CONTRIBUTIONS

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296. A NOTE ON SOME RECENT FORAMINIFERA FROM NORTHWEST ICELAND

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ABSTRACT

Seventeen species of foraminifera were retrieved from the littoral marine sediments of three small fjords in northwest Iceland. Seven have not previously been recorded in Icelandic waters.

INTRODUCTION

During the summer of 1961, nine samples of littoral marine sands were collected from Isafjordur, Lonseyri and Leirafjordur, in northwest Iceland (Text Figure 1). A 50 gm. standard dry weight of each sample was studied for foraminiferal content. Two proved unfossiliferous, whilst varying numbers of seventeen species of foraminifera were retrieved from the remaining sediments. No new species were observed. Two distinct faunal zones were determined for the area as a whole.

This account forms part of the report for the U.C.W. Expedition to Northwest Iceland, 1961.

DISCUSSION

Of the seventeen species recovered seven have not previously been reported from Icelandic waters:

Technitella sp.
Oolina apiopleura (Loeblich and Tappan)
Angulogerina angulosa (Williamson) var. *carinata* (Cushman)
A. angulosa (Williamson) var. *fluens* (Todd)
Cibicides fletcheri Galloway and Wissler
Elphidium excavatum (Terquem)
E. orbiculare (Brady)

It is interesting to note that all forms excluding *Cibicides fletcheri* Galloway and Wissler are typically cold water species. This exception however has so far only been reported from the warm water areas off the southwest United States, and the Holocene sediments of central Cardiganshire, Wales.

Cibicides lobatulus (Walker and Jacob) and *Elphidium excavatum* (Terquem) were found living in Isafjordur and Leirafjordur respectively.

Two faunal associations were determined.

A. Isafjordur: characterized by a maximum development of *Cibicides lobatus* (Walker and Jacob) and *Elphidium excavatum* (Terquem). These two species were associated with eleven others, the fauna being characteristic of normal inner marine or estuarine areas.

B. Lonseyri and Leirafjordur: characterized by an almost complete dominance of *Elphidium excavatum* (Terquem) together with a well developed ostracod fauna. *Oolina melo* d'Orbigny, *Elphidium incertum* (Williamson) and *Technitella* sp. are restricted to this association. The latter may in fact be a derived freshwater member of the Thecamobinidae. The predominance of *Elphidium excavatum* to the exclusion of almost all else indicates a peculiarity in prevalent environmental conditions. This robust species thrives in areas of rapid salinity and diurnal temperature changes. In the Dovey Estuary, North Cardiganshire, it has been found to be the predominant living species of the intertidal zone, whilst in Christchurch Harbour, England, living populations are known to tolerate a chlorinity range of 0 o/oo to 19 o/oo (Murray 1961). In Leirafjordur low salinity values predominate, the presence of *Elphidium excavatum* reflecting its high adaptability in comparison to the other foraminiferal forms present.

TAXONOMY

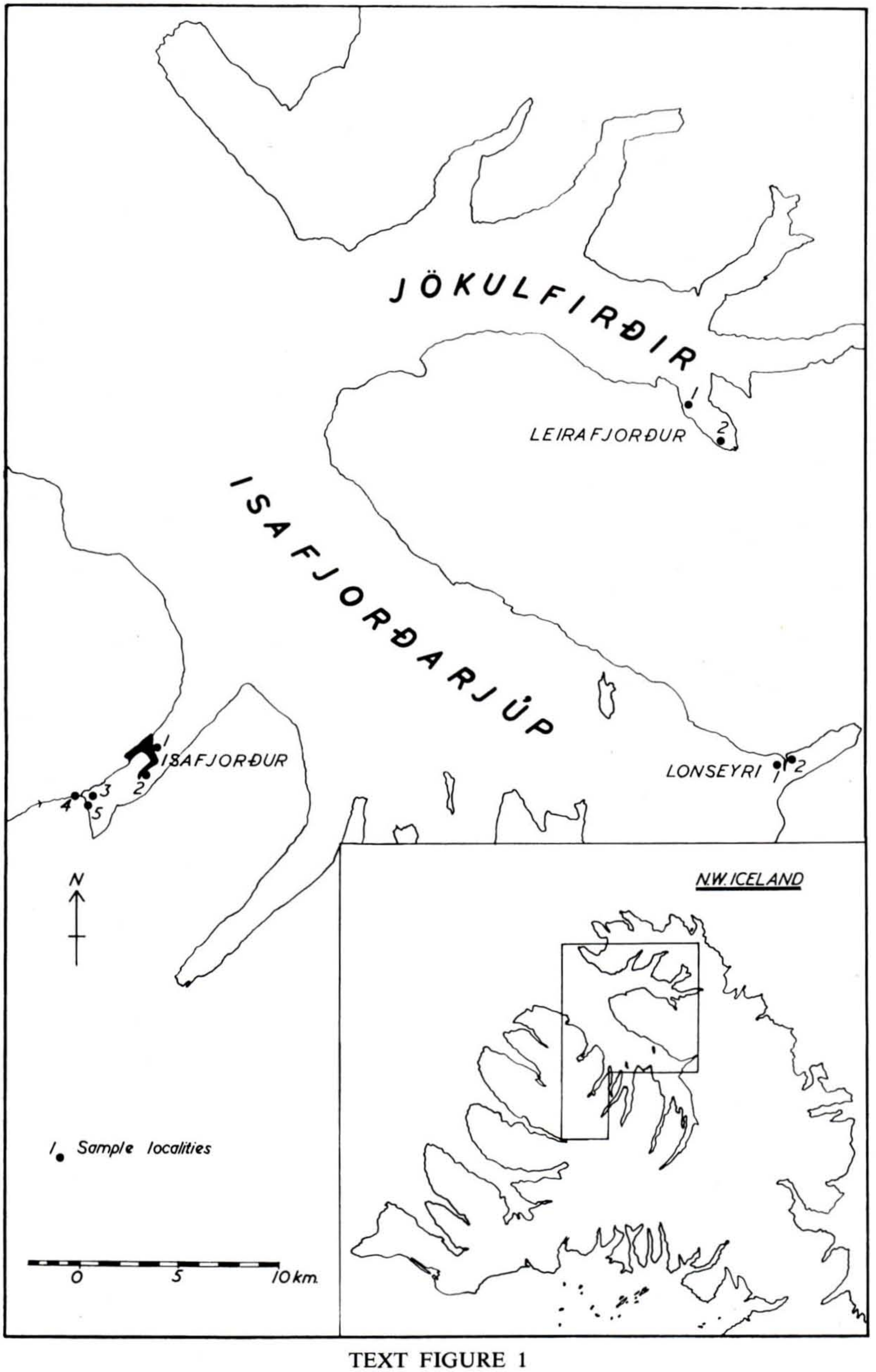
Superfamily ASTRORHIZIDEA
Family SACCAMMINIDAE
Subfamily SACCAMMININAE
Genus **Technitella** Norman
Technitella melo Norman

Technitella melo Norman. CUSHMAN, 1948, p. 14, pl. 1, figs. 11, 12.

Remarks.—This form has been reported as occurring in both Arctic and Antarctic regions, as well as in the cold areas of the North Atlantic proper. In the present study nine specimens were retrieved from sample 1, Leirafjordur. It has not previously been recorded from Icelandic waters.

Superfamily MILIOLIDEA
Family MILIOLIDAE
Genus **Quinqueloculina** d'Orbigny
Quinqueloculina seminulum (Linné)
Plate 5, figure 16

Serpula seminulum LINNAEUS, 1758, p. 1264.
Miliolina seminula (Linné). WILLIAMSON, 1858, p. 85, pl. 7, figs. 183-185.
Miliolina seminula (Linné). BRADY, 1884, p. 157, pl. 5, fig. 6.
Quinqueloculina seminulum (Linné). NORVANG, 1945, p. 7, fig. 2.
Quinqueloculina seminulum (Linné). CUSHMAN, 1948, p. 34, pl. 3, figs. 14, 15.



TEXT FIGURE 1

Remarks.—Brady (1884) comments on the universal and cosmopolitan distribution of the species in every latitude at depths varying from 0 to 3000 fathoms. It has common occurrence throughout the Arctic and Antarctic regions, with the exception of the Canadian area. It is well represented in British offshore sediments. In general one may note an increase in abundance of *Quinqueloculina seminulum* with decrease in temperature through either latitude or depth.

Forty specimens of this species were retrieved from sample 1, Isafjordur.

Genus **Miliolinella** Wiesner

Miliolinella subrotunda (Montagu)

Plate 5, figure 15

Vermiculum subrotundum MONTAGU, 1803, p. 521.

Quinqueloculina subrotunda (Montagu). NORVANG, 1945, p. 8.

Quinqueloculina subrotunda (Montagu). CUSHMAN, 1948, p. 35, pl. 3, figs. 20-22, pl. 4, fig. 1.

Remarks.—The species occurs in abundance throughout the shallow water regions of the Arctic and sub Arctic, the Eastern seaboard of the United States, and in the offshore areas around western Europe.

In the present study twelve specimens were retrieved from sample 1, Isafjordur.

Superfamily LAGENIDEA

Family LAGENIDAE

Genus **Oolina** d'Orbigny

Oolina apiopleura (Loeblich and Tappan)

Plate 5, figure 5

Lagena apiopleura LOEBLICH and TAPPAN, 1953, p. 59, pl. 10, figs. 14, 15.

Remarks.—This species has so far only been recorded from Arctic regions and the North Sea. The recovery of four specimens from sample 1, Isafjordur, marks its first recorded occurence in Icelandic waters.

Oolina melo d'Orbigny

Plate 5, figure 4

Oolina melo D'ORBIGNY, 1839, p. 20, pl. 5, fig. 9.

Oolina melo d'Orbigny. LOEBLICH and TAPPAN, 1953, p. 71, pl. 12, figs. 8-15.

Remarks.—This species has variable occurrence throughout the Antarctic, Arctic and Icelandic waters, as well as in the cold areas of the North Sea and in the shallow water zones off the New England coast.

Two specimens were retrieved from sample 2, Lonseyrifjord.

Superfamily BULIMINIDEA

Family UVIGERINIDAE

Genus **Angulogerina** Cushman

Angulogerina angulosa (Williamson)

Plate 5, figure 2

Uvigerina angulosa WILLIAMSON, 1858, p. 67, pl. 5, fig. 140.

Angulogerina angulosa (Williamson). NORVANG, 1945, vol. 2, p. 37.

Angulogerina angulosa (Williamson). UCHIO, 1961, pl. 7, fig. 18.

Remarks.—This species has widespread occurrence throughout the boreal and lusitanian regions of the Atlantic and Pacific oceans.

Ten specimens were retrieved from samples 1 and 2, Isafjordur.

Angulogerina angulosa (Williamson) var. **carinata** (Cushman)

Plate 5, figure 1

Angulogerina carinata CUSHMAN, 1927, p. 159, pl. 4, fig. 3.

Angulogerina carinata Cushman. UCHIO, 1960, p. 55, pl. 7, fig. 19.

Remarks.—Since continuous gradation between *A. angulosa* and *A. carinata* has been frequently observed within the same populations, (Hoglund, 1947), the latter has been reduced to varietal status.

Sixteen specimens were retrieved from sample 1, Isafjordur.

Angulogerina angulosa (Williamson) var. **fluens** (Todd)

Plate 5, figure 3

Angulogerina fluens Todd. CUSHMAN and MCCULLOCH, 1948, pl. 16, figs. 6, 7.

Angulogerina fluens Todd. LOEBLICH and TAPPAN, 1953, p. 112, pl. 20, figs. 10-12.

Remarks.—Since continuous gradation between *A. angulosa* and *A. fluens* has been observed within the same populations (Hoglund, 1947), the latter has been reduced to varietal status.

Sixteen specimens were retrieved from sample 1, Isafjordur.

Family CASSIDULINIDAE

Genus **Cassidulina** d'Orbigny

Cassidulina islandica Norvang

Plate 5, figure 13

Cassidulina islandica NORVANG, 1945, p. 43, fig. 8.

Remarks.—This species has been commonly found off the coast of Iceland, and throughout the Arctic region.

Four specimens were retrieved from sample 1, Isafjordur.

Cassidulina laevigata d'Orbigny
Plate 5, figure 14

Cassidulina laevigata D'ORBIGNY, 1826, p. 282, pl. 15, figs. 4-5.

Cassidulina laevigata d'Orbigny. NORVANG, 1945, Zool. Iceland, vol. 2, pt. 2, p. 43, text fig. 9.

Remarks.—This species has widespread distribution in both eastern and western hemispheres, occurring in all oceans, with a maxima in Arctic regions, but diminishing in frequency towards the equator.

Four specimens were retrieved from sample 1, Isafjordur.

Superfamily MONOLAMELLIDEA
Family EPONIDIIDAE
Genus **Buccella** Andersen
Buccella frigida (Cushman)
Plate 5, figure 9

Pulvinulina frigida CUSHMAN, 1922, p. 12, pl. 5, figs. 5, 6.

Buccella frigida (Cushman). LOEBLICH and TAPPAN, 1953, p. 115, pl. 22, figs. 2, 3.

Remarks.—This species is mainly associated with Arctic, subarctic and cool temperate regions.

Sixteen specimens were retrieved from sample 1, Isafjordur.

Family NONIONIDAE
Genus **Nonion** Montfort
Nonion depressulus (Walker and Jacob) emmend Murray, MS
Plate 5, figure 12

Nonion depressulus (Walker and Jacob). MURRAY, 1961, p. 423, pl. 5, figs. 1, 2.

Remarks.—This species is commonly referred to in material collected from British seas and the North Atlantic, and has already been recorded from off Iceland by Norvang (1945).

Eight specimens were recovered from sample 1, Isafjordur, ten from sample 1, Lonseyri, and two from sample 2, Leirafjordur.

Superfamily BILAMELLIDEA
Family ANOMALINIDAE
Genus **Cibicides** Montfort
Cibicides fletcheri Galloway and Wissler
Plate 5, figure 11

Cibicides fletcheri GALLOWAY and WISSLER, 1927, p. 64, pl. 10, figs. 8-9.

Cibicides fletcheri Galloway and Wissler. UCHIO, 1960, pl. 10, figs. 1-3.

Remarks.—This species has been retrieved in small numbers from San Diego and Todos Santos Bays.

In the present study twenty specimens and eleven specimens respectively were retrieved from samples 1 and 2, Isafjordur. This is the first recorded occurrence of the species in Icelandic waters.

Cibicides lobatulus (Walker and Jacob)
Plate 5, figure 10

Nautilus lobatulus WALKER and JACOB, 1798, p. 642, pl. 14, fig. 36.

Cibicides lobatulus (Walker and Jacob). NORVANG, 1945, p. 49.

Remarks.—This species is common at every latitude from the most northern parts of the Arctic ocean to the Antarctic ice barrier.

In the present collections it was by far the most dominant form, over a thousand specimens being retrieved from sample 1, Isafjordur, one hundred and thirty-five from sample 2, Isafjordur, three from sample 3, Isafjordur, thirty from sample 2, Lonseyri, and 2 from sample 2, Leirafjordur.

Superfamily ROTALIDEA
Family ELPHIDIIDAE
Genus **Elphidium** Montfort
Elphidium excavatum (Terquem)
Plate 5, figure 7

Polystomella excavata TERQUEM, 1875, p. 25, pl. 2, figs. 2a-f.

Elphidium excavatum (Terquem). CUSHMAN, 1949, p. 28, pl. 6, fig. 2.

Remarks.—This species has been commonly retrieved from the waters off northwest Europe. It is common in the present study material, twelve specimens being identified from sample 1, Isafjordur, two hundred and eighty from sample 3, Isafjordur, one from sample 1, Leirafjordur, and two hundred and sixty from sample 2, Leirafjordur. This is the first recorded occurrence of the species in Icelandic waters.

Elphidium incertum (Williamson)
Plate 5, figure 6

Polystomella umbilicatula (Walker) var. *incerta* WILLIAMSON, 1858, p. 94, pl. 3, fig. 82.

Elphidium incertum (Williamson). NORVANG, 1945, vol. 2, p. 30.

Remarks.—This species is generally restricted to fairly shallow waters of Arctic and temperate zones.

Ten specimens were retrieved from sample 2, Lonseyri, one from sample 1, Leirafjordur, and 18 from sample 2, Leirafjordur.

Elphidium orbiculare (Brady)
Plate 5, figure 8

Nonionina orbicularis BRADY, 1884, p. 727, pl. 109, figs. 20, 21.

Nonion orbiculare (Brady). CUSHMAN, 1948, p. 53, pl. 6, fig. 3.

Elphidium orbiculare (Brady). LOEBLICH and TAPPAN, 1953, p. 102, pl. 19, figs. 1-4.

Remarks.—This species is generally associated with arctic areas. It has not previously been recorded from Icelandic waters.

Twelve specimens were retrieved from sample 1, Isafjordur, and six from sample 2, Lonseyri.

ACKNOWLEDGMENTS

The authors are indebted to Professor Alan Wood for critically reading this manuscript.

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297. THE FORAMINIFERA IN A SAMPLE DREDGED FROM THE VICINITY OF SALISBURY ISLAND, DURBAN BAY, SOUTH AFRICA

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ABSTRACT

Forty-three species of Foraminifera were found in a dark grey clay dredged in 1962 from the vicinity of Salisbury Island, Durban Bay. The species are all well known in Recent sediments from Africa and elsewhere.

Although thirteen species found are not recorded in Braga's work on the Foraminifera from the coast of Mozambique, ten of these have been found by Heron-Allen and Earland in material from the Kerimba Archipelago.

The most common species are **Spiroloculina communis**, **Spiroloculina antillarum**, **Quinqueloculina striata**, **Rotalia beccarii**, **Nodosaria subscalaris pauci-costata**, **Quinqueloculina lamarckiana**, **Loxostomum limbatum** and **Asterorotalia inflata**.

INTRODUCTION

A sample of dark grey clay dredged from approximately 30 feet below sea level in the vicinity of Salisbury Island during harbour deepening operations in 1962, was given to me by Professor J. J. Frankel for determination of the Foraminifera.

The material was received in a dry state and the specimens appear to have been dead when collected but are perfectly preserved and not abraded. The sample is inferred to be of Recent age.

Owing to the nature of such dredging operations, it is not possible to state with certainty that the sample represents one particular layer of harbour mud; very likely it represents a section through a thickness of several feet. It is thought, however, that this has not had any appreciable effect upon the assemblage of Foraminifera in the sample.

The only available data on the ecology is that of Day and Morgans (1956). They describe the general area from which the sample was obtained as a dredged channel with a sandy mud bottom on which very few larger benthonic animals live.

LIST OF SPECIES

In the following list of species from the Durban Bay sample no formal systematics is attempted although a synonymy, critical but obviously very incomplete, is indicated in each instance. The species are recorded under five Superfamilies of the Order Foraminifera.

Superfamily LITUOLIDEA

cf. "*Textularia aspera* Brady, 1884"

Textularia aspera—Brady, 1884, p. 367, Pl. 44, figs. 12, 13

Textularia aspera Brady—Braga, 1960, p. 48, Pl. 3, fig. 7

Only one specimen and a small fragment.

cf. "*Textularia hauerii* d'Orbigny, 1846"

Textularia hauerii—d'Orbigny, 1846, Foram. Fossiles du Bassin Tertiaire de Vienne, Paris, p. 250, Pl. 15, figs. 13-15

Textularia hauerii d'Orbigny—Heron-Allen and Earland, 1915, p. 628, Pl. 47, figs. 21-23

Only few fragments which make the identification quite doubtful.

Eggerella propinqua (Brady) 1884

Verneulina propinqua—Brady, 1884, p. 387, Pl. 47, figs. 8-12

Eggerella propinqua (Brady)—Cushman, 1937, p. 53, Pl. 5, figs. 21, 22

Few specimens with wall finely arenaceous.

Superfamily MILIOLIDEA

Quinqueloculina agglutinans d'Orbigny, 1839

Quinqueloculina agglutinans—d'Orbigny, 1839, in R. de la Sagra, Hist. Fis. Pol. Nat. Cuba, p. 195, Pl. 12, figs. 11-13

Miliolina agglutinans (d'Orbigny)—Heron-Allen and Earland, 1915, p. 575

Quinqueloculina agglutinans d'Orbigny—Braga, 1960, p. 65, Pl. 5, fig. 1

Few specimens.

Quinqueloculina lamarckiana d'Orbigny, 1839, Pl. 6, figs. 1, 2

Quinqueloculina lamarckiana—d'Orbigny, 1839, in R. de la Sagra, Hist. Fis. Pol. Nat. Cuba, p. 189, Pl. 11, figs. 14, 15

Quinqueloculina lamarckiana d'Orbigny—Cushman, 1932, p. 24, Pl. 6, figs. 2a-c

Quinqueloculina lamarckiana d'Orbigny—Braga, 1960, p. 66, Pl. 5, fig. 3

Very abundant with many specimens quite well developed. The figured specimen a triloculine form, with the following dimensions: length 0.77 mm., breadth 0.58 mm., thickness 0.4 mm.

Quinqueloculina seminulum (Linné) 1767

Serpula seminulum—Linné, 1767, System naturae, Edit. 12, Leipzig, 1, 264

Miliolina seminulum (Linné)—Brady, 1884, p. 157, Pl. 5, Fig. 6

Quinqueloculina seminulum (Linné)—Barker, 1960, p. 10, Pl. 5, fig. 3

Few and small specimens.

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Quinqueloculina semireticulosa Cushman, 1932
Quinqueloculina semireticulosa—Cushman, 1932, p. 27, Pl. 7, figs. 2a, b
Quinqueloculina semireticulosa Cushman—Braga, 1960, p. 69, Pl. 5, fig. 8
Only one specimen.

Quinqueloculina striata d'Orbigny, 1826, Pl. 6, figs. 3, 4
Quinqueloculina striata—d'Orbigny, 1826, Ann. Sci. Nat., Paris, vol. 7, p. 301, No. 4
Miliolina striata (d'Orbigny) — Heron-Allen and Earland, 1915, p. 579, Pl. 44, figs. 13-17

This species abundant. Dimensions of figured specimen: length 1.10 mm., breadth 0.53 mm., thickness 0.36 mm.

Spiroloculina antillarum d'Orbigny, 1839, Pl. 6, fig. 5
Spiroloculina antillarum—d'Orbigny, 1839, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, Foraminiferes, p. 166, Pl. 9, figs. 3, 4
Spiroloculina antillarum d'Orbigny—Cushman and Todd, 1944, p. 44, Pl. 6, figs. 28-32

Many beautiful specimens; one of the commonest species found in the sample. The dimensions of the figured specimen: length 1.52 mm., breadth 0.71 mm., thickness 0.25 mm.

Spiroloculina communis Cushman and Todd, 1944, Pl. 6, fig. 6
Spiroloculina excavata—Brady, 1884, p. 151, Pl. 9, figs. 5, 6
Spiroloculina grateloupi Cushman—Cushman, 1932, p. 34, Pl. 8, figs. 10-11
Spiroloculina communis—Cushman and Todd, 1944, p. 63, Pl. 9, figs. 4, 5, 7, 8
Spiroloculina communis Cushman and Todd—Braga, 1960, p. 80, Pl. 6, fig. 7

Many specimens, very well developed and reaching relatively large dimensions. With *S. antillarum*, very abundant. Dimensions of the figured specimen: Length 1.25 mm., breadth 0.80 mm.; thickness 0.3 mm.

Spiroloculina laevigata Cushman and Todd, 1944
Spiroloculina limbata—Heron-Allen and Earland, 1915, p. 553, Pl. 40, figs. 14-17
Spiroloculina laevigata—Cushman and Todd, 1944, p. 67, Pl. 9, figs. 26-29
Spiroloculina laevigata Cushman and Todd—Braga, 1960, p. 79, Pl. 6, fig. 6

Few specimens.

Triloculina tricarinata d'Orbigny, 1826
Triloculina tricarinata—d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 299, No. 7
Triloculina tricarinata d'Orbigny—Braga, 1960, p. 87, Pl. 7, figs. 3, 4

Many specimens, but generally small in size.

Triloculina trigonula (Lamarck) 1804
Miliola trigonula—Lamarck, 1804, Ann. Mus. d'Hist. Nat., vol. 5, p. 351, No. 3
Miliolina trigonula Williamson—Brady, 1884, p. 164, Pl. 3, figs. 14-16
Triloculina trigonula (Lamarck)—Braga, 1960, p. 85, Pl. 7, fig. 1
Several specimens.

Superfamily LAGENIDEA

Robulus limbosus (Reuss) 1863
Robulina limbosa—Reuss, 1863, Sitz. Akad, Wiss, Wien, vol. 48, pt. 1, p. 55, Pl. 6, figs. 69a, b
Robulus limbosus (Reuss)—Braga, 1960, p. 102, Pl. 9, fig. 2

Only two specimens, which are smooth, umbonate and with 7 chambers in the last whorl.

Vaginulinopsis sp. cf. *V. robusta* (Galloway and Wissler) 1927

A few specimens, only one of which shows the uncoiled portion.

Dentalina filiformis (d'Orbigny) 1826
Nodosaria filiformis—d'Orbigny, 1826, Ann. Sci. Natl., vol. 7, p. 253, No. 14
Nodosaria filiformis d'Orbigny—Brady, 1884, p. 500, Pl. 63, figs. 3-5
Dentalina filiformis (d'Orbigny)—Barker, 1960, p. 132, Pl. 63, figs. 3-5
Several specimens.

Nodosaria subscalaris pauci-costata Cushman, 1917, Pl. 6, fig. 7
Nodosaria subscalaris var. *pauci-costata* — Cushman, 1917, Proc. U. S. Nat. Mus., vol. 51, p. 654
Nodogenerina subscalaris pauci-costata Cushman—Braga, 1960, p. 146, Pl. 15, fig. 3

Very abundant and the specimens are well developed. Dimensions of figured specimen: Length 1.15 mm., diameter 0.29 mm.

Lagena semistriata Williamson, 1858
Lagena vulgaris var. *semistriata*—Williamson, 1858, On the Recent Foraminifera of Gt. Britain, Roy. Soc., London, p. 6, Pl. 1, fig. 9
Lagena semistriata Williamson—Heron-Allen and Earland, 1915, p. 658
Lagena semistriata Williamson—Braga, 1960, p. 129, Pl. 12, fig. 12
Only one specimen.

Lagena striata (d'Orbigny) 1839
Oolina striata—d'Orbigny, 1839, Voyage dans l'Amérique Méridionale, Foraminifères. Strasbourg, 5, pt. 5, p. 21, Pl. 5, fig. 12
Lagena striata (d'Orbigny)—Brady, 1884, p. 460, Pl. 57, figs. 22, 28
Lagena striata (d'Orbigny)—Brady, 1960, p. 129, Pl. 12, fig. 11

Three specimens. Two of them with a short broken aboral spine, which appears in fig. 28 by Brady (loc. cit.)

Guttulina problema (d'Orbigny) 1826

Polymorphina problema — d'Orbigny, 1826, Ann. Sci. Nat., Paris, 266, No. 14, Modèles, No. 61

Guttulina problema d'Orbigny—Braga, 1960, p. 130, Pl. 12, fig. 14

Guttulina problema (d'Orbigny)—Barker, 1960, p. 150, Pl. 72, fig. 19

Only one specimen.

Superfamily BULIMINIDEA

Bulimina marginata d'Orbigny, 1826

Bulimina marginata—d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 269, No. 4, Pl. 12, figs. 10-12

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

Only two specimens.

Loxostomum limbatum (Brady) 1879

Bolivina limbata—Brady, 1879, Quart. Journ. Micr. Sci., 21, p. 27

Bolivina limbata (Brady)—Heron-Allen and Earland, 1915, p. 646, Pl. 50, figs. 1-4

Loxostoma limbatum (Brady)—Cushman, 1937, p. 186, Pl. 21, figs. 26-29

Common.

Siphogenerina striata (Schwager) 1866

Dimorphina striata—Schwager, 1866, Novara-Exped., Geol. Theil, vol. 2, p. 251, Pl. 7, fig. 99

Sagrina striata (Schwager)—Heron-Allen and Earland, 1915, p. 676, Pl. 51, figs. 6-8

Siphogenerina striata (Schwager)—Braga, 1960, p. 158, Pl. 15, fig. 21

Several specimens.

Siphogenerina striatula Cushman, 1913

Siphogenerina striatula—Cushman, 1913, p. 108, Pl. 47, fig. 1

Siphogenerina striatula — Cushman — Braga, 1960, p. 158, Pl. 15, figs. 22

Only three specimens.

Superfamily ROTALIIDEA

Cibicides lobatula (Walker and Jacob) 1784

Nautilus lobatulus—Walker and Jacob, 1798, in G. Adams, Essays on the Microscope, p. 642, Pl. 14, fig. 36

Truncatulina lobatula (Walker and Jacob)—Heron-Allen and Earland, 1915, p. 706

Cibicides lobatula (Walker and Jacob)—Braga, 1960, p. 194, Pl. 20, figs. 4, 5

Few specimens only.

Cibicides refulgens Montfort, 1808

Cibicides refulgens—Montfort, 1808, Conchyliologie Systematique et Classification mèthodique des Coquilles, vol. 1, p. 122, 31 me genre

Truncatulina refulgens (Montfort)—Brady, 1884, p. 659, Pl. 92, figs. 7-9

Cibicides refulgens Montfort—Braga, 1960, p. 193, Pl. 20, figs. 2-3

Several specimens.

Cibicidella variabilis (d'Orbigny) 1826

Truncatulina variabilis—d'Orbigny, 1826, Ann. Sci. Nat., Paris, vol. 7, p. 279, No. 8

Truncatulina variabilis d'Orbigny — Heron-Allen and Earland, 1915, p. 706

Cibicidella variabilis (d'Orbigny)—Cushman, 1950, p. 339, Pl. 36, figs. 20a, b

Few specimens (small) but all show the typical arrangement of the chambers.

Globigerina bulloides d'Orbigny, 1826

Globigerina bulloides—d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 277, No. 1, Pls. 17, 76

Globigerina bulloides d'Orbigny—Brady, 1884, p. 593, Pl. 79, figs. 3-7

Globigerina bulloides d'Orbigny—Braga, 1960, p. 177, Pl. 18, fig. 5

Few specimens.

Globigerina eggeri Rhumbler, 1900

Globigerina dubia—Egger, 1900, Neues Jahrb. für Min., p. 281, Pl. 9, figs. 7-9

Globigerina dubia Egger—Braga, 1960, p. 178, Pl. 18, fig. 8

Globigerina eggeri Rhumbler—Barker, 1960, p. 164, Pl. 79, figs. 17a-c

Few specimens.

Globigerinoides conglobata (Brady) 1879

Globigerina conglobata—H. B. Brady, 1879, Quart. Journ. Micr. Sci., Vol. 19, p. 72

Globigerina conglobata Brady—Brady, 1884, p. 603, Pl. 80, figs. 1-5

Globigerinoides conglobata (Brady)—Braga, 1960, p. 179, Pl. 18, fig. 9

One specimen only.

Globigerinoides quadrilobata sacculifera (Brady) 1877

Globigerina sacculifera—H. B. Brady, 1877, Geol. Mag., Dec. 2, vol. 4, p. 535

Globigerina sacculifera Brady—Brady, 1844, p. 604, Pl. 80, figs. 11-17

Globigerinoides sacculifera (Brady)—Braga, 1960, p. 180, Pl. 18, fig. 10

Many specimens but none with the typical last-formed chamber.

Cymbaloporella tabellaeformis (Brady) 1884

Cymbalopora tabellaeformis—Brady, 1884, p. 637, Pl. 102, figs. 15-18

Cymbalopora tabellaeformis Brady — Heron-Allen and Earland, 1915, p. 688

Cymbaloporella tabellaeformis (Brady) — Barker, 1960, p. 210, Pl. 102, figs. 15-18

Only two specimens but very well developed.

Nonion boueanum (d'Orbigny) 1846

Nonionina boueana—d'Orbigny, 1846, Foraminifères fossiles du bassin tertiare de Vienne, p. 108, Pl. 5, figs. 11, 12

Nonion boueanum (d'Orbigny)—Braga, 1960, p. 134, Pl. 13, fig. 2

Many specimens with maximum diameter of 0.5 mm.

Elphidium advenum (Cushman) 1922

Polystomella subnodosa—Brady, 1884, p. 734, Pl. 110, figs. 1a, b

Polystomella subnodosa Brady—Heron-Allen and Earland, 1915, p. 733

Polystomella advena—Cushman, 1922, Carnegie Inst. Washington, Pub. 311, p. 56, Pl. 9, figs. 11, 12

Elphidium advenum (Cushman) — Cushman, 1939, p. 60, Pl. 16, figs. 31-32

Several specimens very well developed.

Elphidium craticulatum (Fichtel and Moll) 1798

Nautilus craticulatus—Fichtel and Moll, 1798, Test. Micr. p. 51, Pl. 5, figs. h-k

Elphidium craticulatum (Fichtel and Moll)—Cushman, 1939, p. 56, Pl. 15, figs. 14-17

Elphidium craticulatum (Fichtel and Moll)—Braga, 1960, p. 137, Pl. 13, figs. 4, 5

Very common and several specimens reach dimensions up to 2 mm. in diameter.

Elphidium crispum (Linné) 1767

Nautilus crispus—Linné, 1767, Systema Naturae, Edit. 10, p. 709

Elphidium crispum (Linné)—Cushman, 1939, p. 50, Pl. 13, figs. 17-21

Elphidium crispum (Linné)—Braga, 1960, p. 135, Pl. 13, figs. 6, 7

Few specimens.

Elphidium macellum (Fichtel and Moll) 1798

Nautilus macellus—Fichtel and Moll, 1798, Test. Micr. p. 66, var. β, Pl. 10, figs. h-k

Polystomella macella (Fichtel and Moll)—Heron-Allen and Earland, p. 734

Elphidium macellum (Fichtel and Moll)—Braga, 1960, p. 136, Pl. 13, figs. 8, 9

A few small specimens.

Ammonia beccarii (Linné) 1767

Nautilus beccarii—Linné, 1767, Syst. Nat., Edit. 12, p. 1162

Rotalia beccarii (Linné)—Heron-Allen and Earland, 1915, p. 717

Rotalia beccarii (Linné)—Braga, 1960, p. 170, Pl. 17, fig. 7

This species is common in the sample.

Asterorotalia inflata (Millet) 1904, Plate 6, figs. 8-10

Rotalia schroeteriana, var. *inflata*—Millet, 1904, Jour. Roy. Micr. Soc., p. 504, Pl. 10, fig. 5

Rotalia schroeteriana, var. *inflata* Millet—Heron-Allen and Earland, 1915, p. 719

Asterorotalia inflata (Millet)—Hofker, 1951, p. 504, figs. 342a, b

Very abundant; specimens clearly show, on the ventral side, the sutural plates (Pl. 6, fig. 10). Dimensions of the figured specimen: diameter 0.82 mm., thickness 0.5 mm. Recorded, as abundant, in the Red Sea (Hofker, loc. cit.).

Rosalina bertheloti d'Orbigny, 1839

Rosalina bertheloti—d'Orbigny, 1839 in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, 2, pt. 2, Foraminifères, p. 135, Pl. 1, figs. 28, 30

Discorbis bertheloti (d'Orbigny)—Braga, 1960, p. 162, Pl. 16, figs. 4, 5

Discopulvinulina bertheloti (d'Orbigny)—Barker, 1960, p. 184, Pl. 89, figs. 11-12

Few specimens but two of them are of relatively large size.

Poroeponides lateralis (Terquem) 1878

Rosalina lateralis—Terquem, 1878, Mem. Soc. Géol. France, ser. 5, 1, mem. 3, p. 25, Pl. 2, figs. 11a, b

Eponides lateralis (Terquem)—Braga, 1960, p. 165, Pl. 16, figs. 10, 11

Poroeponides lateralis (Terquem) — Barker, 1960, p. 218, Pl. 106, figs. 2, 3

Few specimens only.

Cancris oblongus (Williamson) 1858

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

Pulvinulina auricula (Fichtel and Moll) — Heron-Allen and Earland, 1915, p. 714

Cancris oblongus (Williamson) — Cushman and Todd, 1942, p. 80, Pl. 20, figs. 2-5

Cancris auricula (Fichtel and Moll) Cushman —Braga, 1960, p. 173, Pl. 17, fig. 11

Only few specimens.

Baggina philippinensis (Cushman) 1921

Pulvinulina hauerii (d'Orbigny)—Brady, 1884, p. 690, Pl. 106, fig. 7

Pulvinulina hauerii (d'Orbigny)—Heron-Allen and Earland, 1915, p. 715

Pulvinulina philippinensis—Cushman, 1921, U. S. Nat. Mus., Bull. 100, vol. 4, p. 331, Pl. 58, figs. 2a-c

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

Few specimens; agree with the description and figures by Cushman (loc. cit.)

CONCLUSION

The single small sample offers no basis for definite conclusions, but the following comments may be made.

Amphistegina lessoni is not present in the sample, whereas it was recorded by Belderson (1961) from the entrance to Durban Bay and as being common in shallow water off the Mozambique Coast by Braga (1960, p. 174). Its absence, combined with the great abundance of *Rotalia beccarii* and miliolids suggests a shallow sheltered environment, possibly with lowered salinity. On the other hand the absence of species more typical of brackish water, suggests that the salinity was not greatly lowered.

The most common species found are listed below in decreasing order of relative abundance: *Spiroloculina communis, Spiroloculina antillarum, Quinqueloculina striata, Asterorotalia inflata, Rotalia beccarii, Nodosaria subscalaris pauci-costata, Quinqueloculina lamarckiana, Nonion boueanum, Loxostomum limbatum, Elphidium craticulatum.*

TABLE 1

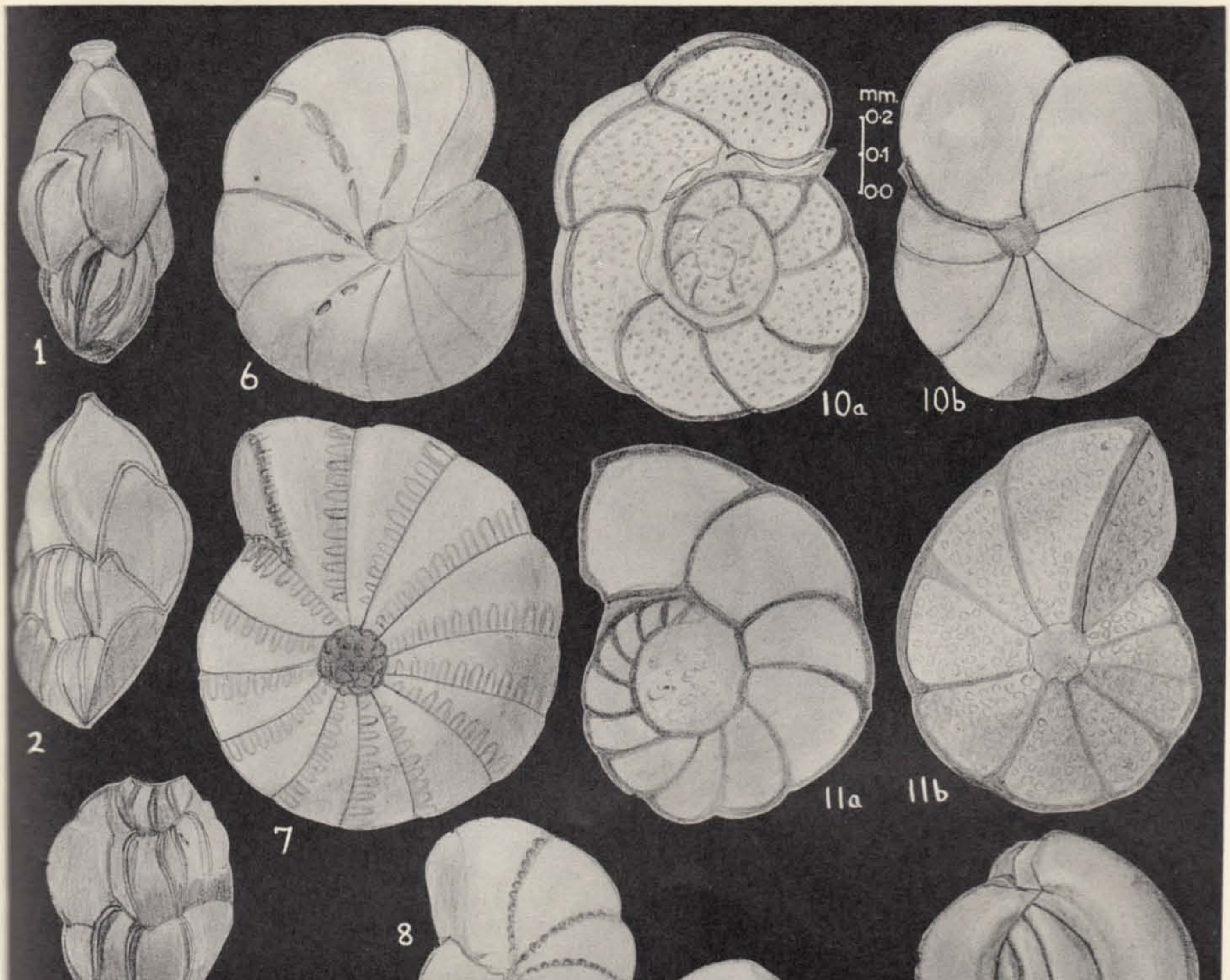
	Braga 1960	Heron-Allen & Earland 1915
Textularia aspera	X	—
Textularia hauerii	—	X
Eggerella propinqua	—	—
Quinqueloculina agglutinans	X	X
Quinqueloculina lamarckiana	X	X
Quinqueloculina seminulum	—	X
Quinqueloculina semireticulosa	X	—
Quinqueloculina striata	—	X
Spiroloculina antillarum	—	X
Spiroloculina communis	X	X
Spiroloculina laevigata	X	X
Triloculina tricarinata	X	X
Triloculina trigonula	X	X
Robulus limbosus	X	—
Dentalina filiformis	—	—
Nodosaria subscalaris pauci-costata	X	—
Lagena semistriata	X	X
Lagena striata	X	—
Guttulina problema	X	X
Bulimina marginata	—	X
Loxostomum limbatum	—	X
Siphogenerina striata	X	X
Siphogenerina striatula	X	—
Cibicides lobatula	X	X
Cibicides refulgens	X	X
Globigerina bulloides	X	X
Globigerina eggeri	X	X
Globigerinoides conglobata	X	X
Globigerinoides sacculifera	X	—
Cymbaloporetta tabellaeformis	—	X
Nonion boueanum	X	X
Elphidium advenum	—	X
Elphidium craticulatum	X	X
Elphidium crispum	X	X
Elphidium macellum	X	X
Rotalia beccarii	X	X
Asterorotalia inflata	—	X
Rosalina bertheloti	X	—
Poroeponides lateralis	X	X
Cancris oblongus	X	X
Baggina philippinensis	—	X
Cibicidella variabilis	—	X

The present investigation provides additional data on the distribution of Foraminifera.

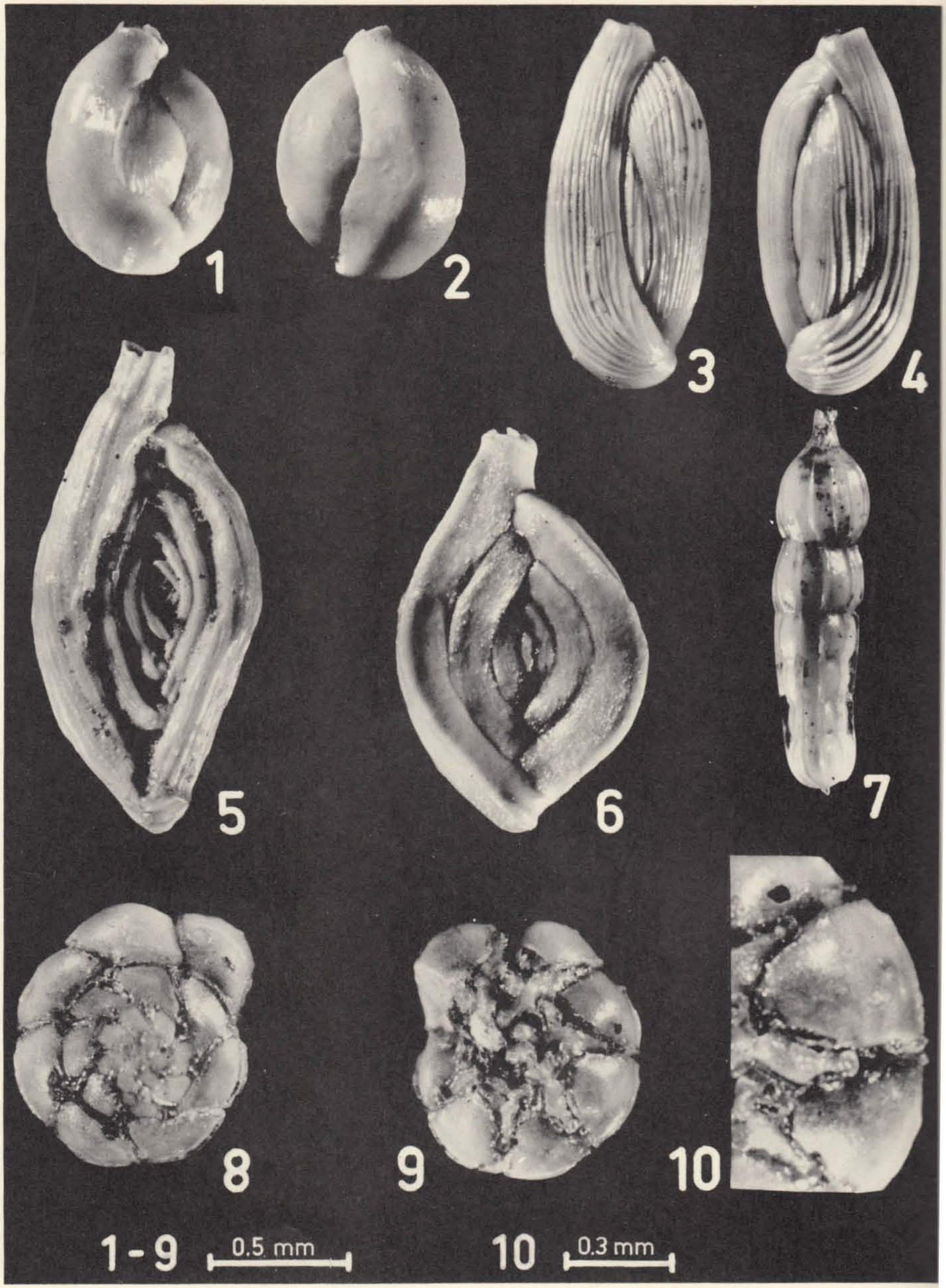
The only previous comprehensive surveys of Foraminifera along the East African Coast are those of Braga on the Mozambique Coast (1960) and of

EXPLANATION OF PLATE 5

FIGS.		PAGE
1.	*Angulogerina angulosa* var. *carinata* (Cushman)	57
2.	*Angulogerina angulosa* (Williamson)	57
3.	*Angulogerina angulosa* var. *fluens* (Todd)	57
4.	*Oolina melo* d'Orbigny	57
5.	*Oolina apiopleura* (Loeblich and Tappan)	57
6.	*Elphidium incertum* (Williamson)	58
7.	*Elphidium excavatum* (Terquem)	58
8.	*Elphidium orbiculare* (Brady)	58
9.	*Buccella frigida* (Cushman)	58
10.	*Cibicides lobatulus* (Walker and Jacob)	58
	Magnification approximately ½ that of the rest of the plate.	
11.	*Cibicides fletcheri* Galloway and Wissler	58
12.	*Nonion depressulus* (Walker and Jacob)	58
13.	*Cassidulina islandica* Norvang	57
14.	*Cassidulina laevigata* d'Orbigny	58
15.	*Miliolinella subrotunda* (Montagu)	57
16.	*Quinqueloculina seminulum* (Linné)	55



Adams and Frampton: Recent Foraminifera from Iceland



Albani: Foraminifera dredged from Durban Bay, South Africa

Heron-Allen and Earland in the Kerimba Archipelago (1915). These areas are both north of Durban Bay (Text-Figure 1).

The occurrence in these areas of the species which occur in Durban Bay are given in Table 1.

Summarizing, from this table, the species which are present in Durban Bay and in the Kerimba Archipelago, but not along the coast of Mozambique, are: *Textularia hauerii, Quinqueloculina seminulum, Quinqueloculina striata, Spiroloculina antillarum, Bulimina marginata, Loxostomum limbatum, Cymbaloporetta tabellaeformis, Elphidium advenum, Asterorotalia inflata, Baggina philippinensis* and *Cibicidella variabilis.*

The most noteworthy foraminiferal occurrence in Durban Bay is that of *Asterorotalia inflata.* This species was first described from the Malay Archipelago, by Millet (1904); it occurred abundantly in his samples from that area. The species was also reported to be common in the Philippines and in the Red Sea (Hofker, 1951). Heron-Allen and Earland recorded it only from Tungi Bay but it was not recorded by Braga from the coast of Mozambique.

The occurrence recorded here, in the Durban Bay locality where the species is abundant, is about 1200 miles south of Tungi Bay. The species has not been recorded from the intervening region.

Asterorotalia inflata has recently been found by the writer in Port Hacking, New South Wales, the first record of the species on the Australian coast. It occurs at the same depth, in a similar environment to that of Durban Bay and at approximately the same latitude.

Present distributional records suggest that *A. inflata* has a sporadic distribution, possibly controlled by its preference for certain environmental conditions.

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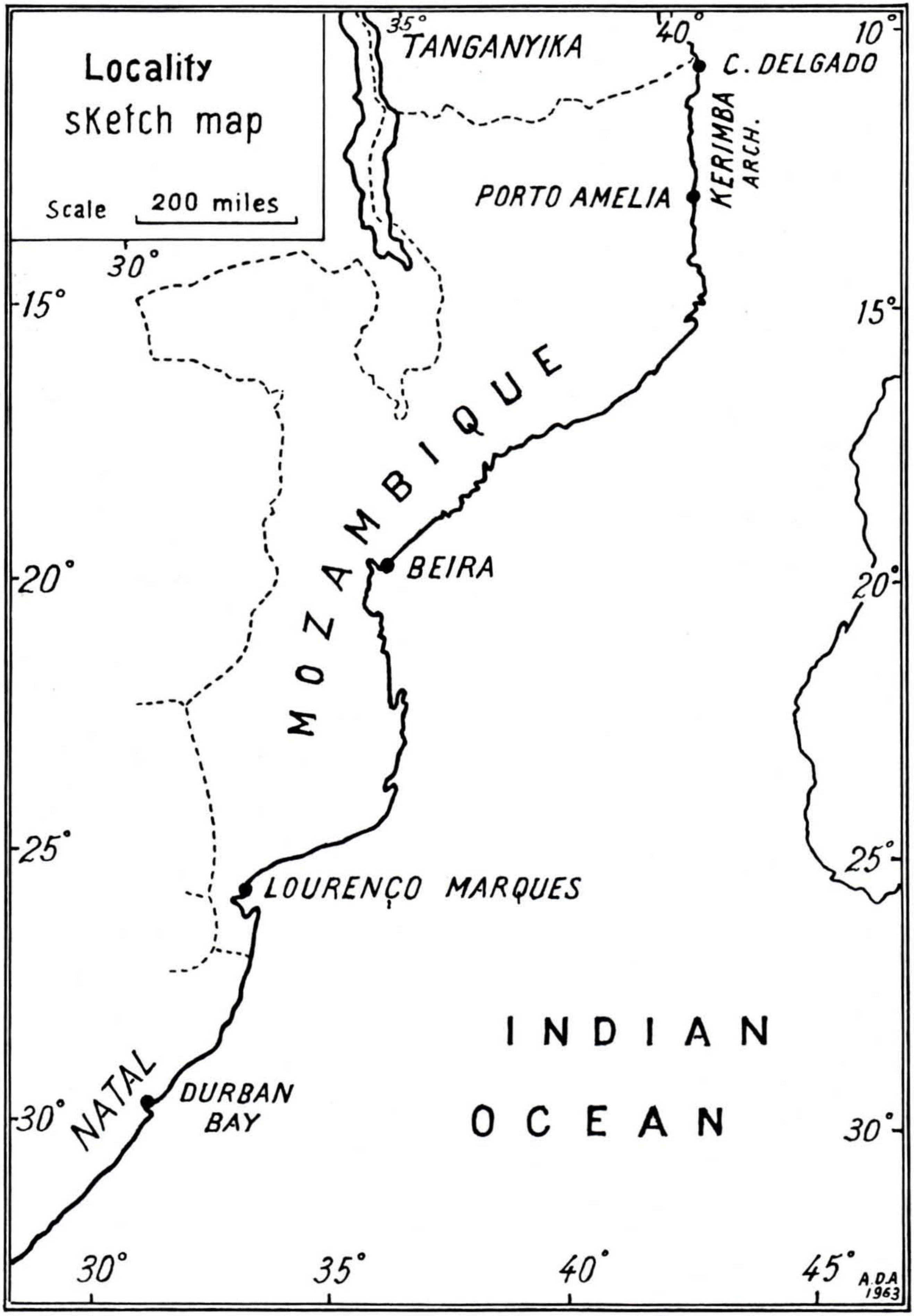
EXPLANATION OF PLATE 6

FIGS.		PAGE
1, 2.	*Quinqueloculina lamarckiana* d'Orbigny—Side views	60
3, 4.	*Quinqueloculina striata* d'Orbigny—Side views	61
5.	*Spiroloculina antillarum* d'Orbigny—Side view	61
6.	*Spiroloculina communis* Cushman and Todd—Side view	61
7.	*Nodosaria subscalaris* var. *pauci-costata* Cushman—Side view	61
8-10.	*Asterorotalia inflata* (Millet)—Fig. 8, dorsal side; fig. 9, ventral side; fig. 10, part of ventral side, showing the sutural plates	63



TEXT FIGURE 1

CONTRIBUTIONS FROM THE CUSHMAN FOUNDATION
FOR FORAMINIFERAL RESEARCH
VOLUME XVI, PART 2, APRIL, 1965

298. OBSERVATIONS ON SOME RECENT FLORIDA BAY FORAMINIFERA

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ABSTRACT

Valvulina oviedoiana d'Orbigny, **Triloculina bassensis** Parr and **Bolivinita rhomboidalis** (Millet) from Florida Bay and environs are described and discussed. Specimens of **Valvulina oviedoiana** lacking the valvular tooth are quantitatively compared with those with valvular tooth and are presently considered to represent the same species. **Triloculina bassensis** from Florida Bay is compared and considered conspecific with specimens of **Miliolina angularis** Flint, **Triloculina bassensis** from Australia and **Triloculina** cf. **T. bassensis** from Bikini. **Triloculina bassensis** Parr is considered to be the valid name of the species at the present time. A specimen previously listed as **Bolivina** sp. from Florida Bay is identified as **Bolivinita rhomboidalis** (Millet).

INTRODUCTION

Lynts (1962) described the distribution of the foraminiferal total population and standing crop from the shallow waters of upper Florida Bay and its environs. During that study, the author observed several interesting species which were investigated further and reported upon herein.

Variation in the species *Valvulina oviedoiana* d'Orbigny is discussed with reference to the presence or absence of the valvular tooth over the aperture. Specimens of *Triloculina bassensis* Parr from Florida Bay are compared with cotypes of *Miliolina angularis* Flint, a topotype of *Triloculina bassensis* Parr and specimens of *Triloculina* cf. *T. bassensis* Parr from Bikini, Marshall Islands (Cushman *et al.*, 1954). A single specimen listed in Lynts (1962) as *Bolivina* sp. is here considered to be *Bolivinita rhomboidalis* (Millet).

Bush (1958), Bock (1961) and Scholz (1962) described the foraminiferal distribution in Biscayne Bay, southwestern Florida Bay and Hawk Channel, respectively. Bush found *Valvulina oviedoiana* to be one of the most abundant species in Biscayne Bay and Bock found it to be quite rare in the area he studied. Bush found *Triloculina bassensis* to be quite abundant in Biscayne Bay and Bock found it present at the majority of the stations he investigated, but constituting a low frequency of the population. *Bolivinita rhomboidalis* was not identified in either Bush's or Bock's studies. Scholz did not find these species in the stations she investigated from Hawk Channel.

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Dr. Roger L. Batten under whom the study of Florida Bay foraminiferal ecology was initiated. Dr. James Bush checked the identification of some of the species. The U. S. National Museum made available type specimens for comparison.

SYSTEMATIC PALEONTOLOGY

Order FORAMINIFERIDA Eichwald, 1830
Suborder TEXTULARIINA
Delage and Hérouard, 1896
Superfamily LITUOLACEA de Blainville, 1825
Family ATAXOPHRAGMIIDAE Schwager, 1877
Subfamily VALVULININAE Berthelin, 1880
Genus **Valvulina** d'Orbigny, 1826
Valvulina oviedoiana d'Orbigny, 1839
Plate 7, figures 1-4

Valvulina oviedoiana D'ORBIGNY, 1839, *in* de la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminifères," p. 103, pl. 2, figs. 21, 22.

Description.—Test pyramidal, initial end triserial, pointed, apertural end may have more chambers per whorl, broadly rounded; sutures indistinct in initial portion, slightly depressed, distinct in later portion; slightly umbilicate at apertural end; wall finely agglutinated; aperture a large opening at base of last formed chamber, extending up septal face, with or without large valvular tooth extending over it into umbilical area.

Discussion.—The specimens are alike except for the striking presence or absence of the valvular tooth. For convenience of discussion, the typical specimens with valvular tooth are designated group 1 and those specimens lacking valvular tooth as group 2. Group 1 consists of 160 specimens and group 2 of 120 specimens. Group 2 appears to be restricted to upper Florida Bay and its environs, as neither Bush (1958) nor Bock (1961) identified any specimens lacking the valvular tooth.

The tooth has not been broken away as the specimens without the tooth have a smooth, unbroken aperture. The earlier chambers, observed by breaking away the outer chambers, also lack the valvular tooth. Similarly, the specimens with a valvular tooth have it present on earlier chambers. The presence or absence of the valvular tooth does not appear to be related to growth stage, because it may or may not be present on comparable sized specimens (Table 1). A significant difference in size is observed between specimens of the two groups. Specimens of group 1 have a larger mean size than those

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of group 2 (Table 1). This difference is in size only because no significant difference in the width-length ratio is found between the two groups (Table 1 and Text Fig. 1).

TABLE 1

Bivariate statistical characterization of *Valvulina oviedoiana*, Groups 1 and 2.
(x = length; y = width; measurements in microns)

Statistic	Group 1	Group 2
N	82	38
$\bar{x}$	673	473
$\bar{y}$	516	361
$s_{\bar{x}}$	329	221
$s_{\bar{y}}$	205	148
r	0.851	0.965
OR_x	1772-217	1099-217
OR_y	1116-200	800-200
a	633	670
σ_a	11	29
b	97	44
$t_{y/x}$	0.724	

The presence or absence of valvular tooth may be related to ecological conditions. Though the two groups often occur in the same sample (Lynts, 1962), the rigorous ecological conditions found in Florida Bay may mask the true relationships. Both groups appear to prefer coarser sediment, as Lynts (*Ibid.*, Table 6) showed their frequency indicated a direct relationship with sand-size particles and an inverse relationship with silt-size particles. Possibly, group 2 is a new mutation in which the normal type with valvular tooth is dominant over the mutant lacking the valvular tooth. The true relationship between the two groups will not be understood until they are cultured and lineage studies undertaken.

Suborder MILIOLINA Delage and Hérouard, 1896

Superfamily MILIOLACEA Ehrenberg, 1839

Family MILIOLIDAE Ehrenberg, 1839

Subfamily QUINQUELOCULININAE Cushman, 1917

Genus **Triloculina** d'Orbigny, 1826

Triloculina bassensis Parr, 1945

Plate 7, figures 7-9

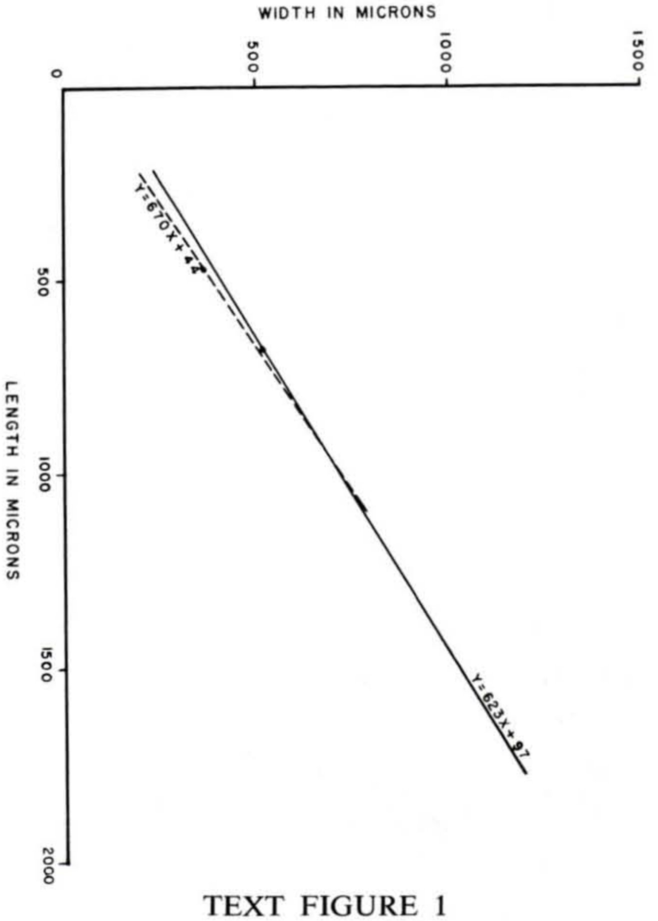
Miliolina angularis FLINT (not Howchin), 1899, Ann. Rept. U. S. Nat. Mus. (1897), p. 300, pl. 46, fig. 1.

Triloculina bassensis PARR, 1945, Roy. Soc. Victoria Proc., vol. 56 (n. ser.), pt. 2, p. 198, pl. 8, figs. 7a-c.

Triloculina cf. *T. bassensis* Parr. CUSHMAN, TODD and POST, 1954, U. S. Geol. Surv. Prof. Paper 260-H, p. 337, pl. 85, fig. 14.

Description.—Test longer than wide; chambers angular, typically quadrate, surface may be covered with short, delicate ridges which give a matte effect; apertural end of last formed chamber extended into neck; sutures distinct; wall porcelaneous; aperture subquadrate, with long tooth which may be simple or bifid.

Discussion.—This species is highly variable in Florida Bay. A wide range of variation occurs in the amount of inflation of the chambers. There appears to be a direct relationship between the amount of inflation and the angularity of the chambers, with most specimens being inflated and angular. The length-width ratio is also related to the inflation of the chambers, with the length approaching width with increased inflation. The aperture varies considerably in the type of tooth and the length-width ratio. A large number of the specimens have a bifid tooth. A majority of the specimens also have an aperture which is nearly as wide as long. Most specimens with a long narrow aperture have a simple tooth.



TEXT FIGURE 1

Sample of *Valvulina oviedoiana* characterized by reduced major axes relating length and width. Length of lines corresponds to observed range. Points represent joint means. Data given in Table 1. (——, Group 1; - - -, Group 2)

The Florida Bay specimens were compared with cotypes of *Miliolina angularis* Flint, a topotype of *Triloculina bassensis* Parr and specimens of *Triloculina* cf. *T. bassensis* Parr (Bikini, Marshall Islands). The Florida Bay specimens were identical to the cotypes of *Miliolina angularis,* and are considered conspecific. Since *Triloculina angularis* was used by d'Orbigny in 1850, it has priority. The only difference observed between *Triloculina bassensis* and *Miliolina angularis* was that the former was not as inflated as the latter, and they are considered to be the same species. Therefore, *Triloculina bassensis* is the valid name of the species. Specimens of *Triloculina* cf. *T. bassensis,* from Bikini, were similar to the topotypes of *Triloculina bassensis* except that they were less inflated. The three groups of specimens are therefore considered conspecific and represent variations in amount of inflation of the chambers. *Triloculina bassensis* may be a junior synonym of *Triloculina quadrilateralis* d'Orbigny, 1839, but the type specimens were not available for comparison.

Suborder ROTALIINA Delage and Hérouard, 1896

Superfamily BULIMINACEA Jones, 1875

Family BOLIVINITIDAE Cushman, 1927

Genus **Bolivinita** Cushman, 1927

Bolivinita rhomboidalis (Millet), 1899

Plate 7, figures 5-6

Textularia rhomboidalis MILLET, 1899, Jour. Roy. Micr. Soc., 1899, p. 559, pl. 7, fig. 4.

Bolivina rhomboidalis (Millet). CUSHMAN, 1922, Publ. 311, Carnegie Inst. Washington, p. 28.

Description.—Test small, tapering, sutural area depressed; chambers biserial, numerous, somewhat inflated, subquadrate; sutures depressed, distinct; wall coarsely perforate; aperture an opening at base of last formed chamber, extending up septal face.

Discussion.—This single specimen was found at station H-5, Card Sound, and listed in Lynts (*Ibid.*) as *Bolivina* sp.

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299. SOME OBSERVATIONS ON RECENT FORAMINIFERS FROM VENEZUELA: PART I[1]

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ABSTRACT

Two new genera of foraminifers are described, **Orectostomina** gen. nov. and **Sigmoilinita** gen. nov., as well as seven species, two of which are new: **Orectostomina camachoi** sp. nov. and **Nodosaria ericsoni** sp. nov.; and a third one is **Quinqueloculina brodermanni**, nomen novum. The remaining four species have been rarely recorded in foraminiferal literature.

INTRODUCTION

The purpose of this paper is to describe three new species and two new genera of the order *Foraminiferida* found in recent sediments of the submarine shelf off Araya Peninsula, Eastern Venezuela. Some recent miliolids rarely recorded in foraminiferal literature are also described.

This work represents part of a systematic study of recent foraminifers of the Araya shelf. We have dealt as well with their distribution. Many of the foraminifers found in this area have been encountered previously only in the Pacific and Indian Oceans and in the Mediterranean Sea. Some of them were abundant. Similar benthic assemblages of warm water foraminifers will be found in different parts of the world when extensive studies are made. For this reason the geographical subdivision of warm-water benthic foraminifers made by Joseph A. Cushman will lose much of its significance. Of course, the atolls of the Pacific Ocean, non-existent in the Atlantic, have typical ecological conditions and consequently their foraminiferal assemblages are different. These differences are, however, of an ecological and not of a geographical character. In this work we describe some species that are common to these different seas.

Thanks are given to Dr. Pedro J. Bermúdez for giving us worthwhile suggestions as well as for allowing us the use of his personal library.

MATERIALS

The samples used for this paper were taken in several cruises made by the research vessel "Guaiquerí," of the Instituto Oceanográfico, Cumaná, in October 1962 and during the first month of 1963. Most of these samples were taken by means of a jaw dredge; the others with a core sampler.

1 Contribution from the Instituto Oceanográfico, Universidad de Oriente, Cumaná.

SYSTEMATICS

Family TEXTULARIIDAE Ehrenberg, 1839

Subfamily SPIROPLECTAMMININAE Cushman, 1927

Genus **Orectostomina** gen. nov.

Type species.—Orectostomina camachoi sp. nov. Recent; near Los Testigos Islands, Venezuela.

Description.—Test small and elongated, slightly compressed. Proloculus with early chambers forming a planispiral followed by a biserial stage. Wall arenaceous, with the internal surface smooth and covered by a thin layer of segregated material. Aperture in the central part of the inner face of the last chamber, and provided with a thick lip.

Remarks.—The closest genus to *Orectostomina* is *Spiroplectammina* Cushman, 1927, but in *Orectostomina* the aperture is not at the base of the inner margin, but in the central area of the inner face of the last formed chamber. This same characteristic of the aperture and the planispiral early chambers differentiate *Orectostomina* from *Morulaeplecta* Hoeglund, 1947. The arrangement of the early chambers around the proloculus in this last genus is irregular, and it must not be confused with the planispiral growth plan that sometimes covers the proloculus of the younger chambers of *Orectostomina*. The peculiar arrangement of the aperture and the development of a test in planispiral biserial stages is sufficient to differentiate *Orectostomina* from all others of the same family.

Orectostomina camachoi sp. nov.

Plate 8, figures 1a, b and 2

Description.—Test small and elongated, slightly compressed. Proloculus followed by several chambers in a planispiral; sometimes the planispiral covers the proloculus; then follows a biserial stage. Wall arenaceous, fine grained and of uniform size that gives more or less a smooth appearance; color brownish red. Aperture is in the central area of the inner face of the last formed chamber and provided with a thick lip that usually projects outside in the form of a beak. Length between 0.26 mm. and 0.54 mm.; average length 0.42 mm.

Holotype.—The holotype is represented by figures 1a, b, plate 8, and may be found in the Department of Geology of the Instituto Oceanográfico, Cumaná. The typical locality is Station 16, Cruise

G-6306, located at 11° 15′ North, and 63° 00′ West, at a depth of 29 meters and in the neighborhood of Los Testigos Islands.

This sample is composed of large fragments of corals, bryozoans shells, and a small amount of sand consisting of shell fragments.

Other specimens were found on Station 23, Cruise G-6308, at 11° 11′ North and 63° 45′ West, 33 meters deep and also near Los Testigos Islands.

This sample consists of a clean cream-colored calcarenitic sand composed of shell fragments.

Remarks.—The outside projection of the apertural lip in the form of a beak is very remarkable in this species and it gives a peculiar appearance to the test. The name is given in honor to Dr. Enrique C. Camacho from Shell Oil Company, Lafayette, Louisiana.

Family MILIOLIDAE Ehrenberg, 1839

Subfamily QUINQUELOCULININAE Cushman, 1917

Genus **Quinqueloculina** Orbigny, 1826

Quinqueloculina brodermanni nom. nov.

Plate 8, figures 3a, b, c and 4a, b; Plate 9, figure 1

Miliolina auberiana var. *arenacea* HERON-ALLEN and EARLAND, 1922 (preoccupied name), Brit. Mus. Zool., vol. no. 2, part 2, p. 232, pl. 1, figs. 1-3.

Quinqueloculina cf. *agglutinata* BOLTOVSKOY (not Cushman), 1959, Foram. Rec. Sur Brasil, p. 47, pl. 3, fig. 12a, b; BOLTOVSKOY (not Cushman), 1960, Ciencias Zool., t. 6, no. 6, p. 301, pl. 4, figs. 33 and 34.

Description.—Test small to medium for the genus, in front view more or less circular. Peripheral border of the two last chambers at least, with tendency to form a more or less square-shaped and truncated keel. Adults have twelve to fourteen chambers; the chambers are arched and almost semi-circular. Wall arenaceous, grain of nearly uniform size and smoothly cemented; on account of this, some sutures are nearly invisible. Aperture provided with a simple tooth of irregular form. Length between 0.56 mm. and 0.69 mm.

Remarks.—The name *Miliolina auberiana* (Orbigny) var. *arenacea* Heron-Allen and Earland = *Quinqueloculina arenacea* (Heron-Allen and Earland), has been previously occupied by *Quinqueloculina arenacea* Rhumbler = *Miliolina* (*Quinqueloculina*) *arenacea* Rhumbler, 1906, Zool. Jahrb., Abt. System. Jena, vol. 24, p. 43, pl. 3, figs. 24, 25 from Hawaii. The specimens of the species described by Heron-Allen and Earland were taken offshore from Rio Janeiro.

The specimens in the description made here are from Station 4, Cruise G-6303 at a depth of 94 meters and 10° 38′ North, 64° 20′ West, near the reefs offshore of Punta Escarceo, Araya Peninsula, Venezuela.

The tendency of this species to have a circular form in front view and a dull and nearly square-shaped keel is enough to differentiate it from the remaining species of the genus. The closest species is *Quinqueloculina agglutinata* Cushman, 1917, from which it is differentiated because the sutures of *Q. brodermanni* nom. are frequently invisible or hardly visible. For this reason, externally it looks like *Sigmoilopsis* Finlay, 1947. The name is given in honor of Jorge Brodermann.

Quinqueloculina sp. cf. **Q. philippinensis** Cushman

Plate 9, figures 2a, b

Quinqueloculina kerimbatica (Heron-Allen and Earland, 1915) var. *philippinensis* CUSHMAN, 1921, U. S. Nat. Mus., Bull., no. 100, vol. 4, p. 438, pl. 89, figs. 2 and 3, text-fig. 34.

Description.—Test more or less elongated. Borders of the chambers rounded in peripheral view. Walls of the chambers reticular with the exception of two smooth bands in each chamber and parallel to the sutures of the chambers; network with net projecting and with deep concavities. Wall calcareous. Aperture preceded by a smooth neck and provided with a bifid tooth. Length between 0.40 mm. and 0.84 mm.

Remarks.—A similar species was originally described by Cushman from water near the Philippine Islands, Pacific Ocean. We have found it in samples from Station 14, Cruise G-6306 (11° 05′ N. and 63° 00′ W.) at a depth of 26 meters, and Station 26, Cruise G-02 (11° 00′ N. and 63° 00′ W.), at a depth of 30 meters. The sediments of the first station are composed mostly of reef fragments (algae, corals, bryozoans, worm tubes, etc.) and shells of all sizes. The sediments of the second station are composed mainly of fragments of calcified algae more or less of uniform size. These samples were taken in or near the reefs southeast of Los Testigos Islands. Nevertheless this species is probably originally from shallower depths.

Quinqueloculina sp. aff. **Q. reticulostriata** Cushman

Plate 9, figures 3a, b

Description.—Test large and elongated. Chambers elongated and rounded in peripheral view. Chamber walls, in the peripheral face, provided with longitudinal, thick and irregular costae. On account of this, many tests show only elongated concavities irregularly disposed as well. Wall calcareous. Aperture preceded by an elongated neck and provided with a bifid tooth. Length, 1.05 mm. to 2.25 mm.

Remarks.—A similar species, *Quinqueloculina reticulostriata* Cushman, 1921, was originally described from waters near the Philippine Islands. We have found it in the same stations as *Quinqueloculina* sp. cf. *Q. philippinensis* Cushman.

Genus **Pyrgo** Defrance, 1824

Pyrgo jugosus Cushman

Plate 9, figures 4a, b; 5a, b, c

Pyrgo jugosus CUSHMAN, 1935, Smith. Inst. Misc. Coll., 91 (Pub. 3327), p. 6, pl. 2, figs. 9-11. Recent.

Description.—Test medium, ellipsoidal. Chambers semi-ellipsoidal and provided with a broad and very thin keel. Each chamber is provided with just one central, thick costa with a length equal to three quarters the length of the chamber; in very long specimens the costa is bifurcated. The part of the last chamber opposite to the aperture is denticulated. Aperture wide, provided with a tooth in the form of a Greek T (Tau). Length 0.71 mm. to 1.10 mm.

Remarks.—This species was described by Cushman from recent marine sediments off Puerto Rico. We found it in the same localities as the two preceding species.

Pyrgo oeensis (Martinotti)

Plate 8, figures 5a, b, c; 6a, b

Biloculina oeensis MARTINOTTI, 1920, Soc. Ital. Sci. Nat. Milano, LIX, p. 253, pl. 1, figs. 1-3, text-fig. 1. Recent.

Description.—Test medium. Front view, oval-shaped in outline. Each chamber is provided with a thick keel, and well separated from the keel of the next chamber. The sutures are rather depressed. In about half of the specimens, the part of each chamber close to the aperture shows four or five weakly developed costae; they reach only one fourth the total length of each chamber. Aperture wide and provided with a broad tooth that covers a large portion of it. Length 0.60 mm. to 1.01 mm.

Remarks.—This species was described by Martinotti from samples taken at a beach in Tripolis, Mediterranean Sea. We have found it in the same stations mentioned before.

Genus **Sigmoilinita** gen. nov.

Type species.—*Sigmoilinita tenuis* (Czjzek) = *Quinqueloculina tenuis* CZJZEK, 1848, Haidingers Nat. Abh., vol. 2, p. 149, pl. 13, figs. 31-34.

Description.—Test small to medium. First chambers quinqueloculine-like, later ones biloculine and added in planes of a little more than 180° from one another, so that in transverse section their centers are in a sigmoidal curve; chambers two in a coil and evolute. Sutures visible. Wall calcareous; the wall of each chamber has several layers of calcite and each wall with its respective layers covers only the corresponding chamber and not the former ones. Aperture terminal with or without a tooth.

Remarks.—*Sigmoilina sigmoidea* (Brady) = *Planispira sigmoidea* Brady, type species of the genus *Sigmoilina* Schlumberger, 1887, according to some authors (Barker, 1960) is really *Nummoloculina* Steinmann, 1881. In our opinion, both genera are different. *Nummoloculina* has the apertural tooth in the form of a valve, similar to *Miliolinella* Wiesner, 1931, and in each coil has more than two chambers. The genus *Sigmoilina* has a thin tooth as *Quinqueloculina* and only two chambers per coil. Regardless *Sigmoilina* and *Sigmoilinita* are evidently two different genera. In the first one, the former chambers are covered by the walls of the next ones, in such a way that the sutures are not visible, and the younger chambers are covered by a thick layer. In *Sigmoilinita,* on the other hand, the wall of each chamber does not cover any of the preceding ones, and with the exception of the chambers in the quinqueloculine stage, the remaining ones are visible from the exterior. (See figures 6, 7 and 8, plate 9).

Specimens of *Sigmoilinita tenuis* (Czjzek) gen. nov. were taken at Station 18, Cruise G-6306, 11° 3′ N. Lat. and 63° 00′ W. Long., at a depth of 84 meters, and Station 28, Cruise G-6308, 11° 32′ N. and 63° 45′ W., at a depth of 92 meters.

Family NODOSARIIDAE Ehrenberg, 1839

Genus **Nodosaria** Lamarck, 1812

Nodosaria ericsoni sp. nov.

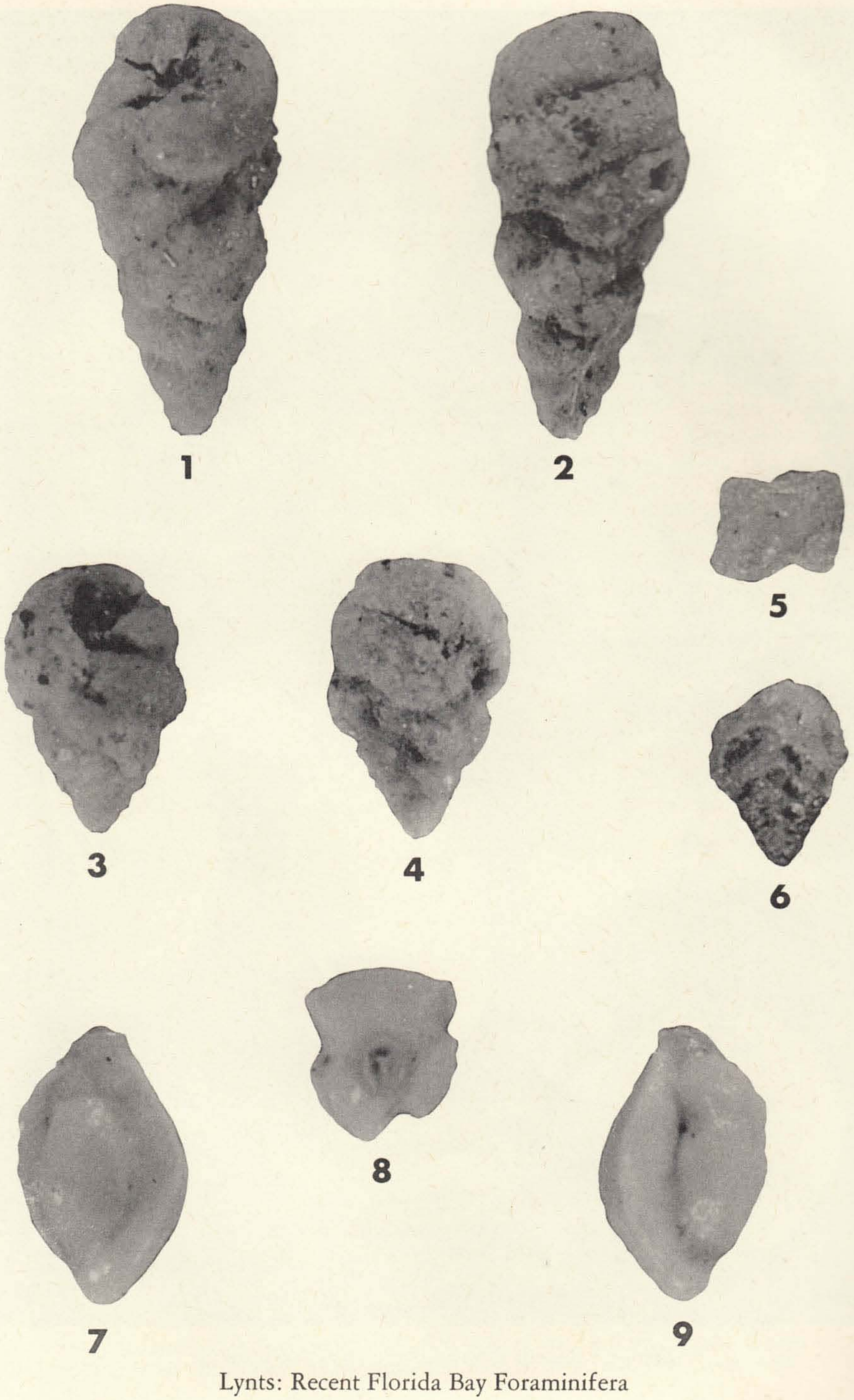
Plate 9, figures 9, 10, 11

Description.—Test small to medium for the genus, elongated. Two or three chambers rather elongated, the first one provided with a long terminal needle-shaped spine; in few instances, the first chamber is very short and curved, and the terminal needle-shaped spine is short and arched. Aperture terminal, radiate with four slits; preceded by a very thin, long, tubular neck. Length from 0.70 mm. to 1.35 mm.

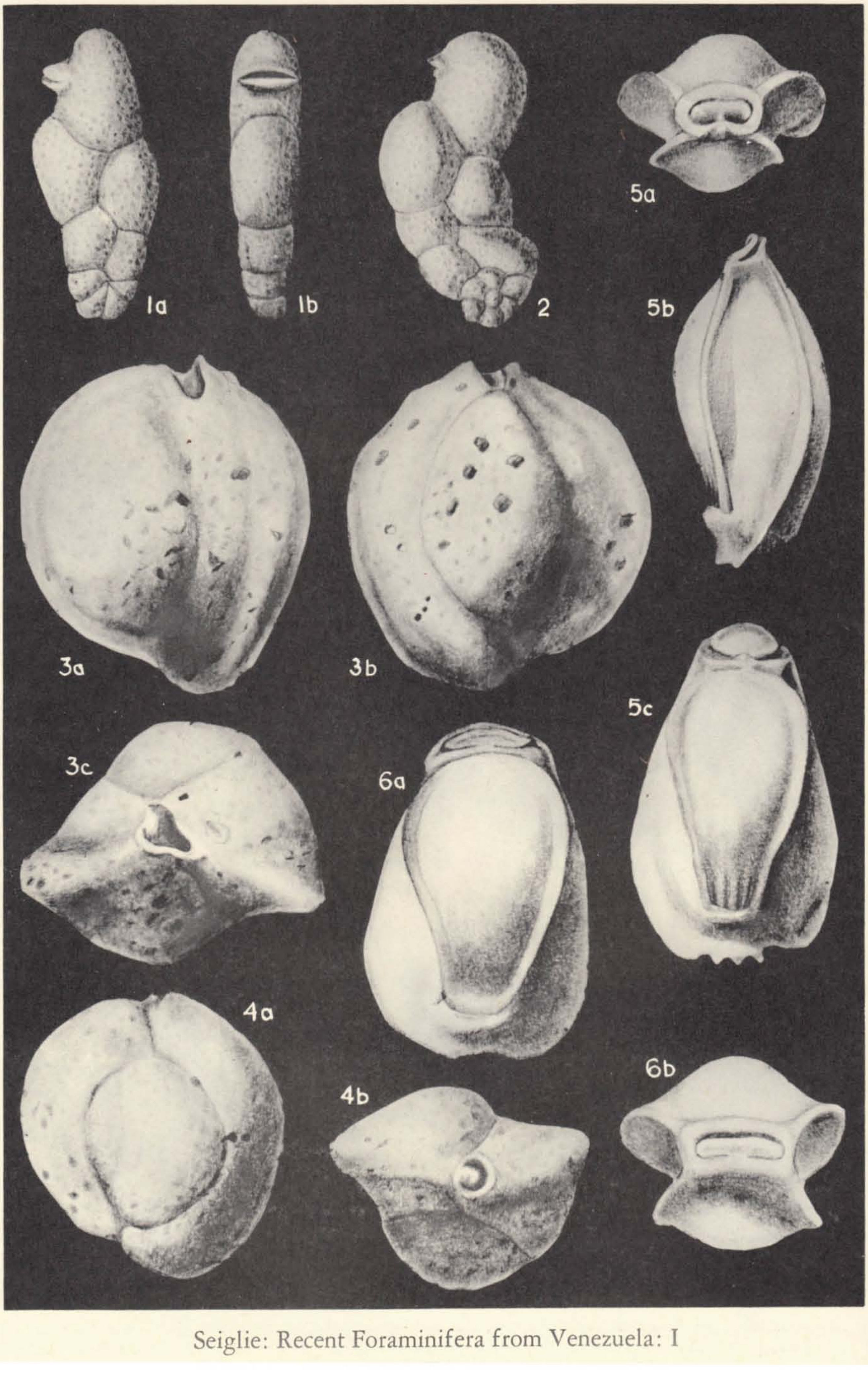
Holotype.—The holotype is represented by figure 10 of the plate 9, and is deposited in the Department of Geology of the Instituto Oceanográfico, Universidad de Oriente, Cumaná. The typical locality is Station 29, Cruise G-6308, 11° 31′ N. Lat.

EXPLANATION OF PLATE 7

FIGS.		PAGE
1-4.	*Valvulina oviedoiana* d'Orbigny, 1839. 1 and 2, side views of typical specimen of Group 1, × 34, station H-3; 3 and 4, side views of typical specimen of Group 2, × 32, station F-3.	67
5-6.	*Bolivinita rhomboidalis* (Millet), 1899. × 117. 5, apertural view; 6, side view. Station H-5.	69
7-9.	*Triloculina bassensis* Parr, 1945. × 65. 7 and 9, side views; 8, apertural view. Station F-2.	68



Lynts: Recent Florida Bay Foraminifera



Seiglie: Recent Foraminifera from Venezuela: I and 63° 45′ W. Long., at 75 meters and also at Northwest of Los Testigos Islands. The specimens were taken from the upper 8 centimeters of core. The sample is a gray silty, sandy clay.

Specimens were also taken from the lower portion of that core and also in Station 25, Cruise G-6308, 11° 35′ N. Lat., and 63° 45′ W. Long., at 140 meters.

Remarks.—The small number of elongated chambers and the long and thin neck are enough to differentiate the remaining species of the genus. In our opinion, the first chamber of the specimen represented in figure 11, plate 9, is abnormal. If this is not so, it is then a microspheric specimen and the species may be included with the genus *Amphicoryna* Schlumberger, 1881. The name is given in honor to David B. Ericson from Lamont Geological Observatory.

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EXPLANATION OF PLATE 8

FIGS.		PAGE
1a, b.	*Orectostomina camachoi* gen. nov., sp. nov., holotype, length 0.44 mm., × 102. Station 16, Cruise G-6306	70
2.	*Orectostomina camachoi* gen. nov., sp. nov., length 0.44 mm., × 102. Station 23, Cruise G-6306	70
3a, b, c.	*Quinqueloculina brodermanni* nom. nov., holotype, length 0.60 mm., × 88. Station 4, Cruise G-6303	71
4a, b.	*Quinqueloculina brodermanni,* nom. nov. length 0.52 mm., × 85. Station 4, Cruise G-6303	71
5a, b, c.	*Pyrgo oeensis* (Martinotti), 1920, length 0.91 mm., × 58. Station 4, Cruise G-6306	72
6a, b.	*Pyrgo oeensis* (Martinotti), 1920, length 0.94 mm., × 58. Station 26, Cruise G-02	72

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300. FUSULINIDS FROM THE *CYATHOPHYLLUM* LIMESTONE, CENTRAL VESTSPITSBERGEN

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ABSTRACT

Thirteen species of fusulinids are illustrated and described from eleven collections within the **Cyathophyllum** Limestone of central Vestspitsbergen. The lower collections at Tempelfjorden and the collection from Mount Lykta contain **Schubertella transitoria**, **Triticites arcticus**, and **Schwagerina anderssoni** and other species typical of the Carboniferous zones C_3C through C_3E of the Ural region of the U.S.S.R. It is suggested that **"Fusulinella" usvae** is a species of **Waeringella.** Higher collections at Tempelfjorden include **Parafusulina furnishi** n. sp. and **Pseudofusulinella tempelensis** n. sp. and a loose block from higher in the succession includes **Schwagerina globosa** and **Monodiexodina** cf. **M. paralinearis** which are suggestive of a late Sakmarian or early Artinskian (Permian) age.

INTRODUCTION

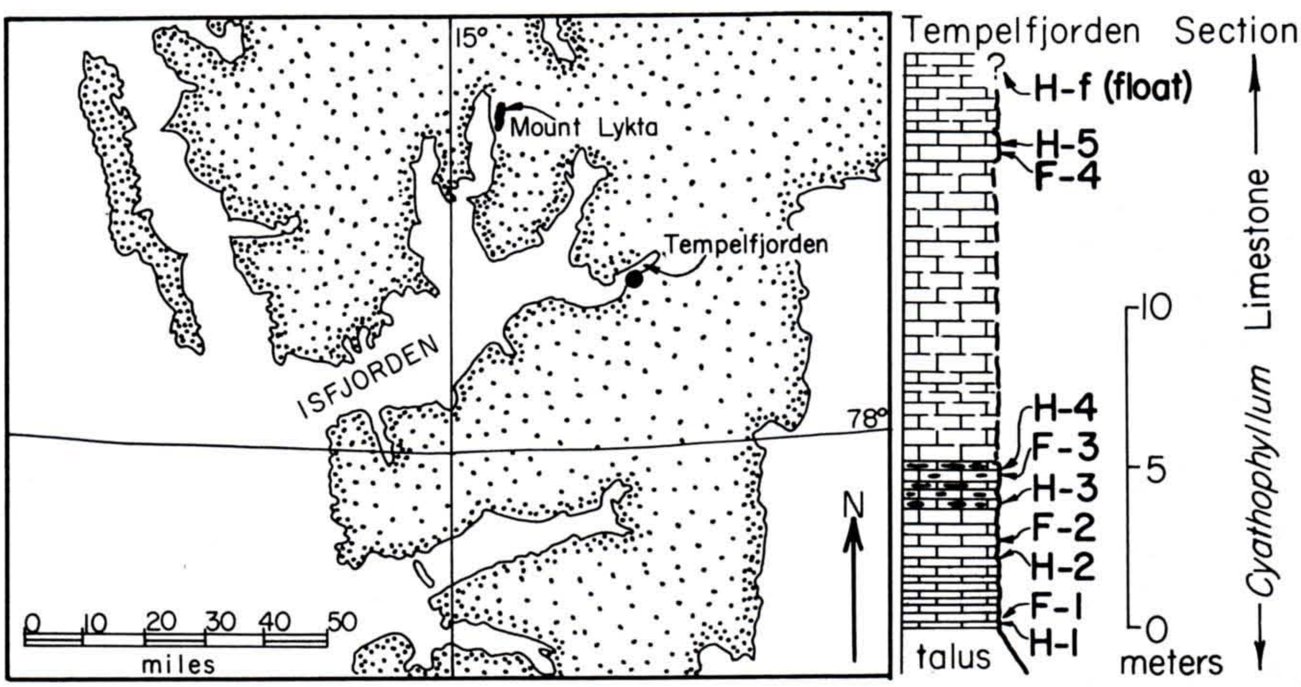
Most of the fusulinids of Spitsbergen, Bear Island, northeast Greenland, and Ellesmereland are faunally related to the fusulinid assemblages of the Ural Geosyncline and they represent an arm of the large Ural faunal province which extended into Arctic North America and which was apparently intermittently connected with the western hemisphere Cordilleran Geosyncline and related depositional basins.

[1] Western Washington State College; previously Illinois State Geological Survey.

The fusulinids of Spitsbergen have been the subject of a number of short taxonomic studies; however, the abundant fauna remains largely undescribed. The fusulinids studied in this report come from only a small part of the total section that has fusulinids but it is significant in that it includes that portion from which *Schubertella transitoria, Triticites arcticus,* and *Schwagerina anderssoni* were originally described. It is also in this part of the sequence that the boundary between the Carboniferous and Permian Systems is located.

PREVIOUS FUSULINID STUDIES

Upper Carboniferous fusulinids from Spitsbergen were first collected by Nathorst in 1882 from several localities along the fjords that lead into Isfjorden, the major fjord (Text-Fig. 1) on the west coast which extends nearly fifty miles into central Vestspitsbergen (Nathorst, 1910). Goës (1884) listed *"Fusulina cylindrica"* in these collections, a name commonly given at that time to elongate, fusiform fusulinids. Schellwien (1908) borrowed this material from the University of Uppsala and described *Fusulina arctica* Schellwien and *F. anderssoni* Schellwien. Staff and Wedekind (1910) restudied



TEXT-FIGURE 1

Map of Central Vestspitsbergen showing location of Mount Lykta and section at Tempelfjorden. Columnar section at right shows position of collections from the middle part of the *Cyathophyllum* Limestone at Tempelfjorden.

this material and described *Schubertella transitoria* Staff and Wedekind, and, for the first time illustrated *Schellwienia anderssoni* (Schellwien) from it. Thompson (1937) in his restudy of the genus *Schubertella* studied samples from the Riksmuseum in Stockholm, apparently also collected by Nathorst, and considered them to be topotype material for *Schubertella transitoria*. From material collected by the Cambridge University Expeditions, Gee, Harland, and McWhae (1952), Baker, Forbes, and Holland (1952), and Forbes, Harland, and Hughes (1958) listed fusulinids in their faunal lists for the Carboniferous and Permian succession at many places in central Vestspitsbergen. Forbes (1960) described and illustrated many of these forms and outlined the fusulinid succession.

DISTRIBUTION OF FUSULINIDS

The species described in the present report were collected by W. M. Furnish, State University of Iowa, and W. W. Hay, University of Illinois, during the Twenty-first International Geological Congress excursion to Svalbard (Spitsbergen) in 1960. The fusulinid-bearing collections that they made came from two localities (Text-Fig. 1): (1) the southern side of Tempelfjorden where they made detailed collections in the lower twenty meters of the nearly 200 meters of *Cyathophyllum* Limestone; and (2) from Mount Lykta near the north end of Dicksonfjord where a thin section of *Cyathophyllum* Limestone caps the mountain. A summary of the geology of these and other localities is given by Winsnes, Heintz, and Heintz (1960) in their guide book for this excursion.

The distribution of the fusulinid species from central Vestspitsbergen studied in this report is shown in Table 1. The collections from the lower 5 meters at Tempelfjorden and at Mount Lykta appear to represent a single faunal assemblage zone; two higher collections (H-5 and F-4) represent a second assemblage zone; and the loose block (H-f) apparently represents a third assemblage zone from a higher but unknown position in the succession.

The lowest faunal assemblage of this report includes the Upper Carboniferous species: *Triticites arcticus* (Schellwien), *T. pseudoarcticus* Rauser-Chernoussova, *T. paraarcticus* Rauser-Chernoussova, *T. dagmarae* Rozovskaya, *Schwagerina anderssoni* (Schellwien), and *Waeringella*(?) *usvae* (Dutkevitch). According to the zonal classification of the Upper Carboniferous used by Rozovskaya (1958) these species have restricted stratigraphic ranges in the southern Ural Mountain region: *T. arcticus, T. pseudoarcticus,* and *T. paraarcticus* have ranges that overlap in Rozovskaya's zone C_3C (Zone of *T. stuckenbergi*); *T. dagmarae* occurs in zone C_3D (Zone of *T. jigulensis*); and *Schwagerina anderssoni* occurs in zone C_3E (Zone of *Pseudofusulina*). In the Spitsbergen collections examined, these species appear to be associated or interbedded with one another and the stratigraphic zonation used in the Ural region is difficult to apply. The lowest faunal assemblage of this report represents a part of Rozovskaya's zones C_3C through C_3E. These Spitsbergen strata are correlative with part of the upper Pennsylvanian of North America, probably some part of the Virgilian Series.

TABLE 1
DISTRIBUTION OF SPECIES OF FUSULINIDS
IN COLLECTIONS STUDIED, CENTRAL VESTSPITSBERGEN

Collection Species	H-ML	H-1	F-1	H-2	F-2	H-3	F-3	H-4	F-4	H-5	H-f (float)
Triticites paraarcticus	X	X	X	X	-	-	X	-	-	-	-
T. pseudoarcticus	X	-	-	X	X	?	X	-	-	-	-
T. arcticus	X	-	-	-	X	-	X	X	-	-	-
T. dagmarae	-	X	X	-	-	-	-	-	-	-	-
Schwagerina anderssoni	X	-	-	X	X	-	X	-	-	-	-
Schubertella transitoria	X	-	-	X	X	-	-	-	-	-	-
Waeringella(?) *usvae*	-	-	-	X	-	-	-	-	-	-	-
Parafusulina furnishi	-	-	-	-	-	-	-	-	X	X	-
Pseudofusulinella tempelensis	-	-	-	-	-	-	-	-	X	-	-
Bartramella(?) sp.	-	-	-	-	-	-	-	-	-	-	X
Schwagerina spp.	-	-	-	-	-	-	-	-	-	-	X
Schwagerina globosa	-	-	-	-	-	-	-	-	-	-	X
Monodiexodina cf. *M. paralinearis*	-	-	-	-	-	-	-	-	-	-	X

The second, higher fusulinid assemblage contains a primitive species of *Parafusulina*, *P. furnishi* n. sp., and an advanced species of *Pseudofusulinella*, *P. tempelensis* n. sp. The low cuniculi in *Parafusulina furnishi* suggest a stage of evolution comparable to that found in early Leonardian species of *Parafusulina*, such as *P. leonardensis* Ross. Closely similar elongate species with heavy secondary deposits have not been noted in the fusulinid literature from the U.S.S.R. or North America.

The fusulinid assemblage from the loose block (collection H-f) which is apparently from strata above collections H-5 and F-4, contains *Schwagerina globosa* (Schellwien and Dyhrenfurth), *Monodiexodina* cf. *M. paralinearis* (Thorsteinsson), and *Schwagerina* sp. which are closely similar in their stages of evolution to the early Leonardian, shallow water species, *S. hawkinsi* Dunbar and Skinner, *S. hessensis* Dunbar and Skinner, and *M. linearis* (Dunbar and Skinner), from the western Glass Mountains, Texas (Ross, 1962). This Spitsbergen assemblage is also closely similar to that described from the lower part of the "Darvas Series" (Artinskian?) in the Darvas region of the U.S.S.R. by Schellwien and Dyhrenfurth (1909).

Forbes (1960) in his description of fusulinids collected during various Cambridge Expeditions to Central Vestspitsbergen followed the stratigraphic terminology of Gee, Harland, and McWhae (1952), modified by Forbes, Harland, and Hughes (1958). In these reports the *Cyathophyllum* Limestone was divided into two major units, the Wordiekammen Limestone below and the Upper Gypsiferous Series above. Within the Wordiekammen Limestone several subunits based on lithology were recognized. The lower fusulinid assemblage studied in this report seems to have come from the "black band of bituminous fusuline limestone" about 8 meters thick near the middle of the Wordiekammen Limestone that Forbes, Harland, and Hughes (1958) called the "Mid Wordiekammen Limestones." Forbes (1960) placed the Carboniferous-Permian boundary within this 8-meter unit. It is from this lithology that the type specimens of *Triticites arcticus, Schubertella transitoria,* and probably also *Schwagerina anderssoni* occur. In the Tempelfjorden section, this unit seems to have only a Carboniferous fusulinid fauna typical of the C_3C through C_3E faunal assemblages of the Ural Mountain region and lacks fusulinids typical of the Zone of *Pseudoschwagerina* of either the North American (Wolfcampian Series) or the Ural Mountain (Asselian Series) regions. At Tempelfjorden the next higher fusulinid-bearings beds (about 10 meters higher) from which collections are available have a primitive species of *Parafusulina* that is probably younger than the Zone of *Pseudoschwagerina,* if the occurrence of the genus here corresponds to stratigraphic occurrences elsewhere. Thus the collections studied in this report raise the interesting question as to whether the Zone of *Pseudoschwagerina* is present or absent in the 10 meters of strata from which samples were not obtained. Forbes, following the generic concept of *Schwagerina* outlined by Dunbar and Skinner (1936), described several species of *Schwagerina* from other parts of Central Vestspitsbergen which may belong to the Zone of *Pseudoschwagerina.* The float collection from Tempelfjorden, which is most likely from strata of late Sakmarian or early Artinskian age, is believed to have come from within the "Upper Wordiekammen" Limestones of Forbes, Harland, and Hughes (1958).

In addition to the species that are described and illustrated in this study, collection H-4 includes recrystallized and crushed specimens of an ozawainellid which has low asymmetrical chomata, high

EXPLANATION OF PLATE 9

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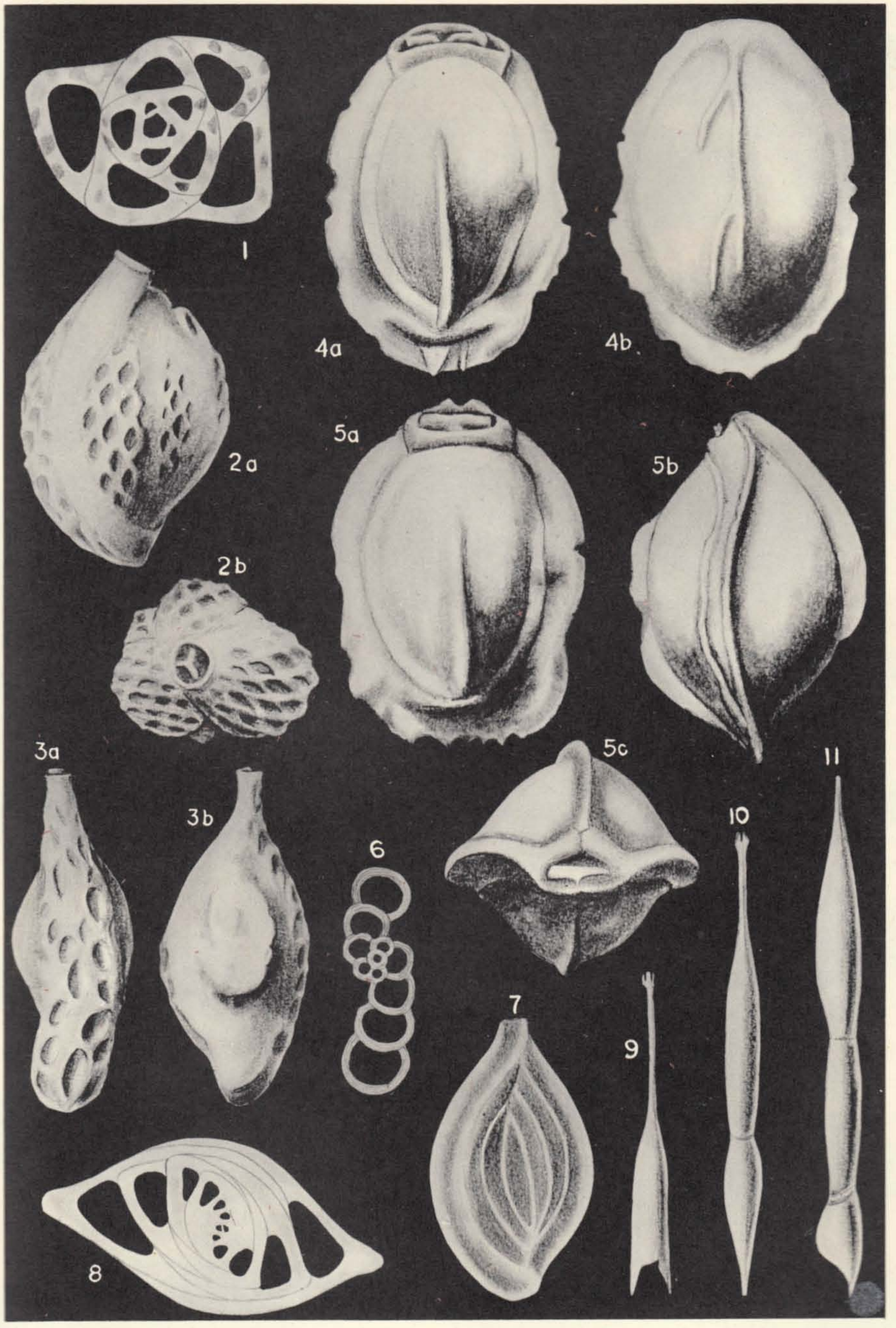
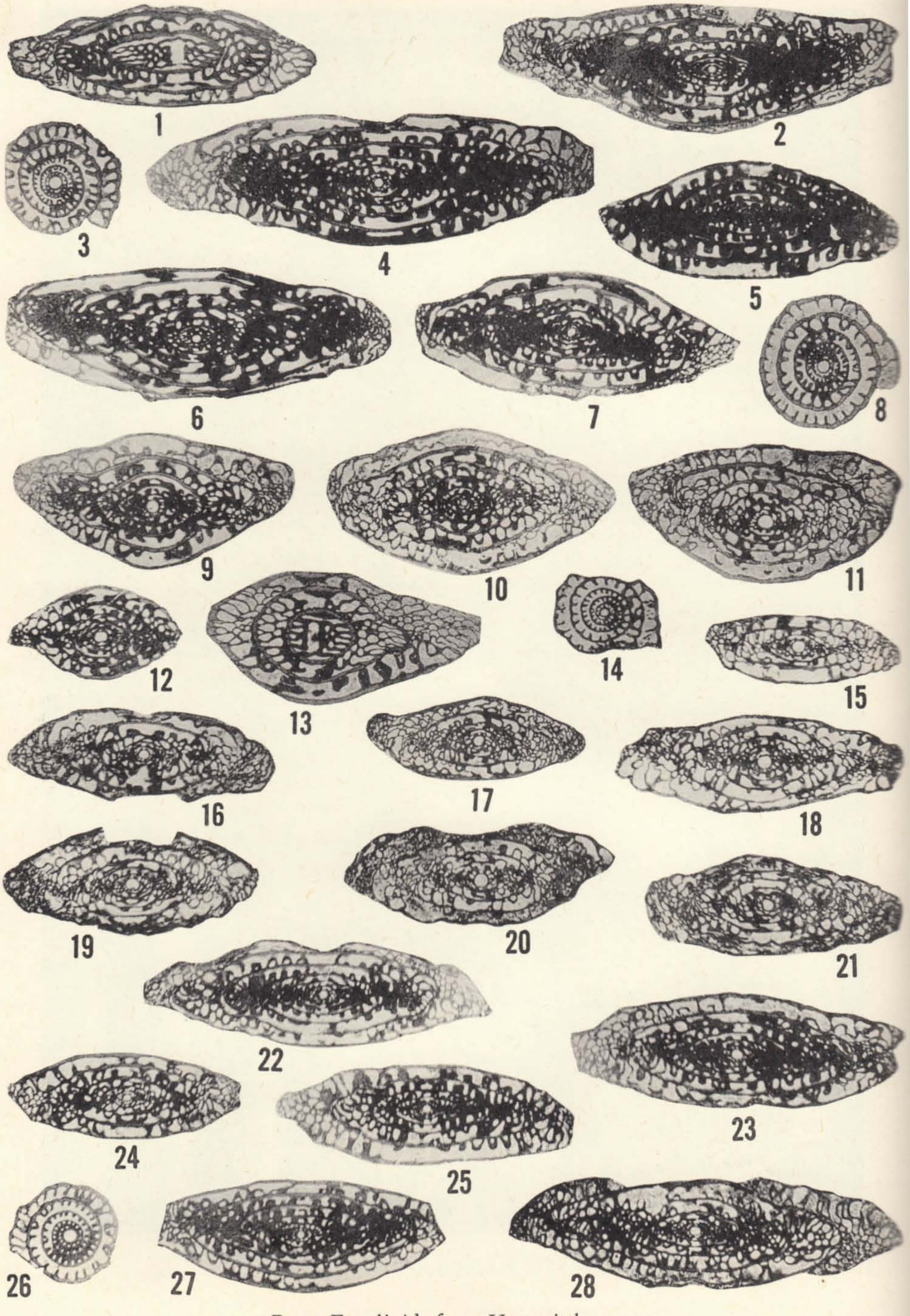


Seiglie: Recent Foraminifera from Venezuela: I



Ross: Fusulinids from Vestspitsbergen

volutions, and a relatively long axis of coiling. These features and the broadly angular periphery and slightly umbilicate axis are suggestive of *Nankinella* Lee (1933) although, as Thompson (1948, p. 29) mentions, this genus is poorly known and its relations poorly understood. Smaller Foraminifera such as *Tetrataxis, Globivalvulina, Geinitzina, Neogeinitzina*?, *Bradyina,* and *Climacammina* are common in many of the collections.

ACKNOWLEDGMENTS

I thank W. M. Furnish, State University of Iowa, and W. W. Hay, University of Illinois, for kindly making these collections available for study.

REPOSITORIES

Specimens illustrated are housed in the paleontological collections of the State University of Iowa (abbreviated to SUI in text) and bear catalog numbers of that collection.

SYSTEMATIC PALEONTOLOGY

Genus **Parafusulina** Dunbar and Skinner, 1931

Parafusulina furnishi n. sp.

Plate 10, figures 1-7

Description.—Elongate fusiform tests commonly reach 8 mm. in length and 2.2 mm. in diameter in 6 to 7 volutions. Proloculi in megalospheric individuals average about 0.14 mm. outside diameter and may reach 0.25 mm. in some individuals. Tests become progressively more elongate in successive volutions and polar extremities are commonly irregularly extended in later volutions. Wall is composed of a tectum and keriotheca having medium sized alveoli. Septal folds are low across the center of chamber, and increase in height toward poles. Low cuniculi are present in later volutions (Pl. 10, fig. 1). Secondary deposits form dense coating on septal folds and along axis. These deposits give the septal folds a distinctive appearance of having flattened crests (Pl. 10, figs. 2, 4, 5). Chomata are rudimentary in first volution and lacking in later volutions. Measurements are given in Table 2.

Microspheric individual (Pl. 10, fig. 5) is about the same size as megalospheric individuals and also has a well defined tunnel.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden; collections H-5 and F-4.

Remarks.—*Parafusulina furnishi* is larger and more elongate than *Schwagerina anderssoni* (Schellwien) which has similar secondary septal and axial deposits. The heavy secondary deposits, elongate shape, and low cuniculi are distinctive features of *P. furnishi.* This species is named in honor of W. M. Furnish who has contributed greatly to the understanding of Paleozoic faunas and stratigraphy.

Genus **Triticites** Girty, 1904

Triticites dagmarae Rozovskaya

Plate 10, figures 8-13

Triticites (*Jigulites*) *dagmarae* ROZOVSKAYA, 1950, p. 39, pl. 8, figs. 6-7; ROZOVSKAYA, 1958, p. 103, pl. 10, fig. 6.

Description.—Thickly fusiform to subglobose tests that commonly reach 5 mm. in length and 2.5 mm. in diameter in 5 to 6 volutions. Proloculi average about 0.25 outside diameter. Early volutions high and short; later volutions increase slightly more in length than in height to reach form ratios of 2.0. Septal folds are high and irregular; septal wall is thin (Pl. 10, fig. 11). Spiral wall is thin in early volutions (0.02 mm.) but increases markedly in later volutions (0.09 mm.). Tectum is thin and keriotheca coarsely alveolar. Secondary deposits include well developed, low chomata and deposits

EXPLANATION OF PLATE 10

All figures × 10

FIGS.		PAGE
1-7.	*Parafusulina furnishi* n. sp., *Cyathophyllum* Limestone, Tempelfjorden 1, Tangential section showing low cuniculi in next to last volution, collection F-4, SUI 11134. 2, Axial section, collection F-4, SUI 11135. 3, Sagittal section, collection H-5, SUI 11155. 4, Axial section of holotype, collection F-4, SUI 11136. 5, Axial section of microspheric individual, collection H-5, SUI 11156. 6, Axial section, collection F-4, SUI 11137. 7, Axial section, collection H-5, SUI 11157.	77
8-13.	*Triticites dagmarae* Rozovskaya, *Cyathophyllum* Limestone, Tempelfjorden, collection F-1 8, Sagittal section, SUI 11138. 9-12, Axial sections, SUI 11139, SUI 11140, SUI 11141, and SUI 11142. 13, Tangential section, SUI 11143.	77
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TABLE 2
MEASUREMENTS OF SPECIMENS FROM PLATE 10

		Parafusulina furnishi			*Triticites dagmarae*		
	Volution	fig. 2	fig. 4	fig. 6	fig. 9	fig. 10	fig. 11
Radius vector (mm.)	0	0.06	.08	.07	.10	.09	.13
	1	.10	.18	.22	.30	.18	.25
	2	.20	.30	.35	.50	.28	.40
	3	.30	.45	.50	.75	.45	.50
	4	.50	.65	.75	1.05	.70	.70
	5	.75	.90	1.00	......	.95	1.05
	6	1.05	1.15	1.20	......	1.25	......
Half length (mm.)	1	.30	.25	.30	.60	.30	.40
	2	.60	.75	.60	.90	.50	.65
	3	.90	1.50	1.05	1.30	.85	.90
	4	1.80	2.10	1.50	2.00	1.20	1.30
	5	2.40	2.80	2.30	......	1.80	2.10
	6	3.70	3.90	3.05	......	2.50	......
Form ratio	1	3.3	1.4	1.4	2.0	1.7	1.6
	2	3.3	2.5	1.7	1.8	1.8	1.6
	3	3.3	3.3	2.1	1.7	1.9	1.8
	4	3.6	3.2	2.0	1.9	1.7	1.9
	5	3.2	3.1	2.3	......	1.9	2.0
	6	3.5	3.4	2.5	......	2.0	......
Wall thickness (mm.)	0	.02	.03	.02	.02	.02	.02
	1	.03	.03	.02	.04	.03	.02
	2	.03	.04	.03	.06	.03	.03
	3	.04	.05	.03	.09	.04	.02
	4	.06	.05	.03	.08	.07	.06
	5	.08	.07	.04	......	.08	.09
	6	.09	.06	.04	......	.08	......
Tunnel angle (°)	1	30	25	28	18	18	20
	2	30	27	27	17	16	32
	3	28	28	24	23	23	32
	4	29	29	35	28	24	......
	5	35	34	36	......	......	......

which coat the septal folds in the early volutions giving these volutions a dense appearance (Pl. 10, figs. 8, 9, 10, 12). The tunnel is well defined in all but the last volution. Measurements are given in Table 2.

Occurrence.—Cyathophyllum Limestone, Tempelfjorden; collection F-1 and H-1.

Remarks.—Triticites dagmarae has a distinctive thickly fusiform to subglobose shape and an irregular growth pattern which readily separate it from other species of *Triticites* from Spitsbergen. *T. procullomensis* Rozovskaya (1950) is more elongate than *T. dagmarae.*

Triticites arcticus (Schellwien)
Plate 10, figures 14-21

Fusulina arctica SCHELLWIEN, 1908, p. 173, pl. 16, figs. 3-9.

Triticites arcticus (Schellwien), RAUSER-CHERNOUSSOVA, 1938, p. 115, figs. 4-6; ROZOVSKAYA, 1958, p. 90, pl. 4, figs. 10-11; FORBES, 1960, p. 216, pl. 32, figs. 10-17.

?*Pseudofusulina* (*Rugosofusulina*) *arctica* (Schellwien) ROSS and DUNBAR, 1962, p. 41, pl. 6, figs. 1-7.

Description.—Fusiform tests commonly reach 5 mm. in length and 1.5 mm. in diameter in 5 volutions. Proloculi average about 0.2 mm. outside diameter. Early volutions are short and high; succeeding volutions gradually increase proportionally more in length, commonly reaching form ratios of 2.8. Polar regions are slightly extended in last volution (Pl. 10, fig. 18). Wall composed of tectum and keriotheca having medium alveoli. Septal folds high and slightly irregular in outline; more strongly folded away from midplane. Septal pores are large

TABLE 3
MEASUREMENTS OF SPECIMENS FROM PLATE 10

		Triticites arcticus		*Schwagerina anderssoni*		
	Volution	fig. 16	fig. 20	fig. 22	fig. 23	fig. 28
Radius vector (mm.)	0	.08	.11	.09	.09	.07
	1	.14	.20	.15	.15	.18
	2	.22	.35	.25	.25	.27
	3	.33	.50	.35	.35	.42
	4	.55	.70	.50	.55	.68
	5	.80	......	.70	.75	.90
	6	......	......	.90	1.00	......
Half length (mm.)	1	.20	.40	.25	.40	.45
	2	.35	.80	.60	.70	.80
	3	.70	1.25	1.10	.90	1.40
	4	1.40	1.90	1.80	1.50	2.10
	5	2.25	......	2.60	2.20	3.20
	6	......	......	3.40?	3.10?	......
Form ratio (mm.)	1	1.4	2.0	1.7	2.7	2.5
	2	1.6	2.3	2.4	2.8	3.0
	3	2.1	2.5	3.1	2.6	3.3
	4	2.5	2.7	3.6	2.7	3.2
	5	2.8	......	3.7	2.9	3.6
	6	......	......	3.7?	3.1?	......
Wall thickness (mm.)	0	.01	.01	.02	.02	.01
	1	.01	.03	.02	.02	.01
	2	.03	.03	.02	.02	.02
	3	.03	.06	.03	.03	.02
	4	.04	.08	.04	.03	.04
	5	.07	......	.06	.07	.07
	6	......	......	.04	.09	.08
Tunnel angle (°)	1	25	30	30	25	20
	2	27	30	30	28	25
	3	28	40	30	30	28
	4	35	......	34	35	35
	5	......	......	......	40	......

and closely spaced. Septa thin and widely spaced (Pl. 10, fig. 14). Tunnel and chomata well developed in all but the last volution. Tunnel path slightly irregular; chomata massive, symmetrical, and reach one-half to two-thirds chamber height (Pl. 10, figs. 16, 18, 20). Other secondary deposits weakly developed and may occur as thin coatings on septa. Measurements are given in Table 3.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden and Mt. Lykta; collections H-4, H-M.L., F-2, and F-3.

Remarks.—The type specimens of *Triticites arcticus* came from the Tempelfjorden area of Spitsbergen and the topotype specimens described here agree closely with the specimens illustrated by Schellwien (1908, pl. 16, figs. 3-9). *T. arcticus* differs from associated species in its growth pattern and lack of significant secondary axial deposits. *T. paraarcticus* has more pointed poles and higher and more regular septal folds. The specimens illustrated by Ross and Dunbar (1962) from northeast Greenland seem to be either younger representatives of the *T. arcticus* lineage or may belong to a species of the *Schwagerina prisca* (Ehrenberg) lineage.

Triticites paraarcticus Rauser-Chernoussova
Plate 11, figures 1-9, 18-21

Triticites paraarcticus RAUSER-CHERNOUSSOVA, 1938, p. 117, pl. 4, figs. 7, 9; SEMICHATOVA, 1939, p. 118, pl. 2, figs. 20, 21; PUTRIA, 1940, p. 104, pl. 10, fig. 1; ROZOVSKAYA, 1950, p. 35, pl. 7, figs. 6-8; ROZOVSKAYA, 1958, p. 95, pl. 7, figs. 1-3.

Description.—Small, thickly fusiform to elongate fusiform tests of five to six volutions commonly reach 7.5 mm. in length and 2.3 mm. in diameter.

TABLE 4
MEASUREMENTS OF SPECIMENS FROM PLATE 11

	Volution	*Triticites paraarcticus* fig. 1	fig. 2	fig. 20	fig. 21	*Triticites pseudoarcticus* fig. 12	fig. 14
Radius	0	.09	.08	.09	.10	.15	.12
vector	1	.18	.15	.20	.18	.25	.35
(mm.)	2	.30	.22	.35	.30	.42	.45
	3	.45	.38	.55	.50	.65	.70
	4	.70	.55	.75	.80	.90	.95
	5	.85	.85	1.10	......	......	1.20
Half	1	.25	.20	.35	.30	.40	.60
length	2	.50	.40	.70	.80	.90	.90
(mm.)	3	.90	.65	1.40	1.40	1.80	1.40
	4	1.50	.95	2.10	3.50	2.70	2.30
	5	2.30	1.80	3.60	......	......	3.20
Form	1	1.4	1.3	1.7	1.7	1.6	1.7
ratio	2	1.7	1.8	2.0	2.7	2.2	2.0
	3	2.0	1.7	2.7	2.8	2.8	2.0
	4	2.1	1.7	2.8	4.4	3.0	2.4
	5	2.7	2.1	3.3	......	......	2.7
Wall	0	.01	.01	.02	.02	.02	.04
thickness	1	.01	.02	.02	.02	.03	.04
(mm.)	2	.03	.03	.03	.03	.05	.05
	3	.03	.03	.05	.03	.06	.06
	4	.07	.06	.07	.06	.10	.08
	5	.07	.07	.09	......	......	.08
Tunnel	1	22	22	22	18	24	22
angle	2	25	24	28	22	28	28
(°)	3	34	30	34	24	35	35
	4	......	30	38	......	......	50

Proloculi in specimens examined range from 0.08 mm. to 0.25 mm. outside diameter. First one or two volutions are small and subglobose and succeeding volutions increase in height and length. Convex lateral slopes extend to narrowly rounded poles in early volutions; poles may be extended in later volutions. Wall is composed of tectum and medium to coarsely alveolar keriotheca which thins toward the poles. High, regular septal folds extend across entire chamber in all but last volution where they may be irregular in outline (Pl. 11, fig. 20). Tunnel path is straight and bordered by low symmetrical chomata in all but the last volution. Secondary deposits coat and may infill septal folds and coat crests of septal folds, particularly near tunnel. Measurements are given in Table 4.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden and Mount Lykta; collections H-1, H-2, H-M.L., F-1, F-3.

Remarks.—The specimens of *Triticites paraarcticus* from Spitsbergen compare closely with the type specimens from the Russian Platform illustrated by Rauser-Chernoussova (1938) and specimens assigned to this species by Rozovskaya (1950, 1958). *T. paraarcticus* has lower, early volutions, more closely folded septa, and heavier secondary deposits than *T. arcticus* (Schellwien) and has lower chambers and a smaller test than *T. pseudoarcticus* Rauser-Chernoussova.

Triticites pseudoarcticus Rauser-Chernoussova
Plate 11, figures 10-17

Triticites pseudoarcticus RAUSER-CHERNOUSSOVA, 1938, p. 123, pl. 5, figs. 10, 11, pl. 6, figs. 1, 21.

Triticites (*Triticites*) *pseudoarcticus* Rauser-Chernoussova, ROZOVSKAYA, 1958, p. 91, pl. 5, fig. 1.

Description.—Fusiform tests commonly reach 8 mm. in length and 3 mm. in diameter in 7 volutions. Proloculi average about 0.3 mm. outside diameter. Early volutions are high and short. Succeeding volutions have high chambers and gradually increase in length, commonly attaining form ratios of 2.7. Lateral slopes taper toward small, rounded poles. Wall is formed by a tectum and thick, coarsely alveolar keriotheca. Septal folds high, widely spaced, and irregular; they increase in height away from the midplane. Tunnel path is slightly irregular. Small low chomata border the tunnel. Secondary deposits coat the crests of septal folds and floors of chambers, particularly near tunnel (Pl. 11, figs. 14, 15) and in early volutions. Measurements are given in Table 4.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden and Mount Lykta; collections H-2, H-M.L., F-2, and F-3.

Remarks.—*Triticites pseudoarcticus* from Spitsbergen agrees closely with the type specimens illustrated by Rauser-Chernoussova from the southern Ural region of the U.S.S.R. *T. mogutovensis* Rozovskaya is larger and has higher volutions than *T. pseudoarcticus* although in general construction, particularly of the septal folds, these two species are similar. *T. paraarcticus* Rauser-Chernoussova is smaller and more elongate than *T. pseudoarcticus. Pseudofusulina* (*Daixina*) *amdrupensis* Ross and Dunbar from northeast Greenland is similar in shape to *T. pseudoarcticus,* but is larger, has higher volutions earlier in the ontogeny of the test, and only pseudochomata bordering the tunnel.

Genus **Schwagerina** von Möller, 1877, emend.
Dunbar and Skinner, 1936

Schwagerina anderssoni (Schellwien)
Plate 10, figures 22-28

Fusulina anderssoni SCHELLWIEN, 1908, p. 192 (not illustrated); illustrated as *Schellwienia anderssoni* by Staff and Wedekind, 1910, pl. 3, figs. 1-5.

?*Pseudofusulina anderssoni* (Schellwien) ROZOVSKAYA, 1958, p. 112, pl. 15, figs. 8-9.

Description.—Elongate fusiform tests commonly reach 6.5 mm. to 7.0 mm. in length and 2.0 mm. in diameter in 6 to 7 volutions. Proloculi average about 0.15 mm. outside diameter. Early volutions are low and elongate and succeeding volutions become progressively more elongate, commonly reaching form ratios of 3.5. Poles are bluntly rounded. Wall is composed of tectum and keriotheca having medium to coarse alveoli. Septal folds are evenly spaced and increase slightly in height away from the midplane (Pl. 10, fig. 22). Tunnel is well developed in all but the last volution. Secondary deposits, commonly concentrated in axial region, include heavy dark coatings on septal folds giving them flattened crests (Pl. 10, fig. 25). Chomata are present in early volutions but appear to pass into secondary deposits on septal folds adjacent to tunnel in later volutions. Measurements are given in Table 3.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden and Mount Lykta; collections H-2, H-M.L., F-2, and F-3.

Remarks.—The specimens of *Schwagerina anderssoni* illustrated here compare closely with those illustrated by Staff and Wedekind, particularly their axial sections shown on their plate 3, figs. 4 and 5. Besides lacking cuniculi *S. anderssoni* is smaller and has lighter septal and axial deposits than *Parafusulina furnishi* n. sp.

Schwagerina globosa (Schellwien and Dyhrenfurth)
Plate 12, figures 12-14

Fusulina vulgaris var. *globosa* SCHELLWIEN and DYHRENFURTH, 1909, p. 164, pl. 13, fig. 8, pl. 14, figs. 3-7.

Schwagerina globosa (Schellwien and Dyhrenfurth), DUTKEVICH, 1939, p. 39, pl. 2, figs. 10, 11.

Description.—Thickly fusiform to subglobose tests commonly reach 7 mm. in length and 4 mm. in diameter in 5 volutions. Proloculi average about 0.2 mm. outside diameter and the early volutions are high and subglobose (Pl. 12, fig. 13). Succeeding volutions gradually become proportionally longer than higher. The spiral wall is composed of a tectum and a thick, coarsely alveolar keriotheca which commonly reaches 0.1 mm. in thickness by the third volution. High, regular septal folds extend across the entire chamber (Pl. 12, fig. 13); the crests of the folds are commonly narrow. Irregular tunnel path lacks chomata but pseudochomata thicken the edges of septa adjacent to the tunnel (Pl. 12, fig. 12). Secondary coatings are minor and may be deposited on crests of septal folds. Measurements are given in Table 5.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden; collection H-f (float).

Remarks.—The specimens studied are slightly crushed or incomplete and their mature shape is not readily determined. In nearly all internal features these specimens resemble *Schwagerina globosa* (Schellwien and Dyhrenfurth). *S. vulgaris* (Schellwien and Dyhrenfurth) has a more elongate test and *S. princeps* (Ehrenberg) has more narrowly folded septa and lower earlier volutions than *S. globosa*. *S. schwageriniformis* Rauser-Chernoussova, Beljaev, and Reitlinger is more elongate and has lower early volutions.

Schwagerina sp.
Plate 12, figures 7-9

Description.—Thickly fusiform to subglobose tests commonly reach 5.5 mm. in length and 2.5 mm. in diameter in five volutions. Proloculi in specimens examined average about 0.18 mm. outside diameter. The first two volutions are low and short. Succeeding volutions increase markedly in height and length giving the test a loosely coiled appearance (Pl. 12, fig. 9). The poles appear slightly pointed in later volutions. The spiral wall is composed of a tectum and a keriotheca which becomes

TABLE 5
MEASUREMENTS OF SPECIMENS FROM PLATE 12

		Schubertella transitoria	*Waeringella(?) usvae*	*Schwagerina globosa*	*Pseudofusulinella tempelensis*		*Monodiexodina* cf. *M. paralinearis*
	Volution	fig. 1	fig. 11	fig. 13	fig. 15	fig. 16	fig. 18
Radius	0	.016	.06	.16	.05	.04	.09
vector	1	.030	.12	.40	.11	.10	.15
(mm.)	2	.050	.20	.80	.20	.20	.25
	3	.090	.30	1.20	.30	.30	.35
	4	.130	.40	......	.40	.40	.50
	5	.220	.55	......	.55	.50	.70
	6	......	.70	......	.75	.70	......
	7	......	......	......	.95	.90	......
Half	1	.030	.20	.50	.15	.20	.30
length	2	.060	.50	1.00	.30	.30	.60
(mm.)	3	.120	.70	1.80	.45	.40	1.20
	4	.240	1.05	......	.75	.70	1.70
	5	.460	1.40	......	1.00	.95	2.60
	6	......	1.80	......	1.30	1.50	......
	7	......	......	......	1.70	2.00	......
Form	1	1.0	1.7	1.3	1.4	2.0	2.0
ratio	2	1.2	2.5	1.3	1.5	1.5	2.4
	3	1.3	2.3	1.5	1.5	1.3	3.4
	4	1.8	2.6	......	1.9	1.7	3.4
	5	2.1	2.6	......	1.8	1.9	3.7
	6	......	2.6	......	1.7	2.1	......
	7	......	......	......	1.8	2.2	......
Wall	0	.002	.02	.02	.02	.03	.03
thickness	1	.002	.02	.06	.02	.03	.02
(mm.)	2	.002	.02	.09	.03	.04	.04
	3	.006	.03	.12	.04	.04	.05
	4	.008	.03	......	.04	.04	.05
	5	.016	.03	......	.05	.03	.04
	6	......	.02	......	.05	.04	......
	7	......	......	......	.05	.04	......
Tunnel	1	......	16	25	20	20	25
angle	2	20	15	28	20	22	35
(°)	3	18	20	......	20	24	45
	4	22	28	......	20	18	60
	5	......	28	......	20	20	......
	6	......	......	......	20	20	......
	7	......	......	......	......	......	......

coarsely alveolar in the fourth and later volutions. The septal folds are regularly spaced and extend across the entire chamber. The narrow tunnel is bordered by low chomata only in the low, early volutions; pseudochomata formed by secondary deposits on septa and septal folds outline the tunnel in later volutions. Light secondary deposits are concentrated in early volutions as infillings of septal folds and as thin deposits on the floors of the chambers (Pl. 12, fig. 9).

Occurrence.—Cyathophyllum Limestone, Tempelfjorden; collection H-f (float).

Remarks.—*Schwagerina* sp. is more elongate and has a thinner wall per volution than *S. globosa* (Schellwien and Dyhrenfurth) or *S. vulgaris* (Schellwien and Dyhrenfurth). The specimens examined are incomplete, however, they appear to differ from other common species from Arctic areas in the construction of their early volutions, septal folds, and wall thickness.

Genus **Waeringella** Thompson, 1942
Waeringella(?) **usvae** (Dutkevitch)
Plate 12, figures 10, 11

Fusulinella usvae DUTKEVITCH, 1932, p. 15; DUTKEVITCH, 1934, p. 53, pl. 6, figs. 1-11; DUTKEVITCH (*in* Gorsky *et al.*), 1939, p. 39, pl. 2, figs. 11-13; ROSOVSKAYA, 1958, p. 79, pl. 1, fig. 5; FORBES, 1960 (part), p. 214, pl. 31, figs. 6-8, (not figs. 4, 5).

Description.—Elongate, fusiform tests commonly reach 4 mm. in length and 1.5 mm. in diameter in 6 to 6½ volutions. Proloculus is commonly 0.8 to 1.0 mm. outside diameter and the early volutions are low; succeeding volutions increase slightly in height and increase proportionately more in length to reach form ratios of 2.5 or more (Pl. 12, fig. 11). The wall is composed of three layers: a tectum, a translucent layer below that may be a diaphanotheca, and a secondary outer tectorium. An inner tectorium is apparently lacking although heavy coatings of secondary deposits extend high on the septa. Septa are nearly planar across the center of the test but are slightly folded near the poles. Narrow tunnel is well defined by high massive chomata that may extend over the tunnel at the septa (Pl. 12, fig. 11). Chomata are nearly perpendicular against the tunnel but on the side away from the tunnel they slope more gently and grade into the outer tectorium and other secondary deposits (Pl. 12, figs. 10, 11). Measurements are given in Table 5.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden; collection H-2.

Remarks.—Based on the specimens from collection H-2 and those illustrated by Forbes (1960), Dutkevitch's species *usvae* appears to belong to the genus *Waeringella* Thompson rather than to *Fusulinella*. This assignment is based on the construction of the wall and of the secondary deposits coating the septa and on the mode of septal folds. If this is a species of *Waeringella,* its distribution in Spitsbergen and the Ural region of the U.S.S.R. greatly extends geographic range of the genus.

Genus **Pseudofusulinella** Thompson, 1951
Pseudofusulinella tempelensis n. sp.
Plate 12, figures 15-17

Fusulinella usvae Dutkevitch, FORBES (part), 1960, p. 214, pl. 31, figs. 4, 5.

Description.—Small thickly fusiform tests commonly reach 4 mm. in length and 2 mm. in diameter in 7 volutions. Proloculi average 0.1 mm. in diameter and initial chambers are low and short. Succeeding volutions increase gradually in height and markedly in length. Mature tests have equatorial bulge and long concave lateral slopes ending in narrow poles. Septa nearly planar except near poles where they are slightly wavy (Pl. 12, fig. 16). Spiral wall composed of a tectum, a dark layer (probably a diaphonotheca) and both inner and outer tectoria (Pl. 12, fig. 15). Tunnel well defined by large chomata that commonly extend to roof of chambers at the septa; side toward tunnel nearly vertical or may overlap and side away from tunnel slopes steeply and joins with outer tectorium. Secondary deposits heavily coat septa. Measurements are given in Table 5.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden; collection F-4.

Remarks.—The specimens of *Pseudofusulinella tempelensis* from Tempelfjorden have thicker tests, heavier secondary deposits, and larger chomata than *P. utahensis* Thompson and Bissell (*in* Thompson, 1954, pl. 7, fig. 1) from Utah or specimens of *P. utahensis* illustrated by Thompson, Dodge, and Youngquist (1958) from Idaho and those illustrated by Thorsteinsson (*in* Harker and Thorsteinsson, 1960) from the Grinnell Peninsula, Arctic Canada. *P. tempelensis* is more elongate than *P. occidentalis* (Thompson and Wheeler) (*in* Thompson, Wheeler and Hazzard, 1946) the type species, from California.

Genus **Monodiexodina** Sosnina, 1956
Monodiexodina cf. **M. paralinearis** (Thorsteinsson)
Plate 12, figures 18-21

Monodiexodina cf. *M. paralinearis* (Thorsteinsson) ROSS and DUNBAR, 1962, p. 46, pl. 7, fig. 1.

cf. *Schwagerina paralinearis* THORSTEINSSON (*in* Harker and Thorsteinsson), 1960, p. 24, pl. 4, figs. 1-8.

Description—Elongate, subcylindrical tests reach 11 mm. in length and 2 mm. in diameter in about 7 volutions. Proloculi are small, average about 0.15 mm. outside diameter. Early volutions are low and elongate and succeeding volutions become progressively more elongate (Pl. 12, figs. 18, 19). Spiral wall is composed of a tectum and keriotheca. Septa are strongly folded at their lower edge into low, evenly spaced folds; upper parts of septa are nearly planar. Tunnel widens markedly in later volutions and chomata are lacking (Pl. 12, fig. 19). Secondary deposits are thin and coat septal folds in most of the test, becoming slightly heavier near the polar regions. Measurements are given in Table 5.

Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden; collection H-f (float).

Remarks.—The specimens of *Monodiexodina* cf. *M. paralinearis* from Spitsbergen are similar in size and shape per volution and construction of the chambers to the specimen described by Ross and Dunbar (1962) from northeast Greenland. However, the Spitsbergen specimens have slightly heavier axial deposits than the northeast Greenland specimen and those described by Thorsteinsson from the Canadian Arctic. In this aspect they are similar to *M. linearis* (Dunbar and Skinner) from west Texas. The specimen described by Ross and Dunbar (1962) from northeast Greenland from a position within the zone of *Pseudoschwagerina* is from a lithology that is similar to that in collection H-f from Spitsbergen.

Genus **Bartramella** Verville, Thompson, and Lokke, 1956

Bartramella(?) sp.

Plate 12, figure 6

Discussion.—Collection H-f, a loose block derived from the upper part of the *Cyathophyllum* Limestone, contains a few scattered specimens of a species which appears to belong to the genus *Bartramella* Verville, Thompson, and Lokke (1956). The specimen illustrated (Pl. 12, fig. 6), a slightly oblique section, shows the species to have a small, fusiform test that reaches about 2.5 mm. in length and about 1.0 mm. in diameter in five volutions. The volutions increase gradually both in height and length. The structure of the spiral walls is not distinct but appears to be composed of a tectum and a lower, thicker layer which is translucent. The septal folds are high and rectangular as seen in thin sections. The well defined tunnel is slightly irregular. Secondary deposits infill the septal folds adjacent to the tunnel in early volutions and near the axis.

Bartramella(?) sp. is less elongate than *B. bartrami* Verville, Thompson, and Lokke (1956), the type species, from the Desmoinesian of Nevada or *B. heglarensis* Thompson, Dodge, and Youngquist (1958) from the Wolfcampian of Idaho. *Bartramella*(?) sp. has higher and wider septal folds than *B. heglarensis* which has considerably higher septal folds than *B. bartrami*. *Akiyoshiella ozawai* Toriyama, the type species of *Akiyoshiella*, is much larger and has a darker type of secondary deposits on its septal folds.

Genus **Schubertella** Staff and Wedekind, 1910

Schubertella transitoria Staff and Wedekind

Plate 12, figures 1-5

Schubertella transitoria STAFF and WEDEKIND, 1910, p. 121, pl. 4, figs. 7?, 8; THOMPSON, 1937, p. 122, pl. 22, figs. 1, 3-6; ROSS and DUNBAR, 1962, p. 6, pl. 7, figs. 12-14.

Schubertella cf. *S. transitoria* HOLTEDAHL, 1913, p. 5, 9.

Description.—Small, thickly fusiform tests nearly 1.0 mm. in length and 0.4 mm. in diameter in 4½ volutions. The proloculi are minute and all forms examined are microspheric individuals having a small juvenile stage of 1½ volutions coiled at a high angle to the axis of later volutions. Early volutions are short but later ones increase in length and increase in height toward the poles (Pl. 12, fig. 1). The septa are nearly planar but are curved slightly with respect to the axis of coiling (Pl. 12, figs. 2, 4). The spiral wall is composed of a tectum and lighter layer beneath the tectum which is recrystallized and shows no definite structure in specimens examined (Pl. 12, fig. 5). The tectum is overlain by an outer tectorium at the bottom of the chambers. Well defined tunnel is bordered by high asymmetrical chomata that merge laterally with the outer tectorium. Chomata thicken at the septa and thin between septa (Pl. 12, fig. 4). Secondary deposits heavily coat both sides of septa. Measurements are given in Table 5.

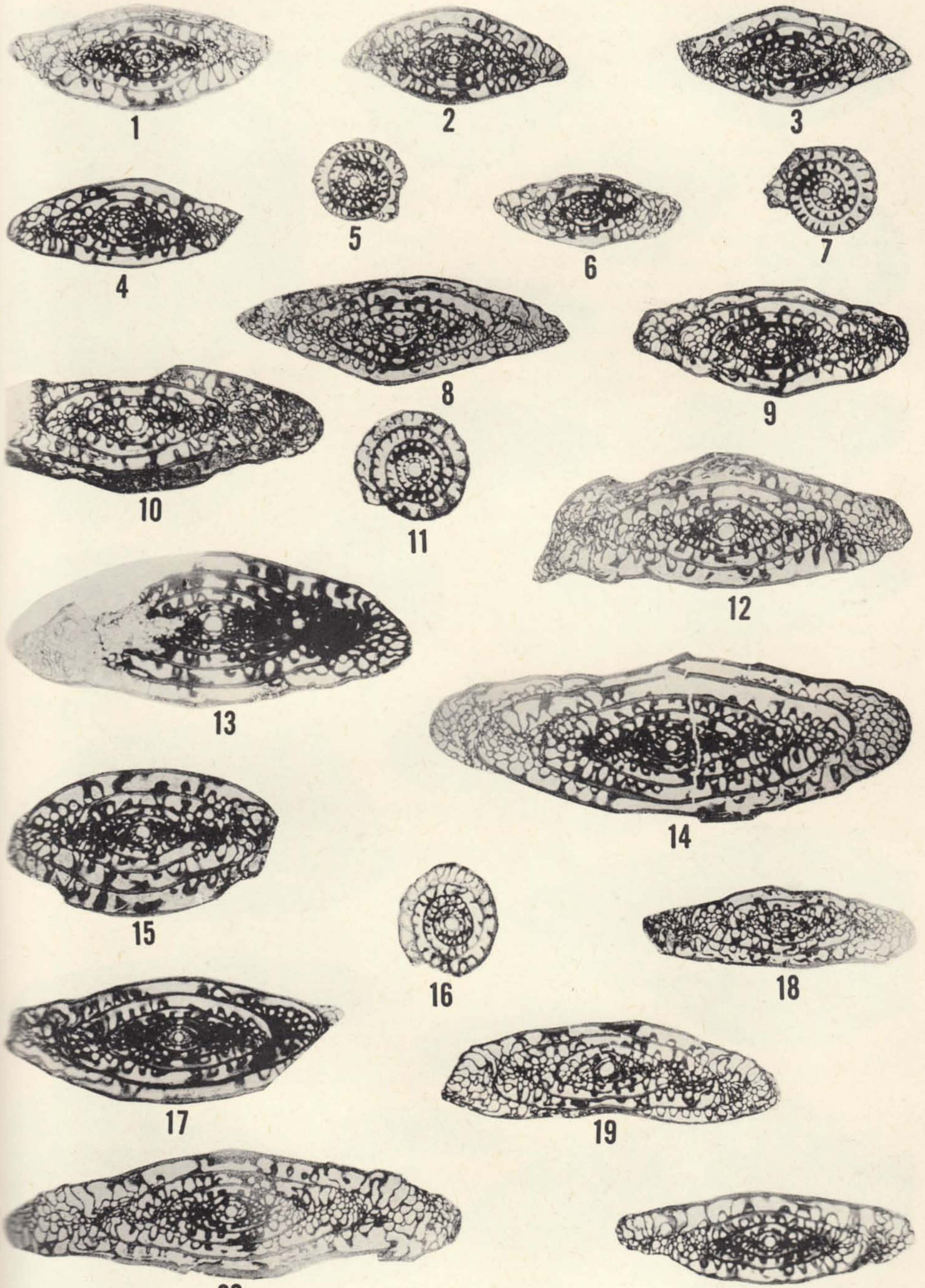
Occurrence.—*Cyathophyllum* Limestone, Tempelfjorden and Mount Lkyta; collections H-2, H-M.L., and F-2.

Remarks.—*Schubertella transitoria* differs from *S. kingi* which commonly occurs in the southwestern United States and Canadian Arctic in hav-

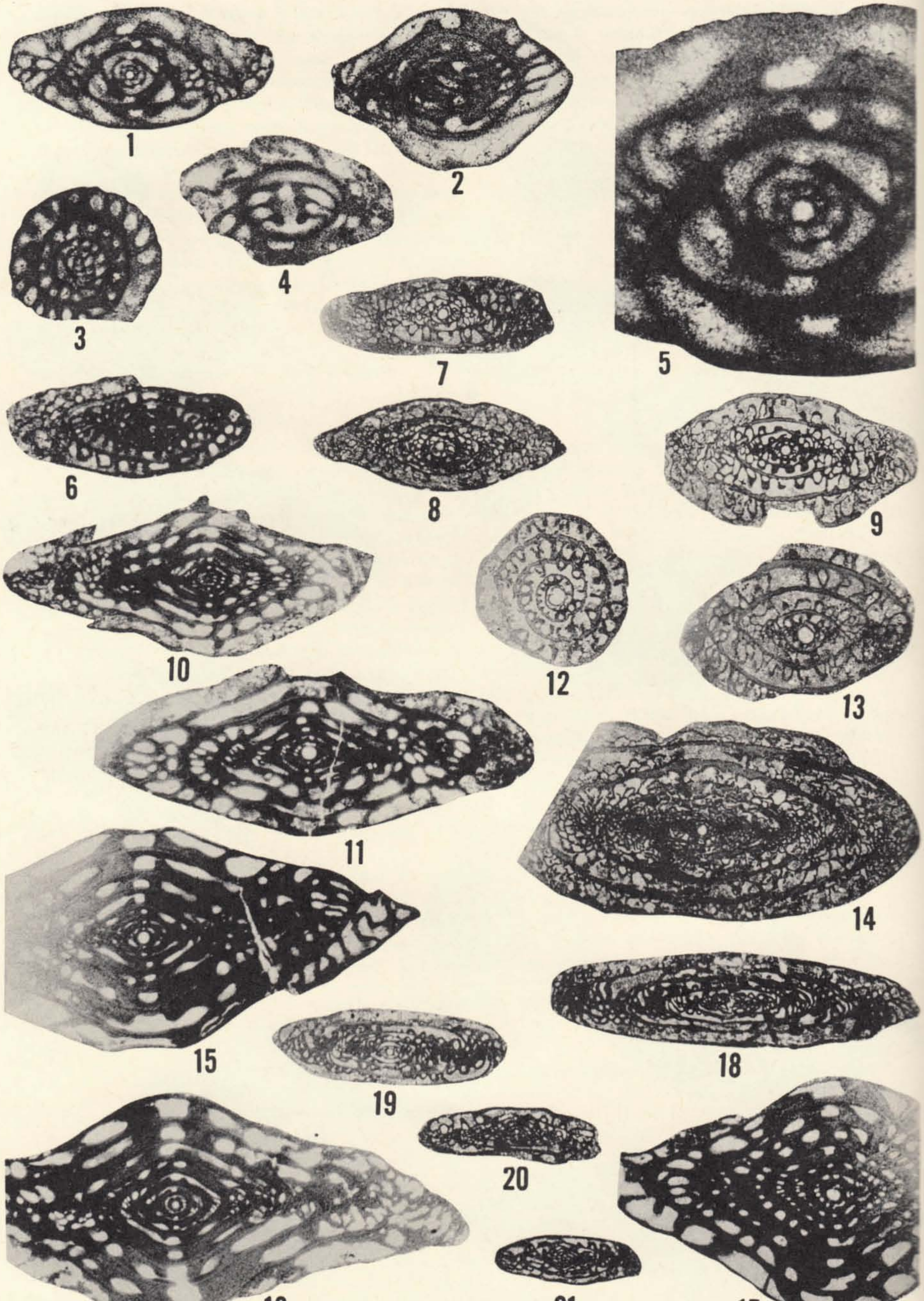
EXPLANATION OF PLATE 11

All figures × 10

FIGS.		PAGE
1-9, 18-21.	*Triticites paraarcticus* Rauser-Chernoussova, *Cyathophyllum* Limestone, Tempelfjorden and Mount Lykta .... 1, 6, 9, 18, 21, Axial sections, collection H-M.L., SUI 11167, SUI 11168, SUI 11169, SUI 11170, and SUI 11171. 2, Axial section, collection F-1, SUI 11149. 3, Axial section, collection F-3, SUI 11150. 4, 8, 19, 20, Axial sections, collection H-1, SUI 11173, SUI 11174, SUI 11175, and SUI 11176. 5, 7, Sagittal section, collection H-1, SUI 11177, and SUI 11172.	79
10-17.	*Triticites pseudoarcticus* Rauser-Chernoussova, *Cyathophyllum* Limestone, Tempelfjorden and Mount Lykta .... 10, Axial section, collection H-M.L., SUI 11178. 11, Sagittal section, collection H-M.L., SUI 11179. 12, Axial section, collection F-2, SUI 11151. 13, 17, Axial sections, collection H-4, SUI 11180 and SUI 11181. 14, 15, Axial sections, collection H-2, SUI 11182 and SUI 11183. 16, Sagittal section, collection H-4, SUI 11181.	80



Ross: Fusulinids from Vestspitsbergen



Ross: Fusulinids from Vestspitsbergen

ing more massive chomata and heavier secondary deposits and in being more thickly fusiform in shape. *S. giraudi* (Deprat) from Indochina is similar to *S. transitoria* but has slightly larger form ratios per volution.

Thompson (1937) in his restudy of topotype material of *S. transitoria* reported this species from Tempel Bay (Tempelfjorden of this report) and associated with *Schwagerina*(?) *arctica* (Schellwien). The material that Staff and Wedekind studied for their original description of *S. transitoria* in part also came from this area. Thompson (1937) also reported this species from Isfjord where he found it associated with *Schwagerina anderssoni*? (Schellwien), and Holtedahl (1913) reported a similar form from an area west of Green Bay, Spitsbergen. Ross and Dunbar (1962) reported *S. transitoria* from Amdrup Land, northeast Greenland.

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EXPLANATION OF PLATE 12

FIGS.		PAGE
1-5.	*Schubertella transitoria* Staff and Wedekind, *Cyathophyllum* Limestone, Tempelfjorden and Mount Lykta	84
	1, Axial section, × 50, collection H-M.L., SUI 11185. 2, Deep tangential section, × 50, collection H-2, SUI 11186. 3, Oblique sagittal section, × 50, collection H-2, SUI 11187. 4, Shallow tangential section, × 50, collection H-M.L., SUI 11188. 5, Part of figure 1 enlarged to × 150, collection H-M.L., 11185.	
6.	*Bartramella*(?) sp., × 20, collection H-f (float), *Cyathophyllum* Limestone, Tempelfjorden	84
	6, Oblique axial section, SUI 11189.	
7-9.	*Schwagerina* sp., × 10, *Cyathophyllum* Limestone, Tempelfjorden, collection H-f (float)	81
	7, 8, 9, Axial sections of fragmentary specimens, SUI 11190, SUI 11191, SUI 11192.	
10-11.	*Waeringella*(?) *usvae* (Dutkevitch), × 20, *Cyathophyllum* Limestone, Tempelfjorden, collection H-2	83
	10, Slightly oblique deep tangential section, SUI 11193. 11, Slightly oblique axial section, SUI 11194.	
12-14.	*Schwagerina globosa* (Schellwien and Dyhrenfurth), × 10, *Cyathophyllum* Limestone, Tempelfjorden, collection H-f (float)	81
	12, Sagittal section, SUI 11195. 13, Fragmentary axial section, SUI 11196. 14, Crushed axial section, SUI 11197.	
15-17.	*Pseudofusulinella tempelensis* n. sp., × 20, *Cyathophyllum* Limestone, Tempelfjorden, collection F-4	83
	15, 16, Axial sections, SUI 11152 and SUI 11153 (holotype). 17, slightly oblique axial section, SUI 11154.	
18-21.	*Monodiexodina* cf. *M. paralinearis* (Thorsteinsson), × 10, *Cyathophyllum* Limestone, Tempelfjorden, collection H-f (float)	83
	18-21, Axial sections, SUI 11198, SUI 11199, SUI 11200, and SUI 11201.	

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RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the Foraminifera that have come to hand.

ALVINERIE, J., CARALP, M., MOYES, J., and VIGNEAUX, M. Considérations sur la limite Oligo-Miocène dans le Nord du bassin Aquitain.—Mém. Bureau de Recherches Géol. et Min., No. 28, pt. 1, Colloque sur le Paléogène (Bordeaux, Sept. 1962), 1964, p. 301-315, pls. 1-4 (maps, charts showing range and abundance). —From information at 6 localities near Bordeaux, *Halkyardia minima* is characteristic of the boundary; *Rotalia rimosa* and *Asterigerina dollfusi* end just below the boundary; *Nonion dollfusi, N. boueanum,* and *Rotalia armata* begin just above the boundary; and 6 other species cross the boundary.

AOKI, NAOAKI. Notes on the foraminiferal genus *Pseudocibicidoides*.—Trans. Proc. Palaeont. Soc. Japan, n. ser., No. 54, June 30, 1964, p. 195-200, pl. 29.—Emended on the basis of the communication system among the initial 3 chambers.

BANDY, ORVILLE L., General correlation of foraminiferal structure with environment, *in* Approaches to Paleoecology, edited by John Imbrie and Norman Newell.—New York, John Wiley and Sons, Inc., 1964, p. 75-90, text figs. 1-9 (range charts).—The morphological features of individual species of a genus show correlation with environment (bay; inner, central, and outer shelf; and upper, middle, and lower bathyal zone). Examples in the arenaceous group are simplicity and small size in shallow environments and increase of size, differentiation, and complexity (labyrinthic interior) toward deeper environments. Trends of size, shape, nature of sutures, internal structure, ornamentation, and type of coiling in genera and in species within the porcelaneous, chilostomellid, coarse perforate, rotaloid, asterigerinid, buliminid, uvigerinid, cassidulinid, virgulinid, and bolivinid groups are graphically illustrated.

Reply [to Subdivision of Miocene].—Bull. Amer. Assoc. Petr. Geol., v. 48, No. 11, Nov. 1964, p. 1848-1850.—Reply concedes that international usage is not yet universally established to permit precise correlation with the European Time Scale and reaffirms the need for stage names for the planktonic sequence.

BANDY, ORVILLE L., and RODOLFO, KELVIN S. Distribution of Foraminifera and sediments, Peru-Chile Trench area.—Deep-Sea Research, v. 11, No. 5, Oct. 1964, p. 817-837, text figs. 1-5 (map, graphs, frequency distribution diagrams), tables 1-4.—Quantitative analysis of species by percentage of the total benthonic or total planktonic population. Study is based on 32 bottom samples (trawls and cores) from depths of 179 to 6250 meters between Panama and Valparaiso. Seven bathymetric groups are recognized, as defined by the upper depth limits of species dominant both among the larger living specimens from the trawls and the smaller specimens from the cores.

BANNER, F. T. On *Hastigerinella digitata* (Rhumbler, 1911).—Micropaleontology, v. 11, No. 1, Jan. 1965, p. 114-116.—Neotype is designated for *Hastigerina digitata*.

BARASH, M. S. Ecology of planktonic Foraminifera in the North Atlantic and their significance for stratigraphic investigations (English summary of Russian text).—Akad. Nauk SSSR, Trudy Instit. Okean., tom 65, 1964, p. 229-258, text figs. 1-9 (range chart, graphs, maps), table 1.—Summary of past work.

BÉ, ALLAN W. H. The influence of depth on shell growth in *Globigerinoides sacculifer* (Brady). —Micropaleontology, v. 11, No. 1, Jan. 1965, p. 81-97, pls. 1, 2, text figs. 1-12 (photomicrographs, drawings, thin sections, diagrams, seasonal maps, graph), table 1.—*Sphaeroidinella dehiscens* develops through a process of shell thickening which is an adaptation of a certain few specimens (about 1.7%) of *Globigerinoides sacculifer* to increasingly deeper habitats (below 300 meters). This hypothesis is supported by excellent photographs.

BERGGREN, WILLIAM A. The recognition of the *Globorotalia uncinata zone* (Lower Paleocene) in the Gulf Coast.—Micropaleontology, v. 11, No. 1, Jan. 1965, p. 111-113, text figs. 1, 2 (correl. chart, drawings).—Dating of upper part of Midway as Montian, through equivalence of *Globorotalia uncinata* zone of Trinidad and *Globigerina inconstans* zone of Crimea and Caucasus. Both species occur in Mexia clay.

BERMUDEZ, PEDRO J. Foraminíferos del Paleoceno del Departmento de El Petén, Guatemala.—Bol. Soc. Geol. Mexicana, tomo 26, No. 1, 1963 (1964), p. 1-56, pls. 1-10, text fig. 1 (map).—Illustrated catalog of 142 species, 18 new and 26 indeterminate.

BOLLI, H. M., and KRAUSE, H. H. Microfossils from the younger Tertiary of La Sabana, Dto. Federal.—Bol. Informativo, Asoc. Venez. Geol., Min. y Petrol., v. 7, No. 5, May 1964, p. 130-133, text fig. 1 (map).—Foraminifera assemblage indicates an age of late middle or early upper Miocene.

BOLTOVSKOY, ESTEBAN. Distribution of the living planktonic Foraminifera in the equatorial Atlantic, western part ("Equalant" Expedition) (in Spanish with English summary).—Argentina Serv. Hidro. Naval, Publ. H639, 1964, p. 1-54, pls. 1-4, maps 1-5, text figs. 1-4 (drawings, graphs), tables 1-7.—From analysis of 109 surface tows and 136 tows at various depths down to 300 meters, between 10°N and 8°S and 33° and 43°W, 3 zones (northern, central, and south-southeastern) are delineated. The northern and central zones are in the Equatorial currents; the south-southeastern zone in the Guiana current. Twenty-one species (1 indeterminate) were found; 1 exclusively in surface waters, 6 exclusively in subsurface waters. The population is densest at 40 meters and no evidence of daily vertical migration of any of the species was found.

Planktological dictionary in five languages: English, Spanish, German, French and Russian (with cross references).—Argentina Serv. Hidro. Naval, Publ. H1019, 1964, p. i-xix, 1-107 (available from Librart S.R.L., Casilla Correo 5047, Buenos Aires, $5.15).—A listing of technical terms used in scientific literature on the principal organisms of the marine plankton, with their equivalents (not literal translations) in the 5 languages. The animal groups included are dinoflagellates, diatoms, foraminifers, radiolarians, tintinnids, chaetognaths, heteropods, pteropods, cladocerans, ostracods, and copepods.

BRÖNNIMANN, PAUL. Taxonomic significance of external and internal features in *Aktinocyclina* Guembel 1868 (Foraminifera).—Archives des Sci., v. 17, fasc. 1, Jan.-April 1964, p. 35-37.

CARTER, A. N. Foraminifera from the Portland Limestone, Appendix No. 3, *in* The Geology and Geomorphology of the Portland Area, by N. Boutakoff.—Geol. Survey Victoria, Mem. No. 22, 1963, p. 156-160, pls. 24-26.—Descriptions and illustrations of 10 species (4 new) from beds interpreted as of late middle Miocene age.

DE CASTRO, PIERO. Nuove osservazioni sul livello ad *Orbitolina* in Campania (Nota preliminare). —Boll. Soc. Nat. in Napoli, v. 71, 1962 (1963), p. 103-135, pls. 1-8, map.—Age reassessed as Barremian-Albian, likely Aptian.

CHARMATZ, RICHARD. On *"Hastigerina digitata* Rhumbler, 1911:" Reply.—Micropaleontology, v. 10, No. 4, 1964, p. 496.—A note to clarify the 1911 background of *H. digitata* and to record the author's intention of an appeal to the Commission.

CICHA, I., CHMELIK, F., PICHA, F.. and STRANIK, Z. Übersicht über den heutigen Stand der Forschungen in der Molassezone Zdanicer und Pouzdraner Einheit Süd-Mährens.—Mitteil. Geol. Gesellschaft Wien, Band 56, heft 2, 1963 (1964), p. 445-468, pls. 1, 2 (geol. map, geol. section), tables 1-3.—Characteristic Foraminifera are given for 12 subdivisions between Jurassic and Miocene.

CIFELLI, RICHARD. Planktonic Foraminifera from the western North Atlantic.—Smithsonian Misc. Coll., v. 148, No. 4, Feb. 23, 1965, p. 1-36, pls. 1-9, text figs. 1-4 (map, drawings), tables 1-8 (available from Smithsonian Publ. Office, Washington, D. C., $1.00).—Illustrations, descriptions of distinguishing characteristics, and quantitative records of seasonal occurrences in shelf, slope, and Sargasso Sea waters of 20 species. Study based on plankton tows along 4 traverses between Cape Cod and Bermuda (summer, fall, winter, and spring).

COLE, W. STORRS. Structure and classification of some Recent and fossil peneroplids.—Bull. Amer. Pal., v. 49, No. 219, Jan. 15, 1965, p. 1-37, pls. 1-10.—Descriptions and illustrations of 7 species (2 each of *Peneroplis, Archaias,* and *Sorites,* and 1 *Marginopora*), none new; all from the Recent except *Archaias floridanus* from the Miocene.

COLOM, G. Los Foraminíferos de la Ría de Vigo. —Invest. Pesquera, tomo 23, June 1963, p. 71-89, pls. 1-4, text figs. 1-5 (map, drawings, columnar section).—In a poor estuarine assemblage of Foraminifera is found the small, slender, arenaceous form, *Siliconodosarina delicatula* nov. gen. n. sp.

Estudios sobre la sedimentación Costera Balear (Mallorca y Menorca).—Mem. Real Acad. Ciencias Artes Barcelona, v. 34, No. 15, May 1964, p. 495-550, pl. 18, text figs. 1-24 (drawings), 2 maps, charts showing distrib. and abundance.—The Foraminifera surrounding Majorca and Minorca from the shore out to 650 meters are recorded quantitatively, and the benthonic species are grouped into 4 biotopes. About 80 species are illustrated; 3 species and 1 variety are described as new.

CRESPIN, IRENE. Micropaleontology of the Maretimo Member, Whaler's Bluff Formation, Portland, Victoria, Appendix No. 2 *in* The Geology and Geomorphology of the Portland Area, by N. Boutakoff.—Geol. Survey Victoria, Mem. No. 22, 1963, p. 148-152, pl. 23, table 1.—Numerous Foraminifera listed from beds interpreted as of late Pliocene age and deposited under moderate shallow and temperate conditions in a bay environment.

CROS, P., and NEUMANN, M. Contribution à l'étude des formations à *Triasina* Majzon des Dolomites Centrales.—Revue de Micropaléontologie, v. 7, No. 2, Sept. 1964, p. 125-137, pls. 1-3, text figs. 1, 2 (map, columnar section).—*Triasina, Trocholina, Involutina,* and associated species indicate a probable Rhaetian-Hettangian age.

DIENI, I., MASSARI, F., and MOULLADE, M. Sur quelques Orbitolinidae des calcaires à faciès "urgonien" du Crétacé inférieur des environs d'Orosei (Sardaigne).—Boll. Soc. Paleontologica Italiana, v. 2, No. 2, 1963, p. 3-8, pl. 1, text figs. 1, 2 (map, comparative table).—Two new species of *Orbitolinopsis* from the Barremian.

DIENI, IGINIO, and PROTO DECIMA, FRANCA. Analisi statistica multidimensionale di due gruppi di *Cribrohantkenina* dell'Eocene superiore di Castelnuovo (Colli Euganei).—Atti Accad. Naz. Lincei, Rend., v. 36, fasc. 3, March 1964, p. 395-399, text figs. 1, 2 (drawings), table 1.

EAMES, F. E., BANNER, F. T., BLOW, W. H., and CLARKE, W. J. New Zealand Mid-Tertiary stratigraphical correlation.—Nature, v. 203, No. 4941, July 11, 1964, p. 180-181, text figs. 1, 2 (range charts).

Dating of some beds in Panama and Trinidad.—Journ. Pal., v. 39, No. 1, Jan. 1965, p. 162-163.—Presence of Oligocene planktonic Foraminifera discounted as reworked specimens.

ESCANDELL, B., and COLOM, G. Notas estratigraficas y paleontologicas sobre los depositos flandrienses del Puerto de San Antonio Abad (Ibiza).—Notas y comuns. Inst. Geol. Min. España, No. 75, Ano 1964, p. 95-117, pls. 1-6, text figs. 1-3 (maps).—Foraminifera from beds intercalated with peat deposits.

FRANKEL, J. J. Recent Foraminifera filled and encrusted with pyrite from Durban Bay.—South African Journ. Sci., v. 60, No. 10, Oct. 1964, p. 299-301, 1 pl.—Significant of deposition under low (estuarine) salinity and reducing conditions.

GERHARDT, H. Biometrische Untersuchungen zur Phylogenie von *Haplophragmium* und *Triplasia* (Foram.) aus der tieferen Unterkreide Nordwestdeutschlands.—Boll. Soc. Paleontologica Italiana, v. 2, No. 2, 1963, p. 9-74, pls. 2-4, text figs. 1-23 (map, diagrams, charts, graphs), tables 1-20.—Biometric analysis of about 4300 individuals of *Haplophragmium subaequale* (circular in section), *Triplasia pseudoroemeri* (triangular), and *T. georgsdorfensis* (indented in section) shows a continuous transition from one to another. The different forms have different ranges: middle Dogger to Hauterivian for the first, upper Valanginian only for the second, and Valanginian to upper Hauterivian for the third.

GORBATSCHIK, T. N. Variation and microstructure of the wall in the shell of *Globigerinelloides algeriana* (in Russian).—Paleont. Zhurnal, Akad. Nauk SSSR, 1964, No. 4, p. 32-37, text figs. 1-6 (drawings, graphs).

GRAMANN, FRANZ. Die Arten der Foraminiferen-Gattung *Asterigerina* d'Orb. im Tertiär NW-Deutschlands.—Paläont. Zeitschr., Stuttgart, Band 38, Nr. 3/4, Sept. 1964, p. 207-222, pls. 20, 21, text figs. 1, 2 (drawings).—Four species (1 new from the lower Oligocene) and 1 subspecies.

GROISS, J. TH. Die Mikrofossilien als Hilfsmittel für die Gliederung des Jura in Franken.—Geol. Blätter für Nordost-Bayern, Erlangen, Band 14, heft 4, Nov. 14, 1964, p. 147-153, 1 pl.—General kinds of Foraminifera characteristic of Lias (lower, middle, and upper), Dogger, and Malm are mentioned and typical species are illustrated.

HAMAOUI, M. *Cycledomia*, a new peneroplid genus.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 438-440, pls. 1, 2.—A peneroplid from beds of Cenomanian-Turonian age in Israel.

HANZLIKOVA, EVA, and PESL, VACLAV. Contribution to the study of facial development of the Lower Palaeogene series of the Raca unit in the Magura Flysch (English summary of Czech text).—Vestnik Ustred. Ustavu Geol., roc. 39, cis. 6, 1964, p. 419-428, pls. 1, 2, text figs. 1-3 (columnar sections with corresponding range charts).—Foraminifera illustrated from and their ranges indicated in the Paleocene to middle Eocene of a well boring.

HASEGAWA, YOSHIYUKI. On phrenotheca in *Pseudofusulina vulgaris globosa* (in Japanese with English abstract).—Earth Science (Chikyu Kagaku), No. 74, Sept. 1964, p. 13-16, pls. 1, 2, text fig. 1.

HERRICK, STEPHEN M. Upper Eocene smaller Foraminifera from Shell Bluff and Griffin Landings, Burke County, Georgia.—U. S. Geol.

Survey Prof. Paper 501-C, Oct. 2, 1964, p. C64-C65, text fig. 1 (map), occurrence and abundance table.

HILLEBRANDT, AXEL VON. Zur Entwicklung der planktonischen Foraminiferen im Alttertiär und ihre stratigraphische Bedeutung.—Paläont. Zeitschr., Stuttgart, Band 38, Nr. 3/4, Sept. 1964, p. 189-206, text figs. 1-5 (drawings, comparison table).—Development-series from *Globigerina* cf. *pseudobulloides* through *G. varianta, G. inconstans, Globorotalia angulata* and *G. aequa* to *G. aragonensis* extends from uppermost Maestrichtian to Cuisian. Another development-series is shown from the same origin to *Globorotalia pseudomenardii* in the Landenian. Development-series from *Globigerina velascoensis* in the Montian extends through 3 lines to *Globorotalia lehneri, G. spinulosa,* and *G. topilensis* in the Lutetian. Range of variability of *Globorotalia velascoensis* is illustrated.

HILTERMANN, HEINRICH. Fortschritte der Mikropaläontologie in Deutschland mit einer Bibliographie für das Jahr 1963.—Paläont. Zeitschr., Stuttgart, Band 38, Sept. 1964, p. 158-169.

HOFKER, J. Foraminifera from the tidal zone in the Netherlands Antilles and other West Indian Islands, *in* Studies on the Fauna of Curaçao and other Caribbean Islands, vol. 21, edited by Dr. P. Wagenaar Hummelinck.—Natuurwetenschappel. Studiekring voor Suriname en de Nederlandse Antillen, No. 39, Dec. 1964, p. 1-119, text figs. 1-274 (drawings, graph, map), table 1 (available from Found. Sci. Res. in Surinam and the Netherlands Antilles, Zool. Laboratory, 3, Janskerkhof, Utrecht, The Netherlands, 10 florins).—Ilustrated systematic catalog of 74 species (4 new). *Palaeopeneroplis* nov. gen. (type species *P. inornatus* nov. spec.) is erected. Study is based on 71 samples, from intertidal to 22 meters.

Wall structure of Globotruncanidae, *Globorotalia* and *Gavelinella*.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 453-456, pl. 1, text figs. 1-9.—Using unrecrystallized and air-filled specimens, the walls in species of the Globotruncanidae and in *Globorotalia tumida* are shown to be single, not double as they are in *Gavelinella* and as they have been thought to be (through misinterpretation of recrystallized walls) in other planktonic specimens.

HOOPER, KENNETH. Electron-probe X-ray microanalysis of Foraminifera: an exploratory study. —Journ. Pal., v. 38, No. 6, Nov. 1964, p. 1082-1092, pls. 163-168, text-fig. 1 (diagram), table 1.

HOTTINGER, L. Les genres *Operculina* et *Heterostegina* (Foraminifères) et leur utilité stratigraphique.—Mem. Bureau de Recherches Géol. et Min., No. 28, pt. 2, Colloque sur le Paléogène (Bordeaux, Sept. 1962), 1964, p. 1013-1031, pls. 1-7.

HYDE, PETER, and KRINSLEY, DAVID. An improved technique for electron microscopic examination of Foraminifera.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 491-493, text figs. 1-3 (diagrams).

JENKINS, D. GRAHAM. New Zealand Mid-Tertiary stratigraphical correlation [and reply].—Nature, v. 200, No. 4911, Dec. 14, 1963, p. 1087, text fig. 1 (correl. table); v. 203, No. 4941, July 11, 1964, p. 181-182, text fig. 1 (range chart).

KAEVER, MATHIAS. Über *Assilina lacunata* Cizancourt aus dem Unter-Eozän Afghanistans.—Geol. Jahrb., Band 82, July 15, 1964, p. 131-142, pl. 5, text figs. 1-4 (map, drawings, graph, range chart).

KANMERA, KAMETOSHI. Fusulines of the Middle Permian Kozaki Formation of southern Kyushu.—Mem. Fac. Sci., Kyushu Univ., ser. D, Geol., v. 14, No. 2, March 1963, p. 79-141, pls. 11-19, text figs. 1-3 (graphs, map, columnar section), tables 1-9.—Twenty-one species (3 new) and 1 new subspecies.

KENNETT, J. P. A Pleistocene anticline at Gladstone, Wairarapa.—New Zealand Journ. Geol. Geophys., v. 7, No. 3, Aug. 1964, p. 561-572, text figs. 1, 2 (maps), tables 1-3.—Foraminifera listed from the Pleistocene.

KOCHANSKY-DEVIDÉ, VANDA. Die Mikrofossilien des jugoslawischen Perms.—Paläont. Zeitschr., Stuttgart, Band 38, Nr. 3/4, Sept. 1964, p. 180-188, pls. 18, 19, text fig. 1 (map).—*Triticites*.

KRASHENINNIKOV, V. A., PONIKAROV, V. P., and RAZVALJAEV, A. V. Geologicheskoe Razvitie Sirii v Paleogenovoe Vremja.—Bull. Moscow Soc. Nat., Geol. Ser., v. 39, No. 5, 1964, p. 77-95, text figs. 1-7 (geol. maps, geol. section), correl. chart.—Zonations from Paleocene to Oligocene in Syria and U.S.S.R. based on planktonics and smaller benthonics.

KUJAWSKI, H. Le Senonien du Nord des Hedil.—Tunis, Notes du Service Géol., No. 21, 1962, 20 p., 3 pls., 1 geol. map, 3 geol. sections.—Includes illustrations of Cretaceous and Paleocene Foraminifera.

LAMB, JAMES L. The stratigraphic occurrences and relationships of some mid-Tertiary Uvigerinas and Siphogenerinas.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 457-476, pls. 1-4, text figs. 1, 2 (correl. chart, range chart).—Three species of *Uvigerina* (2 new), four of *Siphogenerina,* and one of "*Uvigerinella*" are described, illustrated, and reported as having useful restricted ranges between upper Eocene

and lower Miocene. Ranges for each species in Venezuela, California, and the Gulf Coast region are indicated in terms of the Caribbean planktonic zonation.

LEVEN, E. JA. On the classification of the family Verbeekinidae (Fusulinida) (in Russian).—Paleont. Zhurnal, Akad. Nauk SSSR, 1964, No. 4, p. 23-31, pls. 1, 2, text figs. 1, 2 (phylogenetic diagram, drawings).

LIPPS, JERE H. A new species of *Seabrookia* (Foraminiferida) from the Later Tertiary of southern California.—Journ. Protozool., v. 11, No. 2, 1964, p. 242-246, text fig. 1, tables 1, 2 (distrib. chart, occurrence table).—*S. cooperta* from the Puente Formation of Delmontian age. A summary of all other records of the genus is included.

Miocene planktonic Foraminifera from Newport Bay, California.—Tulane Studies in Geol., v. 2, No. 4, Aug. 14, 1964, p. 109-133, pls. 1-4, text figs. 1-3 (maps, drawings), table 1.—Twenty species (6 new) from a sequence of Luisian and Mohnian beds in the Monterey Shale, tentatively correlated with Burdigalian and Helvetian. *Protentella* gen. nov. (type species *P. prolixa* sp. nov.) erected for species with radially elongate chambers.

LOEBLICH, ALFRED R., JR., and TAPPAN, HELEN. Foraminiferal classification and evolution.—Journ. Geol. Soc. India, v. 5, 1964, p. 5-40, text fig. 1 (diagram).—A review of the development of Foraminifera classification. A few minor rearrangements of the Treatise classification are discussed, and *Reissia* n. gen. (type species *Ehrenbergina hystrix* Brady), differing from *Ehrenbergina* by its radial wall and apertural toothplate, is erected in the Islandiellidae.

On "*Hastigerina digitata* Rhumbler, 1911:" Comment.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 494-495.—Opposition to *Hastigerinella eocenica* Nuttall as type species of *Hastigerinella*, and in favor of *H. rhumbleri* as valid replacement name for *Hastigerina digitata* (the type species of *Hastigerinella*).

LUPERTO, E. Nuovo genere di Foraminifero nel Permiano di Abriola (Potenza).—Boll. Soc. Paleontologica Italiana, v. 2, No. 2, 1963, p. 83-88, pls. 6-8, text fig. 1 (drawing).—*Abriolina* nov. gen. (type species *A. mediterranea* nov. sp.) classified in the Nodosaridae.

MAGNÉ, J., and MALMOUSTIER, G. Contribution a l'étude des associations microfauniques du Paléogène Nord-Aquitain.—Mem. Bureau de Recherches Géol. et Min., No. 28, pt. 1, Colloque sur le Paléogène, (Bordeaux, Sept. 1962), 1964, p. 271-282, text figs. 1-6 (locality map, facies maps).—Characteristic planktonic and benthonic species of Foraminifera are listed for lower, middle, and upper Eocene and lower and upper Oligocene. Facies maps indicate deep neritic and littoral facies for these ages, and also lucustrine facies (represented only by charophytes) for the lower Oligocene.

MAJZON, LASZLO. Chemical composition of foraminiferal shells (English summary of Hungarian text).—Bull. Hungarian Geol. Soc., v. 94, no. 2, p. 237-242.

MAMEDOV, T. A. Pervaja Nakhodka Rodov *Asterocyclina* Gümbel i *Actinocyclina* Gümbel iz Eothenovykh Otlozhenij Gornogo Talysha (Lerikskij Rajon).—Akad. Nauk Azerbajdzhan. SSR, tom 20, no. 5, 1964, p. 41-46, 1 pl.—Three Eocene species.

MARIE, P. Les Faciés du Montien (France, Belgique, Hollande).—Mem. Bureau de Recherches Géol. et Min., No. 28, pt. 2, Colloque sur le Paléogène (Bordeaux, Sept. 1962), 1964, p. 1077-1102, pls. 1, 2.—Includes illustrations of 12 species of smaller Foraminifera characteristic of the Montian (6 species and 4 genera new but not described).

MARTIN, LEWIS. Upper Cretaceous and lower Tertiary Foraminifera from Fresno County, California.—Jahrb. Geol. Bundesanstalt, Sonderband 9, 1964, p. 1-128, pls. 1-16, figs. 1-5 (maps), text figs. A-D (photographs), tables 1-12 (correl. tables, range and abundance charts, graphs, occurrence tables), appendices A-E (lists of samples, locality register, range charts).—Illustrated systematic catalog of 167 species and subspecies (29 species new). Study is based mostly on a thick Coniacian to Danian sequence exposed over a 6-mile length in Moreno Gulch. Range and abundance of species in the Moreno Gulch and Laguna Seca Creek sections are indicated. By means of a few distinctive Foraminifera, the Laguna Seca Creek section is correlated with a small part of the Moreno Gulch section. Thirty diagnostic species, having ranges more or less restricted, are selected as locally useful in recognition of formations and members and in correlation with European and Gulf Coastal equivalents.

MCGOWRAN, BRIAN. Foraminiferal evidence for the Paleocene age of the King's Park Shale (Perth Basin, Western Australia).—Journ. Roy. Soc. Western Australia, v. 47, pt. 3, Oct. 30, 1964, p. 81-86, 1 pl.—Correction from Eocene to Paleocene mainly on the basis of *Globorotalia chapmani*.

MEHES, K. The foraminiferal genus *Orbitolina* from Hungary.—Acta Geologica, Budapest, tom. 8, fasc. 1-4, 1964, p. 265-281, pls. 1-5,

text figs. 1, 2 (drawing, map), table 1.—Five species (2 new) and 2 subspecies (1 new) in the upper Aptian and Albian.

MINAKOVA, N. E. K Stratigrafii Verkhneeotheno-vykh i Oligothenovykh Otlozhenij Kyzylkumov. —Russia Vses. geol. instit., Trudy, n. ser., tom 102, 1964, p. 218-235, tables 1, 2 (range chart, correl. chart).—Zonation of upper Eocene and Oligocene by smaller Foraminifera.

MINATO, MASAO, and KOCHANSKY-DEVIDÉ, V. Über die Neoschwagerinen-Arten Jugoslaviens.—Earth Sci.: Journ. Assoc. for Geol. Collaboration in Japan, No. 73, July 1964, p. 13-17, tables 1-3.

MONCHARMONT-ZEI, MARIA. Studio ecologico sui Foraminiferi del Golfo di Pozzuoli (Napoli). —Pubbl. staz. zool. Napoli, v. 34, 1964, p. 160-184, text figs. 1-8 (distrib. maps), tables 1, 2.—Analysis based on 13 bottom samples ranging from 5 to 110 meters in depth. Quantitative listing of 238 species with occurrence and abundance of 7 selected species plotted areally.

MONTANARI, L. *Orbitolina praecursor,* nuova specie del Cretaceo Inferiore della Sicilia.—Riv. Ital. Pal. Stratig., v. 70, No. 2, 1964, p. 265-276, pls. 19-21, text figs. 1, 2 (embryonic chamber, map).

MOSNA, S. "Globigerine" in termini calcarei del Cretaceo inferiore basale affioranti nell'area del Trentino centrale.—Studi Trentini Sci. Nat., Anno 40, fasc. 2, 1963, p. 167-170, 5 pls. (thin sections).

MURRAY, J. W. Significance of benthic foraminiferids in plankton samples.—Journ. Pal., v. 39, No. 1, Jan. 1965, p. 156-157, table 1.—During storms, small thin-walled empty tests are thrown into suspension by wave base disturbance of the bottom sediments of the English Channel.

NAGY-GELLAI, AGNES. Parallelisierung der Oligozänausbildungen im Doroger Becken auf Grund von Foraminiferen-Untersuchungen (German summary of Hungarian text).—Bull. Hungarian Geol. Soc., v. 94, no. 2, p. 254-256, pl. 20. —Brackish assemblages in lower Oligocene.

NEAGU, THEODOR. Albian Foraminifera of the Rumanian Plain.—Micropaleontology, v. 11, No. 1, Jan. 1965, p. 1-38, pls. 1-10, table 1.—Illustrated systematic catalog of 112 species (1 new) and 3 subspecies (all new).

OLIVIERI, R. Rapporti quantitativi fra i Foraminiferi recenti delle spiagge di Rimini, Porto Corsini e Lido di Venezia.—Boll. Soc. Paleontologica Italiana, v. 2, no. 2, 1963, p. 94-108, text figs. 1-3 (population diagrams), tables 1-3.—Population diagrams show the similarity as well as the quantitative differences between beach samples from Rimini, Porto Corsini, and Venezia. Recognition of faunal contamination by inland Tertiary outcrops or by offshore bottom sediments is facilitated through study of those adjacent faunas.

PASINI, M. *Chusenella sosioensis* nuova specie de Fusulinide nel Permiano della Valle del F. Sosio.—Riv. Ital. Pal. Stratig., v. 70, No. 2, 1964, p. 169-182, pls. 10, 11, text figs. 1-4 (graphs). —A redescription of *Fusulina prisca* Ehrenberg of Silvestri, 1933.

PRONINA, M. T. Novye Predstaviteli Roda *Elphidium* v Otlozhenijakh Miothena Nakhichevanskoj ASSR.—Izvest. Akad. Nauk Azerbajdzhan. SSR, ser. geol.-geogr. nauk, 1964, No. 2, p. 53-58, pl. 1.—Three species and two varieties of Miocene *Elphidium,* all new.

RAJAGOPALAN, N. Late Cretaceous and early Tertiary stratigraphy of Pondicherry, S. India—a preliminary note.—Bull. Geol. Soc. India, v. 1, No. 1, July 1964, p. 10-12, tables 1-3.—Zonation by planktonic Foraminifera and correlation with the West Indian section.

RAMALHO, M. DE MAGALHAES. Nota preliminar sobre os foraminíferos do Miocénico da praia do Penedo (a Norte do Cabo Espichel).—Univ. Lisboa, Bol. do Museu e Lab. Min. Geol. Fac. Ciências, v. 9, fasc. 2, 1962-1963, p. 107-123.—Sixty species and varieties (none new) are recorded; none illustrated.

REDMOND, C. D. Lituolid Foraminifera from the Jurassic and Cretaceous of Saudi Arabia.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 405-414, pls. 1, 2, text figs. 1, 2 (diagrams).—Nine species (8 new) in 3 genera (2 new). *Everticyclammina* new genus (type species *E. hensoni* n. sp.) and *Bramkampella* new genus (type species *B. arabica* n. sp.).

REISS, Z., HAMAOUI, M., and ECKER, A. *Pseudedomia* from Israel.—Micropaleontology, v. 10, No. 4, Oct. 1964, p. 431-437, pls. 1, 2.—A new species from the late Cenomanian-?early Turonian with speculation as to its relationships with the Alveolinidae and the Peneroplidae.

DE RIVERO, FRANCES CHARLTON. Consideraciones Generales sobre la Estratigrafía de Cuba.—Mem. Fac. Ciencias, Univ. Habana, v. 1, No. 1, Oct. 1963, p. 25-82, 2 correl. charts.—Correlation of stratigraphic units from Jurassic to Pleistocene with European time scale and planktonic Foraminifera zones.

Ecologia, paleoecologia y distribucion estratigrafica de los arrecifes organicos.—Univ. Central Venezuela, Escuela de Geol. Minas y Metal., Caracas, Geos, No. 11, Sept. 1964, p. 41-122, text figs. 1-6 (reef and atoll diagrams), tables

1-3.—A compilation of previous work on reef organisms, Recent and fossil.

De Rosa, E. Sulla Datazione dell' "Alberese di Farini d'Olmo" (Appennino Settentrionale).—Riv. Ital. Pal. Stratig., v. 70, No. 2, 1964, p. 279-304, pl. 22, text figs. 1-3 (map, columnar sections with range charts).—Seven species of Paleocene planktonic Foraminifera.

Rozovskaya, S. E. Fusulinids from the Bükk Mountains, North Hungary (English resumé of Hungarian text).—Geologica Hungarica, ser. Pal., fasc. 28, 1963, p. 3-42, pls. 1, 2, text fig. 1 (map), table 1.—Descriptions and illustrations of 15 species and 2 subspecies, none new.

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Sen Gupta, Barun K. Morphology of some key species of *Nummulites* from the Indian Eocene.—Journ. Pal., v. 39, No. 1, Jan. 1965, p. 86-96, pls. 15-17, text-figs. 1, 2 (graphs), tables 1-15.—Four species, none new, from the Lutetian.

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Suleimanov, I. S. New agglutinized Foraminifera from the Paleogene of the Central Kizil-Kum (in Russian).—Paleont. Zhurnal, Akad. Nauk SSSR, 1964, No. 4, p. 38-44, pl. 3, table 1.—Five new species: four from upper Eocene-lower Oligocene; one from Maestrichtian.

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3 bathymetric zones. Number of species decreases toward the shore but number of individuals increases. About 50 species are recorded.

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WANGERSKY, PETER J., and JOENSUU, OIVA. Strontium, magnesium, and manganese in fossil foraminiferal carbonates.—Journ. Geol., v. 72, No. 4, July 1964, p. 477-483, text figs. 1-3 (graphs), tables 1-5.—In 3 deep-sea cores going back through the Pleistocene, the strontium ratio remains constant, the magnesium ratio is variable, and the manganese ratio shows an increase with depth in the core.

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