 5.

Distribution. *F. fusiformis* occurs at scattered localities from 2000-3985 m depth, always as less than 1.0% of the total benthic fauna. This species is present in small numbers at various depths in the cores.

Genus *Virgulina* d'Orbigny, 1826

Virgulina subdepressa Brady

Virgulina subdepressa Brady, 1884. Rep. Voy Chall. Zool. pt. 22, vol. 9, p. 416, pl. LII, figs. 14-17. Barker, 1960, p. 106, pl. 52, figs. 14-17.

Distribution. Quite rare; occurring as only two specimens in a surface sample from 2500 m, and a few individuals in several core samples from various levels.

Family Cassidulinidae d'Orbigny, 1839

Genus *Cassidulina* d'Orbigny, 1826

Cassidulina laevigata d'Orbigny

Cassidulina laevigata d'Orbigny, 1826. Ann. Sci. Nat. ser. 1, vol. 7, p. 282, pl. 15, figs. 4-5; Anderson, 1975, pl. 10, fig. 13; Boltovskoy, 1980b, p. 348; Feyling-Hanssen, 1981, pl. 1, figs. 19-21; Rodriguez et al., 1980, p. 50, 54.
Cassidulina laevigata carinata Silvestri. Ingle et al., 1980, p. 131, pl. 6, figs. 5-8.
Cassidulina neocarinata Thalmann. Williamson, 1983, p. 230-231, pl. 5, fig. 17.

Distribution. *C. laevigata* appears in four surface samples from various depths, always in small numbers. In subsurface material, this form is fairly common, and may be present in numbers from <1% of the total benthics to over 50% where it does appear.

Cassidulina reniforme Nørvang

Cassidulina crassa reniforme Nørvang, 1945. Zool. of Iceland, Foram, vol. 2 (2), p. 41, text-figs. 6e-h.
Cassidulina islandica Nørvang. Loeblich and Tappan, 1953. Smithson. Misc. Coll. 12 (7), p. 118, pl. 24, fig. 1, (non Nørvang).
Cassidulina crassa d'Orbigny. Nørvang, 1959, Dansk. Mat. F.V. Medd., vol. 120, p. 36, pl. 9, figs. 24-25 only.
Cassidulina crassa minima Boltovskoy, 1959. Rep. Argentina S. Mar. Serv. Hidr. nov. H1005, p. 100, pl. 13, fig . 12.
Cassidulina bradshawi Uchio, 1960. Cushman Found. Foram. Res. Sp. Publ. 5, p. 68, pl. 9, figs. 11-12.
Cassilaminella subacuta Gudina, 1966. Acad. U.S.S.R., Inst. Geol. and Geophys. p. 67, pl. 7, figs. 4-5; pl. 13, fig. 3.
Cassidulina subacuta (Gudina) Feyling-Hanssen, 1976. Mar. Sed. Sp. Publ. 1 (b), p. 354, pl. 2, figs. 14-19.
Cassidulina reniforme Nørvang. Rodriguez, Hooper and Jones, 1980. J. Foram. Res. vol. 10 (1), p. 58, pl. 2, figs. 2,4,6; pl. 3, figs. 3,8,9,11,12; pl. 5, figs. 10-12. Sejrup and Guilbault, 1980, p. 79-81; figs. 2f-k; Cole, 1981, p. 106-107, pl. 11, fig. 13; Feyling-Hanssen, 1981, pl. 1, fig. 23.

Remarks. Many descriptions and illustrations of this form exist in the contemporary literature, as is obvious from the above lengthy synonym.
Distribution. This species is very rare in surface material, appearing in only 3 samples, always in very small numbers. However, it is the single most common element in core material. In the upper 260 cm of the cores its numbers are fairly small, and is often absent. Below this level it becomes much more prevalent, often exceeding 50% of benthic foraminiferal assemblages. In those samples with very low foraminiferal content *C. reniforme* is often one of the few species present.

Family Nonionidae Schultze, 1854

Subfamily Chilostomellinae Brady, 1881

Genus *Chilostomella* Reuss *in* Czjzek, 1849

Chilostomella oolina Schwager

Chilostomella oolina Schwager, 1878. Boll. Uff. Geol. (R. Com. Geol. (Ital.)) vol. 9, p. 257, pl. 1, fig. 16; Barker, 1960, p. 112, pl. 55, figs. 12, 14, 17-18; Ingle et

al., 1980, p. 132, pl. 6, figs. 9-10; Cole, 1981, p. 108, pl. 19, fig. 65; Blanc-Vernet, 1983, p. 504.

Remarks. This distinctively ovoid form is difficult to confuse with any other species found in the study area.
Distribution. *C. oolina* is found in most surface samples from between 2120 m and 4046 m. Its numbers exceed 1.0% of the benthic total only at 2750 m and 2996 m. It is present in small numbers in only a few subsurface samples from various levels.

Subfamily Nonioninae Schultze, 1854

Genus *Nonion* de Montfort, 1808

Nonion barleeanum (Williamson)

Nonionina barleeana Williamson, 1858. Rec. Foram. Gt. Brit. p. 32, pl. 3, figs. 68, 69.
Nonion barleeanum (Williamson) Cushman and Henbest, 1940. U.S. Geol. Surv. Prof. Paper 196-A, p. 9, fig. 13.
Melonis zaandamae (van Voorthuysen) Loeblich and Tappan, 1953. Smithson. Misc. Coll. 12 (7), p. 87, pl. 16, figs. 11-12; Cole, 1981, p. 115-116, pl. 13, fig. 8.
Gavelinonion barleeanum (Williamson) Barker, 1960, p. 224, pl. 109, figs. 8-9.
Melonis barleeanum (Williamson Corliss, 1979, p. 10,12, pl. 5, figs. 7-8. Belanger and Streeter, 1980, p. 419; Ingle et al., 1980, p. 142, pl. 7, figs. 14-15; Blanc-Vernet, 1983, p. 505, pl. 2, figs. 12-13.

Remarks. Obviously many names exist for this form. I have chosen to retain Cushman and Henbest"s designation because of its seniority.
Distribution. This species occurs in most surface samples from between 2000 m and 4046 m. It appears to be most common from 2487 m to a3247 m, where it often exceeds 1.0% of the total benthic assemblage. At 3050 m it reaches 2.2%. It is also present in small numbers in many samples from the upper 1.5 m of the cores, but is much scarcer below that.

Nonion depressulus (Walker and Jacob)

Natilus depressulus Walker and Jacob, 1798. *In* Adam's Essays on the Microscope, p. 641, pl. 14, fig. 33.
Nonionina depressulus (Walker and Jacob) Parker and Jones, 1859. Ann. Mag. Nat. Hist., ser. 3, vol. 4, p. 339, 341.
Nonion depressulus (Walker and Jacob) MacFadyen, 1940. Geol. Mag. vol. 77, p. 379-381; Barker, 1960, p. 224, pl. 109, figs. 6-7; Cole, 1981, pl. 13, figs. 4, 7.

Remarks. This species can be distinguished from most similar ones by its growth of small papillae near the umbilicus. Even so, one form it does closely resemble is *Haynesina orbiculare* (Brady), and it is possible that some specimens counted as *N. depressulus* may in fact be the other species.
Distribution. *N. depressulus* occurs in most surface samples from 2120 m down to 4030 m, but is most prevalent from 2400 m to 3050 m, where it often exceeds 1.0% or 2.0% of the totals. It is also present in small numbers in a few samples from the upper 1500 m of the cores.

Nonion grateloupi (d'Orbigny)

Nonionina grateloupi d'Orbigny, 1826. Ann. Sci. Nat. Paris, ser. 1, vol. 7, p. 294, no. 19.
Nonion grateloupi (d'Orbigny) Schnitker, 1971. Tulane Studies in Geol. and Paleont., vol. 8, no. 4, p. 206, pl. 10, fig. 6; Cole, 1981, p. 108-109, pl. 14, fig. 3.
Florilus grateloupi (d'Orbigny) Boltovskoy, 1980b, p. 353.
Nonionella grateloupi (d'Orbigny) Ingle et al., 1980, p. 142.

Distribution. *N. grateloupi* occurs at scattered surface locations from between 2000 m to 3985 m depth, never exceeding 1.0% of the benthic totals. It is also present in small numbers in some levels of the cores, twice comprising over 5.0% of the total benthic fauna.

Genus *Astrononion* Cushman and Edwards, 1937

Astrononion gallowayi Loeblich and Tappan

Astrononion gallowayi Loeblich and Tappan 1953. Smithson. Misc. Coll., vol. 121, no. 7, p. 90, pl. 17, figs. 4-7; Vilks, 1969, p. 51, pl. 3, fig. 19; Cole and Ferguson, 1975, pl. 6, figs. 14-15; Cole, 1981, p. 109, pl. 13, fig. 6; Feyling-Hanssen, 1981, pl. 2, fig. 14; Rodriguez and Hooper, 1982b, p. 343; Williamson, 1983, p. 227, pl. 4, fig. 12.

Remarks. With its characteristic pattern of umbilical chamberlets, this species is readily identifiable and difficult to confuse with others.
Distribution. Present in only very small numbers in a few core samples.

Genus *Nonionella* Cushman, 1926

Nonionella atlantica Cushman

Nonionella atlantica Cushman 1947. Contr. Cushman. Lab. Foram. Res. vol. 23, no. 4, p. 90, pl. 20, figs.s 4-5; Parker, Phleger and Peirson, 1953, p. 11, pl. 3, figs. 30-31; Boltovskoy, 1980b, p. 354, pl. 2, figs. 13-14.

Distribution. This species occurs only as scattered individuals in one surface sample (3050 m), and a few core samples.

Nonionella turgida (Williamson)

Rotalina turgida Williamson 1858. Rec. Foram. Gt. Britain, p. 50, pl. 4, figs. 95-97.
Nonionina turgida (Williamson) Brady 1884. Rep. Voy. Challenger, Zool. 9, p. 731, pl. 109, figs. 17-19.
Nonionella turgida (Williamson) Cushman 1930. U.S. Nat. Mus. Bull. 104, vol. 7, p. 15, pl. 6, figs. 1-4; Barker, 1960, p. 224, pl. 109, figs. 17-19; Boltovskoy, 1980b, p. 354, pl. 2, figs. 15-17; Williamson, 1983, p. 228, pl. 4, fig. 13.

Distribution. Limited to subsurface material, the occurrence of this form is quite sporadic, appearing in only a few levels, but at 747-749 cm it makes up over 10.0% of the total benthic assemblage.

Genus *Nonionellina* Voloshinova 1958

Nonionellina labradorica (Dawson)

Nonionina labradorica Dawson 1860. Can. Nat. vol. 5, p. 191, fig. 4.
Nonion labradorica (Dawson) Cushman 1927a. Bull. Scripps. Inst. Oceanogr. Techn. ser. vol. 1, p. 148, pl. 2, figs. 7-8.
Nonionellina labradorica (Dawson) Voloshinova 1958. Mikrofauna SSR, Sb. 9, VNIGRI. Trudy, no. 115, p. 142; Barbieri and Medioli, 1969, p. 861, pl. 62, figs. 4a-c; Vilks, 1969, p. 51, pl. 3, figs. 20a-b; Cole and Ferguson, 1975, pl. 6, figs. 12-13; Cole, 1981, p. 110, pl. 13, fig. 20; Williamson, 1983, p. 227-228, pl. 4, figs. 14-15.
Nonion labradoricum (Dawson) Feylding-Hanssen, 1981, pl. 2, figs. 12-13.
Nonionella labradorica (Dawson) Rodriguez and Hooper 1982b, p. 348.

Remarks. This well-known form is readily distinguishable from other nonionellids.
Distribution. *N. labradorica* appears in only one surface sample, at 4046 m, where it makes up 1.0% of the total benthic assemblage. It is, however, fairly widespread in core material, sometimes accounting for over 5.0% of the benthics.

Genus *Pullenia* Parker and Jones *in* Carpenter, Parker and Jones, 1862

Pullenia bulloides (d'Orbigny)

Nonionina bulloides d'Orbigny, 1826. Ann. Sci. Nat. Paris, ser. 1, vol. 7, p. 293, no. 2.
Pullenia bulloides (d'Orbigny) Cushman and Todd 1943. Contr. Cushman Lab. Foram. Res., vol. 19, p. 13, pl. 2, figs. 15-18; Barker, 1960, p. 174, pl. 84, figs. 12-13; Lohmann, 1978, p. 26, pl. 1, figs. 10-11; Corliss, 1979, p. 8, pl. 4, figs. 1-2; Belanger and Streeter, 1980, p. 418; Boltovskoy, 1980a, pl. 4, figs. 8a, b; Ingle et al. 1980, p. 142, pl. 5, fig. 7; Cole, 1981, p. 111, pl. 14, fig. 5; Blanc-Vernet, 1983, p. 506.

Remarks. The only other species that *P. bulloides* could possibly be confused with in the study material is *Melonis pompiliodes*, but even this resemblance is quite superficial, the former being more spherical, and lacking the large pores of the latter.
distribution. *P. bulloides* enjoys a widespread distribution in surface material. It is absent below 4046 m, but from that point up to 2400 m, it often constitutes 2.0 or 3.0% of the benthic total. This species appears in many core samples, especially in the upper 500 cm. Often it comprises over 3.0% of the benthic foraminiferal total in core samples.

Pullenia osloensis Feyling-Hanssen

Pullenia osloensis Feyling-Hanssen 1954. Norsk. Geol. Tideskr. 33, p. 194, pl. 1, figs. 33-35; Anderson, 1975, pl. 11, figs. 9a-b; Corliss, 1979, p. 9, pl. 4, figs. 3-4; Boltovskoy, 1980a, pl. 5, fig. 4a-b; Boltovskoy, 1980b, p. 354, pl. 2, figs. 20-21; Cole, 1981, p. 111, pl. 13, fig. 9.

Distribution. *P. osloensis* appears fairly regularly in surface samples from 2200 m down to 4046 m. Its numbers often exceed 1.0% of the benthic total below 3050 m. It is also fairly common in core material, appearing in many samples but rarely exceeding 2.0% of the total.

Pullenia quinqueloba (Reuss)

Nonionina quinqueloba Reuss, 1851. Zeitschr. deutsch. Geol. Ges., vol. 3, p. 71, pl. 5, fig. 31.
Pullenia quinqueloba (Reuss) Brady 1882. Proc. Roy. Soc. of Edinburgh, vol. 11, p. 712; LeRoy and Levinson, 1974, p. 14, pl. 7, fig. 9; LeRoy and Hodgkinson, 1975, pl. 9, fig. 11; Ingle et al. 1980, p. 142, pl. 5, fig. 8; Cole, 1981, p. 111-112, pl. 14, fig. 6; Blanc-Vernet, 1983, p. 506; Williamson, 1983, p. 228, pl. 4, fig. 16.
Pullenia subcarinata (d'Orbigny) Heron-Allen and Earland 1932. Discovery Repts. 4, Foram. (1), p. 403; Barker, 1960, p. 174, pl. 84, figs. 14-15; Anderson, 1975, pl. 11, fig. 11; Milam and Anderson, 1981, pl. 11, fig. 5.
Pullenia subcarinata quinqueloba (Reuss) Boltovskoy, 1980a, pl. 5, figs. 1a-b; Boltovskoy, 1980b, p. 354, pl. 2, figs. 22-23.

Distribution. *P. quinqueloba* is present in almost all surface samples down to 4495 m. It appears to be most common below 2750 m, exceeding 5% of the benthic total at 3247 m. It is quite rare in the cores, occurring at several scattered levels in very small numbers.

Family Alabaminidae Hofker, 1951

Genus *Gyroidina* d'Orbigny, 1826

Gyroidina orbicularis d'Orbigny

Rotalia (Gyroidina) orbicularis d'Orbigny 1826. Ann. Sci. Nat., ser. 1, vol. 7, p. 278.
Rotalia orbicularis d'Orbigny. Brady, 1864, Trans. Linn. Soc. London, vol. 24, p. 470, pl. 48, fig. 16.
Gyroidina orbicularis d'Orbigny. Barker, 1960, p. 238, pl. 115, fig. 6. LeRoy and Levinson, 1974, p. 14, pl. 7, figs. 14-16. Cole, 1981, p. 112, pl. 20, figs. 8-9.
Gyroidinoides orbicularis (d'Orbigny). Corliss, 1979, p. 9, pl. 5, figs. 1-3; Corliss and Honjo, 1981, p. 359-360, pl. 4, figs. 1-14.

Distribution. This relatively small gyroidinid occurs in very small numbers in surface samples from 2000 m to 2400 m and is absent from there down to 2996 m. From 2996 m to 3985 m it is present again, but in somewhat greater numbers, reaching over 4.0% of the total at 3985 m. It is very rare in subsurface material, seen only as an occasional specimen in a few samples from the upper 300 cm of the cores.

Gyroidina soldanii d'Orbigny

Rotalia (Gyroidina) soldanii d'Orbigny 1826. Ann. Sci. Nat. vol. 7, p. 278.
Gyroidina neosoldanii Brotzen 1936. Sver. Geol. Unders. Anh., ser. C, no. 396, (Ärsh 30, no. 3) p. 158; Barker, 1960, p. 220, pl. 107, figs. 6-7.
Gyroidina soldanii neosoldanii Brotzen. LeRoy and Levinson, 1974, p. 14, pl. 9, figs. 3-5.
Gyroidina soldanii d'Orbigny. Todd, 1965, U.S. Nat. Mus. Bull. 161, no. 4, p. 19, pl. 6, fig. 4; Boltovskoy, 1980a, pl. 5, figs. 2a-b; Boltovskoy, 1980b, pl. 353, pl. 2, figs. 7-8; Ingle et al. 1980, p. 138, pl. 7, figs. 12-13; Cole, 1981, p. 112-113, pl. 14, fig. 7; Blanc-Vernet, 1983, p. 505; Williamson, 1983, pl. 5, figs. 5-6.
Gyroidinoides soldanii (d'Orbigny) Lohmann, 1978, p. 29, pl. 1, figs. 1-3. Corliss, 1979, p. 9, pl. 5, figs. 4-6; Corliss and Honjo, 1981, p. 360, pl. 5, figs. 1-14.

Remarks. This relatively large form has a well-illustrated very characteristic morphology which distinguishes it quite readily from other similar forms. It is normally of a very white, porcellanous appearance in the study area.
Distribution. *G. soldanii* doccurs in almost all surface samples from 2000 m down to 3985 m. It reaches 5.5% of the benthic assemblage at 3050 m and is generally more common below 2750 m. Also seen, very rarely, in a few samples from the upper 3 m of the cores.

Gyroidina sp.

Remarks. This species is very similar in appearance to *G. soldanii*, but is of a much smaller size. (It may represent a dwarfed form of *G. soldanii*).
Distribution. This form is not seen in surface samples, occurring only as scattered individuals in various levels of the cores.

Genus *Oridorsalis* Andersen 1961

Oridorsalis tenera (Brady)

Truncatulina tenera	Brady, 1884. Rept. Voy. Chall., Zool. pt. 22, vol. 9, p. 665, pl. VC, fig. 11a-c.
Eponides tenera	Brady. Barker, 1960, p. 146, pl. 95, fig. 11. Lagoe, 1977, p. 127, pl. 5, figs. 3,7,14.
Eponides tener	(Brady) Vilks, 1969, p. 50, pl. 3, fig. 16a-b.
Oridorsalis tener	(Brady) Anderson, 1975, pl. 11, figs. 13a-c; Lohmann, 1978, p. 26, pl. 4, figs. 5-7; Corliss, 1979, p. 9, pl. 4, figs. 10-15; Belanger and Streeter, 1980, p. 418; Ingle et al. 1980, p. 142, pl. 5, figs. 5-6; Corliss and Honjo, 1981, p. 362, pl. 7, figs. 1-12.

Remarks. This species can be distinguished from its close relative *O. umbonatus* by its sharper keel. The two species, however, appear to form end members of a continuum, so there are many specimens whose placement in one of the other of these designatioans is somewhat subjective.
Distribution. *O. tener* is very widespread in surface samples, occurring in most from 2000 m to 4046 m. It appears to be most prevalent between 2400 m and 3543 m, often exceeding 2.0% of the total benthics.

It is also present in very small numbers in most samples from the upper 150 cm of the cores, and only very rarely below that.

Oridorsalis umbonatus (Reuss)

Rotalina umbonata	Reuss 1951, p. 75, pl. 5, figs. 35a-c.
Oridorsalis tener umbonatus	(Reuss) LeRoy and Levinson, 1974, p. 14, 16, pl. 7, figs. 17-18.
Oridorsalis umbonatus	(Reuss) Lohmann, 1978, p. 26, pl. 4, figs. 1-3. Boltovskoy 1980a, pl. 4, figs. 4a-b; Boltovskoy 1980b, p. 354. pl. 2, fig. 19; Blanc-Vernet, 1983, p. 505, pl. 2, fig. 11; Williamson, 1983, p. 229, pl. 5, figs. 3-4.

Distribution. *O. umbonatus* is present in scattered surface samples from above 2750 m in very small numbers. Below this level, it is more common, forming 5.0% of the total benthics at 3247 m. It is seen in small numbers only in the upper 150 cm of the cores.

Family Anomalinidae Cushman 1927

Subfamily Anomalininae Cushman 1927

Genus *Melonis* de Montfort 1808

Melonis pompilioides (Fichtel and Moll)

Nautilus pompilioides	Fichtel and Moll 1798. Test. Micr. p. 31, pl. 2, figs. a-e.
Nonion pompilioides	(Fichtel and Moll) Phleger and Parker, 1951. Geol. Soc. Amer. mem. 46(2), p. 11, pl. 5, figs. 19-20.
Nonion (?) *pompilioides*	(Fichtel and Moll) Barker, 1960, p. 224, pl. 109, figs. 10-11.
Nonionina pompilioides	(Fitchtel and Moll) Parker, Jones and Brady, 1865. Ann. Mag. Nat. Hist. ser. 3, vol. 16, p. 18, pl. 3, fig. 98.
Melonis etruscus	de Montfort 1808. Conch. Syst. Class. Meth. Cog., tome 1, p. 66-67, text-figs.
Melonis pompilioides	(Fichtel and Moll) Voloshinova 1958. Mikrofauna SSSR, VNIGRI, Sbornik 9, no. 115, p. 117-191; Lohmann, 1978, p. 29, pl. 1, figs. 12-13; Corliss, 1979, p. 12, pl. 5, figs. 9-10; Cole, 1981, p. 114-115, pl. 14, fig. 9; Ingle et al. 1980, p. 142, pl. 9, figs. 14-15; Blanc-Vernet, 1983, p. 505, pl. 2, fig. 14; Williamson, 1983, p. 230, pl. 5, fig. 8.

Remarks. Known by several names, this form is nevertheless fairly distinctive because of its very broad, subspherical shape and characteristic large pores. As mentioned above, it superficially resembles *Pullenia bulloides* but even a weathered, damaged specimen can still be usually properly identified.

Distribution. *M. pompilioides* occurs in small numbers in most surface samples from 2400 m to 4046 m, but is most common below 2750 m. Small numbers of this form are commonly seen in samples from the upper 150 cm of the cores, but its appearance is much more sporadic below that.

Superfamily Robertinacea Reuss, 1850

Family Ceratobuliminidae Cushman, 1927

Subfamily Epistomininae Wedekind, 1937

Genus *Hoeglundina* Brotzen, 1948

Hoeglundina elegans (d'Orbigny)

Rotalia (Turbinulina) elegans	d'Orbigny 1826. Ann. Sci. Nat. ser. 1, vol. 7, p. 276, no. 54.
Pulvinulina elegans	(d'Orbigny) Brady 1884. Rep. Voy. Challenger, Zool. 9, p. 699, pl. 105, fig. 3-6.
Epistomina elegans	(d'Orbigny) Cushman 1931. U.S. Nat. Mus. Bull. 104(8), p. 65, pl. 13, fig. 6.
Hoeglundina elegans	(d'Orbigny) Parker, Phleger and Pierson 1953. Cushman Found. Foram. Res. Spec. Publ. 2, pl. 43, pl. 9, figs. 24-25; Barker, 1960, p. 216, pl. 105, figs. 3-6; LeRoy and Levinson, 1974, p. 18, pl. 9, figs. 13-14; LeRoy and Hodgkinson, 1975, pl. 9, fig. 24; Lohmann, 1978, p. 29, pl. 4, figs. 10-12; Corliss, 1979, p. 12, pl. 5, figs. 11-13; Ingle et al. 1980, p. 138, pl. 2, fig. 11; Corliss and Honjo, 1981, p. 360, 362, pl. 6, figs. 1-15; Williamson, 1983, p. 231, pl. 5, figs. 11-12.

Höglundina elegans (d'Orbigny) Blanc-Vernet, 1983, p. 505.

Remarks. This large, carinate form is easily distinguished by its lenticular cross section and the presence of its distinctive supplementary apertures positioned just below the keel. Some specimens, especially in the surface material, are clear and hyaline, affording a very good view of the internal structures of the skeleton. Most, however are somewhat etched (presumably because of the aragonitic nature of the test) and as a result are an opaque white.
Distribution. *H. elegans* occurs in most surface sampales from depths between 2200 and 4030 m. Between 2400 m and 3543 m it is one of the principle components of the benthic assemblage, often comprising 5-10% of the total benthic fauna. At 3543 m it reaches 11.6% of the total. Below that point its numbers are very small or it is entirely absent.

This form does not occur at all in subsurface material. It is unclear whether this absence is the result of comparatively rapid dissolution of the aragonitic test of this form, or if conditions at the core site prior to the present had precluded the existence of this form there.

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