STUDIES ON THE FAUNA OF CURAÇAO AND OTHER CARRIBEAN ISLANDS: No. 162

FURTHER STUDIES ON CARIBBEAN FORAMINIFERA

by

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INTRODUCTION

This paper deals with Foraminifera from

1) shallow water samples gathered by dr. P. WAGENAAR HUMMELINCK in the Florida Keys, the Cayman Islands, Jamaica, Puerto Rico, Virgin Islands, several Lesser Antillean islands from St. Martin as far as Tobago, Margarita, Bonaire, and Curaçao;
2) a sample collected by dr. P. J. BERMÚDEZ off La Habana, Cuba, at a depth of 2–5 fathoms;
3) samples gathered by dr. TH. MORTENSEN off St. Croix (= Santa Cruz), W. of Frederiksted, at about 17.5°N 64°W, depths 100, 150 and 500 fathoms; off Thatch Island, between St. Croix and St. John, depth 14–16 fathoms, and a sample taken between Tortola and Jost van Dyke, at a depth of about 20 fathoms.

The species belonging to the samples W. of St. Croix of the families Valvulinidae, the Protoforaminata, the Biforaminata and the Deuteroforaminata including the Globigerinidae and other planktonic groups were already described in my paper on the "Foraminifera dentata; Foraminifera of Santa Cruz and Thatch-Island" (1956). Many other species, however, occurring in the MORTENSEN-samples have not yet been described and will be discussed here.

Foraminifera from the rich samples sent by dr. BERMÚDEZ are also included, as far as they have not been treated in my papers on the "Foraminifera from the tidal zone in the Netherlands Antilles and other West Indian islands" (1964), the "Recent Foraminifera from Barbados" (1969) and "The Foraminifera of Piscadera Bay, Curaçao" (1971), or in other publications.

Special attention has been given to the Miliolidae, since it became clear that after the publications by SCHLUMBERGER very little attention was paid to the inner structure of recent Miliolids – while particularly the inner structures have lead to a better understanding of the systematic places of many species of this group, as the analyses will show. As the primitive agglutinated Foraminifera found in MORTENSEN's samples were described by me (1972) in a more general paper on this group, I will deal with these only superficially, to give a more complete survey of the fauna.

It should be mentioned that the following Figures are depicting species which do not occur in the Caribbean region, or which do occur there but are mentioned in the text only in respect to genera. Some of these species were analysed in other papers by me.

- Fig. 41, *Ammobaculites agglutinans* (d'Orbigny)
- Fig. 42, *Ammoscalaria pseudospiralis* (Williamson)
- Fig. 44, *Ammotium cassis* (Parker)
- Fig. 47, *Valvotextularia affinis* (Fornasini) [St. Croix]
- Fig. 48, *Siphotextularia wairoana* Finlay
- Fig. 96, *Nummuloculina fragilis* (Le Calvez)
- Fig. 114, *Quinqueloculina seminulum* (Linnaeus)
- Fig. 125, *Vertebralina striata* d'Orbigny
- Fig. 132, *Planorbulina mediterranensis* d'Orbigny
- Fig. 146, *Glabratella brasiliensis* Boltowskoy [Cuba]
- Fig. 147, *Siphoninoides echinata* (Brady) [Cuba]

In connection with the analysis of his samples from Piscadera Bay in Curaçao (HOFKER 1971), dr. HUMMELINCK took a comparable number of samples from the Lac of Bonaire, and in addition to these several from the Spaanse Water of Curaçao, the Great Lagoon of Barbuda, and the Bahía Fosforescente of Puerto Rico. Moreover, the contents of samples collected by him at an earlier date in the Simson Bay Lagoon of St. Martin were known already (HOFKER, 1964), so the faunae of six different lagoonal bays could be studied and compared.

The Piscadera Bay and Simson Bay Lagoon are connected with the sea by entrances of only several metres wide; the entrance of the Great Lagoon consists of a mangrove-lined canal through which only very small boats may pass at high tide; contrary to the entrances of the remaining three inland bays, from which that of the Lac is even exposed to the waves of the eastern trade winds.

The author would like to express his sincere gratitude to Dr. P. Wagenaar Hummelinck for preparing the manuscript for the press, and for reading the proofs with the help of Drs. Louise J. van der Steen. Dr. Hummelinck also produced the maps.

The material and the types of new species, together with a number of extracted faunae are stored in the collections of the Netherlands Geological Survey at Haarlem, the Netherlands.

LOCALITIES AND SPECIES

Florida Keys – Table 1

1408 Virginia Key, NE, 4.IX.1963; sand flat with *Syringodium* and *Thalassia* (½–1½ m) – 8 species.

1408A Same area, with pieces of coral and concrete (1½–2 m) – same species.

1409 Virginia Key, piling of The Marine Laboratory, 1.IX.1963; concrete pole in muddy water, some tidal flow (0–1½ m) – 4 sp.

1410 Key Biscayne, Bear Cut, 1.IX.1963; sand with dense *Syr.* and *Thal.* (½–1 m) – 9 sp.

1410B Same area, tidal pools on sandy beach (0–½ m) – 6 species.

1411 Key Biscayne, NE, 7.IX.1963; surf-swept beachrock with pole (0–1 m) – 11 sp.

1412 Key Biscayne, NW swamp, 31.VIII.1963; drainage with *Rhizophora* and *Avicennia* (½–1½ m) – abundant *Archaias angulatus*.

1413 Soldier Key, E, 300 m off, 5.IX.1963; muddy sand flat with some *Thal.* and gorgonids (1½–2½ m) – 15 sp.

1414 Elliott Key, E, 3 km off, 5.IX.1963; small coral reef on sand with *Thal.* and *Syr.* (2–6 m) – 14 sp.

Cuba

s.n. Bahía de Habana; P. J. Bermúdez (2–5 fathoms) – 116 species.

Amphistegina gibbosa d'Origny
Angulogerina spec.
Articulina lineata Brady
— *mucronata* (d'Orbigny)

— *paucicostata* Cushman
— *sagrai* d'Orbigny
Asterigerina carinata d'Orbigny
Bigenerina irregularis Phleger & Parker
Bisaccium imbricatum Andersen
Bolivina limbata Brady
— *cubana* Bermúdez
— *plicatella* Cushman
— *rhomboidalis* (Millett)
— *tortuosa* Brady
Bronnimannia palmerae (Bermúdez)
Buliminella elegantissima (d'Orbigny)
Buliminoides williamsoni (Brady)
Caribbeanella polystoma Bermúdez
Chrysalidinella dimorpha (Brady)
Clavulina nodosaria d'Orbigny
— *tricarinata* d'Orbigny
Cornuspiramia antillarum (Cushman)
Cushmanella browni (d'Orbigny)
Cymbaloporetta squammosa (d'Orbigny)
Dendritina politum (Chapman)
Dentostomia bermudiana Carman
Discogypsina vesicularis (Parker & Jones)
Discopulvinulina bertheloti (d'Orbigny)
— *floridana* (Cushman)
Discorbis candeiana (d'Orbigny)
Elphidiononion discoidale (d'Orbigny)
— *incertum* (Williamson)
— *poeyanum* (d'Orbigny)
Elphidium advenum (Cushman)
— *morenoi* Bermúdez
— *sagrai* (d'Orbigny)
Eponides caribaea (d'Orbigny)
— *repandus* (Fichtel & Moll)
Glabratella brasiliensis Boltowskoy
— *pulvinata* (Brady)
Gypsina plana (Carter)
Hauerina bradyi Cushman
— *howelli* Bermúdez
— *occidentalis* Cushman
Heterostegina antillarum (d'Orbigny)
Lamarckina atlantica Cushman
Massilina gualtieriana (d'Orbigny)
— *inaequalis* (Cushman)
Miliola tricarinata (d'Orbigny)
Miliolinella labiosa (d'Orbigny)
— *suborbicularis* (d'Orbigny)
— *subrotunda* (Montagu)
Neoalveolina pulchra (d'Orbigny)
Neocarpenteria candei Bermúdez
Neoconorbina orbicularis (Terquem)
Neoeponides antillarum (d'Orbigny)
Nonionella grateloupi (d'Orbigny)
Nouria johnsoni Cushman
Orbitolites hemprichi (Ehrenberg)
Patellina corrugata Williamson
Planorbulina acervalis Brady
— *mubahethi* Said
Planogypsina squamiformis (Chapman)
Psammosphaera flinti Hofker
Pseudospyrgo subsphaerica (d'Orbigny)
Pyrgo comata (Brady)
Pyrgoides denticulatus (Brady)
Puteolina (*Arch.*) *angulatus* (Fichtel & Moll)
— *bradyi* (Cushman)
— *carinata* (d'Orbigny)
— *compressa* (d'Orbigny)
— *crassa* Hofker
— *marginalis* (Lamarck)
— *protea* (d'Orbigny)
Quinqueloculina auberiana d'Orbigny
— *bidentata* d'Orbigny
— *bradyana* (Cushman)
— *poeyana* d'Orbigny
— *polygona* d'Orbigny
— *quadrilatera* (d'Orbigny)
Reussella atlantica Cushman
— *mortenseni* Hofker
Rosalina concinna (Brady)
Rotorbinella granulosa (Heron-Allen & Earland)
— *mira* (Cushman)
— *rosea* (d'Orbigny)
Sagrina puchella d'Orbigny
Sigmoilina schlumbergeri Silvestri
Siphogenerina advena Cushman
— *costata* Schlumberger
Siphonia pulchra Cushman
Siphoninoides echinata (Brady)
— *glabra* (Heron-Allen & Earland)
Sphaerogypsina globulus (Reuss)
Spirillina vivipara Ehrenberg
Streblus advenus (Cushman)
— *catesbyanus* (d'Orbigny)
— *parkinsonianus* (d'Orbigny)
Textularia candeiana d'Orbigny

— *caribaea* d'Orbigny
— *conica* d'Orbigny
— *schencki* Cushman & Valentine
Tetromphalus bulloides (d'Orbigny)
Triloculina bertheliniana (Brady)
— *bradyana* (Cushman)
— *carinata* (d'Orbigny)
— *linneana* d'Orbigny
— *striolata* (Brady)
— *transversestriata* (Brady)
Trochammina rotaliformis Wright
Tubinella funalis (Brady)
Valvulina oviedoiana d'Orbigny
Vertebrasigmoilina mexicana (Cushman)
Virgulina compressa (Bailey)
— *squammosa* d'Orbigny
Wiesnerella auriculata (Egger)

Cayman Islands – Table 2

Grand Cayman (Fig. 165)

1684 Head of Barkers, entrance North Sound, 10.VI.1973; sandy sea-grass flat with pieces of limestone (0–½ m) – 27 species.

1686 Sea dyke of Barkers peninsula, North Sound, 10.VI.1973; muddy sand of drainage canal (0–1½ m) – 3 sp.

1687 Same area, 15.V.1973 (½–1 m) – 4 sp.

s.n. Same area, Barkers dyke, 10.VI.1973; sand dredged from drainage canal – 9 sp.

1689A SW North Sound at Turtle Crawls, 25.V.1973; mud with *Thalassia* near *Rhizophora* (½–1 m) – 11 sp.

1690 Rum Point lagoon, North Sound, 27.V.1973; *Rhiz.* in mud (0–1 m) – 5 sp.

s.n. Rum Point beach, entrance North Sound, 27.V.1973; sand – 21 sp.

s.n. W coast at Beach Club, 10.VI.1973; sand – common *Archaias angulatus* and *Rotorbinella rosea.*

1693 South Sound at Red Bay, 23.V.1973; *Rhiz.* in muddy sand (0–1½ m) – 8 sp.

1694 W coast near Jackson's Point, 9.VI.1973; surf-swept limestone, pieces of rock (0–½ m) – 21 sp.
1694A Same area, 9.VI.1973; large sandy pool (0–½ m) – 18 species.

Little Cayman

1698A South Hole Sound, The Bight, 5.VI.1973; *Rhiz.* with some *Thal.* in sandy mud (0–¾ m) – 8 species.

1699 South Hole Sound, Southern Cross Club, 7.VI.1973; growth of *Halodule,* wooden piling, muddy sand (0–½ m) – 11 sp.

1700A Owen Island, South Hole Sound, 7.VI.1973; sand with *Halodule* (½ m) – 17 sp.

s.n. Sandy Point, E coast, 4.VI.1973; sand beach – 7 sp.

Cayman Brac

1703 West Point, Ledges, 3.VI.1973; sandy beach – 8 species.

Jamaica – Table 2

1677 Kingston Harbour W of Airport, 7.V.1973; mud and debris of *Rhizophora* – *Streblus catesbyanus* and *Triloculina trigonula*.

1678 Kingston Harbour, near Port Royal, 7.V.1973; *Rhiz.* in mud (0–1 m) – 5 species.

1679 Fort Rupert Lagoon, Port Royal, 15.V.1973; *Rhiz.* and *Halodule* in mud and sand (0–1½ m) – 5 sp.

1683 Drunkemans Key, S of Port Royal, 15.VI.1973; sandy rock debris – 13 sp.

s.n. Drunkemans Key beach, 15.VI. 1973; sand – 4 sp.

s.n. Great Saltpond beach, W of Port Royal, 8.VI.1973; sand – 4 sp.

Puerto Rico – Table 3 (Fig. 164)

1415 Mayagüez, 4 km off Punta Cadena, 14.IX.1963; muddy sand (abt. 90 m) – 24 species:
Amphistegina gibbosa d'Orbigny, abundant
— *radiata* d'Orbigny, common
Bigenerina irregularis Phleger & Parker, common
Bolivina lanceolata Parker, rare
Cancris oblonga (Williamson), not common
— *sagrai* (d'Orbigny), not common
Cornuspiramina antillarum (Cushman), rare
Dendritina elegans (d'Orbigny), not common
Eponides repandus (Fichtel & Moll), common
Globigerina eggeri Rhumbler, fairly common
— *rubra* d'Orgigny, fairly common
— *triloba* Reuss, common
Globorotalia menardii (d'Orbigny), common
Heterostegina antillarum d'Orbigny, rare
Liebusella soldanii (Jones & Parker), not common
Massilina inaequalis Cushman, rare
Neoeponides antillarum (d'Orbigny), fairly common

Paleopeneroplis inornata Hofker, not common
Planorbulina caribbeana n. sp., not common
Pseudopyrgo subsphaerica (d'Orbigny), not common
Reophax compressus Goës, not common
Quinqueloculina lamarckiana d'Orbigny, common
Spiroloculina caduca Cushman, not common
Textularia conica d'Orbigny, not common

1416 Mayagüez, 4 km off Añasco River, 14.IX.1963; sandy mud (abt. 10 m) – 6 sp.:
Ammoscalaria morenoi (Acosta), rare
Asterigerina carinata d'Orbigny, rare
Bigenerina irregularis Phleger & Parker, not common
Elphidiononion poeyanum (d'Orbigny), not common
Quinqueloculina lamarckiana d'Orbigny, not common
Vertebrasigmoilina mexicana (Cushman), rare

1417 Magueyes island, La Parguera, 17.IX.1963; *Rhizophora* in mud – 4 sp.

1418 Cayo Mágimo, Parguera, 12.IX.1963; sand with *Syringodium* (2 m) – 12 sp.

1419 Mata de la Gata, Parguera, 12.IX.1963; sand with *Rhiz.* and *Thalassia* and poor *Thal.* (0–1 m) – 16 sp.
1419A Same, 12.IX.1963; *Porites* flat with *Thal.* (0–½ m) – 16 sp.

1421 Bahía Fosforescente, SE, 17.IX.1963; sandy bottom with *Rhiz.*, *Thal.* and *Syr.* – *Quinqueloculina poeyana* with abundant *Triloculina rotunda*.

1422 Same area, NW, 17.IX.1963; sandy mud near *Rhiz.* (1½ m) – 4 sp.
1422B Same area, NE, 17.IX.1963; mud near *Rhiz.* (3½ m) – 4 sp.

1423 Same area, central part, 17.IX.1963; mud (4½ m) – 4 sp.
1423A Same area, SW, 17.IX.1963; muddy sand with *Thal.* and *Halimeda* (1 m) – 10 sp.
1423B Same area, SE, 17.IX.1963; muddy sand with *Thal.* (1½ m) – 6 sp.

1424 Bahía Fosforescente, entrance, 17.IX.1963; sandy mud (4½ m) – 6 sp.

VIRGIN ISLANDS – TABLE 4

ST. THOMAS

1674 Benner Bay lagoon, 30.IV.1973; *Rhizophora* in mud – 5 species.

1675 Magens Bay, 30.IV.1973; sandy rock in surf – 3 sp.

St. John

1407 Turner Bay, 18.VI.1955; porfirite rock with boulders and coarse sand (0–½ m) – 12 species.

1408 Frank Bay, near Cruz Bay, 19.VI.1955; boulders on sandy beach (½ m) – 8 sp.

s.n. Between Tortola and Jost van Dyke, 1906, dr. Th. Mortensen (36 m) – 10 species.

s.n. Thatch Island, near West Point, 1906, dr. Th. Mortensen (25–30 m) – 34 species.

St. Croix

1405 Krausse Lagoon, entrance and basin, 15.VI.1955; sandy mud with *Rhiz.*, *Thalassia* and *Halodule* (0–1 m) – 7 species.

Windward Group – Tables 5–8

St. Martin (Table 5)

1400a Fresh Pond, at bridge, 15.X.1963; drying mud flat crowded with *Ruppia* – *Rotorbinella rosea* and abundant *Streblus tepidus*.

1428 Étang des Poissons, Embouchure, 3.X.1963; *Rhizophora* in mud – 13 sp.

1429 Oyster Pond, SE corner, 13.X.1963; some *Rhiz.* in muddy sand with *Thalassia*, *Syringodium* and *Halimeda* – 4 sp.

s.n. Baie aux Cailles, Terres Basses, 28.VII.1967; sandy beach – 15 sp.

s.n. Simson Lagoon, Gret Key, 21.VIII.1949; sandy mud near *Rhiz.* – 3 sp.

s.n. Simson Lagoon, Colline Nettlé, 29.VI.1973; sandy beach debris – 7 sp.

s.n. Flamingo Pond, Simson Lagoon, 19.VII.1973; dredged from abt. 1–5 m – 5 sp.

s.n. Cul-de-Sac Bay, 20.VII.1973; sand and muddy sand, dredged from abt. 2–5 m 5 sp.

FOURCHE (W of St. Barts)

1124 Five Island Bay, 2.VI.1949; sandy rock debris – abundant *Archaias angulatus*.

SABA (Table 5)

1432 Cove Bay at Flat Point, 5.X.1963; volcanic rock (0–½ m) – 12 species.

ST. KITTS (Table 5)

1397 Frigate Bay, 20.VII.1955; volcanic rock and coarse sand (0–1½ m) – 6 species.

BARBUDA (Table 6; Fig. 166)

1396 S of Castle Landing near Codrington Village, Great Lagoon, 4.VII.1955; muddy sand with *Batophora* and *Thal.* near *Rhiz.* (½ m) – 8 sp.

1531 Entrance ot Great Lagoon at Billy Point, 22.VII.1967; sand flat with *Thal.* and *Rhiz.* (0–1½ m) – 17 sp.

1532 Canal of Great Lagoon N of Cuffy Creek, 22.VII.1967; *Rhiz.* on sandy mud, *Thal.* and *Batophora* (0–½ m) – 13 sp.

1533 Cuffy Creek, Great Lagoon, 22.VII.1967; sandy mud flat with scattered *Bat.* (0–½ m) – 10 sp.

1534 Lobster Point, Great Lagoon, 23.VII.1967; muddy sand with *Thal.* and *Halodule* near *Rhiz.* (0–1 m) – 9 sp.

1535 Palm Beach Landing, Great Lagoon, 23.VII.1967; sandy rock, concrete (0–1 m) – 6 sp.

1536 SW part of Great Lagoon, 23.VII.1967; sand with *Thal.* and *Halodule*, *Bat.* pools (0–1 m) – 5 sp.

1537 W of Hudson Landing, Great Lagoon, 23.VII.1967; muddy sand with *Bat.* (½–1 m) – 6 sp.

1538 Castle Landing, Great Lagoon, 21.VII.1967; piling of pier in muddy sand with *Bat.* (0–½ m) – 5 sp.

1539 N of Castle Landing, Great Lagoon, 24.VII.1967; *Rhiz.* in soft mud with *Halodule* – 4 sp.

834 Great Lagoon at Palm Beach Landing, 23.VII.1967; sand from sand from decay of seagrass (= 1535) – Common *Orbitolites hemprichii*.

s.n. Coco Point beach, 23.VII.1967; sand beach - Abundant *Orbitolites hemprichii*.

ANTIGUA (Table 5)

1540A Dickinson Bay, N, 26.VII.1967; sandy boulders with *Thal.* (½–1 m) – 16 species.
1540B Same locality, 26.VII.1967; eroded *Thal.* flat, sand (½–1 m) – 5 spec.

1541 Dickinson Bay pier, 26.VII.1967; wooden piling in sand (0–1½ m) – 7 spec.

MONTSERRAT

1542 Foxes Bay, 20.VII.1967; volcanic boulders (0–½ m) – abundant *Planorbulina acervalis*, *P. retinaculata* and *Rotorbinella rosea*.

GUADELOUPE (Table 7; Fig. 167)

1435 Baie du Nord-Ouest, near Moule, 28.I.1964; sand beach near muddy inlet – 5 species.

1543A Northern entrance of Rivière Salée, 16.VII.1967; *Rhiz.* in muddy sand – 8 sp.

1544 Same area, eastward, 16.VII.1967; *Rhiz.* in soft mud – 5 sp.

1545 Rivière Salée, La Manche à Eau, 16.VII.1967; *Rhiz.* in sandy mud with *Halodule* – 12 sp.

s.n. Gozier beach, 20.VII.1967; sandy shore – 12 sp.

LA DÉSIRADE (Table 7)

1437 Grande Anse, near bridge, 23.I.1964; muddy sand with *Thal.* and *Halodule* few branches of trees (0–½ m) – 27 species.

1438 Grande Anse, pier, 25.I.1964; wooden and concrete piling, *Thal.* flat of muddy sand (0–1 m) – 6 sp.

MARIE-GALANTE (Table 7)

s.n. Capesterre, Les Galéries, 2.II.1964; sandy beach debris – 8 species.

DOMINICA (Table 8)

1546 Prince Rupert Bay near Portsmouth, 15.VII.1967; boulders of volcanic rock (0–1 m) – 11 species.

Table 1

Foraminifera from Florida Keys

· = absent; o = rare; — = not common; x = common; X = abundant

Species / Samples	1408 *Virginia Key*	1409	1410 *Key Biscayne*	1410A	1411	1413 *Soldier Key*	1414 *Elliott Key*
Archaias angulatus	X	·	X	—	X	x	X
Archaias compressus	—	·	—	·	·	o	·
Articulina mucronata	·	·	·	·	·	·	o
Asterigerina carinata	·	·	·	·	—	·	·
Clavulina tricarinata	·	·	·	·	·	o	·
Cornuspiramia antillarum	·	·	—	·	e	·	·
Dendritina elegans	·	·	·	·	·	—	·
Elphidiononion mexicanum	o	·	·	·	·	·	·
Massilina gualtieriana	o	·	—	—	o	·	o
Miliolinella labiosa	—	·	·	·	·	·	—
Neoalveolina pulchra	·	·	·	·	o	·	·
Orbitolites hemprichi	—	·	·	·	o	x	x
Orbitolites marginalis	·	·	·	·	·	·	—
Palaeopeneroplis inornatus	x	·	·	·	x	·	·
Peneroplis arietinus	·	·	o	·	·	·	·
Planorbulina acervalis	·	·	o	·	·	x	—
Planorbulina mabahethi	—	·	o	·	—	·	·
Pseudopyrgo eburnea	·	—	—	—	—	·	·
Puteolina bradyi	·	·	·	·	·	—	—
Puteolina protea	·	·	·	·	—	—	·
Pyrgoides denticulatus	·	·	·	·	·	X	·
Quinqueloculina bidentata	·	·	·	·	·	·	—
Quinqueloculina carinata	·	·	·	·	·	—	·
Rotorbinella mira	·	·	·	·	o	—	—
Sigmoilopsis arenata	·	—	·	·	·	·	·
Spiroloculina antillarum	·	·	·	o	·	—	·
Triloculina linneiana	·	—	·	·	·	—	—
Triloculina carinata	·	·	·	·	·	—	·
Triloculina dilatata	·	·	·	·	·	·	o
Triloculina oblonga	·	·	·	—	·	·	·
Triloculina rotunda	·	—	—	—	—	X	X
Valvulina oviedoiana	·	·	·	·	·	·	o
numbers of species: 32	8	4	9	6	11	15	14

TABLE 2

FORAMINIFERA FROM THE CAYMAN ISLANDS AND JAMAICA

· = absent; O = rare; — = not common; x = common; X = abundant

Species / Samples	1684 *Grand Cayman*	1686/7	Barkers dyke	1689A	1690	Rum Pt beach	1693	1694	1694A	1698A *Little Cayman*	1699	1700A	Sandy Pt beach	1703 *Cayman Brac*	1678 *Jamaica*	1679	1683	Drunk. Key beach	Saltpond beach
Amphistegina gibbosa	·	·	·	·	·	x	·	X	x	·	·	·	—	—	·	·	x	O	—
Archaias angulatus	X	·	X	·	·	x	·	X	x	·	x	x	X	X	·	·	x	x	·
Articulina mucronata	O	·	·	·	·	·	O	·	·	·	·	·	·	·	·	·	·	·	·
Asterigerina carinata	O	·	·	·	·	X	·	X	·	·	·	·	—	O	·	·	·	·	·
Clavulina tricarinata	X	·	·	·	·	·	·	·	·	·	·	O	·	·	·	·	O	·	·
Cymbaloporetta squammosa	X	·	·	·	·	X	O	X	X	x	·	X	·	·	O	·	·	·	·
Dendritina elegans	—	·	·	O	·	·	·	x	·	O	·	·	·	·	·	·	·	·	·
Discopulvinulina floridana	x	·	·	·	·	·	·	·	·	—	·	·	·	·	·	—	·	·	·
Discorbis aguayoi	·	X	·	·	X	·	·	·	·	x	O	·	·	·	·	·	·	·	·
Discorbis floridana	x	·	·	·	·	·	·	O	·	·	—	·	·	·	·	·	·	·	·
Elphidiononion poeyana	·	x	·	x	O	·	O	·	·	x	O	O	·	·	—	·	O	·	·
Elphidiononion discoidale	·	·	·	·	·	O	·	x	O	·	·	·	·	·	·	·	·	·	·
Elphidiononion mexicanum	·	·	·	·	·	O	·	·	·	·	·	·	·	·	·	·	·	·	·
Heterostegina antillarum	·	·	·	·	·	O	·	·	O	·	·	·	·	·	·	·	·	·	·
Homotrema rubrum	·	·	·	·	·	X	·	X	·	·	·	·	x	X	·	·	X	X	·
Massilina gualtieriana	X	·	O	·	·	X	·	O	·	·	·	·	·	·	·	·	·	·	·
Massilina protea	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Miliolinella labiosa	x	·	·	·	O	·	·	·	·	·	·	—	·	O	·	·	·	·	·
Miliolinella suborbicularis	O	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Neoalveolina pulchra	·	·	·	·	·	x	·	X	x	·	·	·	O	·	·	·	·	·	·
Orbitolites hemprichii	x	O	x	O	·	X	O	x	x	O	·	—	·	·	·	·	·	·	·
Peneroplis arietinus	—	·	·	·	·	·	·	·	O	·	O	O	·	·	·	·	·	·	·
Planorbulina acervalis	·	·	·	·	·	X	·	·	·	·	·	·	·	·	·	·	·	·	·
Planorbulina mabahethi	·	·	·	·	·	X	·	·	·	·	·	·	·	·	·	·	O	·	·
Pseudopyrgo subsphaerica	x	·	·	·	·	·	·	X	X	·	·	·	·	·	·	·	·	·	·
Puteolina discoidea	O	·	·	·	·	·	·	O	O	·	·	·	·	·	·	·	·	·	·
Puteolina protea	·	·	O	·	·	·	·	O	O	·	·	O	·	·	·	·	O	·	·
Quinqueloculina bidentata	x	·	O	·	·	·	·	x	O	·	·	·	·	·	·	·	O	·	·
Quinqueloculina carinata	X	·	·	·	·	—	·	X	x	·	·	O	·	·	·	·	·	·	·
Quinqueloculina compta	·	·	·	X	X	·	·	·	·	·	·	X	·	·	·	X	·	·	·
Quinqueloculina agglutinans	·	·	·	·	·	·	·	·	·	·	—	·	·	·	·	·	·	·	·
Quinqueloculina lamarckiana	·	·	·	X	·	·	O	·	·	x	x	·	·	—	·	·	x	·	—
Quinqueloculina obliquinoda	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Quinqueloculina poeyana	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rotorbinella granulosa	·	·	·	·	·	X	·	x	x	·	x	x	O	x	·	·	O	·	X
Rotorbinella mira	·	·	·	x	·	·	·	·	·	·	·	·	·	·	O	·	·	·	·
Rotorbinella rosea	·	·	—	·	·	X	·	X	X	·	·	·	X	X	·	·	X	X	X
Schlumbergerina occidentalis	x	·	·	·	·	O	·	·	O	·	·	·	·	·	·	·	O	·	·
Spiroloculina antillarum	x	·	·	·	·	·	·	x	·	·	—	—	·	·	·	·	·	·	·
Streblus catesbyanus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	—	·	·	·	·
Streblus tepidus	·	X	·	X	X	·	·	·	·	·	·	·	·	·	—	x	·	·	·
Tetromphalus bulloides	O	·	·	·	·	X	O	·	X	·	·	O	·	·	·	·	·	·	·
Triloculina linneiana	X	·	·	·	·	X	·	O	X	·	O	O	·	·	·	·	·	·	·
Triloculina oblonga	x	·	O	x	·	·	O	·	·	x	x	x	·	·	·	—	·	·	·
Triloculina rotunda	·	·	x	X	·	·	·	·	·	·	·	·	·	·	·	X	O	·	·
Triloculina trigonula	O	·	·	O	·	x	O	·	·	·	·	X	·	·	·	·	·	·	·
Trochammina inflata	·	x	·	O	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Valvulina oviedoiana	X	·	O	·	·	X	·	·	·	·	·	·	·	·	·	·	·	·	·
Valvotextularia agglutinans	·	·	·	·	·	·	·	X	·	·	·	x	·	·	·	·	·	·	·
numbers of species: 49	27	5	9	11	5	21	8	21	18	8	11	17	7	8	5	5	13	4	4

Table 3

Foraminifera from Puerto Rico

· = absent; o = rare; — = not common; x = common; X = abundant

Species	Samples	La Parguera				Bahia Fosforescente					
		1417	1418	1419	1419A	1422	1422B	1423	1423A	1423B	1424
Ammobaculites josephi		·	·	·	·	·	·	·	·	·	—
Ammoscalaria morenoi		·	·	·	·	x	x	x	·	·	·
Amphistegina radiata		·	·	·	—	·	·	·	·	·	·
Archaias angulatus		·	—	x	x	·	·	·	x	·	X
Clavulina tricarinata		·	·	·	X	·	·	·	·	·	·
Cornuspiramia antillarum		·	·	·	·	·	·	·	—	·	·
Cymbaloporetta poeyi		·	·	—	—	·	·	·	·	·	·
Dendritina elegans		·	—	o	·	·	·	·	·	·	·
Elphidiononion poeyanum		x	·	·	·	X	x	x	—	X	·
Homotrema rubrum		·	—	·	·	·	·	·	·	·	·
Massilina gualtieriana		·	·	·	·	·	·	·	·	·	X
Miliolinella labiosa		·	—	—	·	·	·	·	—	·	·
Nonionella grateloupi		x	·	·	·	—	—	·	·	—	·
Orbitolites hemprichi		·	·	X	—	·	·	·	·	·	·
Planorbulina acervalis		·	·	—	·	·	·	·	·	·	·
Planorbulina retinaculata		·	·	·	x	·	·	·	·	·	·
Pseudopyrgo subsphaerica		·	o	x	x	·	·	·	·	·	·
Puteolina protea		·	x	·	·	·	·	·	o	·	·
Quinqueloculina bidentata		·	·	—	—	·	·	·	·	·	—
Quinqueloculina carinata		·	·	—	o	·	·	·	·	·	·
Quinqueloculina poeyana		·	·	·	·	·	·	·	—	—	·
Quinqueloculina polygona		·	o	·	—	·	·	·	—	·	·
Quinqueloculina quadrilatera		·	·	—	X	·	·	·	·	·	·
Rotorbinella mira		·	·	X	X	·	·	·	·	·	·
Rotorbinella rosea		·	·	·	X	·	·	·	·	·	·
Schlumbergerina occidentalis		·	o	·	·	·	·	·	·	·	·
Spiroloculina antillarum		·	o	—	—	·	·	·	·	·	·
Streblus tepidus		·	·	·	·	X	X	—	x	X	X
Triloculina linneiana		—	—	—	·	·	·	·	·	·	·
Triloculina rotunda		—	—	—	—	·	·	—	X	X	X
Triloculina trigonula		·	—	—	—	·	·	·	—	—	·
Valvulina oviedoiana		·	·	o	·	·	·	·	·	·	·
numbers of species: 32		4	12	16	16	4	4	4	10	6	6

TABLE 4

FORAMINIFERA FROM THE VIRGIN ISLANDS

except the samples gathered by Mortensen off St. Croix

· = absent; O = rare; — = not common; x = common; X = abundant

Species / Samples	1674 *St. Thomas*	1675	1407 *St. John*	1408	*Thatch Island*	*Tortola-Jost van Dyke*	1405/6 *St. Croix*
Amphistegina gibbosa	·	·	—	·	X	·	x
Amphistegina radiata	·	O	—	·	·	—	·
Archais angulatus	O	x	O	·	X	·	—
Archais compressus	·	·	·	·	—	·	·
Asterigerina carinata	·	·	·	—	—	—	·
Bigenerina irregularis	·	·	·	·	—	X	·
Clavulina tricarinata	·	·	·	·	—	·	·
Cymbaloporetta squammosa	·	·	—	·	·	·	—
Dendritina elegans	·	·	·	·	x	·	·
Elphidionion discoidale	·	·	·	·	—	·	·
Eponides repandus	·	·	·	·	x	·	·
Globigerina aequilateralis	·	·	·	·	—	·	·
Globigerina rubra	·	·	·	·	—	·	·
Globigerina triloba	·	·	·	·	—	·	·
Globorotalia menardii	·	·	·	·	—	·	·
Globorotalia truncatulinoides	·	·	·	·	—	·	·
Gypsina plana	·	·	·	·	X	·	·
Heterostegina antillarum	·	·	·	·	—	·	·
Homotrema rubrum	·	·	x	—	·	·	·
Massilina protea	x	·	·	·	·	·	·
Massilina gualtieriana	·	·	x	x	·	·	·
Miliolinella labiosa	O	·	O	O	·	·	·
Neoalveolina pulchra	·	·	·	·	O	·	·
Nonionella grateloupi	·	·	·	·	·	O	·
Orbitolites hemprichi	·	·	·	·	—	·	—
Planogypsina squamiformis	·	·	·	·	—	O	·
Planorbulina caribbeana	·	·	·	·	·	—	·
Planorbulina mabahethi	·	·	O	O	·	·	·
Pseudopyrgo subsphaerica	·	·	·	·	x	·	·
Puteolina protea	·	·	·	—	—	—	·
Puteolina crassa	·	·	·	·	x	·	·
Pyrgo depressa	·	·	·	·	—	·	·
Pyrgoides denticulatus	·	·	·	·	—	·	·
Quinqueloculina bidentata	·	·	·	·	X	·	·
Quinqueloculina carinata	·	·	·	·	O	·	—
Quinqueloculina lamarckiana	·	·	·	·	—	—	·
Quinqueloculina polygona	·	·	O	·	·	—	·
Quinqueloculina quadrilatera	·	·	O	—	·	·	·
Rotorbinella mira	·	·	·	·	·	·	—
Rotorbinella rosea	·	·	X	·	·	·	·
Sphaerogypsina globulus	·	·	·	·	—	·	·
Streblus tepidus	—	·	·	·	·	·	—
Triloculina bradyana	·	·	·	·	—	·	·
Triloculina oblongoides	·	x	·	x	·	·	·
Triloculina rotunda	x	·	—	·	·	·	·
Textularia conica	·	·	·	·	—	—	·
Valvotextularia agglutinans	·	·	·	·	—	·	·
Valvulina oviedoiana	·	·	·	·	—	·	·
Vertebrasigmoilina mexicana	·	·	·	·	—	·	·
numbers of species: 49	5	3	12	8	33	10	7

TABLE 5

FORAMINIFERA FROM ST. MARTIN, SABA, ST. KITTS AND ANTIGUA

· = absent; O = rare; — = not common; x = common; X = abundant

Species / Samples	*St. Martin* Baie aux Cailles	Cul-de-Sac Bay	1428	1429	Great Key	Colline Nettlé	Flamingo Pond	1432 *Saba*	1397 *St. Kitts*	1540A *Antigua*	1540B	1541
Amphistegina gibbosa	—	·	X	·	·	·	·	—	·	·	·	·
Amphistegina radiata	·	·	·	·	·	·	·	—	O	·	·	·
Archaias angulatus	X	·	·	·	·	·	·	·	O	—	·	·
Archaias compressus	x	·	·	·	·	·	·	·	·	·	·	·
Articulina mucronata	·	·	·	·	·	·	·	·	·	—	·	·
Articulina sagrai	·	·	·	·	·	·	·	·	·	·	O	·
Asterigerina carinata	O	O	O	·	·	·	·	O	·	·	·	·
Clavulina tricarinata	·	·	X	·	·	·	·	·	·	·	—	·
Cornuspiramia antillarum	·	·	·	·	·	·	·	·	·	O	·	·
Cymbaloporetta squammosa	—	·	—	·	·	·	·	·	·	·	·	·
Dendritina elegans	O	·	O	·	·	O	O	·	·	—	·	·
Discorbis aguayoi	—	·	·	·	·	x	·	—	·	·	·	·
Elphidiononion poeyanum	·	—	·	·	·	O	·	·	·	·	·	O
Eponides repandus	·	·	—	·	·	·	·	·	·	·	·	·
Hauerina bradyi	·	·	·	·	·	·	·	·	·	x	·	·
Heterostegina antillarum	·	·	O	·	·	·	·	·	·	·	·	·
Homotrema rubrum	·	·	·	·	·	·	·	x	·	·	·	·
Massilina gualtieriana	·	·	·	·	·	·	·	·	O	·	·	O
Miliola tricarinata	O	·	·	·	·	·	·	·	—	·	·	·
Miliolinella labiosa	O	·	·	O	·	·	·	·	·	·	·	·
Miliolinella semicostata	·	·	·	·	·	·	·	O	·	·	·	·
Orbitolites hemprichi	—	·	x	·	·	O	·	·	·	—	·	·
Paleopeneroplis inornatus	—	·	·	·	·	·	·	·	·	·	·	·
Planorbulina mabahethi	X	·	·	·	·	·	·	·	·	·	·	·
Pseudoeponides anderseni	·	·	·	·	O	·	·	·	·	·	·	·
Pseudopyrgo eburnea	x	·	·	·	·	·	·	·	·	·	·	·
Puteolina protea	·	X	·	O	·	·	x	O	·	X	·	·
Quinqueloculina carinata	·	·	·	·	·	·	O	—	·	—	·	·
Quinqueloculina bidentata	·	O	·	·	·	·	·	·	·	X	·	·
Quinqueloculina lamarckiana	·	X	·	·	·	O	X	·	·	—	·	O
Quinqueloculina polygona	·	·	·	·	·	·	x	·	·	X	·	O
Quinqueloculina quadrilatera	·	·	·	·	·	·	·	—	—	X	·	·
Rotorbinella granulosa	·	·	x	·	·	·	·	·	·	·	·	·
Rotorbinella mira	·	·	·	x	·	·	·	·	·	X	·	·
Rotorbinella rosea	x	·	X	·	·	·	·	—	·	·	x	·
Spiroloculina antillarum	·	·	O	·	·	·	·	·	·	x	·	O
Spiroloculina ornata	·	·	·	·	·	·	·	·	·	·	—	·
Spiroloculina planulata	·	·	·	·	·	·	·	·	·	·	·	O
Streblus parkinsonianus	·	·	·	·	·	·	·	·	·	·	—	·
Tetromphalus bulloides	X	·	·	·	·	·	·	·	·	·	·	·
Triloculina rotunda	·	·	—	—	—	·	·	—	·	X	·	X
Triloculina trigonula	·	·	·	·	·	x	·	·	—	·	·	·
Trochammina inflata	·	·	·	·	x	·	·	·	·	·	·	·
Vertebrasigmoilina mexicana	·	·	·	·	·	·	·	O	·	X	·	·
numbers of species: 44	15	5	12	4	3	7	5	12	6	16	5	7

Table 6

Foraminifera from Barbuda

· = absent; o = rare; — = not common; x = common; X = abundant

Species / Samples	Great Lagoon 1531	1532	1533	1534	1535	1536	1537	1538	1539	1396
Archaias angulatus	X	X	X	X	·	·	X	o	·	—
Articulina mucronata	o	·	·	·	·	·	·	·	·	·
Asterigerina carinata	·	·	·	·	·	·	·	o	·	—
Clavulina angularis	·	·	·	·	·	·	·	·	·	—
Clavulina tricarinata	·	·	—	X	x	·	—	o	·	·
Discogypsina vesicularis	o	·	·	·	·	·	—	·	·	·
Discorbis aguayoi	·	·	·	·	·	·	·	·	x	·
Elphidiononion discoidale	o	·	·	·	·	·	·	·	·	·
Massilina gualtieriana	·	x	·	·	·	·	·	·	·	·
Miliolinella labiosa	x	o	·	X	·	·	·	·	·	·
Neoalveolina pulchra	·	·	·	·	·	—	·	·	·	·
Orbitolites hemprichi	—	·	—	X	—	·	·	·	·	·
Planorbulina acervalis	·	X	·	·	—	·	·	·	·	·
Planorbulina mabahethi	o	·	·	·	·	·	·	·	·	·
Planorbulina retinaculata	·	X	·	·	·	·	·	·	·	·
Pseudopyrgo eburnea	X	—	—	·	·	·	·	·	·	·
Puteolina protea	o	·	·	·	·	·	·	·	·	·
Quinqueloculina bidentata	·	—	·	·	·	·	·	·	·	·
Quinqueloculina bosciana	·	·	—	·	·	·	—	·	·	·
Quinqueloculina carinata	·	o	·	·	·	·	·	·	·	—
Quinqueloculina lamarckiana	·	·	·	·	·	—	·	·	·	·
Quinqueloculina poeyana	—	·	—	x	·	·	—	·	x	·
Quinqueloculina quadrilatera	—	·	x	x	·	·	·	—	·	—
Rotorbinella granulosa	·	o	·	·	·	·	·	·	·	·
Rotorbinella mira	—	—	·	·	—	·	·	·	·	·
Rotorbinella rosea	·	x	·	·	·	·	·	·	·	—
Sigmoilopsis arenata	·	x	—	·	·	—	·	·	·	·
Streblus parkinsonianus	o	·	·	·	·	·	·	·	·	·
Streblus tepidus	·	·	·	·	·	·	·	·	X	·
Triloculina linneiana	—	o	·	·	·	o	·	·	·	—
Triloculina oblonga	—	·	·	—	·	·	·	·	·	·
Triloculina rotunda	X	·	—	X	X	x	X	X	—	x
Valvulina oviedoiana	o	·	X	X	X	·	·	·	·	·
numbers of species: 33	17	13	10	9	6	5	6	5	4	8

Table 7

Foraminifera from Guadeloupe, La Désirade, Marie-Galante and Martinique

• = absent; O = rare; — = not common; x = common; X = abundant

	Guadeloupe					*La Désirade*		*Marie-Galante*	*Martinique*	
Species / Samples	Gozier beach	1435	1543A	1544	1545	1437	1438	Capesterre	1439	Islet Hardy
Amphistegina gibbosa	•	x	•	•	•	•	•	•	•	•
Amphistegina radiata	•	•	•	•	•	—	•	•	•	•
Archaias angulatus	x	•	•	•	•	X	•	x	X	X
Archaias compressus	•	O	•	•	•	•	•	—	—	•
Asterigerina carinata	O	•	x	•	x	—	•	•	•	•
Biaritzina proteiformis	•	•	•	•	•	O	•	•	•	•
Clavulina tricarinata	•	•	•	•	•	O	•	•	•	•
Cornuspiramia antillarum	•	•	•	•	•	—	•	•	•	•
Cymbaloporetta squammosa	•	•	•	•	•	x	O	•	•	•
Dendritina elegans	•	•	•	•	O	—	•	•	•	•
Discogypsina vesicularis	•	•	•	•	•	•	•	X	•	•
Discorbis aguayoi	•	•	•	•	—	•	•	•	•	•
Discorbis globularis	•	•	•	•	—	•	•	•	•	•
Elphidiononion discoidale	•	•	O	•	•	•	•	•	•	O
Elphidiononion elegantum	•	•	X	•	•	•	•	•	•	•
Elphidiononion kugleri	•	•	X	—	X	•	•	•	•	•
Elphidiononion laneiri	•	•	—	•	—	•	O	•	•	•
Elphidiononion mexicanum	O	•	—	—	—	•	•	•	•	•
Hauerina bradyi	•	•	•	•	—	•	•	•	•	•
Hauerina ornatissima	•	•	•	•	•	—	•	•	•	•
Heterostegina antillarum	•	•	•	•	•	—	•	•	•	O
Homotrema rubrum	•	—	•	•	•	—	—	X	x	x
Massilina gualtieriana	•	•	•	•	•	•	•	•	—	•
Miliola tricarinata	O	•	•	•	•	•	•	•	•	•
Neoalveolina pulchra	O	•	•	•	•	—	•	•	•	•
Nonionella grateloupi	•	•	—	—	—	•	•	•	•	•
Orbitolites hemprichi	•	•	•	•	•	—	—	•	•	•
Paleopeneroplis inornatus	X	•	•	•	•	•	•	•	•	—
Planorbulina mabahethi	•	•	•	•	•	—	•	•	—	•
Planorbulina retinaculata	•	•	•	O	•	—	•	x	•	•
Planorbulina acervalis	O	•	•	•	•	•	•	•	•	•
Pseudopyrgo eburnea	•	•	•	•	•	—	•	•	•	•
Puteolina protea	O	•	•	•	•	—	•	•	•	O
Quinqueloculina bidentata	•	•	•	•	•	X	•	•	•	•
Quinqueloculina lamarckiana	•	•	•	•	•	•	•	•	•	—
Quinqueloculina polygona	•	•	•	•	•	—	•	•	•	x
Quinqueloculina quadrilatera	•	•	•	•	•	X	•	•	•	•
Rotorbinella granulosa	X	•	•	•	•	x	•	•	•	x
Rotorbinella mira	•	•	•	•	•	x	•	•	•	—
Rotorbinella rosea	—	—	•	•	•	X	X	X	X	X
Schlumbergerina occidentalis	•	•	•	•	•	—	•	•	•	•
Spiroculina antillarum	O	O	•	•	•	X	O	•	•	—
Sporadotrema rubrum	•	•	•	•	•	•	•	X	x	•
Streblus parkinsonianus	•	•	•	•	—	•	•	•	•	•
Streblus tepidus	•	•	—	—	•	•	•	•	•	•
Tetromphalus bulloides	•	•	•	•	•	•	•	X	•	•
Textularia conica	•	•	•	•	•	•	•	•	•	O
Triloculina bradyana	•	•	•	•	•	—	•	•	•	•
Triloculina linneiana	•	•	•	•	•	•	•	•	•	x
Triloculina rotunda	•	•	•	•	X	•	•	•	X	—
Triloculina trigonula	•	•	•	•	—	x	•	•	•	•
Valvotextularia agglutinans	O	•	•	•	•	•	•	•	•	•
numbers of species: 52	12	5	8	5	12	27	6	8	8	15

Table 8

Foraminifera from Dominica, St. Lucia, St. Vincent, Barbados, Grenada, Tobago and Margarita

· = absent; o = rare; — = not common; x = common; X = abundant

Species / Samples	1546 *Dominica*	1548 *St. Lucia*	1549 *St. Vincent*	1553 *Barbados*	Lavera *Grenada*	Rockly Bay *Tobago*	1447 *Margarita*	1448
Ammobaculites josephi	·	·	·	·	·	·	—	·
Ammoscalaria morenoi	·	·	·	·	·	·	—	·
Amphistegina gibbosa	x	·	·	—	·	·	·	·
Amphistegina radiata	·	·	—	·	o	·	·	·
Archaias angulatus	—	·	o	·	·	·	·	·
Discorbis aguayoi	·	o	·	·	·	·	·	·
Elphidiononion poeyanum	·	x	·	·	·	·	·	·
Elphidiononion mexicanum	·	·	·	·	·	·	—	·
Heterostegina antillarum	·	·	·	·	o	·	·	·
Homotrema rubrum	X	·	·	·	·	·	·	·
Massilina gualtieriana	—	·	X	X	·	·	—	·
Miliola tricarinata	·	·	·	·	·	o	·	·
Miliolinella labiosa	·	—	·	·	·	·	·	·
Neoeponides antillarum	—	·	·	·	·	·	·	·
Orbitolites hemprichi	·	·	·	·	·	—	·	·
Orbitolites marginalis	·	o	·	·	·	·	·	·
Planorbulina acervalis	—	·	·	o	·	·	·	·
Planorbulina mabahethi	o	·	·	·	·	·	·	·
Rotorbinella granulosa	·	·	·	·	o	·	·	·
Rotorbinella mira	·	·	o	—	·	·	·	·
Rotorbinella rosea	·	·	x	X	—	—	·	·
Quinqueloculina cuvieriana	X	·	·	·	·	·	·	·
Quinqueloculina dilatata	·	·	·	·	·	·	·	o
Quinqueloculina lamarckiana	·	·	·	·	·	·	—	·
Quinqueloculina quadrilatera	·	·	·	·	·	—	·	·
Sphaerogypsina globulus	·	o	·	·	·	·	·	·
Sporadotrema rubrum	—	·	·	·	·	·	·	·
Streblus catesbyanus	·	·	·	·	·	·	X	·
Streblus compactus	·	·	·	·	·	·	·	X
Streblus parkisonianus	·	o	·	·	·	·	·	·
Streblus tepidus	·	—	·	·	·	·	·	·
Tetromphalus bulloides	·	o	·	·	·	·	·	·
Triloculina rotunda	o	—	·	·	·	·	x	—
Triloculina trigonula	o	·	o	·	·	·	—	·
numbers of species: 34	11	9	6	5	4	4	8	3

Table 9

Foraminifera from the Lac, Bonaire

Species alphabetically arranged	Species ecologically arranged	1560	1561	1562	1037	1651	1563	1652	1564	1565	1565	1647	1593	1567	1569	1570	1571	1572	1573	1653	1591
Amphistegina gibbosa	*H. rubrum*	x	x	x	x	x	x	x	x	x	x	x	·	·	·	·	·	·	·	·	·
Archaias angulatus	*Q. bidentata*	x	x	x	·	·	x	·	·	·	x	·	x	x	x	x	x	·	·	x	·
Articulina mucronata	*R. rosea*	·	x	x	x	·	x	·	·	x	·	·	x	x	x	x	x	x	x	x	x
Articulina sagra	*O. hemprichi*	x	x	x	x	x	x	x	·	·	x	x	x	·	·	·	·	x	x	x	x
Asterigerina carinata	*A. angulata*	x	x	x	x	·	x	x	·	x	x	x	x	·	x	x	x	x	x	·	·
Bolivina spatuloides	*Q. carinata*	·	x	·	x	·	·	x	·	·	·	·	·	·	·	x	x	x	x	x	·
Cancris auriculus	*P. acervalis*	·	x	x	x	·	x	x	·	x	x	x	x	·	·	·	·	x	x	·	·
Cibicides lobatulus	*R. mira*	·	x	x	x	·	·	·	·	·	·	x	·	x	x	x	x	x	·	x	x
Clavulina tricarinata	*A. mucronata*	·	x	·	x	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	·
Cornuspiramia antillarum	*T. rotunda*	·	x	·	·	x	x	·	x	·	x	x	·	·	·	x	·	x	x	·	x
Cymbaloporetta squammosa	*P. bradyi*	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·
Dendritina elegans	*E. poeyiana*	·	x	·	x	·	·	x	·	·	·	·	·	·	x	·	·	·	·	·	·
Discopulvinulina floridana	*S. ornata*	·	x	·	x	·	·	·	·	·	·	·	·	·	·	·	·	x	x	x	·
Discopulvinilina valvulata	*S. antillarum*	·	x	x	x	·	x	x	·	·	x	·	·	x	·	·	·	·	·	x	·
Discorbis aguayoi	*D. elegans*	·	x	·	x	·	x	x	x	·	·	x	·	·	·	·	·	·	x	·	·
Elphidiononion poeyiana	*M. labiosa*	·	x	x	x	·	x	·	·	x	x	x	x	·	·	·	x	·	·	x	x
Eponides repandus	*P. protea*	·	x	·	x	·	x	x	·	·	·	·	·	x	x	x	·	x	·	x	·
Hauerina bradyi	*N. orbicularis*	·	x	·	x	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	x
Hauerina ornatissima	*Q. polygona*	·	x	·	x	·	x	x	·	x	·	·	·	·	·	·	·	x	x	x	x
Homotrema rubrum	*N. pulchra*	·	x	·	x	·	·	x	·	x	x	·	·	·	·	·	·	x	x	x	·
Massilina protea	*C. antillarum*	·	x	·	x	x	x	·	·	·	·	·	·	·	·	·	·	·	x	x	·
Milionella labiosa	*P. subsphaerica*	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Neoalveolina pulchra	*V. agglutinans*	·	x	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Neocarpenteria candei	*C. squammosa*	·	·	x	x	·	·	x	x	·	x	x	·	·	·	x	·	·	x	·	·
Neoconorbina orbicularis	*S. densipunctata*	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Nodobacularia bonairensis	*C. lobatulus*	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Nodobacularia minima	*H. ornatissima*	·	·	x	·	·	x	·	·	x	·	·	·	·	·	·	·	·	x	x	·
Nodobacularia sageninaeformis	*S. costata*	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Nonionella grateloupi	*A. gibbosa*	·	·	x	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x
Orbitolites hemprichi	*V. oviedoiana*	·	·	·	x	·	x	·	·	·	x	·	·	·	·	x	·	·	x	x	·
Placopsilina confusa	*H. bradyi*	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	x	·
Planorbulina acervalis	*D. valvulata*	·	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·
Planorbulina mabahethi	*D. floridana*	·	·	·	x	·	x	·	·	x	x	x	x	·	·	·	·	·	x	x	x
Pseudoeponides anderseni	*Q. quadrilatera*	·	·	·	·	·	x	·	·	·	·	·	·	x	·	·	·	x	·	x	·
Pseudopyrgo subsphaerica	*T. linneiana*	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Puteolina bradyi	*A. carinata*	·	·	·	·	·	x	·	·	·	·	·	·	x	·	·	·	·	x	x	·
Puteolina compressa	*P. confusa*	·	·	·	·	x	·	x	·	·	·	·	·	·	·	·	·	·	x	x	·
Puteolina protea	*E. repandus*	·	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·
Quinqueloculina agglutinans	*N. grateloupi*	·	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·	·	·	·
Quinqueloculina bidentata	*Q. compta*	·	·	·	·	·	·	·	x	·	x	·	x	·	·	·	x	x	·	·	x
Quinqueloculina carinata	*S. pulchra*	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·
Quinqueloculina compta	*C. auriculus*	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	·
Quinqueloculina lamarckiana	*S. compactus*	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	x	·	x
Quinqueloculina polygona	*T. bulloides*	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	x	·	·
Quinqueloculina quadrilatera	*P. compressa*	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·
Rotorbinella mira	*T. trigonula*	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·
Rotorbinella rosea	*Q. lamarckiana*	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·
Sigmoilopsis arenata	*N. candei*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	x	·
Siphogenerina costata	*M. protea*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	x	·	x
Siphonina pulchra	*S. arenata*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	x	·
Spirillina densipunctata	*N. minima*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·
Spiroloculina antillarum	*C. tricarinata*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·
Spiroloculina ornata	*D. aguayoi*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·	x
Sporadotrema rubrum	*N. bonairensis*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	x
Streblus compactus	*P. mabahethi*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·
Tetromphalus bulloides	*Q. agglutinans*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Triloculina linneiana	*B. spatuloides*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·
Triloculina rotunda	*N. sageninaeformis*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	·
Triloculina trigonula	*P. anderseni*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Triloculinella obliquinoda	*S. rubrum*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·
Valvotextularia agglutinans	*T. obliquinoda*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·
Valvulina oviedoiana	*A. sagra*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
numbers of species: 62		4	23	16	22	6	21	15	5	9	15	12	8	10	6	11	8	17	29	29	14
sand/sandy = ○, muddy sand = x, muddy/mud = –		○	○	○	○	○	○	○	○	○	○	x	x	○	○	○	○	x	x	x	x

1592	1574	1594	1596	1597	1568	1575	1576	1577	1578	1579	1580	1583	1598	1589	1590	1595	1600	1599	1601	1602	1603	1604	1581	1584	1585	1586	1587	1588	1607	1608	1609	number of samples × $\frac{100}{62}$
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x	x	.	x	.	.	x	.	.	.	x	.	.	.	x	.	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20
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x	x	.	.	x	.	.	.	.	.	x	.	.	.	.	.	.	x	.	x	x	x	.	x	.	x	x	x	x	x	x	x	36
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12	17	6	12	15	6	10	5	8	2	5	3	6	3	2	3	2	5	2	3	6	3	1	2	1	4	3	2	2	2	3	4	
x	x	x	x	x	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	x	x	x	—	x	—	—	—	

TABLE 10

FORAMINIFERA FROM THE SPAANSE WATER, CURAÇAO

(Locality labels 1336, 1340 and 1342 possibly confounded!)

Species alphabetically arranged	Species ecologically arranged	1036/1636	1627	1336	1635	1632	1633	1637	1631	1639	1640	1626	1630	1628	1037	1340	1342	number of samples × $\frac{100}{16}$
Amphistegina gibbosa	*T. inflata*	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	6
Archaias angulatus	*Q. bidentata*	x	x	x	·	x	·	·	x	·	x	x	·	x	x	·	·	56
Articulina mucronata	*M. labiosa*	x	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	12
Articulina sagra	*A. mucronata*	x	·	·	x	·	x	·	·	·	·	x	·	·	·	·	·	25
Bigenerina irregularis	*A. sagra*	x	·	·	·	·	x	·	·	·	x	·	·	x	·		·	25
Bolivina lanceolata	*H. ornatissima*	x	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	6
Bolivina spathuloides	*H. bradyi*	x	·	·	·	·	·	x	·	·	x	·	·	·	·	x	x	31
Clavulina tricarinata	*S. densipunctata*	x	x	·	x	x	x	·	·	·	·	x	x	x	·	x	·	56
Cymbaloporetta squammosa	*S. tepidus*	x	x	·	x	x	x	·	·	·	·	x	x	x	·	x	·	56
Dendritina elegans	*P. anderseni*	x	x	·	x	·	·	·	·	·	x	·	·	·	·	·	·	25
Discogypsina vesicularis	*R. mira*	x	·	·	x	·	·	·	·	x	·	x	·	·	·	·	·	25
Discopulvinulina floridana	*E. poeyiana*	x	x	x	x	·	x	·	x	x	x	x	·	x	·	·	·	62
Elphidiononion discoidale	*P. compressa*	·	·	x	x	x	·	·	x	·	x	·	·	·	·	·	·	31
Elphidiononion poeyiana	*S. parkinsonianus*	·	·	x	·	·	·	·	·	·	x	x	·	x	·	·	·	25
Elphidiononion salmonense	*A. angulatus*	·	·	x	·	·	x	·	x	·	x	x	·	x	·	·	·	37
Hauerina bradyi	*S. globulus*	·	·	x	·	·	·	·	x	x	·	·	·	·	·	·	·	18
Hauerina ornatissima	*T. trigonula*	·	·	x	x	·	·	x	x	·	x	·	·	x	x	x	·	43
Heterostegina antillarum	*P. discoidea*	·	·	x	·	·	·	·	·	·	x	·	·	·	·	·	·	12
Lituotuba spec.	*P. protea*	·	·	x	x	·	x	·	x	·	x	x	x	x	x	·	·	56
Massilina inaequalis	*Q. quadrilatera*	·	·	x	x	·	·	·	x	x	·	·	·	x	x	·	·	37
Massilina protea	*Q. polygona*	·	·	x	·	·	·	x	x	·	·	·	x	·	·	·	·	25
Massilina gualtieriana	*N. grateloupi*	·	·	·	·	x	·	x	·	·	x	x	·	x	·	·	·	31
Miliola tricarinata	*V. agglutinans*	·	·	·	x	·	·	·	x	·	x	x	x	x	x	·	·	43
Miliolinella labiosa	*A. gibbosa*	·	·	·	x	·	·	·	·	x	x	x	x	x	·	·	·	37
Miliolinella subrotunda	*Q. lamarckiana*	·	·	·	x	·	·	·	·	·	x	·	·	x	·	·	·	18
Monalysidium polytum	*S. orientalis*	·	·	·	x	·	·	·	x	·	·	·	x	x	·	·	·	25
Neoalveolina pulchra	*T. rotunda*	·	·	·	x	·	x	·	·	x	x	x	·	x	·	·	·	37
Nodobaculariella striata	*E. discoidale*	·	·	·	x	·	·	·	x	·	·	x	·	x	·	·	·	25
Nonionella grateloupi	*D. elegans*	·	·	·	·		·	·	·	·	x	x	·	x	·	·	·	25
Orbitolites hemprichi	*Q. carinata*	·	·	·	·	·	·	·	x	·	x	·	·	·	·	·	·	12
Palmerinella palmerae	*N. striata*	·	·	·	·	·	·	·	x	·	x	x	·	·	·	·	·	18
Peneroplis arietinus	*S. antillarum*	·	·	·	·	·	·	x	x	x	·	·	·	·	·	·	·	18
Planorbulina mabahethi	*P. bradyi*	·	·	·	·	·	·	·	·	·	·	x	x	x	·	·	·	18
Pseudoeponides anderseni	*B. irregularis*	·	·	·	·	·	·	·	·	x	·	x	x	·	·	·	·	18
Puteolina bradyi	*H. antillarum*	·	·	·	·	·	·	x	·	·	·	·	·	·	·	·	·	6
Puteolina compressa	*B. spatuloides*	·	·	·	·	·	·	x	x	·	·	·	·	x	·	·	·	18
Puteolina discoidea	*D. vesicularis*	·	·	·	·	·	·	·	·	x	x	·	·	·	·	·	·	12
Puteolina protea	*P. mabahethi*	·	·	·	·	·	·	·	·	x	x	·	·	·	·	·	·	12
Quinqueloculina bidentata	*P. palmerae*	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	6
Quinqueloculina carinata	*D. floridana*	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	6
Quinqueloculina lamarckiana	*B. lanceolata*	·	·	·	·	·	·	·	·	x	·	·	·	x	·	·	·	12
Quinqueloculina oblonga	*Q. oblonga*	·	·	·	·	·	·	·	·	x	·	·	·	x	·	·	·	12
Quinqueloculina polygona	*T. suborbicularis*	·	·	·	·	·	·	·	·	x	·	x	·	·	·	·	·	12
Quinqueloculina quadrilatera	*O. hemprichi*	·	·	·	·	·	·	·	·	x	x	·	·	·	x	x	·	25
Reophax spec.	*C. squammosa*	·	·	·	·	·	·	·	·	x	·	·	·	·	x	·	·	12
Rotorbinella mira	*S. arenata*	·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	·	6
Schlumbergerina occidentalis	*M. qualtieriana*	·	·	·	·	·	·	·	·	·	x	x	·	x	·	·	·	18
Sigmoilopsis arenata	*N. pulchra*	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	12
Sigmomorphina spec.	*P. arietinus*		·	·	·	·	·	·	·	·	x	·	·	·	·	·	·	6
Sphaerogypsina globulus	*M. polytum*	·	·	·	·	·	·	·	·	·	x	·	·	x	·	·	·	12
Spirillina densipunctata	*Reophax* sp.	·	·	·	·	·	·	·	·	·	·	x	·	·	·	·	·	6
Spiroloculina antillarum	*C. tricarinata*	·	·	·	·	·	·	·	·	·	·	x	x	·	·	·	·	12
Streblus parkinsonianus	*E. salmonense*	·	·	·	·	·	·	·	·	·	·	x	·	x	·	·	·	12
Streblus tepidus	*M. tricarinata*	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	6
Tetromphalus bulloides	*M. inaequalis*	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	6
Triloculina rotunda	*Sigmomorphina* sp.	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	·	6
Triloculina suborbicularis	*M. subrotunda*	·	·	·	·	·	·	·	·	·	·	·	·	·	x	x	x	18
Triloculina trigonula	*M. protea*	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	·	6
Triloculina obliquinoda	*T. obliquinoda*	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	x	12
Trochammina inflata	*Lituotuba* sp.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	6
Valvotextularia agglutinans	*T. bulloides*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	x	·	6
numbers of species: 61		12	5	11	16	6	8	7	16	18	27	23	10	29	10	7	4	
sand/sandy = O, muddy sand = x, muddy/mud = —		—	—	O	—	—	—	—	—	x	x	x	x	x	O	—	—	

MARTINIQUE (Table 7)

1439 Anse de l'Âne, Trois-Îslets, 10.II.1964; sandy rock with some *Thal.* (0–½ m) – 8 species.

s.n. Islet Hardy, 11.II.1964; sand beach with detached algae – 15 sp.

ST. LUCIA (Table 8)

1548 Port Castries, Trou Garnier, 11.VII.1967; wreck, *Rhiz.*, soft mud (0–1½ m) – 9 species.

ST. VINCENT (Table 8)

1549 Calliaqua Bay, Johnston Point, 10.VII.1967; sand with some *Thal.*, pebbles of volcanic rock, *Conocarpus* (0–½ m) – 6 species.

BARBADOS (Table 8)

1553 Conset Bay, 7.VII.1967; limestone in surf, sand (0–½ m) – 5 species.

GRENADA (Table 8)

s.n. Lavera Beach, 9.VII.1967; sand – 4 species.

TOBAGO (Table 8)

s.n. Rockley Bay, 20.I.1955; sandy rock debris (0–½ m) – 4 species.

LEEWARD GROUP – TABLES 8–10

MARGARITA (Table 8)

1447 Punta de Piedras, Estación Invest. Marinas, 12.I.1964; jetty in muddy sand, *Thalassia* beds (0–1 m) – 8 species.

1448 Punta de Piedras, lagoon entrance, 12.I.1964; *Rhiz.* – 3 sp.

BONAIRE – Lac (Table 9; Fig. 168)

1067 W tip of Cay, 17.IX.1948, sandflat with *Thal.* (1½–2 m) – 22 species (cf. HOFKER 1964).

1560 Entrance S of Cai, 25.VIII.1967, sand (8 m) – 4 sp.

1561 Entrance W of Cai, 11.VIII.1967, sand, some *Thal.* and *Syr.* (6 m) – 23 sp.

1562 Entrance, Bao di Dam, 25.VIII.1967, sand, *Acropora* (1 m) – 16 sp.

1563 Awa Blancu, Bao di Dam, 25.VIII.1967, sand, *Thal.* (½ m) – 21 sp.

1564 Awa Blancu, NE Sorobon, 25.VIII.1967, sand slope (¾–2½ m) – 5 sp.

1565 Secu di Sorobon, 21.VIII.1967, sandy *Lithotamnion* flat (¼–1 m) – 9 sp.

1566 Secu di Sorobon, 21.VIII.1967, *Thal.* – *Porites* flat ($\frac{1}{10}$–½ m) – 15 sp.

1567 Binnenklip, 24.VIII.1967, sand, some *Thal.* (3 m) – 10 sp.

1568 Binnenklip, 24.VIII.1967, sandy (2 m) – 6 sp.

1569 E Palu Calbas, 11.VIII.1967, sandy, *Thal.*, *Syr.*, *Halimeda* (2 m) – 6 sp.

1570 Central Lac, 11.VIII.1967, sandy, *Thal.* (3 m) – 11 sp.

1571 Central Lac, 11.VIII.1967, sandy, *Thal.* (3½ m) – 8 sp.

1572 Central Lac, 11.VIII.1967, muddy sand, *Thal.*, *Hal.* (2 m) – 17 sp.

1573 Central Lac, 25.VIII.1967, muddy sand, *Thal.*, *Hal.* (1½ m) – 29 sp.

1574 Puitu, 10.VIII.1967, sandy mud, some *Thal.* (2½ m) – 17 sp.

1575 Puitu entrance, 11.VIII.1967, mud, *Rhiz.* (0–¼ m) – 10 sp.

1576 Cai, E side, 16.IX.1967, mud, *Rhiz.* (0–½ m) – 5 sp.

1577 Puitu, 10.VIII.1967, sandy mud, *Rhiz.* (0–½ m) – 8 sp.

1578 Puitu, 10.VIII.1967, sandy mud, *Rhiz.*, *Thal.* (0–½ m) – 2 sp.

1579 Puitu, 10.VIII.1967, muddy, *Rhiz.* (0–½ m) – 5 sp.

1580 Puitu, 10.VIII.1967, mud, *Rhiz.* (0–½ m) – 3 sp.

1581 Awa di Salinja, 9.IX.1967, soft mud, *Rhiz.*, *Batophora* (½–1 m) 21–23 g Cl′/l – 2 sp.

1582 Boca di Pos, 14.VIII.1967, *Rhiz.* (0–½ m) – 5 sp.

1583 Boca di Pos, 14.VIII.1967, sand and mud, *Rhiz.* (0–½ m) – 6 sp.

1584 Boca di Coco, 15.VIII.1967, mud, sand, *Rhiz.*, *Avrainvillea* (0–½ m) – 1 sp.

1585 Boca di Coco, 15.VIII.1967, mud, sand, *Rhiz.* (0–½ m) – 4 sp.

1586 Boca Chikitu, 15.VIII.1967, mud, sand, *Rhiz.* (0–¼ m) 21–22 g Cl′/l – 3 sp.

1587 Boca Fogon, 24.VIII.1967, sandy mud, *Rhiz.*, *Acetabularia* (0–½ m) – 2 sp.

1588 Boca Fogon, 24.VIII.1967, muddy sand, *Rhiz.*, *Acet.* (0-½ m) – 2 sp.

1589 Inlet S. of Fogon, 14.VIII.1967, sandy mud, *Rhiz.* (0-½ m) – 2 sp.

1590 Inlet S. of Fogon, 14.VIII.1967, sandy mud, *Rhiz.*, *Bat.* (0–½ m) – 3 sp.

1591 Punta di Rancho, 18.VIII.1967, sandy, *Thal.*, *Hal.* (0–½ m) – 14 sp.

1592 Punta di Palu Calbas, 5.IX.1967, muddy sand, *Rhiz.* (0–¾ m) – 12 sp.

1593 Punta di Palu Calbas, 5.IX.1967, muddy sand, *Thal.* *Hal.* (¼–¾ m) – 8 sp.

1594 Mangel Altu, 23.VIII.1967, sandy, *Thal.*, *Hal.* (½–1 m) – 6 sp.

1595 Boca Jewfish, 24.VIII.1967, *Rhiz.*, *Caulerpa* (¼–1½ m) – 2 sp.

1596 Boca Jewfish, 24.VIII.1967, sink hole, sand and mud (2–5 m) – 12 sp.

1597 Boca Jewfish, 22.VIII.1967, sandy mud, *Rhiz.* *Acet.* (0–¼ m) – 15 sp.

1598 Boca Jewfish, 22.VIII.1967, sandy mud, *Rhiz.*, *Acet.*, *Bat.* (0–¼ m) 21–22 g Cl′/l – 3 sp.

1599 Boca Pedro creek, 4.IX.1967, *Rhiz.* (0–½ m) – 2 sp.

1600 Awa di Pedro, 4.IX.1967, mud., *Rhiz.*, *Thal.* (0–¼ m) – 5 sp.

1601 Awa di Palu Grandi, 31.VIII.1967, mud, *Rhiz.*, *Acet.*, *Bat.* (0–½ m) 21–24 g Cl′/l – 3 sp.

1602 Awa di Palu Grandi, 30.VIII.1967, muddy sand, *Rhiz.*, *Acet.* (0– ½ m) 22–25 g Cl′/l – 6 sp.

1603 Isla Juwana, 13.VIII.1967, muddy, *Rhiz.*, *Acet.* (0–½ m) – 3 sp.

1604 Punta Wanapa, 18.VIII.1967, muddy, *Bat.*, *Ruppia* (0–¼ m) 24–32 g Cl′/l – 1 sp.

1607 Awa Lodo di S. José, 28.VIII.1967, mud, *Rhiz.*, *Avic.*, *Bat.* (¼–¾ m) – 2 sp.

1608 Awa Lodo di Bacuna (W), 15.VIII.1967. mud, *Avic.*, *Bat.*, *Ruppia* (0–¾ m) 45–50 g Cl′/l – 3 sp.

1609 Awa Lodo di Bacuna, 15.VIII.1967, mud, *Rhiz.*, *Bat.* (0–½ m) 45–50 g Cl′/l – 4 sp.

1647a Cas di Meeuchi, 9.III.1970, sandy beach – 12 sp.

1651 Dam, 9.III.1970, sandy beach rock, pools (0–½ m) – 6 sp.

1652 Awa Blanco, 10.III.1970, sand (1 m) – 15 sp.

1653 Sorobon near Boca Jewfish, 10.III.1970, sandy, *Rhiz.* (0–½ m) - 29 sp.

1655 Rancho, NW, 7.III.1970, mudflat, *Avic.*, *Ruppia* (0–½ m) – 1 sp.

CURAÇAO – Spaanse Water (Table 10; Fig. 169)

1036 New Haven, landing, 10.IV.1949; pieces of rock in soft mud near *Rhiz.* (0–½ m) – 12 species (incl. 1636).

1037 Spaanse Baai, Santa Barbara Beach, 21.IV.1949; sandy (0–½ m) – 10 sp.

1336 Boca at Kabrietenberg (loc. uncertain), 3.II.1955 (Zaneveld); coral pebbles (0–½ m) – 11 sp.

1340 Brakke Put (loc. uncertain), 19.I.1955 (Zaneveld); rock and mud with *Thal.* (0–1 m) – 7 sp.

1342 Brakke Put (loc. uncertain), 19.XII.1954 (Zaneveld); sandy mud with *Thal.* and *Rhiz.* (0–1 m) – 4 sp.

1626 W Kabrietenberg, 1.XI.1968; sandy mud (5 m) – 23 sp.

1627 W Brakke Put, 1.XI.1968; muddy, *Thal.* (2 m) - 5 sp.

1628 W Brakke Put, 1.XI.1968; sandy, algae (5 m) – 29 sp.

1630 Jan Sofát – Isla di Yerba, 1.XI.1968; muddy sand (5 m) – 10 sp.

1631 Jan Sofát – Isla Kiniw, 1.XI.1968; sandy mud (4 m) – 16 sp.

1632 SW Santa Barbara, 1.XI.1968; sandy mud (2 m) – 6 sp.

1633 SW Sta Barbara, 1.XI.1968; muddy (3 m) – 8 sp.

1635 SW Sta Barbara, 1.XI.1968; mud, shell debris (3 m) – 16 sp.

1636 New Haven, 1.XI.1968; mud (2 m) – 12 sp. (incl. 1036)

1637 Centre, Bai di Biná, 1.XI.1968; mud (8 m) – 7 sp.

1639 Centre, entrance, 1.XI.1968; muddy sand (6 m) – 18 sp.

1640 Centre, entrance, W, 1.XI.1968; sandy debris, coral (3 m) – 27 sp.

DISTRIBUTION

Numbers of species found in the Caribbean region (Fig. 160)

From the samples gathered by Th. Mortensen in 1906 W. of Frederiksted, St. Croix, 87 species were already described by the present author (1956, 1964, 1969, 1971). Adding those from the same localities described in this paper a total of 197 were found.

This paper inclusive, the number of species of Foraminifera found by the present author in the Caribbean Sea amounts to about 325, and studies of other specialists suggest that this number may increase to 400.

d'Orbigny, 1839, Cuba: 118 species.
Cushman, 1926, Puerto Rico: 63 species (San Juan Harbour, 1–10 m).
Bermúdez, 1935, Cuba: 249 species (North coast, Bahía de Matanzas, 2–45 m).
Parker, Phleger & Peirson, 1953, Texas: 63 species (San Antonio Bay, 1–18 m).
Phleger, 1954, Texas: 45 species (Mississippi Sound, 5–7 m).
Hofker, 1956, St. Croix: 197 species (180–800 m).
Bermúdez, 1956, Los Roques: 45 species (shallow water).
Todd & Brönnimann, 1957, Gulf of Paria: 169 species (1–22 m).
Drooger & Kaasschieter, 1958, Orinoco Shelf: 167 species (10–100 m).
Hofker, 1964, Antilles: 72 species (Bahamas 41, Virgin I. 13, Anguilla 7, St. Martin 49, St. Barts 10, Saba 1, St. Eustatius 16, St. Kitts 12, Barbuda 23, Antigua 14, Islote Aves 16, Grenada 12, Tobago 10, Las Aves 21, Bonaire 46, Curaçao 38, Aruba 38).
Hofker, 1969, Barbados: 87 species (100 and 200 m).
Hofker, 1971, Curaçao: 45 species (Piscadera Baai, ½–6 m).
Hofker, present paper: Florida Keys 31 species, Cuba 116 (Bahía de Habana), Cayman Islands 48, Jamaica 20, Puerto Rico 55, Virgin Islands 48, St. Martin-Antigua 48, Barbuda 34, Guadeloupe-Martinique 55, St. Lucia-Tobago 21, Margarita 9, Bonaire 62 (Lac), Curaçao 60 (Spaanse Water).

The coasts of Cuba obviously have a very rich foraminiferal fauna.

Generally we may assume that the number of species increases with depth up to 800 m, and that shallow habitats have relatively poor faunae. As was already found after examination of the deeper samples W. of Barbados (1969, p. 5), there is a strong indication that in the open sea Foraminifera are strongly tied to certain depths. Whereas station 1415 (Mayagüez, 92 m) has many species in common with station 1442 (Barbados, 100 m), and with the samples from 100 and 150 fathoms from off St. Croix, the deep-water sample off St. Croix (500 fathoms) shows an enormously rich fauna which is characterized by many species unknown from the Barbados samples. The latter samples, however, differ in many species from those from St. Croix and Mayagüez, especially in respect to their adhering species, due to the more solid sea floor.

Sandy bottoms show a higher number of species than a muddy environment, though in the latter the number of individuals may be larger.

Muddy bottom combined with a more brackish salinity as found in inner bays after heavy rains, or in estuarine areas, stimulates the development of faunae poor in species but rich in individuals (cf. HILTERMANN, 1966). The enormous quantities of individuals of the few species often found in such environments indicate the lack of competitors in such biocenoses.

Various kinds of restrictive conditions may give rise to large quantities of only few species of organisms. Sample 118 of the Ingolf Expedition (1060 Danish fathoms, 68°27'N, 10°20'W) shows a very rich fauna of three species only (viz. *Planulina wuellerstoffi, Pyrgo sarsi* and *Cribrostomoides bradyi*), due to a temperature of — 1° C. Temperature, however, is not the main factor for optimal conditions, for rich faunae were also recorded from the northern Iceland fjords by NORVANG (1945). PARR (1950) found 86 species in a sample of greyish sandy mud from 540 m depth in the Antarctic. Depths from 100 to 800 m seem to constitute optimal conditions for the development of Foraminifera, as also found in the samples off St. Croix.

Optimal conditions for most Foraminifera seem to be normal salinity, a high percentage of oxygen, sand with large quantities of organic detritus, and tropical or subtropical temperatures.

With regard to HUMMELINCK's shallow water samples, the richest of them did not yield more than 27–35 species, viz. from Curaçao (1453, 1640), Bonaire (1067, 1573), La Désirade (1437), St. Martin (1127), and Grand Cayman (1684).

Distribution of shallow water Foraminifera

To get any idea about the numerousness of the species (not of the specimens) distributed over 39 island localities studied, the number of localities in which they were found was divided by 39 and the figure obtained multiplied × 100. In this way, a resulting number 3 indicates that a species was found in one locality only, whereas the number 50 shows, that a species was found in 19 out of the 39 localities.

Ammobaculites josephi	5
Ammoscalaria morenoi	5
Amphistegina gibbosa	70
Articulina mucronata	30
Articulina sagrai	8
Articulina paucicostata	8
Asterigerina carinata	40
Bisaccium imbricatum	3
Bolivina lanceolata	5
Bolivina rhomboidalis	3
Bolivina subexcavata	13
Bolivina tortuosa	5
Cibicides lobatulus	3
Clavulina tricarinata	21
Clavulina angularis	13
Clavulina nodosaria	5
Cornuspiramia antillarum	13
Cymbaloporetta sqammosa	24
Dendritina elegans	34
Discogypsina vesicularis	10
Discopulvinulina floridanus	13
Discopulvinulina valvulata	3
Discorbis aguayoi	13
Elphidiononion elegantum	3
Elphidiononion discoidale	5
Elphidiononion incertum	5
Elphidiononion kugleri	3
Elphidiononion mexicanum	13
Elphidiononion poeyanum	32
Elphidium lanieri	5
Eponides repandus	3
Hauerina ornatissima	13
Hauerina bradyi	23
Heterostegina antillarum	10
Homotrema rubrum	36
Massilina gualtieriana	30
Massilina inaequalis	5
Massilina protea	10
Miliolinella labiosa	36
Miliola tricarinata	5
Neoalveolina pulchra	40
Neocarpenteria candei	5
Neoconorbina orbicularis	15
Neoeponides antillarum	5
Nodobacularia bonairensis	3
Nodobacularia minima	3
Nodobacularia sageninaeformis	3
Nonionella grateloupi	15
Nouria johnsoni	3
Orbitolites hemprichii	58
Orbitolites marginalis	8
Palaeopeneroplis inornatus	15
Palmerinella palmerae	5
Peneroplis arietinus	8
Placopsilina confusa	3
Planogypsina squamiformis	10
Planorbulina acervalis	48
Planorbulina mabahethi	40
Planorbulina reticulata	18
Pseudoeponides anderseni	18
Pseudopyrgo eburnea	15
Pseudopyrgo subsphaerica	30
Puteolina (Archaias) annulata	45
Puteolina (Archaias) compressa	30
Puteolina discoidea	23
Puteolina crassa	5
Puteolina bradyi	13
Puteolina protea	66
Puteolina pseudodiscoideus	3
Puteolina (Sorites) marginalis	5
Pyrgoides denticulatus	8
Quinqueloculina agglutinans	8

Quinqueloculina bidentata	50
Quinqueloculina compta	8
Quinqueloculina cuvieriana	13
Quinqueloculina lamarckiana	30
Quinqueloculina obliquinoda	8
Quinqueloculina poeyana	8
Quinqueloculina polygona	30
Quinqueloculina quadrilateralis	50
Rotorbinella conica	5
Rotorbinella granulosa	23
Rotorbinella mira	37
Rotorbinella rosea	55
Schlumbergerina orientalis	13
Sigmoilopsis arenata	13
Siphogenerina costata	8
Siphonina pulchra	8
Siphoninoides glabra	3
Sphaerogypsina globulus	13
Spirillina densepunctata	5
Spirillina vivipara	3
Spiroloculina antillarum	45
Spiroloculina ornata	10
Spiroloculina planulata	3
Sporadotrema rubrum	8
Streblus advenus	13
Streblus catesbyanus	13
Streblus compactus	10
Streblus ornatus	3
Streblus parkinsonianus	19
Streblus tepidus	29
Tetromphalus bulloides	23
Triloculina carinata	3
Triloculina cultrata	3
Triloculina dilatata	3
Triloculina linneiana	34
Triloculina obliquinoda	5
Triloculina oblonga	30
Triloculina oblongoides	21
Triloculina rotunda	55
Triloculina trigonula	18
Trochammina inflata	13
Valvulina oviedoiana	31
Valvulineria candieana	5
Valvotextularia agglutinans	29
Valvulineria candeiana	8
Vertebrasigmoilina mexicana	10

Abundant species are those which have obtained a number higher than 49:

Amphistegina gibbosa
Orbitolites hemprichii
Puteolina protea
Quinqueloculina bidentata
Quinqueloculina quadrilateralis
Rotorbinella rosea
Triloculina rotunda

Common species are in this way those between 49 and 24:

Articulina mucronata
Asterigerina carinata
Dendritina elegans
Elphidionion poeyana
Homotrema rubrum
Massilina gualtieriana
Miliolinella labiosa
Neoalvelolina pulchra
Planorbulina acervalis
Planorbulina mabahethi
Pseudopyrgo subsphaerica
Puteolina (Archaias) annulata
Puteolina compressa
Quinqueloculina lamarckiana
Quinqueloculina polygona
Rotorbinella mira
Spiroloculina antillarum
Streblus tepidus
Triloculina linneiana
Triloculina oblonga
Valvulina oviedoiana
Valvotextularia agglutinans

All other species are not common, or are even rare in the Caribbean shallow water samples. The species with the figures 3 and 5 are found in one or two localities only and thus belong to the rare species, 39 in number.

Though most of these rare species are also poor in specimens, we have to bear in mind that some of them may be very rich in individuals in some of the samples, e.g. if taken from a specialized environment as found in Bahía Fosforescente on Puerto Rico, or in some parts of the Lac, Bonaire. To such species belong *Ammoscalaria morenoi* and *Massilina protea*, and the epiphytic *Nodobacularia* and *Placopsilina confusa* found in the Lac on *Halimeda*. To these specialized species seem to belong *Clavulina nodosaria*, *Discorbis aguayoi* and *Puteolina pseudodiscoidea* also.

Trochammina inflata, *Rotorbinella mira*, *Elphidiononion mexicanum* and *Pseudoeponides anderseni* seem to be restricted to a *Rhizophora* habitat; *Streblus tepidus*, *S. compactus*, *Elphidiononion poeyanum*, *Miliolinella labiosa*, *Triloculina oblonga*, *T. rotunda* and *T. obliquinoda* are mud-dwellers.

Very typical are the red-coloured species *Rotorbinella rosea*, *Homotrema rubrum*, and *Sporadotrema rubrum* which are found in clear, shallow water with normal salinity. To this community belong *Archaias annulatus* and *A. compressus*, together with *Valvotextularia oviedoina* and *Puteolina protea*. In such an environment, often rich in species, *Asterigerina carinata* and *Streblus parkinsonianus* are also common.

Some species, i.a. *Rotorbinella granulosa* and *Streblus tepidus*, are much more common in the northern part of the Caribbean than in the southern part.

Many are found adhering to plants, such as species of *Planorbulina*, *Nodobacularia*, *Cornuspiramia*, *Puteolina*, *Orbitolites* and *Planogypsina*, or on shells and coral rock, such as *Homotrema* and *Sporadotrema*.

Because of these explainable environmental restrictions the faunae of the sandy parts of the Lac with normal salinity and clear water, are quite different from those found near *Rhizophora* or in extremely muddy parts which may sometimes attain a high salinity (Table 9).

In the sandy, open parts of the Lac *Valvolina oviedoiana*, *Rotorbinella rosea*, *Puteolina angulata*, *Homotrema rubrum*, *Hauerina ornatissima* and *Triloculina carinata* are common, whereas in the muddy and sometimes oversalted parts with mangroves very few species are found in great numbers, viz. *Massilina protea*, *Streblus compactus* and *Pseudoeponides anderseni*.

The influence of a sandy bottom in contrast to a muddy bottom was demonstrated in my paper on Piscadera Bay (1971, p. 148–149): to the sandy environment are restricted *Cymbaloporetta squammosa*, *Quinqueloculina bidentata*, *Dendritina elegans*, *Asterigerina carinata* and *Quinqueloculina lamarckiana*; to the muddy central part of the inner bay *Streblus compactus* and *Triloculina trigonula*.

Similar results are demonstrated in Table 9. In the sandy samples of Lac *Amphistegina gibbosa*, *Asterigerina carinata*, *Cymbaloporetta squamosa*, *Dendritina elegans*, *Neoalveolina pulchra*, *Quinqueloculina bidentata*, *Q. polygona*, *Q. pulchra* and *Rotorbinella rosea* almost exclusively occur, whereas *Streblus compactus* is restricted mainly to the muddy parts, together with species not found in Piscadera Bay, such as *Triloculina obliquinoda* and *Massilina protea*.

In the Spaanse Water on Curaçao these restrictions are not so distinct, though here *Cymbaloporetta squammosa*, *Dendritina elegans* and *Quinqueloculina bidentata* occur in sandy environment too, whereas *Triloculina trigonula* commonly occurred in the muddy parts. But as a whole, the fauna of this nicely handshaped bay is rather different from that found in Piscadera Bay of Lac.

Piscadera Bay yielded 45 species of Foraminifera from 58 samples. Five of these were not found in Lac and Spaanse Water: *Articulina pauciloculata*, *Nouria johnsoni*, *Puteolina pseudodiscoidea*, *Streblus advenus* and *Triloculina cultrata*.

Lac produced 62 species from 52 samples, twenty-five of which did not occur in the Spaanse Water.

The Spaanse Water yielded 61 species from 17 samples, twenty-seven of which could not be found in the Lac.

In total in all three bays 103 species were found. Between the Lac and Spaanse Water there is a striking difference in the foraminiferal faunae, amounting into about slightly less than one half of the species differing, wheras in the Piscadera Bay only 1/9 of the species did not occur in Lac and Spaanse Water together.

In Barbuda's Great Lagoon 33 species were found in 10 samples, five of which did not occur in Piscadera Baai, Spaanse Water and Lac: *Clavulina angularis*, *Planorbulina retinaculata*, *Pseudopyrgo eburnea* and *Rotorbinella granulosa*.

In Puerto Rico's Bahía Fosforescente 15 species were found in 6 samples, three of which were not met in the other bays: *Ammobaculites josephi*, *Ammoscalaria morenoi*, and *Quinqueloculina poeyiana*.

Especially in the Bahía Fosforescente the number of specimens of several of the relatively few species observed was extremely large: *Ammobaculites morenoi*, *Elphidiononion mexicanum*, *E. poeyianum*, *Streblus tepidus* and *Triloculina rotunda*. Such a poor fauna rich in specimens always points to unfavourable conditions, as also present in the inner Piscadera Baai, the northernmost part of Lac and the northern parts of Spaanse Water. It may be assumed that in the greater part of those habitats the chlorine contents of the water may be very different at various times, changing from slightly oversalted in dry periods to brackish after heavy rains, while some influence of local pollution also must be taken into account.

In the Lac of Bonaire several foraminiferal associations may be distinguished (Table 9, Fig. 68):

1. *Halimeda – Nodobacularia* association (Sta. 1573, 1592, 1653).
2. *Pseudoeponides – Streblus compactus* association (Sta. 1585, 1587, 1588).
3. *Streblus compactus – Massilina protea* association (Sta. 1601, 1604, 1609).
4. *Massilina protea – Rotorbinella mira* association (Sta. 1570, 1574, 1590).
5. *Quinqueloculina carinata – Rotorbinella rosea* association (Sta. 1561, 1570, 1571, 1572, 1573).
6. *Rotorbinella rosea – Homotrema rubrum* association (Sta. 1561, 1562, 1563).
7. *Valvulina oviedoiana – Rotorbinella rosea* association (Sta. 1563, 1570, 1573, 1591).

In the Spaanse Water of Curaçao the following associations may be traced (Table 10, Fig. 169):

1. *Schlumbergerina* – *Elphiodiononion discoidale* association (Sta. 1628, 1630, 1631, 1635).
2. *Quinqueloculina bidentata* – *Streblus parkinsonianus* association (Sta. 1036, 1628, 1640).
3. *Streblus tepidus* – *Triloculina rotunda* association (Sta. 1340, 1633, 1635, 1640).

It is obvious that these associations greatly differ from those, found in the Lac. Both bays form two different biotopes as regards Foraminifera.

SYSTEMATICS

This paper describes the Agglutinantia as far as they have not yet been described in my papers of 1964, 1969 and 1971, the Lagenidae with the same restriction, the Miliolidae with this restriction but with some more details, the species around *Planorbulina*, the structure of *Rotorbinella*-species, some Bagatellidae, a species of *Neocarpenteria* and of *Bisaccium*, some new species of *Nodobacularia*, *Cornuspiramia antillarum*, etc. The primitive Agglutinantia are described only succinctly, since they have been dealt with in another paper (HOFKER, 1972).

Several new species and new genera are established, viz: *Planorbulina caribbeana*, *Paradentalia caribbeana*, *Pseudopyrgo*, *Pyrgoides*, *Quinqueloculina cruziana*, *Vertebrasigmoilina*, *Spirorutilus*, *Saracenaria caribbeana*, *Nodobacularia minima*, *Nodobacularia bonairensis*, *Nodobacularia sageninaeformis*, *Elphidiononion elegantum*.

The type-species of the new genera are:
Pyrgoides: *Biloculina ringens* Lamarck var. *denticulata* Brady; *Pseudopyrgo*: *Biloculina globulus* Bornemann; *Vertebrasigmoilina*: *Articulina mexicana* Cushman; *Spirorutilus*: *Textularia carinata* d'Orbigny.

Most of the specimens and the extracted faunae are stored in the collections of the Geological Survey at Haarlem, Holland.

Rhabdammina abyssorum Carpenter Fig. 1

Rhabdammina abyssorum CARPENTER, 1881, p. 562–563, fig. 321c–d; BRADY, 1884, p. 266, pl. 21 fig. 1–3; FLINT, 1897, p. 271, pl. 12 fig. 2; HOFKER, 1972, p. 27, pl. 5, fig. 1–6.

Test composed of a central chamber from which three, four or five stolons radiate, mostly in one plane. Wall consisting of fine to middle fine sand grains, mostly in more than one layer, firmly cemented by a brown cement. Ends of stolons narrower than the beginning, open ends function as apertures. The central part is the proloculus.

Common in the sample off St. Croix, depth 800 m.

Rhabdammina linearis Brady Fig. 2

Rhabdammina linearis BRADY, 1879, p. 37, pl. 3 fig. 10–11; 1884, p. 269, pl. 22 fig. 1–6; FLINT, 1897, p. 271, pl. 14 fig. 1; CUSHMAN, 1918, p. 19, pl. 17 fig. 2–5; HOFKER, 1972, p. 29, pl. 6 fig. 2–5.

Test composed of a proloculus in the middle and two tubes originating from it in opposite directions. Test walls agglutinated with fine sand grains. Walls rather thick. The tubes are narrower at their ends and the open ends serve as apertures. The cement between the grains has a brownish colour.

Very common in the sample off St. Croix, depth 800 m.

Rhabdammina triangularis (Earland) Fig. 3

Astrorhiza triangularis EARLAND, 1933, p. 52, pl. 1 fig. 8–9; HOFKER, 1972, p. 29, pl. 6 fig. 6–14.

Test triangular, compressed, consisting of a triangular proloculus with three stolons which are mostly broken away, ending narrower into the open apertures. Testwall composed of a single layer of fine sand grains, with thin inner coating. This thin wall does not point to *Astrorhiza* which has thick walls, but to *Rhabdammina*. The tests are very friable.

Very common in the sample off St. Croix, 800 m.

Psammosphaera parva Flint Fig. 4

Psammosphaera parva FLINT, 1897, p. 268, pl. 9 fig. 1; CUSHMAN, 1910, p. 36, fig. 29–30; 1918, p. 35, pl. 12 fig. 4–6; HOFKER, 1972, p. 32, pl. 7 fig. 4–5.
Psammosphaera fusca (part.), BRADY, 1884, p. 230, pl. 18 fig. 4.

Test globular, very small, built around a large sponge-spicule which pierces the test. Wall consisting of one single layer of sand grains, cemented by brown organic matter. Apertures are small openings between the grains.

Common in the samples off St. Croix, 800 m and 200 m.

Psammosphaera flinti Hofker Fig. 5

Saccammina sphaerica (not Sars), FLINT, 1897, p. 269, pl. 9 fig. 2.
Psammosphaera flinti HOFKER, 1972, p. 33, pl. 7 fig. 8–9.

Test globular, smaller than typical *Psammosphaera fusca* or *Saccammina sphaerica*, outer surface relatively smooth, consisting of calcitic pieces of molluscan shells and occasionally Foraminifera, cemented by an orange to brownish cement; grains in a single layer, greyish. Small openings in the cement function as apertures, this characteristic gives the difference from *Saccamina*, which has one larger opening on a short neck.

Common in the sample off St. Croix, 800 m.

Psammosphaera testacea Flint — Fig. 6

Psammosphaera testacea FLINT, 1897, p. 268, pl. 8 fig. 2; CUSHMAN, 1918, p. 38, pl. 15 fig. 1–3; HOFKER, 1972, p. 33, pl. 7 fig. 6–7.

Test globular; wall composed of foraminiferal tests, mostly Globigerines, in a single layer, cemented by greyish granular matter. Small openings in the cement function as apertures.

Very common in the samples off St. Croix, 800 m and 300 m.

Reophax scorpiurus Montfort — Fig. 7

Reophax scorpiurus MONTFORT, 1808, p. 330; CARPENTER, 1881, p. 564, fig. 321e; BRADY, 1884, p. 291, pl. 30 fig. 12, 15–17; GOËS, 1894, pl. 6 fig. 168; FLINT, 1897, p. 273, pl. 16 fig. 3; CUSHMAN, 1920, pl. 1 fig. 5–7; HOFKER 1972, p. 38, pl. 8 fig. 17–18.

Test elongate, always slightly curved, consisting of 3–5 chambers rapidly increasing in size. Last formed chamber showing the aperture on a short neck, chambers with their bases overlapping the pointed ends of former chamber. Agglutination consisting of sand grains in a single layer, greyish.

Abundant in samples off St. Croix, 200 and 800 m.

Reophax bilocularis Flint — Fig. 8

Reophax bilocularis FLINT, 1897, p. 273, pl. 17 fig. 2; CUSHMAN, 1920, p. 10, pl. 3 fig. 3–4; HOFKER, 1972, p. 38, pl. 9 fig. 3–4.

Test composed mostly of two chambers, slightly curved, constricted in between, with distinct apertural neck. Wall always composed of planktonic Foraminifera, with some benthonic specimens, forming a single layer.

Very common in the samples W. of St. Croix, 300 and 800 m.

Reophax compressus Goës — Fig. 9

Reophax compressus GOËS, 1894, p. 27, pl. 6 fig. 203–210; HOFKER, 1969, p. 17 fig. 10–14; 1972, p. 39, pl. 9 fig. 5–8.

Common in the Barbados samples; occurring also in the samples 200 and 300 m deep off St. Croix. Possibly restricted to depths from 100 to 300 m.

Reophax spiculifer Brady — Fig. 10

Reophax spiculifer BRADY, 1879, p. 54, pl. 4 fig. 10–11; 1884, p. 295, pl. 31 fig. 16–17; CUSHMAN, 1920, p. 23; HOFKER, 1930, p. 120, pl. 49 fig. 9; 1972, p. 39, pl. 9 fig. 9–13.

Test elongate and slender, consisting of 4–6 chambers, each showing its broader part somewhat below the middle, and each chamber slightly overlapping the former. The tests may be straight or slightly curved; the test wall consists of one layer of longitudinally placed sponge-spicules.

Not common in the sample off St. Croix, 800 m.

Nouria johnsoni Cushman

Nouria johnsoni CUSHMAN, 1935, p. 2, pl. 1 fig. 5–6; HOFKER, 1971, p. 10, fig. 1–4.
Proteonina comprima PHLEGER & PARKER, 1951, p. 2, pl. 1 fig. 1–3.

Very common in the sample off Habana, depth 3.5–9 m. Here the young specimens, consisting of one compressed chamber, were common also; they were mentioned by PHLEGER & PARKER as *Proteonina comprima*.

Nouria atlantica (Cushman) — Fig. 11

Technitella atlantica CUSHMAN, 1947, p. 87, pl. 18 fig. 17; HOFKER, 1969, p. 13, fig. 2–3.
Nouria atlantica (Cushman), HOFKER, 1972, p. 40, pl. 10 fig. 1–6.

Tests with one, two or three chambers, arranged in a polymorphine spiral. Wall consisting of one layer of longitudinally arranged sponge-spicules, with at the side of each of the chambers a long spicule projecting at the apical side. This typical spicule was also found in the unilocular specimens described by CUSHMAN and me as *Technitella atlantica.*

Full-grown specimens, together with the young ones, were found in the samples from off St. Croix, depths 300 and 800 m. The species seems to get its full development from 300 to 800 m, whereas at 200 m (Barbados) only the young, not fully developed specimens are found.

Pelosina variabilis Brady — Fig. 12

Pelosina variabilis BRADY, 1879, p. 30, pl. 3 fig. 1–3; 1884, p. 235, pl. 26 fig. 7–9; FLINT, 1897, p. 266, pl. 4 fig. 1; CUSHMAN, 1918, p. 53, pl. 22 fig. 1–4; HÖGLUND, 1947, p. 61, pl. 6 fig. 5–7; HOFKER, 1972, p. 42, pl. 10 fig. 7–9a.

Test elongate, slightly curved, pointed at the closed end, rounded at the apertural end. Test consisting of fine mud, greyish, with some larger grains or spicules placed transversely to the axis.

Not common in the sample off St. Croix, 800 m. Found by FLINT in the Gulf of Mexico.

Hyperammina elongata Brady — Fig. 13

Hyperammina elongata BRADY, 1878, p. 433, pl. 20 fig. 2; 1884, p. 257, pl. 23 fig. 4, 7–10; FLINT, p. 270, pl. 10 fig. 2, partim; LOEBLICH & TAPPAN, 1964, p. 190, fig. 106, 2; HOFKER, 1972, p. 45, pl. 12 fig. 4–7.

Test elongate, nearly straight, consisting of an ovoid proloculus gradually passing into the tubular part which is slightly narrower than the proloculus. Test consisting of several layers of small grains with some larger grains in between, with darker grains at the surface intercalated. Colour reddish brown to yellowish.

BARKER (1960) believed that only BRADY's pl. 23 fig 8 is *H. elongata*; this specimen was recorded from the Caribbean Sea.

Abundant in the sample off St. Croix, 800 m.

Hyperammina laevigata Wright — Fig. 14

Hyperammina elongata BRADY, 1884, pl. 23 fig. 9–10; GOËS, 1894, p. 17, pl. 4 fig. 55.
Hyperammina elongata BRADY, var. *laevigata* WRIGHT, 1891, p. 466, pl. 20 fig. 1; CUSHMAN, 1910, p. 61 fig. 75.
Hyperammina laevigata Wright, CUSHMAN, 1918, p. 77, pl. 29 fig. 5–6.
Hyperammina laevigata Wright, HOFKER, 1972, p. 46, pl. 11 fig. 10–14.

Test elongate and slender with elongate subcylindrical proloculus and only slightly slenderer tubiform chamber. Wall very smooth, composed of small sandgrains in a single layer with abundant reddish brown cement. Aperture at the open end of the tube.

Not common in the sample off St. Croix, 800 m.

Hyperammina friabilis Brady — Fig. 15

Hyperammina friabilis BRADY, 1884, p. 258, pl. 23 fig. 1–3, 5–6; FLINT, 1897, p. 269, pl. 10 fig. 1; CUSHMAN, 1918, p. 75, pl. 29 fig. 1–3; HOFKER, 1972, p. 46, pl. 12 fig. 8–12.

Test elongate, large, at the outside with somewhat conical apical part, followed by a slightly narrower tube, consisting of several parts, often these parts have different agglutination. Wall thick, with grains and sponge-spicules. The oral part of the test in thinnest.

The species was very abundant in the sample off St. Croix, 800 m.

Hyperammina adunca (Brady) — Fig. 16

Reophax aduncus BRADY, 1884, p. 296, pl. 31 fig. 23–26; FLINT, 1897, p. 274, pl. 18 fig. 5; CUSHMAN, 1920, p. 15, pl. 5 fig. 1.
Hyperammina adunca (Brady), HOFKER, 1972, p. 48, pl. 13 fig. 1–5.

Test composed of a proloculus and several growth parts which may be taken as chambers; but the next "chamber" is not placed over the apertural end of the former, but the narrower part of a "chamber" continues into the broader part of the next part. Moreover, the wall does not consist of one layer of grains and so this species cannot belong to *Reophax*; comparing the "chambers" with the growth parts of *Hyperammina friabilis*, it is obvious that this species belongs to *Hyperammina*. The "chambers" are the outcome of a periodical growth. The test consists of grains of different sizes so that the surface becomes somewhat roughened. The aperture of the test is the rounded opening of the last formed "chamber". Colour yellowish by the cement.

Abundant in the sample off St. Croix, 800 m. FLINT mentions it from the Gulf of Mexico. Most ot the localities given by CUSHMAN are in deep water.

Hyperammina spiculifera Lacroix — Fig. 17

Hyperammina spiculifera LACROIX, 1928, p. 14, fig. 13; HOFKER, 1972, p. 50, pl. 14 fig. 1–4.

Test as in *H. elongata* but slightly stouter. Wall consisting of longitudinally arranged sponge spicules. The colour of the cement is yellowish brown.

Abundant in the sample off St. Croix, 800 m.

Hyperammina distorta Cushman — Fig. 18

Hyperammina distorta CUSHMAN, 1918, p. 78, no figure; HOFKER, 1972, p. 50, pl. 14 fig. 9–14.

Test elongate, beginning with a pear-shaped proloculus followed by a contorted tube with many growth-rings. Test yellowish by much cement which agglutinates a large number of sponge-spicules laid down in different directions and which are poorly visible owing to the large amount of cement. At different places planktonic Foraminifera tests are adhering to the tube.

Abundant in the sample off St. Croix, 800 m.

Hyperammina (Saccorhiza) caribbeana Hofker Fig. 19

Hyperammina (*Saccorhiza*) *caribbeana* HOFKER, 1972, p. 54, pl. 15 fig. 9–14.

Test smaller than in the type-species, with two short branches at the end of the tube. The proloculus is oval passing into the tube. Test wall at the outside covered by a felt of fine sponge-spicules which protrude in several directions. Colour light yellowish.

Very common in the sample off St. Croix, 800 m.

Hyperammina (Tolypammina) vagans Brady Fig. 20

Hyperammina vagans BRADY, 1879, p. 33, pl. 3 fig. 5; 1884, p. 260, pl. 24 fig. 1–9; FLINT 1897, p. 270, pl. 11 fig. 2; HERON-ALLEN & EARLAND, 1913, p. 41, pl. 2 fig. 9.
Tolypammina vagans RHUMBLER, 1902, p. 281, fig. 97; CUSHMAN, 1910, p. 67, fig. 84–85.
Girvanella vagans RHUMBLER, 1911, pl. 4 fig. 1–2; 1913, p. 419; CUSHMAN, 1918, p. 91, pl. 35 fig. 4–5, pl. 36 fig. 1.
Hyperammina (*Tolypammina*) *vagans* Brady, HOFKER, 1972, p. 55, pl. 16 fig. 8–10.

Test at least partly adherent, consisting of an oval proloculus and a long irregularly winding tube, unbranched. Wall consisting of fine sand grains in one or two layers, with a large amount of cement which is yellowish-brown. Wall smooth.

Abundant in the sample off St. Croix, 800 m.

Ammodiscus turbinatus (Cushman) Fig. 21

Ammodiscoides turbinatus CUSHMAN, 1909, p. 424, pl. 33 fig. 1–4; RHUMBLER, 1913, p. 388, fig. 124, a, d; CUSHMAN, 1918, p. 98, pl. 36 fig. 3–6, pl. 37, pl. 89 at least fig. 2.
Ammodiscus turbinatus (Cushman), HOFKER, 1972, p. 57, pl. 16 fig. 11–17.

Test in the microspheric form beginning with a conical spiral, in the megalospheric form totally flat. Colour reddish brown, last whorl more yellowish. Agglutination consisting of fine grains arranged obliquely to the periphery.

Common in the sample off St. Croix, 800 m.

Lituotuba lituiformis (Brady) Fig. 22

Trochammina lituiformis BRADY, 1879, p. 59, pl. 5 fig. 16; 1884, p. 342, pl. 40 fig. 4–7; FLINT, 1897, p. 281, pl. 26 fig. 1.
Lituotuba lituiformis (Brady), RHUMBLER, 1895, p. 84; 1913, p. 379, fig. 128; CUSHMAN, 1910, p. 114, fig. 175; 1918, p. 59, pl. 12 fig. 1–2; 1921, p. 88; HOFKER, 1972, p. 58, pl. 17 fig. 1–12.
Trochamminoides proteus (Karrer), CUSHMAN, 1910, p. 98, fig. 142–144; 1918, p. 36, pl. 8 fig. 7; HOFKER, 1930 (*Glomospira gordialis* (Jones & Parker)), pl. 45 fig. 2–12.

Test in one generation beginning with a relatively small proloculus, followed by a tube which is coiled irregularly around the proloculus part, then coiling in a planospiral part which is divided into kinds of chambers by periodical growth; in the end the tube becomes uncoiled. In another generation, with large proloculus, the test following the proloculus is a spiral tube, first undivided, later divided into the chambers as described above, and in the end also uncoiling. In the coiled parts the tube invariably consists of the outer, peripheral wall only, so that the walls of coils remain simple, where as the uncoiled part is surrounded by its wall. Wall consisting of fine sand-grains with a yellowish-brownish cement, smoothly finished.

Both forms are found in the sample off St. Croix, 800 m.

Hormosina mortensi Hofker Fig. 23

Hormosina mortenseni HOFKER, 1972, p. 62, pl. 18 fig. 6–12.

Test consisting of several elongate chambers in a straight line. Megalospheric proloculus cylindrical, followed by shorter chambers which are somewhat pyriform with the broadest part at the proloculus side. Last chamber with rounded aperture. Test wall from the outside finely arenaceous with scattered dark grains, smooth, with reddish-brown colour. Microspheric form beginning with small proloculus and next chambers increasing in size as added.

Found abundantly in the sample off St. Croix, 800 m.

Hormosina ovicula Brady Fig. 24

Hormosina ovicula BRADY, 1879, p. 61, pl. 4 fig. 6; 1884, p. 327, pl. 39 fig. 7–9; FLINT, 1897, p. 280, pl. 25 fig. 2; CUSHMAN, 1920, p. 28, pl. 6 fig. 2; HOFKER, 1972, p. 62, pl. 18 fig. 6–12.

Test mostly straight, composed of several oval chambers, the last formed one pyriform, with distinct neck on which the rounded aperture. A slender neck divides two successive chambers. Wall with fine somewhat protruding sand grains and at the base of each chamber some bristling sponge needles. Colour yellowish to yellowish brown.

Found in the sample off St. Croix, 800 m.

Hormosina spiculifera Hofker Fig. 25

Hormosina spiculifera HOFKER, 1972, p. 63, pl. 19 fig. 1–4.

Test small, consisting of about 5 chambers or less, gradually increasing in size and globular. The test may be straight or slightly twisted. The sutures are well depressed and distinct. Testwall at the outside with smaller and larger sand grains and sponge-spicules in between, which often form a bristling appearance as they protrude from the wall. The last chamber forms a short neck on which the small rounded aperture is found.

Abundant in the sample off St. Croix, 800 m.

Hormosina hispidula (Cushman) Fig. 26

Reophax hispidula CUSHMAN, 1920, p. 24, pl. 5 fig. 7.
Hormosina hispidula (Cushman), HOFKER, 1972, p. 64, pl. 19 fig. 5–7.

Test consisting of few pyriform chambers, widest at the somewhat truncate base. Aperture of last formed chamber on a tapering neck. Wall composed of hyaline, organic matter in which sponge-spicules of different sizes are embedded, many of them protruding at the outside. There are several layers of these spicules, so the species cannot belong to *Reophax*.

Found commonly in the sample off St. Croix, 800 m.

Ammolagena clavata (Parker & Jones) Fig. 27

Trochammina irregularis, var. *clavata* PARKER & JONES, 1860, p. 304.
Webbina clavata (Parker & Jones), BRADY, 1884, p. 349, pl. 41 fig. 12–16; GOËS, 1894, p. 32, pl. 6 fig. 245–246; FLINT, 1897, p. 279, pl. 24 fig. 3; CUSHMAN, 1918, p. 89, pl. 34 fig. 2–5, pl. 35 fig. 1–3.
Ammolagena clavata (Parker & Jones), EIMER & FICKERT, 1899, p. 673; HOFKER, 1972, p. 65, pl. 19 fig. 12–16.

Test attached on smooth surfaces, composed of a round or oval depressed proloculus, flat on one side, convex on the other, giving rise to a narrow tube of nearly uniform diameter. Wall finely arenaceous with much yellowish to brownish cement.

Commonly found in sample 1443 off Barbados, and the samples off St. Croix at 300 and 800 m depth.

Crithionina hispida Flint Fig. 28

Crithionina pisum Goës, var. *hispida* FLINT, 1897, p. 267, pl. 6 fig. 2; CUSHMAN, 1918, p. 68, pl. 26 fig. 4; HÖGLUND, 1947, p. 36, pl. 2 fig. 3, pl. 23 fig. 24–29.
Crithionina hispida Flint, HOFKER, 1972, p. 68, pl. 20 fig. 7–10.

Test originally attached with one flattened side; larger individuals mostly globular. Sponge-spiculae attached in a colourless substratum, many of them projecting at the surface.

Abundant in the sample off St. Croix, 800 m.

Bathysiphon rufus de Folin Fig. 29

Bathysiphon rufus de Folin, 1887, p. 283, pl. 6 fig. 8; Flint, 1897, p. 267, pl. 7; Cushman, 1910, p. 32, fig. 22; 1918, p. 29; 1921, p. 42, pl. 2 fig. 2; Hofker, 1930 (part.), p. 112, pl. 43 fig. 5, pl. 45 fig. 7-10, 13–14; 1972, p. 75, pl. 23 fig. 7–10.

Test relatively small, slender, mostly slightly curved, one end narrow, the other end thicker, tapering, with many constrictions which on section appear to be formed by periodical growth. Agglutination by fine short parts of sponge-spicules. Colour brownish.

Very common in the sample off St. Croix, 800 m.

Technitella melo Norman Fig. 30

Technitella melo Norman, 1878, p. 280, pl. 16 fig. 5–6; Brady, 1884, p. 246, pl. 25 fig. 7; Cushman, 1918, p. 60, pl. 16 fig. 6; Hofker, 1972, p. 78, pl. 23 fig. 19–21.

Test oval, simple aperture at one end. Wall consisting of two layers of sponge-spicules, the outer one longitudinally arranged.

Rare in the sample off St. Croix, 800 m.

Technitella erinaceus Hofker Fig. 31

Technitella erinaceus Hofker, 1972, p. 78, pl. 24 fig. 7–12.

Test strongly curved so as to form almost a circle. At the outside the proloculus is seen as a somewhat pointed structure covered by sponge needles which are directed towards the apical end like the tail of a porcupine; the larger part of the test is curved, the sponge needles directed to all sides but always with the tendency described for the "tail". The apertural end is found where the tail begun. The colour of the test is white. The aperture is slit-like.

Rare in the sample off St. Croix, 800 m.

Marsipella elongata Norman — Fig. 32

Marsipella elongata NORMAN, 1878, p. 281, pl. 16 fig. 7; BRADY, 1884, p. 265, pl. 24 fig. 10–19; CUSHMAN, 1918, p. 23, pl. 8 fig. 2–3; HOFKER, 1972, p. 80, pl. 24 fig. 13–21, pl. 25 fig. 1.

Test elongate, fusiform with the thickest part below the middle, mostly somewhat curved, in very young tests resembling "*Technitella*" *atlantica*, (but for the sponge needle to which it adheres). One end elongated into a long apertural neck, the other end always closed. Older tests in the middle part covered with bristling sponge needles and adhering small sand grains. Ends of tests formed by needles only.

Very common in the sample off St. Croix, 800 m.

Marsipella cylindrica Brady — Fig. 33

Marsipella cylindrica BRADY, 1884, p. 285, pl. 24 fig. 20–22; CUSHMAN, 1918, p. 24, pl. 8 fig. 4–6, pl. 9 fig. 8–9; HOFKER, 1972, p. 81, pl. 25 fig. 2–8.

Test consisting of a more or less fusiform proloculus and a long tube which very gradually widens into the wide broad opening at the end. In the proloculus-part sponge-spicules are arranged as in *M. elongata*, tile-wise; in the tube they are arranged more irregularly and often they are protruding at the surface.

Common in the sample off St. Croix, 800 m; one specimen found at 300 m.

Marsipella cervicornix Hofker Fig. 34

Marsipella cervicornix HOFKER, 1972, p. 81, pl. 25 fig. 9–11, pl. 26 fig. 1–4.

Test consisting of a closed proloculus-part, followed by a more triangular part ending in two short tubes which are narrowing towards the rounded two apertures. These tubes may be slightly curved, so that the whole test has the form of the antler of a roe. The test wall is composed of sponge-spicules, arranged like roofing-tiles and with few yellowish cement.

Common in the sample off St. Croix, 800 m.

Marsipella rustica (Heron-Allen & Earland) Fig. 35

Psammosphaera rustica HERON-ALLEN & EARLAND, 1912, p. 383, pl. 5 fig. 3–4, pl. 6 fig. 2–4; CUSHMAN, 1918, pl. 9 fig. 3–4, pl. 10 fig. 2–4.
Sorosphaera confusa CUSHMAN (not Brady), 1918, p. 39, pl. 15 fig. 4–5.
Rhabdammina cornuta Brady, var. *spiculotesta* CUSHMAN, 1918, p. 18, no figure.
Marsipella rustica (Heron-Allen & Earland), HOFKER, 1972, p. 82, pl. 26 fig. 5–7, pl. 27 fig. 1–5.

Test with more or less tetrahedral proloculus and, when attached, often tent-like. Some large needles may protrude at the edges. Sponge needles neatly covering the surface. To this proloculus three or four chambers may be added, in a more or less straight line with distinct depressed necks in between, the whole obscured by extra needles. Later chambers gradually increasing in size beginning to form stolons. These later chambers often use sand grains between the needles. Often whole conglomerates of chambers may be formed in this way.

Very common in the sample off St. Croix, 800 m.

Textularia parvula Cushman — Fig. 36

Textularia parvula CUSHMAN, 1922, p. 11, pl. 6 fig. 1–2.

Test small, very much elongate. Apical end bluntly rounded, as in the specimens recovered the proloculi are relatively large (diameter 60 μ). Test only slightly tapering towards the apertural end, greatest breadth near the end, 180 μ. The greatest length measured was 675 μ; this individual has 11 biserial rows of chambers. Chambers distinctly inflated, sutures much compressed. Walls very thin, mainly consisting of pseudochitinous material with very fine detritus. Aperture rounded at the median suture of the last formed chamber.

Common in a sample W. of St. Croix, 200 m.

Gaudryina flintii Cushman — Fig. 37

Gaudryina subrotundata FLINT (not *G. subrotundata* Schwager), 1897, p. 287, pl. 33 fig. 1.
Gaudryina rugosa GOËS (not *G. rugosa* d'Orbigny), 1896, p. 39.
Gaudryina flintii CUSHMAN, 1911, p. 63, fig. 102; 1921, p. 146, pl. 29 fig. 1; 1922, p. 69, pl. 12 fig. 1–2; 1937, p. 62, pl. 10 fig. 18–20.

Tests subcylindrical, initial triangular part distinct but short, followed by more or less distinctly biserially arranged chambers which show depressed sutures and somewhat inflated walls. Later chambers with rounded apertures which are sunken down in the apertural face and of which the sutural parts are more or less closed, though the closed part remains visible as a slit running down from the rounded aperture to the basal suture. Test wall smoothly finished, thick, consisting of loosely cemented calcareous grains of uniform size. Length of tests from 1.5 to 5 mm.

The proloculi of the tests which measure from 1.5–3.5 mm have diameters ranging from 190–225 μ inner diameters. The tests with a length from 4 to 5 mm have much smaller proloculi, measuring from 37 to 15 μ. These may be microspheric specimens.

Mentioned by CUSHMAN and others from the Pacific, in the area around Australia, along the coast of Brazil, the Caribbean Sea, the Gulf of Mexico and the coast of Georgia. Found in many specimens in the sample W. of St. Croix, depth 800 m. This widespread species is also known from the Miocene of Jamaica and Trinidad.

Cribrostomoides bradyi Cushman Fig. 38

Haplophragmium latidorsatum BRADY (not Bornemann), 1884, p. 307, pl. 34 fig. 9.
Cribrostomoides bradyi CUSHMAN, 1910, p. 108, fig. 167; 1920, p. 51, pl. 10 fig. 3.

Test large, slightly compressed. Chambers involute, umbilicate, or the umbilicus filled with whitish material. Visible chambers about 6 in the megalospheric generation, about 8 in the microspheric, often not quite in one plane. Wall arenaceous, smoothly finished, with distinct sand grains and parts of sponge-spicules. In the megalospheric specimens aperture a simple areal slit near to the margin, in the microspheric generation in full-grown specimens a much larger slit with a length about half of the total breadth of the test and with lips which aproach each other in several places even to separate the slit into several openings. On sections the apertures (foramina) are surrounded by brown material forming the borders and the lips of the apertures. These sections reveal that especially the early chambers are streptospirally arranged, so that in a section transverse to the last formed coil the whole spiral is seen, whereas in sections in the plane of the last formed coil several chambers of the first coils are sectioned transversely. In this way the species strongly reminds one of *Endothyra*, but in the latter genus the lips of the foramina are missing and the aperture is not areal as in *Cribrostomoides* but marginal sutural. The chamber walls are very thick and consist of several layers of irregularly arranged grains of various sizes. The colour is yellowish brown.

There seem to be three generations, the microspheric one with diameter about 2–3 mm, proloculus-diameter about 10–18 μ; the A_1-generation with diameter of about 1.5–2 mm, proloculus-diameter about 33 μ; the A_2-generation with diameter of about 0.8–1.6 mm, proloculus-diameter about 46 μ.

HÖGLUND (1947, p. 144) believed that *Cribrostomoides* is a synonym of *Labrospira*, regarding the lips of the foramina. But his species *L. subglobosa* (Sars), from the North Atlantic which should be, according to Höglund, synonymous with *Cribrostomoides bradyi* Cushman, does not show the streptospiral initial part, and he placed such streptospiral species in *Recurvoides* Earland. This genus does have the areal apertures as found in *Cribrospiroides*. Whether the latter genus is a valid genus or the species *C. bradyi* has to be placed in *Recurvoides*, is not clear; Loeblich & Tappan, 1964, p. 225 believe *Labrospira* Höglund to be a synonym with *Cribrostomoides* Cushman; they do not mention the streptospiral initial part of the latter. Loeblich & Tappan stress this streptospiral part for *Recurvoides* Earland; but as this genus has the typical apertural features of *Cribrostomoides* (but for the dental slit), it may be that all these species and genera with areal slit-like apertures belong together.

Found abundantly in the sample W. of Frederiksted, St. Croix, depth 800 m. Cushman mentions the species from the Caribbean, the Gulf of Mexico and the eastern coast of North America, all the stations he mentions being in deep water.

Discammina Lacroix

Test agglutinated, mostly with coarse sand grains, possibly also with an amount of sponge-spicules. Planospiral from the beginning, chambers in the first coils more or less compressed, later chambers more inflated. Aperture marginal, always slightly areal, with lips ventrally and dorsally from it, consisting mainly of pseudochitinous material which here is thickened and continues thinly over the inner side of the chamber walls. Aperture not continuing over the sides of the apertural face, narrow. Mostly 7 chambers in the last formed coil, with depressed sutures so that the periphery becomes more or less lobulated. Interior of the chambers distinctly alveolar, with thick septa; especially the later chambers show the alveolar structure. At least two generations, a microspheric and a megalospheric one. Grains in the walls strongly cemented; cement of yellowish or brownish colour.

This genus was well-described by LACROIX, but later authors obviously did not understand the figures given by him. BRÖNNIMANN (1951, p. 103) believed that the second chamber in the megalospheric form was tubular, as was first believed by LACROIX also, but in 1935 LACROIX corrected this view by means of an optical section through a clarified specimen, and LOEBLICH & TAPPAN (1964, p. 226) also stressed that the test was chambered from the beginning. However, the latter authors did not quite understand the optical section by LACROIX, as they took the fine inner pseudochitinous layer of the septum for the septum, declaring that these thin septa resembled those of *Ammoscalaris*; in reality the septa are thick, with a basal thin brown layer which is the one seen in LACROIX's figure. Moreover, LOEBLICH & TAPPAN misunderstood the areal apertures in the same section, and so came to their description that in *Discammina* the aperture was low interiomarginal equatorial, whereas the apertures are low, equatorial and areal.

The type-species of *Discammina* certainly is *D. fallax* Lacroix, which is identical with *Lituolina irregularis* var. *compressa* Goës, described from the deeper water of the Caribbean. The species is identical with *Haplophragmium* (*Haplophragmoides*) *emaciatum* Brady which in the type-figures (BRADY, 1884, pl. 33, fig. 26–28) very much resembles the type given by GOËS, 1882, but not the textfigures given by CUSHMAN for that species in 1920 (p. 41, fig. 1–3), where the apertures are quite different. There seems to have been some confusion in CUSHMAN's description, for pl. 8 fig. 4 may represent our species.

Discammina compressa (Goës) Fig. 39

Lituolina irregularis var. *compressa* GOËS, 1882, p. 141.
Haplophragmium compressum BRADY, 1884, p. 305, pl. 33 fig. 26–28; FLINT, 1899, p. 276, pl. 19 fig. 5, only for the specimens with sand grains, possibly from the Caribbean; CUSHMAN, 1920, p. 40, pl. 8 fig. 4 (but not the specimens in textfig. 1–3).
Discammina fallax LACROIX, 1932, p. 2, fig. a–2.
Discammina compressa (Goës), LACROIX, 1935, p. 15; BARKER, 1960, p. 68.

Test planospiral, first whorls much compressed, chambers of last whorl more inflated, rounded, with rounded margin and more or less lobulated periphery, since the sutures between the chambers are depressed. All specimens with a depressed umbilicus since the chambers of the last formed whorl do not wholly overlap the former whorls. Agglutination by more or less coarse quarz grains embedded in a brownish cement. Aperture a narrow, slightly curved slit, equatorial, areal, bordered by a more or less distinct lip, near the suture.

Air-filled specimens give the inner characteristics as figured by LACROIX, each chamber having a narrow central hollow from which irregular canals emerge into the thick outer wall; horizontal sections show these alveoles in the walls which are more developed in later chambers. The septa are thick, with a thin basal pseudochitinous layer of brownish colour. The coarse grains are embedded in the same material. Each aperture shows a thickened border of this brown material, slightly protruding and also found at the outer wall of a former coil so that the aperture is wholly surrounded by it (areal aperture). The microspheric tests are larger than the megalospheric ones, beginning with a proloculus of about 10 μ in diameter; mostly they have 7 chambers in the last formed whorl and are relatively common: 34 microspheric specimens were found against 59 megalospheric ones. The megalospheric specimens are smaller, with proloculi from 37.5 to 137.5 μ in diameter, with two tops, one at about 80 μ and another at about 125 μ; so the species seems to be trimorphic. The megalospheric specimens have in average 6 chambers in the last formed whorl. The microspheric specimens measure from 1.125 up to 2 mm in diameter, the megalospheric ones from 0.5 up to 1.6 mm. The number of coils is about 4 in the microspheric specimens and about 3 in the megalospheric ones. Sponge-spicules could not be traced in the material at hand.

Common in sample W of St. Croix, depth 800 m. Mentioned by CUSHMAN from the Atlantic coast of North America, the Caribbean Sea and the Gulf of Mexico; generally from deep water.

Cyclammina cancellata Brady — Fig. 40

Cyclammina cancellata BRADY, 1884, p. 351, pl. 37 fig. 8–16; FLINT, 1897, p. 282, pl. 27 fig. 3, pl. 28 fig. 1; CUSHMAN, 1920, p. 53, pl. 10 fig. 4–5.

Cyclammina compressa CUSHMAN, 1910, p. 111, fig. 171; 1920, p. 54, pl. 11 fig. 1.
Cyclammina pusilla BRADY, 1881, p. 53; GOËS, 1894, p. 32, pl. 6 fig. 242–244; FLINT, 1897, p. 282, pl. 28 fig. 2; CUSHMAN, 1910, p. 111, fig. 172; 1920, p. 56, pl. 11 fig. 4–6.

Obviously, from statistic investigation, the three "species" mentioned form the three generations of one single species. All three occurred in one sample in large quantities, W. of St. Croix, depth 800 m; typical specimens with the characteristics of *C. cancellata* all showed to be microspheric with proloculus diameter of 6–15 μ; all specimens with the characteristics of *C. compressa* showed to be megalospheric with proloculus-diameter of 23–32.5 μ; all specimens with the characteristics of *C. pusilla* had large proloculi with diameters of 44–185 μ.

Horizontal sections revealed that the specimens with microspheric proloculus show about 20 initial chambers which do not have any labyrinthic structure of the outer walls; the specimens with proloculus-diameters of 23–32.5 μ show 12 simple initial chambers; those with the largest diameters of proloculi have only 2 or 3 chambers with simple walls, but here the hollows of the latter chambers are voluminous and typical labyrinthic structure is difficult to be seen.

All three generations have the same general characteristics; but the individuals which are microspheric are very large and, in full-grown specimens, show a strongly rounded margin and chambers filling up the umbilicus; they measure from 3–5 mm in diameter. The specimens resembling *C. compressa* are smaller, with more compressed tests and the chambers of the last-formed whorl not totally overlapping the umbilicus; their diameters range from 1.25–2.25 mm. The third group of specimens, with distinct depressed umbilicus and with sub-acute margin, is the smallest one, with diameters ranging from 1–2 mm. In all three forms the aperture consists of a narrow slit at the base of the apertural face of the last formed chamber. The number of chambers in the last formed coils for the three generations is: *cancellata* 12–17, *compressa* 12–14, *pusilla* 12–14.

As in the two forms *compressa* and *pusilla* no microspheric specimens were found and as all specimens sectioned of *cancellata* were microspheric, it is obvious that *C. cancellata* is the microspheric (B)-generation, *C. compressa* is the A_1-generation and *C. pusila* is the

A_2-generation of a single species which, according to the Rules of Nomenclature has to be named *Cyclammina cancellata* Brady.

In many B-specimens round openings on a short protruding tube are found spread over the apertural face; such openings may also be found in the A_1-specimens, but never in the A_2-individuals. As the B- and A_1-generations are known to form plasmodiospores, in contrast to the A_2-generation which forms gametes, this once again strengthens the fact that these three forms are the generations of one single species.

Occurring in large quantities W. of St. Croix at 800 m depth.

Ammobaculites Cushman, **Ammotium** Loeblich & Tappan, and **Ammoscalaris** Höglund

These genera were put in the Subfamily Lituolinae de Blainville by Loeblich & Tappan (1964, p. 238). They are characterised as "Similar to Haplophragmoidinae but spire uncoiling in adult, or cyclical, interior simple."

Ammobaculites shows a close-coiled early portion, followed by a series of uncoiling chambers in a straight line, rounded in section. Each chamber is surrounded by a simple agglutinated wall and the uncoiling chambers are lined by these agglutinated walls also; they are superposed over the apertural part of each former chamber. The type-species, *Spirolina agglutinans* d'Orbigny, is known from the Miocene to the Recent. A sample from the harbour of Falmouth contained good specimens (Fig. 41). The outer sutures of the uncoiling chambers are straight; the coiled part is planispiral and involute.

Ammotium is defined by Loeblich & Tappan as follows: "Test free, compressed, ovate in outline, chambers planispirally coiled and evolute, later chambers tending to uncoil but reaching backward toward coil at inner margin; wall agglutinated; aperture simple, rounded, terminal, at dorsal angle of final chamber." It is obvious from this description that nothing is said about the septa, especially in the uncoiling part. The type-species is *A. cassis* (Parker) (Fig. 44).

Specimens sent to me by LOEBLICH showed simple agglutinated septa: so the genus is very close to *Ammobaculites*.

Ammoscalaria was analysed by me (1932, p. 87–91, fig. 14–15) and by HÖGLUND (1947, p. 151–163, fig. 133–138, pl. 31 fig. 1–2, pl. 9 fig. 15–24). Typical for this genus is, that the septa do not consist of agglutinated material but only of the inner pseudochitinous lamellum. Consequently, the description given by LOEBLICH & TAPPAN "later uncoiling and rectilinear, original development as tubular test with secondarily formed septa and resultant chamber development" cannot be correct as the pseudochitinous lamellum is a primary wall on which the agglutination is laid down. In the type-species, *A. tenuimargo* Brady (Fig. 42), the septa in the tubular part are perpendicular to the length of the uncoiling part, but they occur in the coiled part also. There may be species in which these septa are obliquely arranged in the length of the uncoiling part.

Ammobaculites josephi Acosta — Fig. 43

Ammobaculites josephi ACOSTA, 1940, p. 271, pl. 49 fig. 2, 7, 10.
Ammobaculites subcatenulatus WARREN, 1957, p. 32, pl. 3 fig. 11–13.

Test consisting of a more or less compressed coiled part and a straight series of uncoiling chambers. Test wall agglutinated with uniform sand grains, forming a single layer. Sutures indistinct in the coiled part, distinct and transverse in the straight one. Septa consisting of outer walls of former chamber, with agglutination. Aperture at the end of the last formed chamber, round. It is very probable that *A. subcatenulatus* is a synonym.

Found, never commonly, in samples from Puerto Rico (1424) and Margarita (1447).

Ammoscalaria morenoi (Acosta) — Fig. 45

Ammobaculites morenoi ACOSTA, 1940, p. 272, pl. 49 fig. 1, 3, 8.
Ammotium fragile WARREN, 1957, p. 32, pl. 3 fig. 14–15.
Ammobaculites salsus CUSHMAN & BRÖNNIMANN, 1948, p. 16, pl. 3 fig. 7–9; SEIGLIE, 1974, p. 36, fig. 1–4.

Test compressed, early chambers in a planospiral coil, later chambers uncoillng with oblique sutures bending to the ventral side. Agglutination fine with some larger grains, mostly in a single layer. Aperture in the coiling part triangular, slightly areal, near the wall of a former coil, symmetrically placed, in the uncoiling part in the centre in the first chambers, later placed near the dorsal margin, often with a slight neck. Septa in the coiled part straight, consisting of a pseudochitinous brown substance. In the straight part the ventral parts of the septa are formed by the agglutinated chamber walls, but for the larger part they consist of the pseudochitinous substance, as in *Ammoscalaria*. Aperture a rounded opening. At least two generations seem to exist; the smaller the proloculus, the larger is the number of coiling chambers. Proloculi with diameters of about 20 μ are followed by 15, 13, 17, 10, 16 coiling chambers; proloculi with a diameter of 50–70 μ are followed by 10, 9, 10, 10, 11, 12, 10 coiling chambers.

The species *A. fragile* and *A. salsus* are, according to the figures given, so similar to the variable group studied here, that they are believed to be identical or only geographic varieties.

Found, often in large quantities, in samples from Puerto Rico (Table 3) and Margarita (1447).

Trochammina inflata (Montagu) Fig. 46

Trochammina inflata (Montagu), HOFKER, 1964, p. 15, fig. 1; 1975, p. 12.

In 1964 attention was paid to the synonymy and the outer characteristics. Well-preserved specimens show a finely agglutinated wall, a more or less slit-like ventral aperture provided with a more or less distinct lip, and an open umbilicus which is more or less narrow.

Sections show that at least two generations exist, one with a proloculus with a diameter of about 27 μ, the other with a smaller proloculus of about 16 μ. The chamber walls of the more initial chambers consist of relatively fine grains with a diameter of about 25 μ. The smoothly finished wall has a uniform thickness of about

20 μ, caused by brownish to yellowish cement. Later chambers show a layer of fine grains at the inside and one of coarser grains at the outside. On transverse section each chamber opens near the axis of the test in an axial umbilical hollow which can be followed from the proloculus to the open umbilicus at the ventral side. In protoplasm-filled specimens only the last formed chamber and some axial parts of chambers of former rows are filled with protoplasm, and then also the umbilical hollow is filled with it, so that in many of the specimens part of the umbilicus is filled with protoplasm. Each of the chambers is connected with a former and a following chamber by the ventral foramina which are distinctly divided from the umbilical opening. Characteristic of these foramina is that they are slightly loop-shaped, with the narrower part dorsally and the broader part ventrally placed.

In the description given by various authors the open umbilicus is never mentioned. However, treating the genus *Tiphotrocha*, LOEBLICH & TAPPAN (1964, p. 266) mention that this genus differs from "*Trochammina* in its open umbilical apertures". So, obviously, they believe the genus *Trochammina* to have closed chambers towards the umbilicus; this certainly is not so and it seems that the genus *Tiphotrocha* differs from *Trochammina* in having these umbilical openings somewhat more protruding in the umbilical region; this may be caused by the more flattened test in *Tiphotrocha* and may not be a real generic difference.

Two groups of specimens could be separated from each other, according to their direction of coiling. Right coiling specimens in most instances were somewhat larger with more chambers to a coil than left coiling ones. Together with these two directions, which occurred right : left = 1 : 2, proloculi were measured. Just as was found for many other species of Foraminifera (see HOFKER, 1969, p. 141), left-coiling specimens showed a larger proloculus than the right-coiling ones.

Found in mangrove-lined lagoons and marine pools in Grand Cayman (Table 2), St. Martin (Great Key), and Curaçao (Table 10). Already known from Curaçao (Piscadera Bay), Barbuda, St. Martin and Anguilla.

Trochammina globigeriniformis (Parker & Jones) Fig. 53

Globigerina bulloides WILLIAMSON, 1858, p. 56, pl. 5 fig. 116–118.
Lituola nautiloidea (Lamarck), var. *globigeriniformis* PARKER & JONES, 1865, p. 405, pl. 55 fig. 46–47.
Lituola (*Haplophragmium*) *globigeriniformis* TERRIGI, 1880, p. 175, pl. 1 fig. 3.
Haplophragmium globigeriniforme (Parker & Jones), BRADY, 1884, p. 312, pl. 35 fig 10–11j; FLINT, 1897, p. 277, pl. 21 fig. 1.
Trochammina globigeriniformis (Parker & Jones), CUSHMAN, 1920, p. 78, pl. 16 fig. 5–6.
Ammoglobigerina globigeriniformis (Parker & Jones), EIMER & FICKERT, 1899, p. 704; BARKER, 1960, p. 72.

Test relatively small, with 4 chambers in the last formed whorl which are globular, with deeply depressed radial sutures, so that the general form is that of a *Globigerina*. Wall arenaceous, with fine sand grains and smooth surface. Aperture a slit at the ventral suture, opening in the open umbilicus which is narrow and often closed by greyish material. Colour reddish-brown to yellowish-brown.

The transverse section as well as the horizontal section show that the wall consists of two layers, an inner one of very fine material, whereas the outer one consists of larger rounded grains which are cemented together by a brownish material. In transverse section the open umbilicus may be seen clearly. This structure of the wall is that found in *Trochammina inflata* also, so LOEBLICH & TAPPAN are right in placing *Ammoglobigerina* in the synonymy of *Trochammina*.

Common in the material from off Frederiksted, St. Croix, 800 m.

Tritaxis siphonifera (Cushman) Fig. 54

Trochaminella siphonifera CUSHMAN, 1943, p. 95, pl. 16 fig. 18–20.
Tritaxis siphonifera (Cushman), LOEBLICH & TAPPAN, 1964, p. 266, fig. 177, 4.

Test trochoid, dorsal side conical, ventral side flat which slightly concave umbilical part. Margin acute, slightly keeled. Three chambers to each of the whorls. Chambers increasing in volume as added. In attached situation the test is surrounded by an irregular mass of material with several protuberances which open at their ends. Wall finely arenaceous, ventral walls of all chambers very thin, consisting of one layer of the agglutinated material, side-walls of the conus thicker, with several layers of material which consists of small sand grains of different shape and volume, intermingled with small particles of sponge needles. Colour brownish, darkest in the initial part of the test, attached by fine granular chalky greyish material. Aperture more or less loop-shaped, at the umbilical suture of the last-formed chamber with a more or less distinct thickened rim.

The name of this low-spiralled form from the Caribbean points, according to the description, to more or less developed tubes which are formed by the attaching mass. But many other attached Foraminifera form such irregular masses of attaching material (*Tritaxis fusca, Trochammina globigeriniformis, Rosalina globularis, Orbitolites hemprichi*) and in all these instances this attaching mass is provided with irregular protuberances with openings to the outer world; so LOEBLICH & TAPPAN were right in suppressing the genus-name *Trochaminella.*

Found W. of St. Croix, at 800 m.

Siphotextularia FINLAY, **Valvotextularia** HOFKER, **Textilina** NÖRVANG, **Textularia** DEFRANCE, AND **Spirorutilus** GEN. NOV.

In 1939 FINLAY described a new species, *Siphotextularia wairoana,* type-species of a new genus, *Siphotextularia* Finlay: "Similar to *Textularia* in all respects, except that the aperture is a distinct short, slit-like tube, not at the margin of the chamber but in the apertural face. Here may be included also such forms as *Heterostoma* Fornasini, which have a very elongate, asymmetrical slit, *aperturalis* Cushman, where the adult has the extremely long aperture divided medially, *catenata* Cushman, where the adult opening becomes subterminal and rounded, in fact, all Textularians whose aperture has risen above the contact of the two last whorls and is entirely surrounded by a raised lip. Practically all species are subquadrate in section, instead of suboval or subrhomboid shaped, as in true *Textularia*, and nearly all are much smaller in size."

The type-species is small, with a rectangular transverse section. FINLAY figures the coarse scattered pores in the walls distinctly (pl. 68 fig. 2b), but does not mention that in the megalospheric form the test begins with three chambers and not with two, following the proloculus.

In this way the species gets all the characteristics typical of *Karreriella*, as described by me in 1951 (Siboga p. 21–25) in the form of *K. bradyii* Cushman, with the type-species *K. siphonella* (Reuss). I showed that here too the test begins not with 5, but with 3 chambers in both generations, and that the test wall shows distinct pores. Just the type-species of *Karreriella* shows a long series of biserial chambers following the short triserial one. The same can be said about *Textularia catenata* Cushman from the West Indies, taken by me as the type-species of *Valvotextularia*. This species from the West Indies (in Siboga 1951, p. 30, I said: "The genotype is *Valvotextularia catenata* (Cushman) from the West-Indian area") is not *V. catenata* as found in the Pacific. It was identified by PHLEGER & PARKER, 1951, p. 4, pl. 1 fig. 22, with *Siphotextularia affinis* (Fornasini); see also ANDERSEN, 1961, p. 24, pl. 2 fig. 5 (Fig. 47). Here, as in *Siphotextularia wauroana* Finlay (Fig. 48), the first triserial part is very short, in the megalospheric generation consisting of one whorl, in the microspheric form of two whorls, as I described it in 1956, p. 32–34, pl. 2 fig. 1–12), so that the only difference between *Valvotextularia* Hofker and *Siphotextularia* Finlay is found in the quadrangular transverse section of the latter. But FINLAY mentions *catenata* as belonging to *Siphotextularia*, and the study of specimens of *S. wairoana* Finlay, kindly sent to me by HORNIBROOK, leaves no doubt as to the close affinity of the two species, though *S. catenata* does not have the quandrangular transverse section.

However, the species described by me in 1951 as *Valvotextularia*, *V. milleti* (Cushman) and *V. stricta* (= *V. vertebralis*) (Cushman) remain. Later, I described it as a *Valvotextularia foliacea* (Heron-Allen & Earland), 1968, p. 16, pl. 2 fig. 7–14. These species do not show the areal aperture with neck, but they all show the triserial beginning of the tests. NÖRVANG (1966) once again analysed *Textularia* *stricta* Cushman, together with a species very close to *Textularia foliacea* Heron-Allen & Earland, viz. *Textularia agglutinans* d'Orbigny (= *T. candeiana* d'Orbigny), described by me also as a *Valvotextularia* with pores in the walls (1951, p. 34–35; the pores of this species had already been observed by MÖBIUS in 1880 (p. 93–94, pl. 9 fig. 1–8); MÖBIUS nor I found the triserial beginning of the tests of *T. agglutinans*, but NÖRVANG found this structure in the microspheric form; the first of three chambers following the proloculus was mentioned by NÖRVANG as the "adventitious chamber", a not so well-chosen name. This chamber is not adventitious, but a relict, reminding us of the group to which the species in question actually belongs (*Karreriella*).

Obviously, the group with pores in the walls and with three chambers in the initial part, having an areal aperture with more or less protruding neck belongs to the genus *Karreriella* as well, and consequently *Siphotextularia* (with type-species *S. wairoana* Finlay and with angular transverse section) as well as *Valvotextularia* (with *V. catenata* (Cushman) and rounded margin) are synonyms of *Karreriella* Cushman. But the other species with triserial initial arrangement and pores in the walls, but with a sutural aperture without a lip are descendants of another genus. For these species NÖRVANG proposed the genus *Textilina* with type-species *Textularia stricta* Cushman. To this genus belong the type-species, *Textularia foliacea* Heron-Allen & Earland, *Textularia milleti* Cushman, *Textularia agglutinans* d'Orbigny, *Textularia rugulosa* Cushman.

NÖRVANG believed that *Textularia conica* d'Orbigny belonged to that genus also; but a close study showed that the fine pores he believed to see are not pores and the species does not show any trace of a triserial initial part. It is very probable that the genus *Dorothia* Plummer, type-species *Dorothia bulletta* Plummer, is the original of this group of *Textularia*-resembling species. In *Dorothia* the genotype has pores in the walls, the initial part is more or less triserial in arrangement, and the aperture is a sutural slit. Many of its species show the triserial part only feebly developed and most of the test is in biserial arrangement of the chambers.

The affinities between the genera involved are:

Karreriella (*Valvotextularia*)
↗
Dorothia (*Textilina*) *Karreriella* (*Siphotextularia*)
↖ ↗
Karreriella
↗
Dorothia

Type-species of genus *Dorothia*: *Dorothia bulletta* Plummer; *Dorothia* (*Textilina*): *Textilina stricta* (Cushman); *Karreriella: Gaudryina siphonella* Reuss.

Type-species of subgenus *Karreriella* (*Siphotextularia*): *Siphotextularia wairoana*, Finlay; *Karreriella* (*Valvotextularia*): *Textularia catenata* Cushman.

Characteristics of the genera and subgenera (all have pores in the walls):
Dorothia: Tests beginning with several coils more or less triserially arranged, apertures slit-like, sutural.
Dorothia (*Textilina*): Test beginning with one triserial whorl, aperture sutural.
Karreriella: Test beginning with more than one coil of triserial chambers, aperture rounded or slit-like, areal, provided with surrounded lip.
Karreriella (*Siphotextularia*): Test beginning with one coil of triserial chambers, transverse section of test quadrangular, aperture a rounded areal opening surrounded by lip.
Karreriella (*Valvotextularia*): Test beginning with one triserial coil, margin of test rounded, aperture a rounded opening provided with surrounding lip.

There is a group of textularine species which begin with a more or less triserial coil, but lack the pores, and with sutural aperture without lip; for these species, obviously derived from *Eggerella*, Höglund created the genus *Morulaeplecta* Höglund, type-species *Morulaeplecta bulbosa* Höglund; to this group seem to belong *Textularia tenuissima* Earland, *Textularia contorta* Höglund, *Textularia bigenerinoides* Lacroix, *Textularia cochleata* Lacroix. Comparison with the test structures of *Eggerella scabra* (Williamson) and *E. arctica* Höglund leaves little doubt as to the affinity of *Eggerella* to *Morulaeplecta*. This would mean that in reality such forms without pores in the walls have to be called *Eggerella* (*Morulaeplecta*).

NÖRVANG believed that the name *Textularia* has to be reserved for those species which begin with a planospiral set of chambers with its axis arranged perpendicularly to the length of the later biserial test. This group, with the type-species *Textularia sagittula* Defrance as defined by LACROIX, 1929, 1933, shows a lozenge-shaped transverse section. These forms were known formerly as *Spiroplectammina* also. HÖGLUND (1947, p. 163 ff.) showed that the type-species of the latter genus is *Spiroplectammina biformis* (Parker & Jones); whether this type-species also belongs to *Textularia* s.s. as defined by NÖRVANG is not yet settled. But *S. biformis* does not have the lozenge-shaped transverse section.

Possibly *Textularia*-like species with a biserial set of chambers directly following the proloculus are forms which reduced the spiral up to the proloculus only; in that case it should be observed whether or not the transverse section is lozenge-shaped. Such forms should belong to *Textularia*. Obviously forms without pores in the walls and with biserial chambers only, having not a lozenge-shaped transverse section, belong to quite different groups of forms.

However, in 1930 (p. 365–378, pl. 12 fig. 1–3) I identified the species *sagittula* Defrance, known from the Mediterranean, as *Spiroplectammina*. LACROIX (1929, 1932, 1933) believed that this species was the one, named by DEFRANCE (1824) as *Textularia sagittula* and described from the Pliocene of Castel' Arquato and Siena, Italy. Later, HÖGLUND (1947, p. 167–171) took to the side of LACROIX, and from that time on *Spiroplectammina sagittula* from the Mediterranean and the coasts of Europe was considered to be the type-species of *Textularia*, as mentioned above. LOEBLICH & TAPPAN (1964, p. 253) showed that the species described by DEFRANCE from the Pliocene could not be the same species living now in the Mediterranean; they showed that the species, described by DEFRANCE was a species biserial from the beginning, without an initial spiral and with an oval transverse section. This means that just those species which are known as *Textularia* are biserial throughout and that the species with a spirally arranged initial part have to be called *Spiroplectammina*, not with the type-species *T. sagittula* Defrance, but with the type-species *Textularia biformis* Parker & Jones, 1865.

Textularia sagittula Defrance is a large species, length up to 3 mm. Yet, NÖRVANG once again described the small living species from the Mediterranean as *Textularia sagittula* Defrance (p. 11, pl. 1 fig. 9–23, pl. 2 fig. 12), and gave a reproduction from the work by DEFRANCE, on pl. 1 fig. 10. No spiral initial part is figured by DEFRANCE in his quite accurate drawings. In the Pliocene of Castel'Arquato several large specimens of *Textularia*-like species are found, each of which may be the species described by SOLDANI and DEFRANCE. One of them is an elongate *Textulariella* with secondary septa.

So there is a group of species with sutural apertures beginning with a planospiral, with a lozenge-shaped transverse section, the type-species of which may be *Textularia sagittula* Hofker or Lacroix. To this group belong many fossil species, all with the lozenge-shaped transverse section, hitherto grouped in the genus *Spiroplectammina*, but belonging to a genus differing from that with the type-species *Spiroplectammina biformis* Parker & Jones, this latter not having the lozenge-shaped transverse section. I propose for such forms the genus *Spirorutilus* with the type-species *Textularia carinata* d'Orbigny, 1846, a common species of the Oliocene-Miocene, as described exhaustively by TEN DAM, 1942 (p. 42, fig. 2, pl. 2–3). To this genus also belongs *Textularia sagittula* (not Defrance) from the Recent, as described by HOFKER, 1930 (p. 365–278, pl. 12 fig. 1–3), LACROIX, 1929 (p. 1–12, fig. 1–12), HÖGLUND, 1947 (p. 167–171, fig. 143–146, pl. 12 fig. 3–4) and wrongly described as *Textularia sagittula* Defrance which species does not have a spirally built initial part (as detected by LOEBLICH & TAPPAN, 1964, p. 253, fig. 165, 1–2), the type-species of *Textularia*. The recent species can be maintained as *Spirorutilis sagittula* Brady, 1884 (not Defrance).

Valvotextularia agglutinans (d'Orbigny) Fig. 49

Textularia agglutinans D'ORBIGNY, 1839, Cuba, p. 136, pl. 1 fig. 17–18, 32, 34; GOËS, 1896, p. 41; FLINT, 1897, p. 284, pl. 29 fig. 4; CUSHMAN, 1922, pl. 1 fig. 6;

1922, p. 7, pl. 1 fig. 6; MÖBIUS, 1880, p. 93, pl. 9 fig. 1–8; NÖRVANG, 1966, p. 8, pl. 1 fig. 2–4, pl. 2 fig. 3–5, 13.

Textularia candeiana D'ORBIGNY, Cuba, p. 143, pl. 1 fig. 25–27; CUSHMAN, 1922, p. 23, pl. 2 fig. 2; CUSHMAN, 1922, p. 8, pl. 1 fig. 1–3; ANDERSEN, 1961, p. 22, pl. 2 fig. 3.

Valvotextularia candeiana (d'Orbigny), HOFKER, 1956, p. 34–35, pl. 2 fig. 13–30; 1964, p. 72, fig. 193–196; 1971, p. 12.

The study of specimens of both "species" in oil and on sections revealed that they show the same agglutination with pores in the tests (*Valvotextularia*), already fully described by MÖBIUS in 1880 for *T. agglutinans*, the same compressed part in the beginning of the test, the same more inflated chambers later, the same irregular "coarse" agglutination but finished smoothly on the surface, the same aperture, slit-like in a hollow part of the apertural face, and the same colour (greyish). Differences between the two "species" are: *agglutinans* has a more or less club-like test, with chambers often only slightly increasing in width (though there are specimens which taper distinctly); the proloculus is large, with diameters about 50 μ; *candeiana* has a distinctly tapering test, with small chambers in the beginning and much inflated chambers in the apertural end, whereas in undemolished specimens the proloculus is small with diameters about 20–25 μ. Obviously *candieana* is the microspheric form of *agglutinans*, as has already been suggested by NÖRVANG, 1966.

Both forms were found in the same areas by D'ORBIGNY and by CUSHMAN, and were found by me in the sample off St. Croix, depth 220 m. BERMÚDEZ found them off La Habana, at 2–5 fathoms, from where he sent me specimens indentified by him as *T. agglutinans* and *T. candeiana*, and in other localities from the north coast of Cuba (1935, p. 151). In the deeper sample off St. Croix (800 m) they did not occur. The depths in which both species were found by CUSHMAN differs from 20 to 382 fathoms. They were not found in the tidal zone. As D'ORBIGNY mentioned in 1839 *agglutinans* first, the species has to be named *Valvotextularia agglutinans* (d'Orbigny).

Found in samples from the Cayman Islands (Table 1), Thatch Island, Guadeloupe (Gozier), Bonaire (Table 9) and Curaçao (Table 10).

Valvotextularia calva (Lalicker) Fig. 50

Textularia calva LALICKER, 1935, p. 287, pl. 9 fig. 17; ANDERSEN, 1961, p. 25, pl. 1 fig. 3; SEIGLIE, 1974, p. 33.

In dry state the species does not look at all like a *Textularia*, as the agglutination, often with projecting sponge-spicules and large sand grains is very dense and conceals the real form, so that one looks at it as a mere conglomeration of sandgrains and other material.

Two forms were found, one of short triangular shape with a large proloculus, the other more elongate and becoming broader at its apertural end, with a small proloculus, followed by a "relic chamber" as in typical *Valvotextularia* (diameter of proloculus 20 μ). The form with larger proloculus (diameter 50–150 μ) does not show the relic chamber following the proloculus but the proloculus is directly followed by the biserially arranged chambers.

The sutures between the relatively low chambers are slightly oblique and indistinct, due to the strong agglutination. As each chamber has a large grain or a sponge-spicule basally at the margin, the margin becomes denticulated.

The apertural face is elliptically rounded with an indentation in the suture of the last formed chamber in which the small and narrow aperture is found. On sections the walls of the chambers are formed by one single layer of irregular sand grains and spiculae, between which coarse pores can be detected.

Length of the B-form 0.80 mm, larger breadth 0.60 mm; thickness 0.40 mm. Length of megalospheric individuals about 0.60 mm, breadth also 0.60 mm.

Found by LALICKER off Puerto Rico; by ANDERSEN in a deepwater mudlump off the Mississippi delta; in a sample W. of St. Croix, at 240 m depth.

Dorothia curta (Cushman) Fig. 51

Gaudryina curta CUSHMAN, 1922, p. 71, pl. 14 fig. 1–4.
Dorothia curta (Cushman), 1937, p. 95, pl. 10 fig. 25.

An analysis of the lengths of the tests showed that this species consists of three forms or generations, the commonest one with large proloculi with a diameter of about 180 μ, a second one with proloculi with diameters of about 30 μ and a third one which is rather rare, with proloculus diameter about 7 μ. The first mentioned generation, the A_2-generation, has small tests with a length ranging from 1–2 mm, with an average of 1½ mm; these tests are nearly globular, consisting of an initial part forming 1/4 of the test with mostly 3 chambers in a coil, followed by 3 or 4 chambers arranged biserially. The sutures are distinct. The aperture is round, covered under the inflated front part of the last formed chamber.

The second mentioned generation has larger tests (± 2½ mm), length : breadth = 3:2. The proloculus is followed by one or two coils of 5 chambers, followed by a set of three chambers and ending the test with one or two coils of two chambers each. Chambers distinct, inflated, sutures distinct in the biserial part; aperture as in first-mentioned generation. This is the A_1-generation. The B-form occurred in the material in only three specimens. Here the tests are much more elongate, triangular in shape, tapering towards the apertural end and with a pointed apical end. At the latter end the chambers form three or four coils of five chambers, followed by several coils with four and three chambers, whereas in the end two or three chambers in a whorl are found. Here too the chambers are more or less globular with distinct sutures in between. The form of this B-generation resembles that of *Verneuilina affixa* Cushman (*Eggerella*).

The colour of the tests in all three forms is deep reddish brown, covered with a greyish shine, as the outer sand grains are not surrounded by the brown cement and protrude at irregular places from the surface. The sand grains are rather large, so that mostly the walls are formed by a single layer of them; between the grains fine pores are visible in the test walls, as is typical for *Dorothia*.

Common in the sample W. of St. Croix, 800 m.

Dorothia scabra (Brady) Fig. 52

Gaudryina scabra BRADY, 1884, p. 381, pl. 46 fig. 7; CUSHMAN, 1922, p. 68, pl. 11 fig. 6–7.
Dorothia scabra (Brady), CUSHMAN, 1937, p. 98, pl. 11 fig. 3–4.

Test oval to elongate, wider near the apertural end, round in transverse section, apical end rounded in the megalospheric forms, more pointed in the microspheric generation. Especially in the microspheric generation the first whorl has five chambers, later three; in specimens with large proloculus the first spiral may be reduced to three chambers. Chambers distinct, sutures depressed, nearly horizontal, partly overlapping the former chambers. Wall coarsely arenaceous, with smaller and larger sand grains and short parts of sponge-spicules. Aperture a low arched slit at the inner margin of the last formed chamber, in some individuals closed by a starry chalk concretion which is whitish. Colour yellowish brown with some dark grains in between. Length from 0.75 mm to 3 mm.

Its length distinguishes this species from the much smaller *Eggerella scabra* (Williamson), which has very thin walls with fine agglutination.

Sections show that the specimens with blunt apical ends have a proloculus of about 150 μ inner diameter, whereas the proloculus of the large and pointed specimens has an inner diameter of about 16 μ. The test-walls consist of about two layers of grains, many of which are arranged perpendicularly to the surface, as they surround the fine pores in the walls. This structure is typical for the genus *Dorothea*, the type-species of which, *D. bulletta* Plummer, shows these pores in the walls (see also HOFKER, 1964, fig. 3b).

Found by CUSHMAN in samples from the Çaribbean only; abundant in the sample W. of St. Croix, at 800 m.

LAGENIDAE

As already mentioned in my paper of 1969, Lagenidae are extremly rare in the tidal zone of the Antilles, whereas they were much commoner in the samples off Barbados, taken at depths of 100 and 200 m. In the samples off St. Croix, depth about 300 m and 800 m, and especially in the latter, they are extremely common and form large part of the foraminiferal fauna. It is obvious that Lagenidae are typical of deeper water, at least in the tropical Atlantic.

Moreover, many of the species found off Barbados, are not found anymore in the samples off St. Croix, whereas other species are common there. This will be obvious from the following List.

Off Barbados depth 100–200 m	Off St. Croix depth 300 m	depth 800 m
Lingulina carinata	—	—
—	—	*Lingulina seminuda*
Nodosaria flintii	*Nodosaria flintii*	—
—	—	*Nodosaria subsoluta*
—	—	*Nodosaria proxima*
—	*Nodosaria albatrossi*	—
—	*Nodosaria obliqua*	*Nodosaria obliqua*
—	*Nodosaria pyrula*	*Nodosaria pyrula*
—	—	*Nodosaria subsoluta*
Dentalina cf. *filiformis*	—	—
—	—	*Dentalina bradyensis*
—	*Dentalina communis*	*Dentalina communis*
Vaginulina filiformis	—	—
Vaginulina bermudensis	—	—
Vaginulina americana	—	—
Vaginulina advena	—	—
—	—	*Vaginulina spinigera*
Marginulina costata	—	—
Marginulina bachei	—	—
—	—	*Vaginulina mexicana*
—	—	*Vaginulina insolutus*
Lenticulina submamilligera	—	—
Lenticulina vortex	—	—
Lenticulina atlantica	—	—
Lenticulina antillea	—	—
Lenticulina calcar	*Lenticulina calcar*	*Lenticulina calcar*
Lenticulina iota	—	*Lenticulina iota*
Lenticulina echinata	—	*Lenticulina echinata*
—	—	*Lenticulina subaculaeata*
—	*Lenticulina peregrina*	*Lenticulina peregrina*
—	—	*Lenticulina novangliae*
Saracenaria acutauricularis	—	—
Saracenaria italica	*Saracenaria italica*	*Saracenaria italica*
—	—	*Saracenaria latifrons*

Off Barbados depth 100–200 m	Off St. Croix depth 300 m	depth 800 m
—	—	*Saracenaria caribbeana*
—	*Astacolus crepidulus*	—
Amphicoryna intercellularis	*Amphicoryna intercellularis*	—
Frondicularia sagittula	*Frondicularia sagittula*	*Frondicularia sagittula*
—	—	*Frondicularia robusta*
—	*Frondicularia* spec.	—
—	*Frondicularia compressa*	*Frondicularia compressa*
Pseudonosaria comatula	—	—
—	—	*Lagena elongata*
—	—	*Oolina globosa*
—	—	*Fissurina* spec.
—	*Paradentalina caribbeana*	—
—	—	*Sporadogenerina proteiformis*
—	—	*Ramulina globulifera*
21 species	14 species	28 species

Lingulina seminuda Hantken Fig. 93

Lingula costata d'Orbigny var. *seminuda* HANTKEN, 1875, p. 41, pl. 4 fig. 8.
Lingulina carinata d'Orbigny var. *seminuda* BRADY, 1884, p. 518, pl. 65 fig. 14–15; FLINT, 1897, p. 312, pl. 48 fig. 4.
Lingulina seminuda (Hantken) CUSHMAN, 1923, p. 95, pl. 17 fig. 8–9, 11; pl. 18 fig. 1–2; BUCHNER, 1942, p. 141 fig. 18.

Compared with *Lingulina carinata*, described by me from Barbados, this species from deeper water is more triangular as the chambers gain size more rapidly and are more inflated, as also stated by BUCHNER, 1942. Moreover, at both sides from the carina at the periphery there are distinct longitudinal striae.

Common in the sample off St. Croix, 800 m.

Lenticulina calcar (Linnaeus) Fig. 55

Nautilus calcar LINNAEUS, 1767, p. 1162, no. 272.
Cristellaria calcar (Linnaeus) BRADY, 1884, p. 55, pl. 70 fig. 9–12; FLINT, 1897, p. 318, pl. 63 fig. 1; CUSHMAN, 1923, p. 115, pl. 30 fig. 7, pl. 31 fig. 4–5.
Robulus calcar (Linnaeus), ANDERSEN, 1961, p. 48, pl. 11 fig. 1.
Lenticulina calcar (Linnaeus), BARKER, 1960, p. 146, pl. 70 fig. 9–12; HOFKER, 1969, p. 52, fig. 124.

Though the apertural opening in the middle of the apertural face is larger than the other openings and the species might thus be placed in the genus *Robulus*, I now believe that LOEBLICH & TAPPAN are right to place these species from the Tertiary and the Recent in the synonymy of *Lenticulina*. Sections reveal that there exists a "Mündungskappen" as JOHANNSEN (1952, p. 183, pl. 13 fig. 17b) called this structure. The spines which are so typical for this species, are hollow and show the fine pores of the normal walls in their basal walls.

Not common in the Barbados-samples, but common in the samples off St. Croix, 300 and 800 m.

Lenticulina echinata (d'Orbigny) Fig. 56

Robulina echinata D'ORBIGNY, 1846, p. 100, pl. 4 fig. 21–22.
Cristellaria echinata (d'Orbigny), CARPENTER, PARKER & JONES, 1862, pl. 12 fig. 3; BRADY, 1884, p. 554, pl. 71 fig. 1–3; FLINT, 1897, p. 318, pl. 66 fig. 2; CUSHMAN, 1923, p. 73, pl. 34 fig. 5.
Lenticulina echinata (d'Orbigny), HOFKER, 1969, p. 53, fig. 145.

Though the specimen described and figured by the author in 1969 did not have the typical spines at the margin, it may belong to this species. In deeper water these spines are distinct and for the rest the shape and ornamentation of the testwall by numerous knobs, in the last formed chambers mostly along the sutures, are the same. There are specimens with the larger slit at the aperture in the apertural face, but this slit may also be absent, as in the specimen figured here.

Relatively rare in the sample off St. Croix, 800 m.

Lenticulina subaculeata Cushman Fig. 57

Cristellaria aculeata Brady (not d'Orbigny), BRADY, 1884, p. 555, pl. 71 fig. 4–5.
Cristellaria subaculeata CUSHMAN, 1923, p. 123, pl. 34 fig. 2.
Cristellaria subaculeata CUSHMAN, var. *glabrata* CUSHMAN, 1923, p. 124, pl. 32 fig. 4, pl. 33 fig. 2–3, pl. 34 fig. 3.

Small tests, often with large proloculus, are longer than broad and thus have the general form of *Astacolus*. More outgrown forms, often with smaller proloculus, and the microspheric adult specimens, show the last formed chambers uncoiled and thus belong to that form, distinguished by CUSHMAN as var. *glabrata*. There are clones which have at the slightly keeled periphery some spines, but those found in the sample studied lacked these spines. The slightly arcuate sutures are, at least in the older chambers, provided with beads which may also occur on the chamberwalls. The number of chambers in the megalospheric forms is relatively low, but in the microspheric form there are many initial chambers. In the unrolled specimens the last formed chambers may be smooth, with distinctly depressed sutures and chambers inflated especially at the inner side.

Common in the sample off St. Croix, 800 m. CUSHMAN mentions the species from the Gulf of Mexico.

Lenticulina peregrina (Schwager) Fig. 58

Cristellaria peregrina SCHWAGER, 1866, p. 245, pl. 7 fig. 89.
Cristellaria variabilis BRADY (not Reuss), 1884, p. 541, pl. 68 fig. 11–16; FLINT, 1897, p. 316, pl. 63 fig. 1; CUSHMAN, 1923, p. 113, pl. 30 fig. 3–4; HOFKER, 1932, p. 116, fig. 30c–d.
Lenticulina peregrina (Schwager), PHLEGER & PARKER, 1951, p. 9, pl. 4 fig. 20; ANDERSEN, 1961, p. 46, pl. 10 fig. 7; HOFKER, 1960, p. 243, fig. 71.

This extremely thin-walled species shows very few chambers in the coiled part (about 3 visible); in most specimens an uncoiled part is added, with 1–3 chambers. The test thus becomes elongate, is somewhat compressed, slightly keeled in the coiled part, but with rounded dorsal periphery in the uncoiled one. In the Mediterranean the specimens do not have the uncoiled part, whereas the coiled part consists of many more chambers than found in the Caribbean. The aperture is radial, without a definite "Mundkappen".

Not uncommon in sample off St. Croix, 800 m.

Lenticulina novanglia (Cushman) Fig. 59

Cristellaria occidentalis Cushman, var. *novangliae* CUSHMAN, 1923, p. 104, pl. 23 fig. 1, pl. 24 fig. 1.

"Variety differing from the typical in the larger size of the test, the broad keel extending nearly the whole circumference of the test, showing lines of growth from each chamber, chambers about 8 in the last-formed coil. Diameter up to 5 mm."

A large number of specimens could be studied. They all have the general characteristics of CUSHMAN's "variety". Only smaller specimens have been figured here. Typical is the form of the last formed chamber with its protruding apertural part which is formed by a kind of chamberlet ("Mundkappen"), with a larger slit at the apertural face (*Robulus*-characteristic); the apertural chamber has a large opening towards the main chamber-lumen. There were in the sample studied three groups of specimens:

GROUP I, with scarcely developed carina, and no tendency of the last-formed chambers to uncoil (Fig. 59):

diameters in mm	1.5	2	2.5	3	3.5	4	4.5	5	5.5
numbers of specimens	3	2	5	4	8	5	14	24	10

GROUP II, with highly developed carina, showing no tendency to uncoil in the last-formed chamber (Fig. 59):

diameters in mm	1.5	2	2.5	3	3.5	4	4.5	5	5.5
numbers of specimens	—	2	1	4	3	1	—	—	—

GROUP III, with well-developed carina, showing tendency to uncoil in the last-formed chamber (Fig. 59, b, g):

diameters in mm	1.5	2	2.5	3	3.5	4	4.5	5	5.5
numbers of specimens	1	2	2	8	10	4	—	—	—

Group I had very large proloculi, measuring from 463–500 μ in diameter; group II showed proloculi of medium size, diameter 150–190 μ; group III showed very small proloculi, diameter 37–62 μ (see Fig. 59d–f). It is obvious that we have here a good example of trimorphism, and it is possible that the forms mentioned by CUSHMAN of *Cristellaria occidentalis* Cushman – typical form, var. *glabrata* and var. *novangliae* – cover these three generations.

The tests are shining, smooth, and typical is the carina when present, with the growth-lines.

Abundant in the sample off St. Croix, 800 m.

Lenticulina iota (Cushman) Fig. 60

Cristellaria cultrata BRADY (not Montfort), 1884, p. 559, pl. 70 fig. 4–6.
Cristellaria iota CUSHMAN, 1923, pl. 111, pl. 29 fig. 2, pl. 30 fig. 1.
Robulus iotus (Cushman), ANDERSEN, 1961, p. 51, pl. 13 fig. 4.
Lenticulina iota (Cushman), HOFKER, 1969, p. 53 fig. 144.

In 1969 I described and figured the obviously megalospheric form of this always rare species; here is given a microspheric specimen, which shows many more chambers in the last-formed whorl. Characteristic is the highly developed carina with its crenulate border; whether ANDERSEN's specimen belongs here, is not certain, for its characteristics are more like those of *L. novangliae*.

Found rarely in the sample off St. Croix, 800 m.

Lenticulina crepidula (Fichtel & Moll) Fig. 73

Nautilus crepidulus FICHTEL & MOLL, 1798, p. 107, pl. 19 fig. g–i.
Cristellaria crepidula (Fichtel & Moll), D'ORBIGNY, 1839, p. 64, pl. 8 fig. 17–18; FLINT, 1897, p. 316, pl. 63 fig. 2; CUSHMAN, 1923, p. 117, pl. 35 fig. 3–4.

Test elongate, compressed, later chambers somewhat uncoiled, apertural side rounded, sutures arcuate, smooth; at the other side the test is nearly straight. The aperture is radiate without larger opening at the apertural face. This species belongs without doubt to the group "*Astacolus*".

Rare in the sample off St. Croix, 300 m. The specimen is rare also in most samples mentioned by CUSHMAN, 1923, p. 118.

Marginulina D'ORBIGNY AND Vaginulina D'ORBIGNY

In 1969 I postulated (p. 45) that the genera *Marginulinopsis* and *Vaginuliopsis* cannot have a systematic status since they form the generations with small proloculi and consequently stronger coiled initial parts of *Marginulina* and *Vaginulina*. In the present paper this is shown with little doubt for the species *Vaginulina spinigera*.

But is there a difference between *Marginulina* and *Vaginulina*? We will try to tackle this question analysing the latest definitions of the two genera, in the treatise by LOEBLICH & TAPPAN (1964). On p. 520 the description for *Marginulina* runs: "Early portion slightly coiled but not completely enrolled, as in *Marginulinopsis*, later rectilinear; sutures oblique, especially in early portion; aperture at dorsal angle, somewhat produced". On p. 524 *Vaginulina* is described: "Test straight to arcuate as in *Dentalina*, but compressed or ovate in section; aperture at dorsal angle, radiate". So we observe that first of all in *Vaginulina* there is no enrolled portion; this characteristic without any doubt is strongly dependent on the size of the proloculus: in the case that this proloculus is large, there is no coiling initial part. Moreover there is the characteristic of the transverse section. If that section is round, the species obviously has to belong to *Marginulina*; if the section is "compressed or ovate" the species belongs to *Vaginulina*. Is this difference a valuable characteristic? For instance in the genus *Pyrgo* there are species which are round in transverse section, whereas other species are strongly compressed; here the two forms are found together in one genus, *Pyrgo*. In 1969 I emphasized this characteristic, but is it justified? The type-species of *Marginula*, *M. raphanus* Linnaeus, has, in most cases, a slightly compressed test, ovate in section; another example of *Marginulina*, mentioned by LOEBLICH & TAPPAN (p. 520) is *M. glabra* d'Orbigny, but this species has an ovate transverse section in many of its specimens also. The genotype of *Vaginulina*, *V. legumen* d'Orbigny, is distinctly compressed, but in so-called *Vaginulinopsis* the same species from Rimini shows the coiled part in specimens belonging to the A_1- and B-generations. There are specimens of *Vaginulina bermudensis* Cushman which in the transverse sections are nearly circular (HOFKER, 1969, p. 50, fig. 138). So there are transitions between *Marginulina* and *Vaginulina*, whereas the lack of initial coiling is no argument for *Vaginnlina* ("as in *Dentalina*"). The same can be said for *Vaginulina filiformis* HOFKER (1969, p. 50, fig. 139). The genus-name *Marginulina* is better not to be dropped, for in the 1826-publication by D'ORBIGNY, *Marginulina* is found on p. 258 and *Vaginulina* on p. 257. In the present paper I will retain the two names, but the doubt remains. *Vaginulinopsis* and *Marginulinopsis* have to be suppressed.

Vaginulina mexicana (Andersen) Fig. 61

Saracenaria mexicana ANDERSEN, 1961, p. 60, pl. 14 fig. 1.

Test elongate, compressed, transverse section ovate. Dorsal side with rounded margin, ventral side slightly lobulate in the later chambers. Sutures slightly, if at all, depressed, strongly oblique. Proloculus in all specimens observed ovate. Aperture at the dorsal side, radiate. Test-wall smooth, thin, glassy. The tests are small.

Abundant in sample off St. Croix, 800 m.

Vaginulina insolitus (Schwager) Fig. 62

Cristellaria insolita SCHWAGER, 1866, p. 242, pl. 6 fig. 85.
Cristellaria schloenbachi Reuss?, CUSHMAN, 1923, p. 118, pl. 35 fig. 8–9.
Cristellaria crepidula (Fichtel & Moll), BRADY, 1884, p. 542, pl. 67 fig. 17 (only).
Astacolus insolitus (Schwager), BARKER, 1960, p. 142, pl. 67 fig. 17.

Small, thin-walled specimens with straight to slightly curved dorsal sides; this side in some specimens slightly sub-acute. Initial part slightly enrolled, proloculus mostly ovate, dorsal side smooth, ventral side mostly slightly lobulate. Sutures radiate, at the dorsal side. Test wall smooth, thin, shining.

The curved dorsal side in some of the specimens points to the genus *Astacolus* but the often nearly uncoiled initial part more to *Vaginulina*, since the transverse sections are distinctly ovate to compressed. In this species we have a transitory form between *Vaginulina* and *Astacolus*. The tests are small.

Common in the sample off St. Croix, 800 m.

Vaginulina spinigera Brady Fig. 63

Vaginulina spinigera BRADY, 1881, p. 63; 1884, p. 531, pl. 67 fig. 13–14; FLINT, 1897, p. 314, pl. 60 fig. 3; CUSHMAN, 1923, p. 138, pl. 37 fig. 6–8; pl. 38 fig. 1.
Vaginulina legumen (Linnaeus) var. *arquata*, BRADY, 1884, p. 530, pl. 114 fig. 13.

Test stout, always strongly compressed, always with curved dorsal side, whereas the ventral side is slightly lobulated in the later chambers. Sutures slightly curved, in the later chambers distinctly oblique, with in the middle a more or less distinct thickening. At the initial end one to three spines; this number differs in the generations. In the microspheric generation with a distinctly coiled initial part the number is three or two; in the megalospheric specimens with relatively small proloculus this number is two; in the megalospheric specimens with a very large proloculus this number is one (this is the generation which has been figured by CUSHMAN on pl. 38 fig. 1, as an old-age specimen, and by BRADY as var. *arquata* of *V. legumen*) This species distinctly shows that there is not a true genus *Vaginulinopsis*, for in that case the microspheric form of this species should belong to this genus.

Many specimens in the sample off St. Croix, 800 m.

Saracenaria latifrons (Brady) Fig. 64

Cristellaria latifrons BRADY, 1884, p. 544, pl. 113 fig. 19.
Saracenaria latifrons (Brady), BARKER, 1960, p. 234, pl. 113 fig. 19.

Test small, consisting of a curved row of chambers triangular in transverse section, with an elongate apertural face and an acute dorsal margin. The test is smoothly walled, and the aperture near to the dorsal side has a distinct "Mundkappen" and a distinct elongate opening in the apertural face. This latter characteristic is usual is *Saracenaria.*

Many specimens in sample W. of St. Croix, depth 800 m.

Saracenaria italica Defrance Fig. 66

Saracenaria italica DEFRANCE, 1824, p. 127; 1827, p. 332; Atlas Conch., pl. 13 fig. 6.
Cristellaria italica (Defrance), FLINT, 1897, p. 316, pl. 63 fig. 6; BRADY, 1884, p. 544, pl. 68 fig. 18, 20, 23.
Saracenaria italica (Defrance), BARKER, 1960, p. 144, pl. 68 fig. 18, 20, 23; HOFKER, 1969, p. 55, fig. 131–133.

This species was described in 1969 by the author from Barbados. In that paper a microspheric specimen was figured, also in section. Fig. 66 in the present paper shows a megalospheric specimen. The tests are always short and stout, with the last-formed chamber relatively inflated, though the transverse section remains triangular.

Rare in the sample off St. Croix, 300 m.

Saracenaria caribbeana n.sp. Fig. 65

Cristellaria italica (not Defrance), BRADY, pl. 68 fig. 17.

Test much elongated, with many chambers in the adult, triangular in transverse section with rounded angles. Test in the initial part coiled, later straight, with slightly sinuous sutures which are not depressed and are nearly perpendicular to the length of the test. In this way the later chambers are not broader than the more initial ones and in megalospheric specimens the latter part is only slightly coiled. The aperture is radial, provided with a longer slit.

This species seems to be restricted to deeper water of the Caribbean Sea; it was already figured from that area by BRADY, 1884, whereas CUSHMAN (1923, p. 125) mentions that GOËS recorded specimens from the West Indies attaining a length of 8 mm, which seems to be this species. The specimens figured by FLINT from the West Indies (1897, pl. 63 fig. 6) are typical *S. italica.*

Common in the sample off St. Croix, 800 m.

Dentalina bradyensis (Dervieux) Fig. 67

Nodosaria inornata d'Orbigny var. *bradyensis* DERVIEUX, 1893, p. 610.
Nodosaria communis (d'Orbigny), BRADY, 1884, p. 504, pl. 62 fig. 19–20.
Dentalina inornata d'Orbigny var. *bradyensis* (Dervieux), BARKER, 1960, p. 130, pl. 62 fig. 19–20.

Test elongate, small, straight to arcuate dorsal side, lobulated ventral one. Chambers increasing only slightly in size as added; initial end rounded to slightly pointed. Sutures distinctly oblique, radiate aperture at dorsal side. Wall thin, hyaline, glassy.

Common in the sample off St. Croix, 800 m.

Dentalina communis d'Orbigny Fig. 68

Dentalina communis D'ORBIGNY, 1826, p. 254, no. 35.
Nodosaria communis REUSS, 1845, p. 28, pl. 12 fig. 21; BRADY, 1884, p. 504, pl. 62 fig. 21–22; FLINT, 1897, p. 310, pl. 56 fig. 2; CUSHMAN, 1923, p. 75, pl. 12 fig. 4.

Test arcuate towards the dorsal side; sutures distinctly oblique, wall smooth, initial part rounded.

Some specimens in the sample off St. Croix, 300 m.

Dentalina cf. **communis** d'Orbigny — Fig. 69–71

Nodosaria communis d'Orbigny, CUSHMAN, 1923, p. 75, pl. 12 fig. 3.
Enantiodentalina communis (d'Orbigny), ANDERSEN, 1961, p. 80, pl. 17 fig. 1.

Test elongate, with numerous chambers, slightly arcuate towards the dorsal side, ventral side distinctly lobulate, radial aperture at the dorsal side, initial part distinctly with spine. Test thin-walled, smooth, glassy.

Common in the sàmple off St. Croix, depth 300 m.

Nodosaria albatrossi Cushman — Fig. 72, 84

Nodosaria vertebralis (Batsch) var. *albatrossi* CUSHMAN, 1923, p. 87, pl. 15 fig. 1.
Nodosaria albatrossi Cushman, ANDERSEN, 1961, p. 70, pl. 17 fig. 11.

Several stout tests, typified by few stout longitudinal costae and hyaline poreless parts over and beneath the sutures, may also belong to this species (Fig. 84).

Found in the samples off St. Croix, 300 m.

Nodosaria subsoluta Cushman — Fig. 81

Nodosaria subsoluta CUSHMAN, 1923, p. 74, pl. 13 fig. 1.
Nodosaria soluta (not Reuss), BRADY, 1884, p. 503, pl. 62 fig. 13–16; FLINT, 1897, p. 310, pl. 56 fig. 3.
Nodosaria farcimen Fornasini, FLINT, p. 309, pl. 55 fig. 5.

Test elongate, tapering to the apertural end, mostly arcuate, often very stout, but also smaller specimens are found, initial chamber rounded or with short spine. Chambers somewhat pyriform, overlapping. Sutures much depressed. The basal part of most of the chambers with fine striae ending in short spines. Aperture central in the last formed chamber on the produced part, radiate. Small specimens have thin hyaline walls, larger specimens get thicker walls.

Among about 70 specimens some have very small elongate proloculi and the following chambers are also narrow; then the typical chambers start (generation B); a second group shows larger proloculi and has short spines (diameter proloculus 25–55 μ); this form remains relatively small (*N. farcimen* from FLINT); this is the A_1-generation. The third group begins with large rounded proloculi (diameter from 75 to 112 μ), followed by large chambers; this is the robust form (generation A_2). It is not impossible that the A_2-form has proloculi which are formed by the last-formed loosened chamber of an A_1-individual.

Extremely common in the sample off St. Croix, depth 800 m. CUSHMAN (p. 75) mentioned the species from many stations; all from deep water.

Nodosaria proxima Silvestri? Fig. 82

Nodosaria proxima SILVESTRI, 1872, p. 63, pl. 6 fig. 138–147.
Nodosaria proxima Silvestri?, CUSHMAN, 1923, p. 73, pl. 15 fig. 3.

Test consisting of two chambers, with longitudinal costae over the surface.

Maybe some of such tests, found in the sample off St. Croix, 800 m, belong here.

Nodosaria flintii Cushman Fig. 83

Nodosaria flintii CUSHMAN, 1923, p. 85, pl. 14 fig. 1; BARKER, 1960, p. 135, pl. 64 fig. 20–23 (*N. obliqua* Brady, not Linnaeus); HOFKER, 1969, p. 47, fig. 134.

Large, mostly straight tests with length up to 8 mm, slender, in some cases slightly curved, initial end with a stout spine. Only last formed chambers slightly inflated, more initial part without depressed sutures. Surface ornamented with longitudinal costae, increasing in number in the later part. Aperture in the centre of the last formed chamber.

Abundant in sample off St. Croix, depth 300 m. Found in the Barbados material too (HOFKER, 1969).

Nodosaria obliqua (Linnaeus) Fig. 85

Nautilus obliquus LINNAEUS, 1767, p. 1163.
Nodosaria (Dentalina) obliqua (Linnaeus), PARKER & JONES, 1859, p. 482.
Nodosaria obliqua (Linnaeus), CUSHMAN, 1913, p. 59, pl. 25 fig. 5.

Test long and slender, arcuate, sutures of later chambers distinctly depressed. Fine longitudinal costae over the later elongate chambers. Aperture with elongate neck on the last-formed chamber.

Some specimens in sample off St. Croix, 300 m.

Nodosaria pyrula d'Orbigny Fig. 86

Nodosaria pyrula D'ORBIGNY, 1826, p. 253, no. 13; BRADY, 1884, p. 497, pl. 62 fig. 10–12; FLINT, 1897, p. 309, pl. 55 fig. 4; CUSHMAN, 1923, p. 69, pl. 18 fig. 1–4; ANDERSEN, 1961, p. 69, pl. 16 fig. 1.

Test very slender, consisting of several flask-like chambers separated from each other by the necks of the apertures; the sutures are found at the bases of each of the chambers. Walls smooth, without any ornamentation.

Found in both samples off St. Croix, 300 and 800 m.

Amphicorina intercellularis (Brady) Fig. 87

HOFKER, 1969, p. 55, fig. 147–152 (literature).

Some more specimens are figured here, all from off St. Croix, 300 m.

Fissurina lucida (Williamson) Fig. 75

Entosolenia marginata var. *lucida* WILLIAMSON, 1848, p. 17, pl. 2 fig. 17.

A small *Fissurina*, characterised by a blunt and broad apertural part, strongly compressed test and two short spines at the basal part of the test.

Found in the sample off St. Croix, 800 m.

Lagena elongata (Ehrenberg) Fig. 80

Miliola elongata EHRENBERG, 1844, p. 274; 1854, pl. 25 fig. 1.
Lagena elongata (Ehrenberg), BRADY, 1884, p. 457, pl. 56 fig. 29; FLINT, 1897, p. 306, pl. 53 fig. 1; CUSHMAN, 1923, p. 15, pl. 3 fig. 4.

Test elongate, possibly open at both ends, slender, in the main part sides parallel, wall smooth, hyaline, glassy.

Several specimens in the sample off St. Croix, 800 m.

Oolina globosa (Montagu) Fig. 88

Vermiculum globosum MONTAGU, 1803, p. 523.
Lagena globosa (Montagu), BROWN, 1844, p. 144, pl. 56 fig. 37, 40; BRADY, 1884, p. 452, pl. 56 fig. 1–3; FLINT, 1897, p. 306, pl. 53 fig. 4; CUSHMAN, 1923, p. 20, pl. 4 fig. 1–2.
Entosolenia globosa (Montagu), WILLIAMSON, 1848, p. 16, pl. 2 fig. 13–14.
Oolina globosa (Montagu), PARR, 1950, p. 302; BARKER, 1960, p. 114, pl. 56 fig. 1–3.
Lagena globosa (Montagu), var. *bicamerata* TOUTKOVSKY, 1888, p. 13, pl. 2 fig. 1.

Test more or less oviform, with slightly flattened bottom, rounded aperture with entosolenian tube. At the bottom a former opening which is secondarily closed. These tests seem to be produced by other tests by budding, which elucidates the closed opening at the bottom. In some cases this budding gives rise to a temporal forming of two adhering tests, and this leads to TOUTKOVSKY's variety *bicamerata*. Such a phenomenon is figured here.

Found in the sample off St. Croix. 800 m.

Frondicularia spec. Fig. 74

Test elongate, slender, compressed. Chambers relatively low, sutures perpendicular to the axis, slightly curved to straight. Two longitudinal costae on each side, from the proloculus upward but not at he last two chambers. Testwall thin, hyaline, aperture radiate in the centre of the convex endwall of the last formed chamber. Length 0.45 mm; breadth of end-chamber 0.17 mm.

A single specimen was found in the sample off St. Croix, 300 m.

Frondicularia robusta Brady Fig. 76

Frondicularia robusta BRADY, 1884, p. 523, pl. 56 fig. 1–2.

Though BRADY's species is a large test (length 3.6 mm), all features described and figured by BRADY are those found in a small specimen found in the material. The test is elongate with nearly parallel sides, much compressed. The sides are lobulate as the sutures which are slightly curved, are depressed. The test is covered by longitudinal fine costae which are somewhat irregular and cover the sides also, but for its middle part. The last formed chamber is without ornamentation. The aperture is found in the middle of the convex outer wall of the last formed chamber. Length 0.67 mm, breadth 0.15 mm, thickness 0.07 mm.

Found as a single specimen in the sample off St. Croix, 800 m.

Frondicularia compressa (Costa) Fig. 77–78

Frondicularia compressa COSTA, 1856, p. 372, pl. 3 fig. 2; CUSHMAN & TODD, 1945, p. 33, pl. 5 fig. 11; ANDERSEN, 1961, p. 73, pl. 16 fig. 22–23.

Test oval, elongate, very much compressed. Initial part consisting of 3–6 chambers arranged as in *Astacolus*, with the aperture at one side, whereas the other side of the chambers bends towards the proloculus. Later chambers with the aperture in the middle and both sides of the chambers strongly overlapping. Aperture a round, distinct opening at the top of the last-formed chamber. One of the specimens has a spine.

The specimens of Fig. 77 was found in the sample off St. Croix, depth 300 m; the other at 800 m.

Frondicularia sagittula van den Broeck Fig. 79

Frondicularia alata d'Orbigny, var. *sagittula* VAN DEN BROECK, 1876, p. 113, pl. 2 fig. 12, 14.
Frondicularia alata d'Orbigny, var. *lanceolata* VAN DEN BROECK, 1876, p. 117, pl. 2 fig. 13.
Frondicularia alata BRADY (not d'Orbigny), 1884, p. 522, pl. 65 fig. 20–23; FLINT, 1897, p. 313, pl. 59 fig. 1.
Frondicularia sagittula van den Broeck, CUSHMAN, 1923, p. 143, pl. 21 fig. 1–2, pl. 20 fig. 4; HOFKER, 1969, p. 58, fig. 153; CUSHMAN, 1943, p. 25–26, pl. 5, pl. 6 fig. 1–3.

CUSHMAN showed in 1943 that the microspheric not adult specimens have the form *lanceolata* of VAN DEN BROECK. Full-grown microspheric specimens get the broad form with alar points, whereas megalospheric forms all have this form. The author (1969) figured a well-developed specimen of the megalospheric generation from Barbados.

In the present paper several specimens have been figured from off St. Croix, depth 800 m. All forms mentioned by CUSHMAN in 1943 are present. The species has a wide variation and seems to be restricted to the Caribbean region.

POLYMORPHINIDAE

Polymorphinidae are rather rare in the material. The following aberrant forms were found in the sample off St. Croix.

Paradentalina caribbeana n.sp. Fig. 89–90

The test begins with a form which very much has the structure of a biserial *Polymorphina*, at least in the microspheric form (Fig. 89); later several chambers are added in a rectilinear arrangement of the chambers, each chamber overlapping the former one. The aperture of the last formed chamber of the megalospheric specimen is found on a protruding neck, which neck is not so typical in the microspheric specimen. The walls are very thin, smooth and glassy. Length of specimen Fig. 89 0.75 mm, that of specimen Fig. 90 0.9 mm.

Both specimens were found in the sample off St. Croix, 300 m.

Sporadogenerina proteiformis Flint Fig. 91

Ramulina proteiformis FLINT, 1897, p. 321, pl. 68 fig. 7; CUSHMAN, 1923, p. 177.
Sporadogenerina flintii CUSHMAN, 1927, p. 95, pl. 11 fig. 6–7.
Sporadogenerina proteiformis (Flint), LOEBLICH & TAPPAN, 1964, p. 537, fig. 420, 13–14.

Test beginning with a proloculus and some chambers which may be placed somewhat irregularly, except in the specimen figured here, where they are regularly placed as in *Glandulina*. From this initial part several chambers are budding, often in both apertural and apical directions, with more than one opening. The later apertures do not have the radial structure. Testwalls smooth, thin, hyaline.

Several specimens were found off St. Croix, 800 m.

Ramulina globulifera Brady Fig. 92

Ramulina globulifera BRADY, 1879, p. 58, pl. 8 fig. 32–33; 1884, p. 587, pl. 8 fig. 32–33; FLINT, 1897, p. 321, pl. 68 fig. 6; CUSHMAN, 1923, p. 177.

Unbroken tests are not known; possibly the first stage is a *Polymorphina* which lives attached. What is known from the test are several irregular more or less globular chambers connected by narrow stolons, and often provided with very small spines all over the surface, as is known from the fistulose chambers of many Polymorphinidae.

The species was not common in the sample off St. Croix, 800 m.

MILIOLIDAE

In the 1964 paper on Caribbean Foraminifera it was pointed out that one group of species has each chamber completely surrounded by its own wall; most of them are fossil species (*Miliola* and *Lacazina* f.i.), but there are recent species also: *Miliola tricarinata* (d'Orbigny). Many of them have a trematophore, but recent species show this characteristic too, such as the genus *Hauerina*, which also shows the other characteristic, the surrounding wall (see 1964, p. 16 and p. 59). Wether *Hauerina* is a *Miliolid*, or belongs to the Peneroplidae (pores in the wall of the proloculus), cannot be solved as yet.

To the Miliolidae also *Cornuspiramina* is brought, as its initial part is formed like a primitive Miliolid (1964, p. 31). But species with the porcellaneous tests typical for the Miliolidae but instead of special chambers, forming a long tube following the proloculus, such as *Cyclogyra*, belong to this family too. A group of species is found in which the test begins with such a simple tube and later forms real chambers; these must be looked upon as periodical growth phenomena. Such a species is *Cornuloculina inconstans* (Brady). Typically the later chambers coil in the same plane as the first initial spiralled chamber. The neck-chamber found in many Miliolids with later chambers coiling in a quinqueloculine, triloculine of biloculine arrangement, must be the relic of this undivided chamber of *Cyclogyra*. A large group of species coiling later in one of the above-mentioned ways, initially have a long neck-chamber which is followed by some chambers coiling in the same plane as the neck-chamber in *Cornuloculina*. In *Nummuloculina* the later chambers are coiled in this plane but, contrary to *Cornuloculina*, each coil is formed by two chambers only. I have called this arrangement the nummuloculine one. It is found in a large group of species which shows another peculiar characteristic: a lip over the aperture instead of the normal tooth in the aperture. So I brought them together in one group, the Miliolids with lip-like teeth.

This characteristic of nummuloculine arrangement of initial chambers following the *Cyclogyra*-chamber, is most distinctly developed in *Planispirinoides*. A species very close to *Planispirinoides* is *Cribropyrgoides*, in which the lip is transformed in an irregular cribate plate, at least in the more adult chambers. Several species of this group with lip-like structure at the aperture and nummuloculine intial chambers in the end, have an arrangement of chambers which may be triloculine or even biloculine. Triloculine are those species which were put into the genus *Miliolinella*. Some of them were hitherto brought into the genus *Pyrgo* but differ from the genotype of this genus by the nummuloculine arrangement of the initial chambers. For these a new genus was created, *Pseudopyrgo*.

In the genus *Pyrgo* no nummuloculine initial chambers are found; in the microspheric generation *Pyrgo* has a succession of quinqueloculine, triloculine and biloculine arrangements. However, "*Pyrgo*" *denticulatus* (Brady) has a succession of triloculine and biloculine chambers in the microspheric generation and the quinqueloculine arrangement is not found. So for this species I established a new genus, *Pyrgoides*. As I had to place the abnormal species of "Pyrgo" near primitive forms as *Cyclogyra* and *Nummuloculina*, I placed the true *Pyrgo*-species directly following the group *Pseudopyrgo* and *Pyrgoides*; *Quinqueloculina* and *Triloculina* are placed here after the *Pyrgo*-group.

In another paper I have proved that in the Albian a *Quinqueloculina* evolved into *Sigmoilina*. So *Sigmoilina* is placed after the *Quinqueloculina-Triloculina*-groups. Recent authors separated the agglutinated forms from *Sigmoilina* and established the genus *Sigmoilopsis*. But as in the genus *Quinqueloculina* the agglutinated forms are not separated from the porcellaneous forms, this would be permitted in case the chamber structure in the agglutinated forms would be different from that found in *Sigmoilina*. Finlay believed this to be the case, assuming that in *Sigmoilina* the distal chamberwalls are strongly overlapping but not so in the agglutinated forms. I found that in the agglutinated forms the distal chamberwalls are just overlapping as in *Sigmoilina*, but that the agglutination often blurs this structure. So the genus *Sigmoilopsis* Finlay has to be dropped. *Schlumbergerina* is a genus which is difficult to place, so I placed it tentatively after *Sigmoilina*. I showed that "*Vertebralina*" *mexicana* (Cushman) has an inner structure which is different from the true *Vertebralina*, and is in some ways allied to *Sigmoilina*. So for this species I created a new genus: *Vertebrasigmoilina*.

The genus *Dentostomina* must be allied to *Massilina*; both genera were placed here following *Quinqueloculina*, as they are nothing but *Quinqueloculina* in which the last formed chambers are placed in opposite directions.

Cyclogyra carinata (Costa) Fig. 94

Operculina carinata COSTA, 1856, p. 209, pl. 17 fig. 1.
Cornuspira carinata (Costa), BRADY, 1884, p. 201, pl. 11 fig. 4; FLINT, 1897, p. 303, pl. 48 fig. 2; CUSHMAN, 1929, p. 83, pl. 20 fig. 7.

Test very flat, close-coiled in the initial whorls, last formed coils broader, but never flaring. Margin with thin sharp keel. Surface smooth but for slightly depressed growing lines in the later part of the test. Aperture narrow slit formed by the open test. Diameter up to 4 mm.

Several specimens were found in the sample off St. Croix, depth 800 m. FLINT's specimens were from the Gulf of Mexico.

Cornuloculina inconstans (Brady) Fig. 95

Hauerina inconstans BRADY, 1879, p. 268.
Ophthalmidium inconstans (Brady), BRADY, 1884, p. 189, pl. 12 fig. 5, 7–8; FLINT, 1897, p. 302, pl. 47 fig. 3.
Cornuloculina inconstans (Brady), BURBACH, 1886, p. 497; LOEBLICH & TAPPAN, 1964, p. 448, fig. 340, 3–7.

Test planispiral, very much compressed, with more or less globular proloculus, when large, followed by a *Cornuspira*-like second chamber, when small, succeeded by a small chamber; then in both forms chambers follow which may form almost a coil in the forms with large proloculus, and in those with small proloculus only half a coil. All later chambers are separated from foregoing ones by a flat, more or less broad carina. Last formed chambers more voluminous and shorter than to form a half coil, so that the end-chambers in full-grown specimens form 1/3 coil. This was the reason why LOEBLICH & TAPPAN, following BURBACH, separated this species from *Ophthalmidium* and named the genus *Cornuloculina* Burbach. But, obviously, the genus is very much allied to *Ophthalmidium*. As in the latter genus, the aperture is the slit-like opening of the last-formed chamber.

The species was found, not uncommonly, in the sample off St. Croix, 800 m. FLINT reported it from the Gulf of Mexico, the Bahama Islands, the North coast of Carolina, in depths from 168–1169 fathoms.

MILIOLIDAE WITH LIP-LIKE TEETH OVER THE APERTURES

A large number of species do not show simple or bifid teeth in the apertures. Here the teeth are broad and form a kind of lip. In LOEBLICH & TAPPAN's treatise (1964) they were placed in the Subfamily Spiroloculinae Wiesner (*Planispirinoides*), in the Quinqueloculininae (some species of *Pyrgo* or *Biloculina, Pyrgoella*), in the subfamily Miliolinellinae Vella (*Miliolinella, Biloculinella, Nummuloculina, Scutuloris*), whereas some genera with aberrant lips were placed in the subfamily Miliolinae Ehrenberg (*Cribropyrgo, Involvohauerina*).

A large number of species belonging to these Miliolidae with lips were found in the material described here, and some remarkable characteristics concerning all these different forms could be traced. These showed that they belong more closely together than might be inferred from the different groups in which they were put by LOEBLICH & TAPPAN.

A species found in material from off Delos, Mediterranean, and described by LE CALVEZ (1958, p. 202, pl. 16 fig. 182–183) as *Biloculinella fragilis*, certainly belongs to the genus *Nummuloculina*

(Fig. 96). Such a form, with a distinct apertural lip, seems to me the prototype of the whole group and that is the reason why I describe it here, though it was not found in the material from the Caribbean region. The species shows a thin and fragile test wall with very fine striae on the chamber walls. Only two chambers are visible from the outside, the chamber walls of the two last formed chambers enveloping all former chambers. The rounded proloculus is followed by about 10 chambers which more or less form a half convolution and not, as in the type-species of the genus, *Nummuloculina contraria* d'Orbigny, only one sixth of a convolution. Each chamber, in horizontal section, shows the distinct lip at its aperture. Only megalospheric specimens were observed.

The genus *Biloculinella* Wiesner has as type-species *Biloculina labiata* Schlumberger. This species was analysed by SCHLUMBERGER (1891, p. 169–170, fig. 13–14, pl. 9 fig. 60–62). The microspheric forms begins quinqueloculine, and via a triloculine stage becomes typically biloculine. The megalospheric generation is totally biloculine. Obviously this species is a typical *Pyrgo* (*Biloculina*) with a flattened lip-like tooth and does not belong to the group which I have here in mind.

The genus *Miliolinella* consists of triloculine forms with the type-species *Vermiculum subrotundum* Montagu. This type-species has a triloculine end-stage and the aperture is provided with a distinct lip. The walls are always very thin in this species; it was studied from material from W. of St. Croix, 800 m deep, and from Secca di Benda Palumno, Bay of Naples, Mediterranian. The microspheric form is wholly triserial, but the megalospheric form begins with a *Nummuloculina*-stage of at least three chambers in one plane; then a chamber follows which coils perpendicularly to this plane, in the transverse section of the test two times sectioned, which chamber gives rise, with its aperture with lip, to a larger chamber, the first one of the trilocular arrangement. So, we have here a *Nummuloculina*-stage, followed by a kind of neck-chamber, and after this the trilocular stage.

Quite the same structures of micro- and megalospheric generations were found in the following species: *Triloculina semicostata* Wiesner, *Triloculina suborbicularis* d'Orbigny, *Triloculina circularis*

Bornemann, *Miliolinella labiosa* d'Orbigny, *Pyrgo subsphaerica* (d'Orbigny), *Pyrgo globulus* (Bornemann) (placed by LE CALVEZ, 1958, in the genus *Biloculinella*), *Nummoloculina irregularis* (d'Orbigny), *Planispirinoides bucculenta* (Brady), *Cribropyrgo robusta* Cushman & Bermúdez (microspheric form) and *Involvohauerina globularis* Loeblich & Tappan (megalospheric form, both genera monotypic and forming the two generations of one single species). Obviously, all these species belong together, as they possess the labiate aperture added to the nummuloculine beginning of the tests in the megalospheric generation, which nummuloculine arrangement of the first chambers is followed by a chamber perpendicular to the plane of coiling of these first chambers. Remarkably these characteristics are also found in the genus *Sigmoilina*, of which the type-species, *S. sigmoidea* (Brady) is as well analysed here; but in this genus the arrangement of chambers differs from that, found in the other species mentioned; the nummuloculina embryonic chambers occur in *Sigmoilopsis schlumbergeri* Silvestri as well.

Nummuloculina irregularis (d'Orbigny) Fig. 97

Biloculina irregularis D'ORBIGNY, 1839, Amérique p. 67, pl. 8 fig. 22–24; BRADY, 1884, p. 140, pl. 1 fig. 17–18.
Nummoloculina irregularis (d'Orbigny), CUSHMAN, 1929, p. 46, pl. 10 fig. 2–3; LE CALVEZ, 1958, pl. 7 fig. 80.

There are two forms, a globular one and an elongate one. Both have the typical aperture, consisting of a semi-circular opening closed nearly wholly by a triangular lip, but the borders of the aperture are not thickened as is always the case in *Pyrgoella sphaera*, and the upper angle is rounded. The elongate forms are megalospheric, the globular forms are microspheric. Some larger globular specimens were obtained in a sample 38°2'S, 149°40'E, depth 95 m, in the South Pacific. These globular forms were microspheric too.

In the tests only the two last formed chambers are visible, with smooth sutures. Characteristic in both forms is the aperture, nearly completely closed by the triangular lip. The walls are extremely thin. Perpendicular to the coiling plane of the later chambers, in the microspheric form the small proloculus is followed by a short neck-chamber ending with the lip; then 3–4 nummuloculine chambers are added in the same plane. A chamber follows which in the transverse section is hit two times and envelops the former coils; then several chambers of the globular forms are added, as in *Pyrgoella.* With their broad sides they form a spiral, well visible on a section going through the last formed aperture; these chambers do not form a half coil but mostly are somewhat shorter. So the species strongly points to a *Nummuloculina* in which the chambers have become globular.

In the megalospheric specimens, the elongate ones, the neck-chamber of the larger proloculus is followed by only one nummuloculine chamber, followed by the enveloping chamber. The later chambers, in transverse section arranged somewhat like in *Pyrgo,* are arranged in a spiral as in *Nummuloculina.*

It may be that this species forms the link between *Nummuloculina* and *Pyrgoella.*

Numerous small specimens were found in the sample W. of St. Croix, depth 800 m.

Pyrgoella sphaera (d'Orbigny) Fig. 98

Biloculina sphaera D'ORBIGNY, 1839, Amérique p. 65, fig. 13, 16; BRADY, 1884, p. 14, pl. 2 fig. 4.
Planispirina sphaera (d'Orbigny), SCHLUMBERGER, 1891, p. 190 fig. 45–46.
Pyrgoella sphaera (d'Orbigny), CUSHMAN & WHITE, 1936, p. 90; LOEBLICH & TAPPAN, 1964, p. 465, fig. 352, 6–7; LE CALVEZ, 1958, p. 198, pl. 7 fig. 72.

In the sample off St. Croix, depth 800 m, the specimens had an average diameter of about 1 mm. In samples from the Ingolf Expedition, North Atlantic, much larger specimens were observed, reaching a diameter of more than 2 mm. Very small specimens have a slit-like aperture over a triangular lip near the suture with the foregoing chamber, which protrudes mostly slightly in the globular test which is always thin-walled. Larger specimens often show some additional apertural openings near the main one. Very large specimens, which proved to be microspheric, showed long series of irregular apertural slits running over a larger part of the test wall of the last formed chamber. SCHLUMBERGER described two sections, a longitudinal one, going through the successive apertures of the chambers, and a transverse one; only the aperture of the last formed chamber is more complicated. He found a long neck-chamber, followed by one nummuloculine chamber which surrounds the proloc- ular part. Such a structure of the embryonic apparatus was also found by me in those specimens which have a large proloculus. However the specimens, which show the more complicated apertures and which are also the larger ones, have a much smaller proloculus and a shorter neck-chamber followed by two nummuloculine chambers. After a chamber which coils perpendicular to the original plane of coiling, and which partly surrounds the embryonic part, the globular chambers start with their apertures in somewhat opposite directions successively. But this arrangement never reaches the typical opposite position of the apertures as found in *Pyrgo*. The walls around the apertures are always thicker than the main chamber walls and this thickness is clearly seen from the outside.

It is obvious from this description that *Pyrgoella* belongs in the close neighbourhood of *Nummuloculina*: it is a *Nummuloculina* with strongly globular chambers.

Common in the sample W. of St. Croix, 800 m.

Planispirinoides bucculentus (Brady) Fig. 99

Miliolina bucculenta BRADY, 1884, p. 170, pl. 4 fig. 1–2, pl. 11 fig. 3.
Triloculina bucculenta (Brady), CUSHMAN, 1929, p. 60, pl. 15 fig. 1.
Planispirinoides bucculentus (Brady), PARR, 1950, p. 287–288, fig. 1–5, pl. 6 fig. 1–6.
Planispirinoides bucculentus (Brady), var. *placentiformis* (Brady), PARR, 1950, p. 289.

The descriptions of the embryonic chambers by PARR and by LOEBLICH & TAPPAN (1964, p. 453) are misleading, as PARR mentions a long coiled spiral described as a *Cornuspira*-stage and LOEBLICH & TAPPAN as coiled as in *Cyclogyra*. SCHLUMBERGER (1892, p. 194–196 fig. 2–4, pl. 8 fig. 6–7) described a similar species under the name of *Planospirina bucculenta* Brady, from the Bay of Gascogne; however, PARR believed already that SCHLUMBERGER described another species, at least in its megalospheric form, whereas the form, figured by him as section, and believed by him to be the microspheric form, has so much thicker walls in the embryonic part, that it is not comparable with the sections given by PARR and found by myself. I studied the species in some rare specimens from W. of St. Croix, depth 800 m, and in numerous specimens from Ingolf St.32 and St. 81, both from the North Atlantic. As bulbous and more compressed specimens occur together in the samples, also at St. Croix, I believe them to be synonymous. Such specimens as described by SCHLUMBERGER as its megalospheric form, were not found either by PARR or by me. The form with the embryonic "spiral" is the only form found by PARR and by me in many sectioned specimens. But it is not a microspheric form, as believed by SCHLUMBERGER.

As PARR found already, the initial spiral is difficult to study; for its plane in the various individuals is far from constant. In many cases it is sectioned axially when the individuals are cut transversely on their apertures, so that the last three chambers are sectioned longitudinally; but as PARR showed, many specimens do not have the plane of the first spiral perpendicular to the plane of the last formed spiral of chambers, so that another method had to be found to study the embryonic spiral in its plane of coiling. This was done as follows: first the individual was sectioned with its aperture on top; then, when the thin-walled inner chambers were reached, the individual was turned and ground down till once again the thin-walled centre, in which the initial spiral lies, was reached. Then the later chambers were removed and the spiral, now visible in the plastic in transmitted light, could be turned in such a way that its plane was that of the grinding. In this way the whole initial spiral could be studied, not only in exactly transverse section, but also in horizontal section. Not all the individuals have the same number of coils in the initial spiral; two sections are figured horizontally through the initial spiral, one with 5½ coils, the other with 4½ coils. And so it became clear that the spiral has nothing to do with *Cornuspira* or with *Cyclogyra*; for both these genera possess a single chamber which is in open contact with the proloculus.

In *Planospirinoides* the globular and relatively large proloculus is followed by a neck-chamber not forming a whole coil, and then follow a series of distinct tubular chambers which are separated from each other not only by a distinct suture, but also by a distinct tooth at each of the successive foramina. 7 or 8 of these chambers are formed after the neck-chamber; on transverse and thin sections these chambers have strongly overlapping walls and the last formed chamber encloses all former coils. Such a structure is found in the genus *Nummuloculina*; *Planispirinoides* has a nummuloculine embryon. From the last formed nummuloculine chamber a new chamber develops which coils perpendicularly to the plane of the initial spiral of the chamber and, in horizontal as well as in transverse section, returns two times enveloping the initial spiral more or less, since it rapidly broadens. In case the whole test is sectioned in the plane of coiling of the last three visible chambers, so that the lips of these chambers are visible in the sections, the lips of the first chambers following the just described initial chambers do not show their apertures and lips in the section; as there are at least three of these chambers next to the enveloping chamber, the test, when young, has the form of a normal triloculine form and now should be called a "*Miliolinella*". But suddenly the plane of coiling, or rather, the situation of the foramina of the chambers, changes: the later chambers show their apertures and lips in the section normally transversely to the initial spiral. So the axis of coiling of the chambers following the enveloping chambers does not change: they maintain their more or less triloculine arrangement. In later chambers, however, the apertures are no longer at the successive opposite poles of the test, but are placed at the broad sides of the original test.

As all specimens studied, by PARR and by me, show the relatively large proloculus in the nummuloculine embryonic spiral, with an inner diameter of 30–50 μ, we may conclude that these specimens are megalospheric and not microspheric as SCHLUMBERGER believed.

Comparison with the species of the genus *Miliolinella* proves that *Planispirinoides* is very close to *Miliolinella*; the microspheric generation, when existing, must have, as in *Miliolinella*, an entirely triloculine structure and thus may be known as such. But even very large specimens (diameter about 3 mm) all showed the initial spiral as described above. Till now the microspheric form is unknown but the megalospheric form as described here strongly points to a relationship with *Nummuloculina*, to which relationship also *Miliolinella* belongs.

Rare specimens in the sample off St. Croix, 800 m.

Cribropyrgoides aspergulum (Schlumberger) Fig. 100

Triloculina aspergulum SCHLUMBERGER, 1892, p. 193 fig. 1, pl. 8 fig. 8–9.
Cribropyrgo robusta CUSHMAN & BERMÚDEZ, 1946, p. 119, pl. 20 fig. 7–9.
Involvohauerina globularis LOEBLICH & TAPPAN, 1955, p. 15, pl. 2 fig. 3–8.

In 1892 SCHLUMBERGER gave a good figure from two sides of a species which is characterised by "l'ouverture [qui] est formée par une série de trous de formes diverses et inégalement disséminés".

The section figured is incomplete but it is obvious that the chambers change the position of their apertures in the end, just as in *Planispirinoides*. The arrangement of the chambers is mainly triloculine, and thus the species is called *Triloculina* by SCHLUMBERGER. It was found by him in some specimens in material from the Açores, depth 1300 m.

In a sample given to me by the late DR. MORTENSEN, St. 18 (Pacific Expedition), Caribbean Sea, several specimens were present which all showed the peculiar aperture, consisting of a cribrate plate, distinctly thicker than the test wall. One specimen shows the two end-chambers as given by CUSHMAN & BERMÚDEZ, and named by them *Cribropyrgo robusta*. When sectioning this specimen it was found that the successive chambers from outer side to deeper in the test show the cribrate plate, but this plate becomes smaller and smaller. When grinding more and more towards the centre, a large chamber becomes visible which may at first sight be looked at as the proloculus, and it seems to me that this chamber was figured as the proluculus in the, obviously in dry state, sectioned specimen figured by CUSHMAN & BERMÚDEZ in their fig. 9. That chamber does not possess the cribrate plate, but a triangular foramen covered by a simple triangular or rounded lip. Within that chamber a set of chambers was found with extremely thin walls (and which in this way will have been destroyed in the section mentioned). These inner chambers envelop the minute proloculus and have a more or less triloculine arrangement around it on transverse section. This arrangement is also found in the later, thick-walled chambers, and only the two last formed chambers are so large, that the arrangement becomes bilocular (*Cribropyrgo*).

Some smaller specimens give the outer characteristics figured by LOEBLICH & TAPPAN for their *Involvohauerina*, which is the same as described and figured by SCHLUMBERGER. So the name *globularis* given by LOEBLICH & TAPPAN must be a synonym of SCHLUMBERGER's name *aspergulum*. Section shows that the specimens are megalospheric, which was also found by SCHLUMBERGER. The globular proloculus shows a short neck-chamber (also seen on the "section" given by LOEBLICH & TAPPAN in their fig. 4), followed by 3 nummuloculine chambers in a plane transversely to the last formed aperture; since the section given here (and that given by LOEBLICH & TAPPAN) is made through the final aperture, the plane of the coiling of the nummuloculine chambers is in the plane of sectioning. The last formed nummuloculine chamber gives rise to the enveloping chamber which is sectioned two times, as usual in the whole group of species studied here, and then several thick-walled chambers follow in triloculine arrangement which is maintained to the end, but the place of the aperture changes in the last formed chambers as was also found in *Planispirinoides*, so that in these last formed chambers the cribrate slightly thickened plate is sectioned. In reality this plate may be a somewhat complex lip.

So we arrive at the following conclusions:
the name of the species might be *Cribropyrgo aspergulum* (Schlumberger);
the species-names *robusta* Cushman & Bermúdez and *globularis* Loeblich & Tappan are synonyms of *aspergulum*;
the genus-name *Involvohauerina* Loeblich & Tappan is synonymous with *Cribropyrgo*, as these names were given to the two generations of one species;
the fact remains, that the type species of the genus *Cribropyrgo*, *C. robusta*, is a younger synonym of *C. aspergulum*.

Therefore I propose to change the name into *Cribropyrgoides*, so that the definite name is *Cribropyrgoides aspergulum* (Schlumberger). The description of the genus is that of the only species known. The genus and the species belong to the vicinity of *Planispirinoides bucculentus* (Brady).

Miliolinella Wiesner

Species which are more or less triloculine in the last formed chambers, but always with a lip at the aperture. In the microspheric generation triloculine throughout, in the megalospheric generation beginning with a neck-chamber following the proloculus, then one or more nummuloculine chambers in the same plane as the neck-chamber, succeeded by a long chamber placed perpendicular to that plane, which chamber gives rise to the triloculine chambers. – Type-species: *Miliolinella rubrotunda* (Montagu).

Miliolinella subrotunda (Montagu) Fig. 101

Vermiculum subrotundum MONTAGU, 1803, p. 521.
Miliolina subrotunda (Montagu), BRADY, 1884, p. 168, pl. 5 fig. 10; HERON-ALLEN & EARLAND, 1913, p. 26.
Milionella subrotunda (Montagu), WIESNER, 1931, p. 63; LOEBLICH & TAPPAN, 1964, p. 467, fig. 355, 1–2.

Test mostly slightly longer than broad, nearly circular in outline, with somewhat inflated chambers, at one side two, at the other side three chambers visible. Aperture crescent-shaped with a distinct rounded lip. Surface smooth. In sections the chamber walls are thin and become thicker at the sutures. In the microspheric generation the proloculus is directly followed by the chambers in trilocular arrangement; diameter of proloculus about 25 μ; especially the chamber-walls of the first coils are extremely thin. In the megalospheric form the proloculus opens in a neck chamber seen in transverse section with the length of about half a coil, with aperture provided with the lip and followed in the same plane by at least two nummuloculine chambers; these chambers thus are coiling in the transverse plane. Then a chamber is added which runs perpendicularly to this plane and, in transverse section, is sectioned two times; it is a kind of neck-chamber. This chamber is followed by the triloculine arrangement of chambers of which mostly four are visible in the section.

These structures as described above shows the characteristics of *Miliolinella*. The longitudinal section reproduced from SCHLUMBERGER (1891) by LOEBLICH & TAPPAN figures the first spiral transversely cut.

The species was identified in several specimens W. of St. Croix, depth 800 m, and in various samples from Curaçao (Table 10).

Miliolinella circularis (Bornemann) Fig. 103

Triloculina circularis BORNEMANN, 1855, p. 349; CUSHMAN, 1917, p. 67, pl. 25 fig. 4, pl. 26 fig. 1.
Miliolina circularis (Bornemann), BRADY, 1884, p. 169, pl. 4 fig. 3, pl. 5 fig. 13–14.

The test is more or less rounded, also in transverse section, with three visible chambers which are rounded, inflated and the last formed chamber strongly embracing. The sutures are slightly depressed and distinct. Wall smooth, polished. Aperture a crescent-shaped slit with a large, flattened, semicircular lip.

The microspheric generation has the larger tests, diameter up to 1 mm; the megalospheric specimens are always smaller. Typical for the species are the thick walls of the last formed chambers. In the microspheric generation all chambers following the proloculus (diameter 20–25 μ) have the triloculine arrangement. The initial chambers have thin walls, and gradually the chamberwalls become thicker (thickness of outer walls about 80 μ). It is remarkable that the microspheric forms were found in deep water (up to 800 m), whereas the megalospheric specimens obtained were found in shallower water. The megalospheric generation begins with a large proloculus (diameter about 100 μ) followed by a neck chamber which is never longer than 1/3 coil; this neck is succeeded by a second chamber in the same plane, nummuloculine in form. Follows a chamber which is coiling perpendicularly to the former one, and sectioned two times in the transverse section. Then the chambers with trilocular arrangement follow.

Specimens were obtained from the Caribbean and from off New Zealand. The species occurred in several specimens in the samples off St. Croix.

Miliolinella suborbicularis (d'Orbigny) Fig. 104

Triloculina suborbicularis D'ORBIGNY, 1826, p. 300, no. 12; 1839, p. 177, pl. 10 fig. 9–11; CUSHMAN, 1929, p. 65, pl. 16 fig. 5, pl. 17 fig. 3; LE CALVEZ, 1958, p. 196, pl. 15 fig. 173–175.
Miliolina suborbicularis (d'Orbigny), SIDEBOTTOM, 1904, p. 9; HERON-ALLEN & EARLAND, 1916, p. 210, pl. 39 fig. 7–9.

Test compressed laterally, broader than long, peripheral margin rounded. Sutures depressed. Wall with longitudinal costae in outgrown specimens. Aperture crescent-shaped with semicircular lip.

From this species I had only megalospheric specimens. The globular proloculus (diameter about 70 μ) is provided with a long neck-chamber, forming 3/4 of a coil, and followed by two nummuloculine chambers in the same plane as the neck-chamber, then the chamber is formed which coils perpendicularly to this plane and which is sectioned two times in the transverse section of the test. The following chambers with triloculine arrangement rapidly increase in size so that there are few of them. The test walls increase slightly and gradually in thickness but are thinner than those found in the formerly mentioned species (thickness of outer walls about 30 μ). Most of the trilocular chambers show costae which are rounded at their outsides.

The species was found in deeper water in the Bay of Naples and W. of St. Croix. Also identified from a sample from Grand Cayman (1684).

Miliolinella semicostata (Wiesner) Fig. 102

Miliolina semi-costata WIESNER, 1923, p. 72, pl. 14 fig. 177.
Quinqueloculina semi-nuda TERQUEM, 1878, pl. 9 fig. 8.
Triloculina semi-costata (Wiesner), LE CALVEZ, 1958, p. 149, pl. 15 fig. 170–172.

Test slightly elongate, slightly compressed, with three chambers visible which are inflated with slightly depressed sutures. Aperture provided with a distinctly thickened border, semi-circular, with a free rounded lip over it. Typical are the few costae on each of the chamber walls, distinct and angular in transverse section. The specimens known are always small, diameter about 0.3 mm.

I had a single specimen which was megalospheric. It begins with a proloculus which is globular (diameter about 30 μ), followed by a neck-chamber of ½ coil provided with the lip; then a shorter nummuloculine chamber is added which shows the lip. The next chamber is the narrow chamber which coils perpendicular to the first chambers and which in transverse section is sectioned two times. Then the normal triloculine chambers follow which all show two or three costae. Thickness of the outer walls about 16 μ.

Found in a sample from Saba (1432).

Miliolinella labiosa (d'Orbigny) Fig. 105

Triloculina labiosa D'ORBIGNY, 1839, p. 157, pl. 10 fig. 12–14; CUSHMAN, 1921, p. 70, pl. 16 fig. 13–14; 1929, p. 60, pl. 15 fig. 2–3.
Miliolina labiosa (d'Orbigny), WIESNER, 1923, p. 71, pl. 13 fig. 171.
Miliolinella labiosa (d'Orbigny), HOFKER, 1964, p. 29, fig. 24–26.

I described this species in 1964, but did not section it. The transverse section shows chambers with very thin walls, even in the last formed ones. The megalospheric proloculus (diameter about 32 μ) is connected with a neck-chamber forming 1/3 coil and ending in an aperture with distinct lip. Then two nummuloculine chambers follow, each of which form ½ coil and end with the characteristic lip. The next chamber is running perpendicularly to the plane of the chambers described and is long enough to meet it two times in the transverse section. This chamber is followed by the few and bulbous chambers, the last formed covers more than ½ coil. These chambers do not reach the apices of the test and so, in the section, often the aperture of one of them is exposed; these chambers have more or less a triloculine arrangement.

The species was found in samples from the Florida Keys (1408, 1414), the Cayman

Islands (Table 2), Puerto Rico (Table 3), St. Thomas and St. John (Table 4), St. Martin (Table 5), Barbuda (Table 6), St. Lucia (1548), Bonaire (Table 9) and Curaçao (Table 10). Already known from many other localities, including Islote Aves, North Bimini and Cat Key.

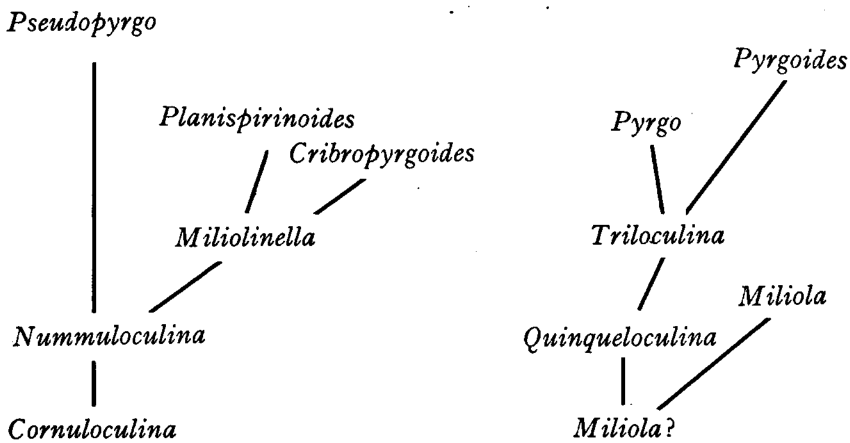
THE *Pyrgo*-GROUP

It will be obvious from the species studied here as well from those analysed by SCHLUMBERGER (1891) that the genus *Biloculina* (*Pyrgo*) is not a homogeneous group. Apart from *Biloculina labiata* Schlumberger, which has a lip-like tooth over the aperture, most of them have a broadened tooth which should be more or less described as bifid. The outer characteristic of *Biloculina labiata* Schlumberger has lead to the establishing of the genus *Biloculinella* Wiesner; but we must bear in mind that the analysis by SCHLUMBERGER showed that this species is in all other ways a true *Biloculina* or *Pyrgo*: the megalospheric generation has a large globular proloculus with neck-chamber followed by the bilocular arrangement of chambers, whereas in the microspheric generation the small proloculus is followed successively by quinqueloculine, triloculine and biloculine chambers. So the only difference with *Pyrgo* should be the broad lip-like tooth. However, this characteristic has led to confusion; in 1958 LE CALVEZ added to the genus *Biloculinella* the species *Biloculina globulus* Bornemann (which here is shown to have a quite different inner structure than the type-species and *Biloculinella fragilis* LE CALVEZ (which is here shown to belong to *Nummuloculina*). Acutally the genus *Biloculinella* must be dropped, as the lip-like tooth is the only difference with most of the species of *Pyrgo*.

On the other hand, SCHLUMBERGER already showed that *Biloculina globulus* Bornemann has an inner structure which differs from the normal one found in *Pyrgo* (*Biloculina*). So I had the right to establish a new genus, *Pseudopyrgo*, the more, since *Biloculina subsphaerica* appeared to belong to the genus as well. Moreover, there is a species which in the microspheric generation is a *Triloculina*, whereas the megalospheric generation looks like a *Pyrgo* (*Triloculina striolata*); this was to be expected, since the microspheric generation in many species of true *Pyrgo* also shows a triloculine stage. Moreover, SCHLUMBERGER already proved that in some species the microspheric generation does not have a quinqueloculine arrangement of the first chambers following the proloculus, but that they begin with the triloculine stage (*Biloculina elongata* d'Orbigny, *Biloculina fischeri* Schlumberger, *Biloculina serrata* Brady); *Biloculina denticulata* Brady is added to this group, for which I create here the genus *Pyrgoides.*

It is obvious that in fact the outer structure of the biloculine group is an endform which may have been reached by many different groups of Miliolidae. *Nummuloculina* may have reached this endstage (*Pseudopyrgo*); *Quinqueloculina* may have reached it, mostly over a triloculine stage (*Pyrgo*); it was also reached by true triloculine forms, as is strikingly proved by *Triloculina striolata* in its megalospheric stage, and it is fully reached by the biloculine species which do not show a quinqueloculine stage in the microspheric generation, but begin directly with a triloculine stage (*Pyrgoides*). In those lip-bearing species in which the megalospheric generation shows the nummuloculine embryonic growth of the chambers, the microspheric one invariably shows a quinqueloculine beginning. So they seem to have developed from *Quinqueloculina.* In microspheric generations of *Triloculina* (*Triloculina carinata* d'Orbigny) the first stage of the microspheric generation is quinqueloculine also. So it may be that at the base of all the groups of higher developed Miliolidae the genera *Nummuloculina* and *Quinqueloculina* are found. *Miliolinella* and *Cribropyrgo,* perhaps also *Planispiroides bucculentus,* may have both genera as ancestors.

From *Quinqueloculina* arose both *Triloculina* and *Pyrgo,* but *Pyrgoides* must be allied to *Triloculina,* not to *Quinqueloculina. Pseudopyrgo,* on the other hand, shows reminiscences of *Nummuloculina,* also in some species in the microspheric generation. So the whole group of biloculine forms can only be analyzed by thin sections, as the biloculine outer form is an end-stage of many quite different forms of evolution.



Pseudopyrgo gen.nov.

The genus *Pyrgo* was studied in sections by SCHLUMBERGER (1891, p. 155–191, pl. 9–12); of most species studied he showed sections of micro- and megalospheric specimens. The microspheric generation begins triloculine or quinqueloculine, the megalospheric generation with a large proloculus shows a neck-chamber which is followed by biloculine chambers only. The microspheric generation of *Biloculina* (now *Pyrgo*) *globulus* Bornemann, however, which in fact may be the A_1-generation, showed quite a different initial part, since here the transversely sectioned embryonic chambers were arranged in a single plane with several thin-walled enveloping chambers around them. SCHLUMBERGER mentions them as "une disposition des loges très remarquable". About the megalospheric form of this species (which was found by SCHLUMBERGER only in very young specimens) he mentions that the neck-chamber is always found in a plane with the proloculus not identical with that in which the later chambers are arranged, in contrast to what is found in the megalospheric forms of normal *Biloculina* (now *Pyrgo*).

The tests of the microspheric form of *B. globulus* are larger than those of the megalospheric generation. In the adult two chambers are visible, both strongly half-globular and the suture between them only slightly depressed. Remarkable is the aperture, which is found slightly areally in the last formed chamber, crescentiform, and closed by a flat broad lip of the same form, nearly completely closing the aperture.

Thus this lip is not the broad bifid tooth as found in most species of *Pyrgo*, but a true lip.

The megalospheric form begins with a large globular proloculus provided with a narrow neck-chamber which always lies obliquely to the later biloculine chambers which have relatively thick walls. In the microspheric form the small proloculus shows a neck-chamber of more than one coil, followed by about 8 narrow nummuloculine chambers which more or less form half a coil each. Then a chamber is formed which grows in a plane somewhat perpendicular to that of the nummuloculine chambers, enveloping the larger part of the embryonic set of chambers, and this chamber is followed by the biloculine set of chambers. The diameter of the megalospheric proloculus is about 220 μ, that of the microspheric chamber about 20 μ. It is obvious that the peculiar lip and the arrangement of the embryonic chambers of the microspheric form strongly point to the group of species around *Nummuloculina* and that a new genus has to be established for this and similar species. The so-called microspheric specimen sectioned by SCHLUMBERGER (1892, p. 189, fig. 43–44) has a proloculus with a diameter of 54 μ and, according to his figure, only two or three nummuloculine chambers followed by the enveloping one. Moreover, there seems to be a second enveloping chamber before the biloculine chambers start. So it may be, that in this species there are three generations, the B-generation, the A_1-generation figured by SCHLUMBERGER as the B-generation, and the A_2-generation, described by SCHLUMBERGER and by me as the megalospheric generation.

Characteristic of *Pseudopyrgo* is that the initial chambers are coiling perpendicular to the coiling of the later chambers.

Type-species: *Biloculina globulus* Bornemann.

Pseudopyrgo globulus (Bornemann) Fig. 106

Biloculina globulus BORNEMANN, 1855, p. 349, pl. 19 fig. 3; SCHLUMBERGER, 1892, p. 188, fig. 42–44, pl. 12 fig. 97, 100.
Biloculinella globula (Bornemann), LE CALVEZ, 1958, p. 201, pl. 7 fig. 76.

Test globular, two opposite chambers visible, sutures only slightly depressed. Aperture rounded with semicircular lip nearly covering the opening. Wall smooth, shining. Microspheric generation beginning as in *Nummuloculina*, with enveloping chamber or chambers, then biloculine. Megalospheric generation (or generations) with larger proloculus, in the A_1 with some nummuloculine chambers, in A_2 only with neckchamber, followed by the biloculine chambers. Megalospheric tests are smaller than the microspheric ones. Diameters of proloculi: B, 20 μ; A_1, 54 μ; A_2, 220 μ.

Since the genotype of *Biloculina*, *Biloculina labiata* SCHLUMBERGER (1891, p. 169–170, fig. 13–14) in the microspheric generation begins with a triloculine arrangement of the chambers, this genus is quite different from *Pseudopyrgo*.

Found, not very commonly, in the sample W of St. Croix, 800 m; moreover, material was available from Cirrus-Expedition, 300 miles off Finisterre, 3600 m deep.

Pseudopyrgo subsphaerica (d'Orbigny) Fig. 107

Biloculina subspaerica D'ORBIGNY, 1839, Cuba, p. 162, pl. 8 fig. 25–27.
Pyrgo subsphaerica (d'Orbigny), CUSHMAN, 1929, p. 68, pl. 18 fig. 1–2; HOFKER, 1964, p. 31, fig. 34–35; 1971, p. 14.

This species, common in many localities of the Caribbean, is always very small, thin-walled, globular, with two visible chambers, both of them semi-globular, the last one with rounded margin and the suture in between nearly flush with the surface. The aperture is open, semi-circular, with a short bifid tooth. In transmitted light in a clarifyer the extremely thin walls of the first chambers cannot be seen exactly, and therefore I wrote in 1964: "In oil the proloculus, which is large in all specimens, appears to be directly followed by a bilocular arrangement of the chambers". But new material of several localities in the Caribbean area could now be studied in thin sections transverse on the two last chambers and gave a remarkable result. Some rare specimens begin with a small proloculus followed by some chambers in a trilocular arrangement. This may be the microspheric generation. Most of the specimens studied, however, show a somewhat larger proloculus opening into a shorter or longer neck-chamber ending with a foramen with lip; then two other nummuloculine chambers follow separated by the lip and these are followed by a larger enveloping chamber coiling perpendicularly on the plane of coiling of the former chambers. This total of embryonic chambers forms a globular structure which was taken by me as the proloculus, as the very thin walls within cannot be seen in a clarifyer. Following the enveloping chamber two or three chambers are arranged irregularly triloculine, followed by the biloculine set of chambers.

This chamber-arrangement distinctly points to that, found in the genotype of *Pseudopyrgo* so that this species also has to belong to this genus, though in most cases the tooth of the aperture is not typically lip-like.

The species occurs in shallow environments as well as in deeper water, since it was found W. of St. Croix, at 800 m, W. of Puerto Rico (1415) at abt. 90 m, Thatch Island, 15–29 m, off Habana, 2–5 fathoms, N. of Congo Cay, and in very shallow habitats at Bimini, Grand Cayman (Table 2), Puerto Rico (Table 3), Islote Aves, Bonaire (Table 9) and Aruba.

Pseudopyrgo eburnea (d'Orbigny) Fig. 108

Triloculina eburnea D'ORBIGNY, 1839, p. 180, pl. 10 fig. 21–23.
Triloculina oblonga d'Orbigny (?), CUSHMAN, 1929, pl. 13 fig. 4 (not *Miliolina seminulum* var. *oblonga* WILLIAMSON, p. 86, fig. 86–87, nor *Vermiculum oblongum* MONTAGU, 1803, p. 522, pl. 14 fig. 9).
Triloculina bermudezi ACOSTA, 1940, p. 37, pl. 4 fig. 1–5.
Biloculina eburnea (d'Orbigny), TODD & LOW, 1971, p. 11, pl. 2 fig. 7.

CUSHMAN, when describing the Miliolidae from the Atlantic Ocean (1929, p. 57) already mentions, that "This species is very widely distributed or else more than one species is recorded under this name". The species described by WILLIAMSON and MONTAGU from the coasts of the British Isles are very different from what has been figured by CUSHMAN as typical from the Tortugas region in 1929; in his work on the Tortugas-Foraminifera (1922, p. 73) CUSHMAN only mentions this species but does not describe or figure it; he adds that specimens may be referred to this species, the most common form similar to that figured by D'ORBIGNY in the Cuban monograph.

So, CUSHMAN seems not to be very certain about this species, and in any case MONTAGU's and WILLIAMSON's species are quite different: much longer, more slender, with a bifid tooth.

On first sight the species which was found in the Lagoon of Barbuda, often in many specimens, very much resembles the one figured by CUSHMAN from the Tortugas in 1929, pl. 13 fig. 4, but for the fact that in many specimens only two chambers are visible and in others only a small part of a third one; the aperture is not oval but more or less triangular, and the tooth is simple, as mentioned by CUSHMAN, covering the aperture but for a very narrow slit. Such a tooth strongly points to the genus *Miliolinella*, but in that genus the arrangement of the chambers is always triloculine. So it seems that this remarkable species forms a transition between *Miliolinella* and "*Pyrgo*"; but the arrangement of the initial chambers points more to *Pseudopyrgo*.

Test elongate, about two times as long as broad, with oval transverse section. Many specimens show two chambers in the adult stage, but some specimens show a small part of a third chamber. The last formed chamber is somewhat inflated, with a slightly protruding oral end, whereas the other end bends over the former chamber and is broadly rounded. In some specimens traces of transverse striae are seen and often irregular shallow depressions are found in the side walls which are distinctly polished. The aperture is rounded triangularly with a slightly protruding lip, triangular also with rounded end, covering most of the apertural opening.

On transverse section the proloculus of distinctly *Pyrgo*-like individuals is relatively small, followed by several nummuloculine chambers, which are followed by one set of chambers arranged more or less triloculine. Then the sets of biloculine chambers start distinctly overlapping at their edges. The sections of individuals with traces of triloculine arrangement in the end show a larger proloculus followed by several nummuloculine chambers; there is no set of trilocularly arranged chambers but several sets of bilocular chambers follow. The last two chambers are arranged in a plane nearly perpendicular to the plane of coiling of the former ones, not wholly overlapping the last formed bilocular chamber; this part of chamber wall is seen from the outside and thus is not due to a real triloculine arrangement, but to the fact that the two last formed chambers were not broad enough to cover the oval transverse section of the former whorls completely, so that only at one side the last formed chamber is overlapping the former one. In this way we do not have a true trilocular arrangement but an imperfect bilocular one. It is remarkable that just in these "triloculine" individuals the shallow depressions of the outer walls were found which, in the sections, are seen in the middle of the chamber walls, as if the animal did not know for certain in which way the last formed chamber should be built.

TODD & LOW describe the aperture as "filled with a distinctive T–shaped tooth that does not project above the margin of the test". This is not true for the species described here, and moreover, is not characteristic of *Biloculinella.*

ACOSTA described the "triloculine" form only, and thus placed it in the genus *Triloculina.*

This remarkable species was found at the Florida Keys (Table 1), Congo Key, St. Martin (Table 5), Barbuda (Table 6) and La Désirade (1437).

Pyrgoides gen.nov.

Since the genus *Pyrgo* Defrance is characterised by a succession of quinqueloculine, triloculine and biloculine arrangements of chambers in the microspheric generation, and since I have created a new genus for those biloculine species which in the megalospheric generation show a first set of chambers in the nummuloculine arrangement (*Pseudopyrgo*), a new name is necessary for those species which in the microspheric generation show the triloculine and biloculine successions of arrangement only. It is remarkable that in one species, *Pyrgo denticulata* (Brady), in both microspheric and megalospheric generations, the arrangement of the initial chambers is trilocular. So I took for the type-species of the new genus *Biloculina ringens* Lamarck, var. *denticulata* Brady = *Pyrgo denticulata* (Brady), which now has to be called *Pyrgoides denticulatus* (Brady).

Type-species: *Biloculina ringens* Lamarck, var. *denticulata* Brady.

Pyrgoides denticulatus (Brady) Fig. 111

Biloculina ringens Lamarck, var. *denticulata* BRADY, 1884, p. 143, pl. 3 fig. 4–5.
Biloculina denticulata (Brady), CUSHMAN, 1917, p. 80, pl. 33 fig. 1.
Pyrgo denticulata (Brady), CUSHMAN, 1929, p. 69, pl. 18 fig. 3–4.

Test oval with the broadest part near the aboral side, lenticular in oral view, with distinct keel which in some specimens may be double. Characteristic is the dentate aboral part of the keel. Aperture a broad slit with broad bifid tooth. Microspheric generation larger than the megalospheric one; specimens from deep water have a more prominent keel and are somewhat more inflated than those from shallow water.

In the microspheric generation the minute proloculus (diameter 15 μ) is followed by three sets of triloculine chambers; then the biloculine chambers are added. In the megalospheric form the proloculus is followed by one or two sets of trilocular chambers (diameter of proloculus about 30 μ); then the bilocular chambers start. Each next chamber adheres to the keel of the former; in case of two keels the next chamber adheres to the ventral side of the former keel.

Collected in S. Florida (1413), Congo Cay, Thatch Island, 14–16 fath., and off St. Croix, 800 m.

Pyrgoides striolatus (Brady) Fig. 109

Biloculina ringens (Lamarck), var. *striolata* BRADY, 1884, p. 143, pl. 3 fig. 7–8.
Biloculina denticulata (Brady), var. *striolata* (Brady), CUSHMAN, 1917, p. 80, pl. 33 fig. 2–3; 1929, p. 69, pl. 18 fig. 5 (*Pyrgo*).

Miliolina insignis BRADY, 1884, p. 165, pl. 17 fig. 2; FLINT, 1897, p. 299, pl. 45 fig. 2.
Triloculina insignis (Brady), CUSHMAN, 1917, p. 72, pl. 27 fig. 3; 1929, p. 64, pl. 17 fig. 2.

As mentioned above, this species consist of two "species", both with longitudinal, distinct striae on the chamber walls and both with an aperture with the broad bifid lip which is so characteristic of *Pyrgo*. One of these "species", known as *Triloculina insignis*, is common in the Caribbean Sea at considerable depths; large and small specimens of this form are always microspheric. The other species, also typical for the Caribbean, is found in shallow water, viz. around Cuba, from which I had the material, and always appears to be megalospheric. In the microspheric form the apertural conditions are unique for *Triloculina*, but typical for *Pyrgo*; it is as if a *Pyrgo* could not get its ultimate biloculine stage. The globular proloculus invariably has a diameter of 16–20 μ (in FLINT's section this proloculus is not reached, and the rounded end of one of the surrounding elongate chambers may be taken as the proloculus). The proloculus is surrounded by several sets of chambers with quinqueloculine arrangement, then the triloculine arangement follows. In the megalospheric generation the much larger proloculus (diameter about 50 μ) is followed by a single set of triloculine chambers, after which the biloculine chambers start. One might take this generation for an elongate *Pyrgo comata*. As it seems that in several Foraminifera the microspheric generation is found in deeper sea, whereas the megalospheric form is found in shallower environment, these two forms have to be considered to belong to one species.

This species had to be called *striolata* as that is the first name mentioned in BRADY's Challenger Report; I named it *Pyrgoides* as the microspheric form shows 3 chambers in the last formed whorl of chambers.

The microspheric form (*insignis*) was common in the sample W. of Cruz, depth 800 m; the megalospheric form (*striolata*) I got from Bermúdez, off Habana, Cuba, depth 2–7 fathoms.

Pyrgo comata (Brady) Fig. 110

Biloculina comata BRADY, 1884, p. 144, pl. 3 fig. 9; FLINT, 1897, p. 294, pl. 39 fig. 3.
Pyrgo comata (Brady), CUSHMAN, 1929, p. 73, pl. 19 fig. 8.

Test rounded, or, in the megalospheric form, slightly elongate, but never as in *Triloculina striolata* (Brady). Always two chambers visible, with more or less distinct longitudinal striae, but for the part near the suture of the last formed chamber which is smooth. Aperture a broad rounded slit with a broad somewhat bifid tooth, often with a distinct thickened border. Small specimens are mostly megalospheric with very large proloculus (diameter about 300 μ); much larger specimens with a small proloculus (about 25 μ). The megalospheric proloculus has a neck chamber which is sectioned one time only in the transverse section; the few biloculine chambers follow the proloculus. The microspheric form shows three sets of quinqueloculine chambers, then a set of triloculine ones, followed by the biloculine chambers. But in several specimens the quinqueloculine chambers were coiled around an axis perpendicular to the axis of the biloculine chambers, in order to be sectioned longitudinally when the biloculine chambers were transversely cut. In such cases the triloculine chambers are much tordated to attain the biloculine plane of coiling.

This species is a typical *Pyrgo*, with quinqueloculine, triloculine and biloculine arrangement of chambers in the microspheric generation, and the large megalospheric proloculus. This arrangement of chambers is also found in the type-species, *Pyrgo laevis* Defrance. (See LOEBLICH & TAPPAN, 1964, p. 465, fig. 352, 3–5).

However, the possibility remains, that *comata* and *striolata* (*insignis*) together form one single species, in which the microspheric generation seldom reaches the bilocular stage, wereas the A_1- and the A_2-generations always reach the bilocular stage. In this case the name *striolata* has priority (BRADY, 1884, p. 143).

Common in the sample W. of St. Croix, 800 m.

Pyrgo depressa (d'Orbigny) Fig. 113

Biloculina depressa D'ORBIGNY, 1826, p. 298, no. 7; Modèles no. 91; BRADY, 1884, p. 145, pl. 2 fig. 12, 16–17, pl. 3 fig. 1–2; SCHLUMBERGER, 1892, p. 160, fig. 1–5, pl. 9 fig. 48–49.
Pyrgo depressa d'Orbigny, CUSHMAN, 1929, p. 71, pl. 19 fig. 4–5.

Test large, very compressed, showing two chambers in the adult with distinct keel. Aperture a sigmoid slit with very narrow lip. Surface smooth, shining.

The species was thouroughly analysed by SCHLUMBERGER. In the microspheric generation he found a quinqueloculine arrangement, followed by a triloculine one; then the biloculine chambers start. In the megalospheric form the large proloculus is followed by a neck-chamber and the biloculine chambers.

The species was very common in the sample off St. Croix, 800 m, and Thatch Island, depth up to 22 m.

Pyrgo fischeri (Schlumberger) Fig. 112

Biloculina fischeri SCHLUMBERGER, 1892, p. 176, fig. 23–25, pl. 11 fig. 77–78.

Test somewhat depressed, circular, margin rounded, without keel. Aperture strongly sigmoid, with a strong lip which nearly fills the aperture.

SCHLUMBERGER described both generations and found in the microspheric one a proloculus with some nummuloculine chambers, followed by a triloculine arrangement before the biloculine chambers start. I could not find a microspheric species. The description by SCHLUMBERGER should point to the genus *Pyrgoides* and not to *Pyrgo*. So I placed it tentatively in *Pyrgo*.

The species was abundant in the sample off St. Croix, 800 m.

Quinqueloculina d'Orbigny

True *Quinqueloculina* species have a quinqueloculine arrangement throughout in microspheric and in megalospheric tests. There are indications that at least some species are trimorphic, forming specimens with very large proloculus with tubular neck never developing a whole coil and only few quinqueloculine chambers (A_2-generation); specimens with a smaller megalospheric proloculus with tubular neck, often forming a whole coil around the proloculus and with more quinqueloculine chambers (A_1-generation); and very large tests with a very small proloculus not followed by a tubular neck and many quinqueloculine chambers (microspheric or B-generation). An example of such a species is *Q. auberiana* d'Orbigny (see also: HOFKER, 1930, *Q. annectens*).

The type-species of *Quinqueloculina* is *Q. seminula* (Linnaeus). As this species was very common in a sample from the beach of Rimini, I have studied it from that type-locality with following results.

The test is elongate with rounded edges; the last formed chamber ends truncately at the end of the test. There is, in Rimini, a difference between the microspheric specimens which are short, whereas the megalospheric specimens are distinctly more elongate. Of the chambers visible three are easily to be seen, whereas the two other chambers are only visible as small ridges. So this genotype is not such a good example of the quinqueloculine arrangement. The test walls are smooth and always lustre, the sutures between the chambers are distinct but only very slightly depressed, and the aperture is the wide open end of the last formed chamber, provided with a simple tooth. In the transverse section the chambers have the tendency to overlap former chambers with their walls so that often the tests seem more or less triloculine; this is the reason why the two older chambers of the quinqueloculine arrangement are hardly visible. The microspheric form begins directly quinqueloculine, whereas the megalospheric proloculus is followed by a short neck-chamber; then the quinqueloculine arrangement starts (Fig. 114).

The species was mentioned by Bermúdez from off Cuba, Bahía de Matanzas, 15 fathoms deep (1935, p. 156), but CUSHMAN (1929, p. 25) denies its occurrence in the tropical Atlantic. I did not find it in any of the samples studied.

Quinqueloculina candeiana d'Orbigny Fig. 115

Quinqueloculina candeiana D'ORBIGNY, 1839, Cuba, p. 170, pl. 12 fig. 24–26; CUSHMAN, 1922, p. 65, pl. 13 fig. 1; 1929, p. 27, pl. 3 fig. 1.

Test more or less oval, about twice as long as broad, last formed chamber rounded over the aboral end and with a distinct apertural neck. Each chamber, distinctly sutured, is provided with a high keel which is sharp and straight. Thus, in apertural view five of these keels are distinguishable. The aperture is the rounded end of the neck and is provided with a short simple tooth. On transverse section the megalospheric proloculus has a neck chamber and all following chambers, arranged quinqueloculine, have a keel; each chamber forms a sharp-angled triangle on section.

The microspheric generation is less elongate and thus more resembles *Quinqueloculina lamarckiana* but for the much more developed carinae. In this form the first chambers surrounding the very small proloculus do not show the carinae, these gradually appear in the later chambers. All this might mean that *Quinqueloculina candeiana* developed from *Q. lamarckiana*. Together with *Q. auberiana* they seem to form a closely related group.

The species was very common in the sample W. off St. Croix, 800 m.

Quinqueloculina auberiana d'Orbigny Fig. 117

Quinqueloculina auberiana D'ORBIGNY, 1839, Cuba, p. 167, pl. 12 fig. 1–3; CUSHMAN, 1917, p. 46, pl. 12 fig. 1; BERMÚDEZ, 1935, p. 157.
Miliolina auberiana (d'Orbigny), BRADY, 1884, p. 162, pl. 5 fig. 8–9.

It is difficult to separate this species from *Quinqueloculina cuvieriana* d'Orbigny (see HOFKER, 1964, p. 21 fig. 9) and *Q. lamarckiana* d'Orbigny, both species with fine longitudinal striae on the test (but not always), also occurring in shallow water. I believe that *Q. auberiana* is restricted to deeper water.

Test elongate to nearly circular; chambers more or less triangular in transverse section, test wall always very thick and on the outside smooth and shining. In the small specimens of the A_1-generation the chambers show a blunt angle; in the larger specimens of the A_2 and the B generations this angle is nearly missing. Chambers arranged in a quinqueloculine pattern, but often the walls are at their sutures somewhat overlapping so that more initial chambers cannot be seen from the outside and the test gets a triloculine character (as in the type-species *Quinqueloculina seminula*). Aperture formed by the mouth of the last formed chamber, rounded, with simple tooth. The three generations are given here. The species is characteristic for deeper water.

Found off Habana, Cuba, depth 14–16 fath., and W. off St. Croix, 800 m.

Quinqueloculina lamarckiana d'Orbigny Fig. 116

Quinqueloculina lamarckiana D'ORBIGNY, 1839, Cuba, p. 187, pl. 11 fig. 14–15; CUSHMAN, 1929, pl. 2 fig. 6; BERMÚDEZ, 1966, p. 561 (literature).
Not: *Q. lamarckiana* d'Orbigny, HOFKER, 1964, p. 22, fig. 10–12.

In 1964 the author described a species which he believed to be *Q. lamarckiana*. It was found in shallow water of the Caribbean islands. In reality it stands between *Q. lamarckiana* and *Q. auberiana*, both species which are ordinarily found in deeper water. Moreover, the shallow water species often show very fine longitudinal striae on their surfaces, whereas the two species mentioned above are smooth. It may be a form allied to *Quinqueloculina crassa* d'Orbigny, var. *subcuneata* Cushman.

Typical *Quinqueloculine lamarckiana* d'Orbigny is distinguishable from *Quinqueloculina auberiana* d'Orbigny by the distinct and short carinae on each of the chambers which in *Q. auberiana* are missing, and from *Q. candeiana* in the elongate form of the latter with its very conspicuous sharp carinae. But in a way all these species belong together, in that they have triangular chambers on transverse section.

Test only slightly longer than broad, last formed chamber ending at the base of the former chamber, but protruding somewhat at the aboral end. Each chamber shows a blunt to sharpened carina and in apertural view the test is triangular. Aperture small, rounded, without definite lip and provided with a small simple tooth.

The microspheric form is slightly larger than the megalospheric one. The latter has a large proloculus with neck which in transverse section is met with twice. The later quinqueloculine chambers all have the blunt carina. In the microspheric form the proloculus is followed by about five chambers which do not show the carina, followed by the typical quinqueloculine chambers.

Found in samples from Congo Cay, Bahamas, Cayman Islands (Table 2), Puerto Rico (1415, 1416), Jost van Dyke, Thatch Island, off St. Croix, St. Martin and Antigua (Table 5), Barbuda (1536), Martinique (Table 7), Margarita (1447), Bonaire and Curaçao (Tables 9–10); previously also mentioned from e.g. Aruba, Grenada, Bimini and Cat Key.

Quinqueloculina cruziana n.sp. Fig. 118

In the description of *Quinqueloculina lamarckiana* d'Orbigny, speaking about the forms found in the West Indian collections, CUSHMAN (1929, p. 27) mentions: "there are two forms which may possibly be distinct. These both have a smooth surface but in one the peripheral angle is acute and the surface smooth and polished whereas in the other the peripheral angle is usually more blunt and the surface dull". The latter form is this new species.

Test nearly as broad as long. Chambers distinct, sutures slightly depressed. Chambers in most cases trapezoid in transverse section which results in blunt peripheral angles. Wall smooth but dull. Apertural end slightly extended, often forming a short neck from which the tooth is somewhat protruding; this tooth may be simple or slightly bifid. In some specimens the two last formed chambers are standing in opposite situation and somewhat flattened, so that the whole test points to the genus *Massilina*. In the megalospheric form the large proloculus is followed by a neck; the quinqueloculine chambers show the blunt periphery. In the microspheric form, which is the larger one, the small proloculus is followed by quinqueloculine chambers which from the beginning show the trapezoid form which in the last formed chambers may be accentuated to form two blunt angles at the periphery. Length of tests from 0.95–1.4 mm.

The species was found abundantly in the sample W. off St. Croix, 800 m. It seems to be typical for deeper water in the Caribbean region.

Quinqueloculina poeyana d'Orbigny Fig. 119

Quinqueloculina poeyana D'ORBIGNY, 1839, Cuba, p. 191, pl. 11 fig. 25–27; CUSHMAN, 1929, p. 31, pl. 5 fig. 2.

Test small, with very thin walls, up to two times as long as broad. Chambers with slightly depressed sutures which are distinct. Periphery rounded and surface with numerous fine longitudinal costae which are very regular. Aperture a crescent-shaped opening at the end of the last formed chamber with an inconspicuous lip and a small tooth which may be simple or bifid.

On transverse section the relatively large proloculus is followed by a neck-chamber and a single set of quinqueloculine chambers. The costae are sharp and often they are not found near the sutures.

Some specimens are more oval, others distinctly elongate. One specimen was observed which showed a triserial arrangement of the chambers.

The species may be confined to shallow water; found in samples off Habana, Grand Cayman (1684), Puerto Rico (1421, 1423A/B), and Barbuda (Table 6).

Quinqueloculina carinata d'Orbigny Fig. 120

Triloculina carinata D'ORBIGNY, 1839, Cuba, p. 179, pl. 10 fig. 15–17; CUSHMAN, 1922, p. 75, pl. 12 fig. 2; CUSHMAN, 1929, p. 65, pl. 17 fig. 4; HOFKER, 1964, p. 25, fig. 20.

Triloculina bicarinata D'ORBIGNY, 1839, Cuba, p. 158, pl. 10 fig. 18–20; CUSHMAN, 1922, p. 76, pl. 12 fig. 7; CUSHMAN, 1929, p. 66, pl. 17 fig. 5.

Quinqueloculina reticulata (non d'Orbigny?), SCHLUMBERGER, 1893, p. 72, fig. 25, pl. 2 fig. 63–64.

Quinqueloculina reticulata d'Orbigny, var. *carinata* d'Orbigny, WIESNER, 1923, p. 52, pl. 8 fig. 88; LE CALVEZ, 1958, p. 183, pl. 5 fig. 34–35, 43.

Already in 1964 I stated that the species begins as *Quinqueloculina* but, as the last formed chambers adhere to the carinae of former chambers, the quinqueloculine arrangement is somewhat reduced to 4 or even 3 outer chambers. The transverse section, given by SCHLUMBERGER of a specimen from the Gulf of Marseille is identical to that given by me in 1964 for a specimen from the southern part of the Caribbean. In that region most specimens show one carina on each of the last formed chambers. However, especially in the North of the Caribbean Sea the tests show two carinae on the last formed chamber in most cases observed (*T. bicarinata* d'Orb.). Former chambers, however, show one carina.

This leads to the conclusion, that all specimens with a reticulate test with one carina, with two carinae or, even, in young specimens, with no carina at all, must be regarded as one single species with the first-mentioned name, *carinata*. Those with two carinae have obviously developed in better circumstances than those with one carina. In the surroundings of Cuba there are very large specimens in which the carinae are distinctly undulating (see BERMÚDEZ, 1935, pl. 12 fig. 1–3).

Especially some bicarinate specimens show the true structure of the species, a quinqueloculine one. SCHLUMBERGER was the first to state the true nature of this species, though it remains remarkable that in the end some of the carinate specimens show a more or less trilocular arrangement of the chambers.

Found in samples from Florida (1413), Congo Cay, off Habana, Cayman Islands (Table 2), Puerto Rico (1419/A), Thatch Island, St. Croix (1405/6), St. Martin, Saba and Antigua (Table 5), Barbuda (1396, 1532), Bonaire (Table 9), Curaçao (1639); previously also listed from Aruba, Aves de Sotavento, St. Croix, New Providence, Bimini and Cat Key.

Massilina gualtieriana (d'Orbigny) Fig. 121

Quinqueloculina gualtieriana D'ORBIGNY, Cuba 1839, p. 186, pl. 11 fig. 1–3.
Quinqueloculina planciana D'ORNIGBY, Cuba 1839, p. 186, pl. 10 fig. 24–25, pl. 11 fig. 4–6.
Quinqueloculina cuvieriana D'ORBIGNY, Cuba 1839, p. 190, pl. 11 fig. 19–21; p. 21, fig. 9; HOFKER, 1964, p. 21, fig. 9.
Miliolina cuvieriana (d'Orbigny), FLINT, 1897, p. 298, pl. 43 fig. 4.

It is a very variable species. Small specimens often show a fine longitudinal strigillation, others are smooth; many larger specimens show a smooth surface with several transverse depressions over the chamber walls. Some have the margins acute, often with a distinct keel, others have two or more costae along the margin of the last formed chamber; some have a rounded margin, or the last formed chamber has such a margin, whereas the former chamber has a keel. Often one gets the impression that the species belongs to *Massilina* with the two last formed chambers opposite to each other. But all specimens have a very conspicuous tooth in the more or less wide open, somewhat loop-shaped aperture with a more or less distinct border which, however, does not protrude over the rest of the test. This tooth consists of a column which begins at the base of the aperture and ends in a broadened part which is but slightly bifurcate; this end of the slender tooth bends down into the apertural opening, so that the tooth resembles a hook when seen from aside. This hook protrudes somewhat, but its end does not.

Very depressed forms resemble *Q. planciana* d'Orbigny, most specimens, when adult, look like *Q. gualtieriana* d'Orbigny; specimens with elongate striae were figured by FLINT as *Q. cuvieriana* d'Orbigny, and specimens with rounded margin, which are young forms or have a large proloculus, resemble *Triloculina gualtieriana* d'Orbigny. The fact that in Barbados and in St. Vincent the species was very common and that it was nearly the only species found in these samples, makes it very probable that all these "species" created by D'ORBIGNY belong to one single species.

In transverse sections in later chambers there is a tendency to overlap some of the quinqueloculine earlier chambers, thus becoming triloculine; moreover, the earlier chambers do not show the keel, and in specimens without any trace of a keel the proloculus is much larger than in the specimens with a keel in the end-chambers. In large specimens with the last formed chambers opposite to each other (angle between the chambers not 72° but 180°), the transverse section is that of *Massilina*, or *Sigmoilina*.

The large variability of the forms which obviously belong together may be compared with the variability of forms of *Triloculina linneiana* d'Orbigny, obtained by SCHNITKER (1967) and of *Spiroloculina hyalina* Schulze by ARNOLD (1964).

Found in samples from S. Florida (Table 1), Grand Cayman (Table 2), Puerto Rico (1424), St. John (1407/8), St. Kitts (1397), Barbuda (1532), Antigua (1541), Dominica (1546), Martinique (1439), St. Vincent (1549), Barbados (1553), Margarita (1447), Curaçao (Table 10). Mentioned by HOFKER, 1964, sub *Quinqueloculina cuvierana*) from Grenada, St. Kitts, St. Martin and Bimini.

Massilina protea Parker — Fig. 122

Massilina protea Parker, 1953, p. 10, fig. 2, pl. 2 fig. 1–4.

Test nearly oval, slightly longer than broad, compressed, with a rounded margin. Chambers in most specimens forming a half coil, in some instances shorter. The last formed chambers opposite each other, former chambers in quinqueloculine arrangement or more or less triloculine. Sutures of the last formed chambers depressed. Wall dull, in many specimens smooth, in others with irregular longitudinal costae, often not continuous. Aperture nearly circular, with a thick polished lip and a broad and low tooth, often with two dents at the ends.

The species is very variable in shape and often the individuals are distorted. It is found in some samples in numerous specimens forming the bulk of the Foraminifera, and in some samples it is the only species found. It seems to be most frequent in localities which are unfavourable for other foraminiferal species, generally in environments with a high salinity. It was first described from San Antonio Bay of the Gulf Coast of Texas.

Found in samples from Grand Cayman (1684), St. Thomas (1674), Lac, Bonaire (Table 9) and Spaanse Water, Curaçao (Table 10).

Dentostomina bermudiana Carman — Fig. 123

Dentostomina bermudiana Carman, 1933, p. 31–32, pl. 3 fig. 6.

Test in megalospheric generation typically quinqueloculine, in the microspheric form more rounded, more compressed, as the last formed chambers are opposite to each other as in *Massilina*. Wall at the outside agglutinated, with one or more layers of sand grains of various diameters, whereas the inner part is porcellaneous calcareous and of a yellowish brown colour. The aperture in full-grown specimens has a bifid tooth and a crenulated border.

Transverse sections show that the megalospheric proloculus is followed by a short neck-chamber; then the quinqueloculine arrangement of chambers starts. In the microspheric generation the proloculus is very small and is directly followed by the quinqueloculine chambers. After three whorls of these chambers the last formed ones are opposite to each other. In 1964 (p. 25) I suggested that there might be a connection between *Quinqueloculina agglutinans* d'Orbigny and *Dentostomina bermudiana* Carman. It may be that the latter is the deep-sea form of *Q. agglutinans.*

It is not impossible that *Quinqueloculina bidentata* d'Orbigny is closely related to this species. It may be the shallow-water form of *D. bermudiana.*

Common in the sample W. of St. Croix, depth 800 m.

Triloculina bradyana (Cushman) Fig. 124

Quinqueloculina bradyana CUSHMAN, 1941, p. 3, pl. 1 fig. 5–6.

Test elongate, the last formed chamber extending from the rest of the chambers at both ends. Chambers with several carinae which irregularly twist along the sides of the test. In adult specimens at least five stronger carinae are visible. Because of these carinae the sutures between the chambers cannot be found, seen from the outside. The rounded aperture is seen at the end of the more or less elongate neck of the last formed chamber and is provided with a simple tooth. Length of tests not more than 1 mm.

On transverse section it appears that the species does not belong to *Quinqueloculina* but that all the chambers in the megalospheric form are arranged in a triloculine structure.

Remarkable is the development of the carinae in the test; the earlier chambers have one carina, later chambers develop two of them, and the last formed chamber shows three carinae.

The species has been described by CUSHMAN (1929, p. 29, pl. 4 fig. 1) from Cuba and Jamaica (but is it not certain that it is the same species as described in 1941), and was now found W. off St. Croix, depth 800 m, off Habana, 2–5 fath., Thatch Island, 14–16 fath., and La Désirade (1437).

Triloculina tricarinata d'Orbigny Fig. 126

Triloculina tricarinata D'ORBIGNY, 1826, p. 299; Modèles no. 94; BRADY, 1864, p. 446, pl. 48 fig. 3; CUSHMAN, 1929, p. 56, pl. 13 fig. 3; HOFKER, 1932, p. 106; 1968, p. 20, pl. 4 fig. 7–10.
Miliolina tricarinata (d'Orbigny), BRADY, 1884, p. 165, pl. 3 fig. 17.

Test with three visible chambers, each chamber with two sharp angles, sutures between the chambers smooth. Test from aside slightly longer than broad, triangular in end view. Wall smooth, polished. Aperture rounded, with bifid tooth in the megalospheric and smaller specimens, in full-grown microspheric specimens the two ends of the tooth grow together and form a circular structure with a distinct opening in the middle. Walls extremely thin.

There are three generations; the large form (length 5–6 mm) is the microspheric one, with a proloculus with a diameter of about 10 μ; the megalospheric generations are smaller with a length up to 4 mm, and proloculi with diameters from 400 μ (A_2-generation) and 125 μ (A_1-generation). The larger the proloculus is, the smaller is the test, with less chambers. In the microspheric tests the proloculus has no neck-chamber, whereas the megalospheric proloculi are provided with a distinct neck-chamber. In the A-generations the tests show 6–10 chambers, whereas the microspheric specimens have up to 23 chambers. Just as was described by me of *Quinqueloculina curta* Cushman (1933, p. 98–102 fig. 19–20, pl. 3 fig. 13–25) the tooth becomes more complicated when the test becomes larger. The end of the complication is the annular tooth.

I had this species from the Mediterranean (Ammontatura, Bay of Naples), where they were very small (1932). It was found abundantly in several stations of the Ingolf Expedition from the North Atlantic. Many specimens occurred in the Sta. W. of St. Croix, depth 800 m. It is a deep-water species. The Atlantic species were larger than those found in the Caribbean sample.

Sigmoilina Schlumberger

The name *Sigmoilina* appears for the first time in SCHLUMBERGER, 1887, not in the text, but only in the explanation of plate 7, on p.

118, where the type-species is designated as *Sigmoilina (Planispirina) sigmoidea* Brady. CUSHMAN, in the Monograph of the Foraminifera of the North Pacific Ocean (1917), designated for the first time *Planispirina sigmoidea* Brady as the type-species on p. 60. So it is not certain at all, that according to the rules of nomenclature the genus should not be named *Sigmoilina* Cushman, for in the text by SCHLUMBERGER the name *Sigmoilina* was not mentioned anywhere.

SCHLUMBERGER gave the description of two other species, called by him *Sigmoilina (Planispirina) celata* Costa and *Sigmoilina edwardsi* Schlumberger, in the explanation of the plate as well. In the text they are mentioned as *Planispirina celata* Costa, sp. and *Planispirina edwardsi* Schlumberger. The designation "*Planispirina celata* Costa sp." shows that SCHLUMBERGER was not certain about the Recent species which he analysed, being identical with the fossil species described by COSTA. Later SILVESTRI (1904, p. 267) named the Recent form *Sigmoilina schlumbergeri* Silvestri.

FINLAY (1947, p. 270) once again tackled *Sigmoilina schlumbergeri* Silvestri; he showed that it belongs to a group which differs from *Sigmoilina sigmoidea* (Brady) in having agglutination in the outer parts of the calcareous walls and showing a distinct tooth in place of a plate; so he created the genus *Sigmoilopsis* Finlay for this group with *S. schlumbergeri* as type-species. But in the first place, there are species of *Quinqueloculina* which also have this outer agglutination, and LOEBLICH & TAPPAN (1964, p. 466) showed that specimens of true *Sigmoilina sigmoidea* may have a tooth also. So LOEBLICH & TAPPAN stressed another difference, as they mention that "they have less enveloping chambers so that more than the final pair are visible externally and the interior does not have the laminated appearance of *Sigmoilina*". However, careful examination of thin sections revealed that the walls of the chambers of the agglutinated group are extending as much over the walls of former chambers as is found in *Sigmoilina sigmoidea*, so that in summary there are no fundamental differences between *Sigmoilina* and *Sigmoilopsis*. Moreover, there is a striking similarity between the entirely calcareous and the agglutinated forms in that the megalospheric proloculus in both instances is followed by one or more very elongate neck-chambers pointing to *Nummuloculina*. The author (1971b) described an orthogenetic evolution from *Quinqueloculina*-like forms through *Sigmoilina* up to *Spirosigmoilina* in the Upper Albian, all of which showed the long narrow chambers encircling the proloculus, but in this series of forms no typical teeth could be found.

So the author believes that *Sigmoilina, Sigmoilopsis* and *Spirosigmoilina* cannot be separated and belong to one form-group, *Sigmoilina,* the latter being derived from quinqueloculine forefathers with nummuloculine embryonic apparatus. This apparatus is clearly shown in the B-form of *Sigmoilina sigmoidea* in fig. 4 in the monograph by SCHLUMBERGER (1887); it is also found in the fig. 7 of a B-specimen of *S. schlumbergeri* as shown by him.

Sigmoilina sigmoidea (Brady) Fig. 127

Planispirina sigmoidea BRADY, 1884, p. 197, fig. 5c, pl. 2 fig. 1–3; SCHLUMBERGER, 1887, p. 106, fig. 1–5, pl. 7 fig. 9–11; FLINT, 1897, p. 302, pl. 47 fig. 6.
Sigmoilina sigmoidea SCHLUMBERGER, 1887, p. 118; GOËS, 1896, p. 80; CUSHMAN, 1917, p. 61, pl. 24 fig. 2–3; 1929, p. 50, pl. 11 fig. 5–6; LOEBLICH & TAPPAN, 1964, p. 465, fig. 353, 1.

The test is more or less lenticular with slightly rounded margin. Only two chambers are visible from the outside, one of them strongly overlapping the preceding one. Seen from the broader side the test is oval. The aperture of the last formed chamber is a crescent-formed slit with a more or less developed lip and in some cases a broad tooth, resembling that of some *Pyrgo*-species. The wall is smooth and shining.

On transverse sections the megalospheric proloculus is furnished with a long neck, followed by two chambers encircling the proloculus in a direction perpendicular to the neck and in a direction perpendicular to the section. In this way the embryonic apparatus strongly resembles that found in *Nummuloculina* and in *Miliolinella.* In the Recent species the sigmoiline chamber-arrangement follows directly upon this embryonic apparatus. The angle between the successive sigmoiline chambers is about 175°, measured from the centre of the proloculus. SCHLUMBERGER figured a section through a microspheric specimen in which many nummuloculine chambers follow the proloculus and in which the last formed chambers form an angle of 180°, thus pointing to the genus *Spirosigmoilina* (fig. 4).

Characteristic of *Sigmoilina* is the fact that each chamber adheres to only one of the sides of a former chamber. In *Sigmoilina sigmoidea* the chamber walls are strongly overlapping each former chamber. This characteristic already begins in the oldest known species from the Albian, and thus is a typical characteristic of *Sigmoilina.*

Known from all oceans, only from deeper water (Pacific from 218–554 fathoms, Atlantic and Caribbean from several hundred fathoms). Found W. of St. Croix, 180 m.

Sigmoilina schlumbergeri Silvestri — Fig. 128

Planispirina celata spec. SCHLUMBERGER (non Costa), 1887, p. 111, fig. 6–7, pl. 7 fig. 12–14; CUSHMAN, 1917, p. 61, pl. 24 fig. 1.
Sigmoilina schlumbergeri SILVESTRI, 1904, p. 267; CUSHMAN, 1921, p. 449; 1929, p. 49, pl. 11 fig. 1–3.
Sigmoilopsis schlumbergeri (Silvestri), FINLAY, 1947, p. 270; LOEBLICH & TAPPAN, 1964, p. 466, fig. 353, 1.

Test ovate, agglutinated at the outside, showing only the last formed chambers more distinctly, with rounded aperture on a short neck provided with an inconspicuous dent. On transverse sections the chamber-hollows themselves are narrow as is the case in *Sigmoilina sigmoidea*; chamberwalls at distal side of each chamber not overlapping, at proximal side strongly overlapping each former chamber till the chamber is reached from the opposite spiral. This structure is known from primitive *Sigmoilina* also. Wall of chambers calcareous but covered at its outside with numerous sand grains as in other agglutinated Miliolidae, such as *Quinqueloculina bidentata* d'Orbigny, "*Sigmoilopsis*" *arenata* (Cushman), *Quinqueloculina agglutinans* d'Orbigny (see for these species the transverse sections given by HOFKER, 1964, fig. 14d, 17e, 23e, 27d, 20–30), *Quinqueloculina annectens* (Schlumberger) (HOFKER, 1930, fig. 8B). The megalospheric proloculus is followed by one or more narrow chambers encircling it in a plane perpendicular to the transverse section, after which the sigmoidally arranged chambers start, and not, as mentioned by LOEBLICH & TAPPAN, by a quinqueloculine set of chambers. The angles between two successive chambers measured from the centre of the proloculus are about 175°, as in *Sigmoilina sigmoidea*. The boundaries between the chambers can only be seen in very thin sections, due to the agglutination (they are not figured in the sections given by SCHLUMBERGER).

As the differences between *Sigmoilina* and *Sigmoilopsis*, in reality, are very insignificant, the author is inclined to believe the genus *Sigmoilopsis* a synonym of *Sigmoilina*; the agglutination is not typical enough to distinguish it from *Sigmoilina*; in that case also agglutinated species of *Quinqueloculina* should be separated from the calcareous species of that genus, which is not done.

The spieces is typical for deep water (for the Atlantic Ocean and the Caribbean Sea CUSHMAN gives depths from 169–2045 fathoms). It was common in the sample W. off St. Croix, 800 m.

Schlumbergerina occidentalis (Cushman) Fig. 129a–b

Schlumbergerina alveoliniformis (Brady), var. *occidentalis* CUSHMAN, 1929, p. 36, pl. 7 fig. 2.
Schlumbergerina areniphora Munier-Chalmas, HOFKER, 1971, p. 15, fig. 10–17.
Sigmoilina asperula (Karrer), CUSHMAN, 1929, p. 49, pl. 49 fig. 4.
Not: *Massilina alveoliniformis* MILLET, 1898, p. 609, pl. 13 fig. 5–7.
Not: *Massilina asperula* (Karrer), CUSHMAN, 1921, p. 447.

In 1971 I described a species as belonging without any doubt to the genus *Schlumbergerina* from the Caribbean, mentioning that CUSHMAN described it from that region as *Schlumbergerina alveoliniformis* (Brady), var. *occidentalis* Cushman.

In 1968 I analysed the species of *Schlumbergerina* which MILLET described and figured as *Massilina alveoliniformis* and demonstrated that in reality this species from the Pacific ought to be named *Schlumbergerina areniphora* Munier-Chalmas. In 1971 I mentioned that the main difference between the species from the Pacific and that found in the Caribbean was that the Caribbean species is much smaller and that the initial part of the Pacific species always begins with 6 chambers surrounding the proloculus and that the later clustering chambers are yet more numerous, till 10 in a coil. In the Caribbean species, the number of chambers surrounding the proloculus is mostly 5, which number is maintained throughout the test. I believed in 1971 that this Caribbean form was smaller and has less chambers due to less favourable circumstances. Moreover, the flat spreading form, found in the Pacific species and leading to the name *Massilina*, was till that time unknown from the Caribbean.

Such a flat form, however, was known from the Caribbean under the name of *Sigmoilina asperula* (Karrer). It is a rare form in the Caribbean, but I found it in the sample off Frederiksted, St. Croix, depth 800 m. Analysis showed that it begins with 5 chambers surrounding the proloculus, but that later chambers are formed more or less in a flat plane, just like the species described by MILLET from the Pacific. This form was found later in the Spaanse Water also.

Since the general structure of the test is that of typical *Schlumbergerina* but the number of chambers is that of the fusiform species described by CUSHMAN from the Caribbean as var. *occidentalis*, this form with fusiform and flattened structure may best be distinguished as a distinct species, *Schlumbergerina occidentalis* Cushman.

The Caribbean material may be described as follows.

Test small, mostly fusiform, in optimal conditions flat and oval, resembling a *Massilina*. The fusiform form is built up as a *Quinqueloculina*, so that even at the outside 5 chambers are visible; in the flat form the initial part with 5 chambers surrounding the proloculus, later chambers two in a whorl and arranged in a more or less flat plane.

Wall finely arenaceous, with larger grains of calcite imbedded in a mass consisting of very fine grains. Transverse sections of chambers with rounded lumen and most of the chambers completely surrounded by the agglutinated wall. Aperture in both forms at the end of the last formed chamber, closed by a very peculiar plate with a number of rounded openings, a typical trematophore. Length of the fusiform variety never more than 1 mm, thickness about 0.5 mm; length of the flat variety 0.9 mm, width 0.6 mm, thickness 0.2 mm, or even more.

This Caribbean species is very close to the Pacific one and even shows the same two varieties as found in the Pacific species. *Schlumbergerina* seems to be an offspring of the fossil genus *Miliola* (chambers completely surrounded by their walls and possessing a trematophore over the aperture).

Occurring in the mouth of Piscadera Bay, Curaçao, and in samples from off St. Croix, depth 300 and 800 m. Found abundantly in the Spaanse Water, Curaçao (Table 10), and in Grand Cayman and Jamaica (Table 2) and La Désirade (1437), also in the flat form.

Vertebrasigmoilina gen.nov.

The genus *Vertebralina* d'Orbigny was based on *Vertebralina striata* d'Orbigny from the Mediterranean. Good material was available from the coast of Delos, from where the topotype derived, figured by LOEBLICH & TAPPAN, 1964 fig. 346, 2. This species was described by LOEBLICH & TAPPAN as follows: "Test free, flattened, early portion trochospiral, later uncoiling; wall calcareous, porcellaneous, surface may have longitudinal ribs or striae; aperture a terminal, narrow, elongate slit with bordering lips, aperture most evident from umbilical side of coil". The tests show two different sides, one slightly convex, the other flat or in the centre even concave; the aperture is opening at the latter side. The transverse section shows a rounded proloculus with short neck-chamber, followed by chambers only slightly trochoidally placed which all show their apertures towards the flat side: most of the chambers overlap former ones at the flat side. There are about 4 chambers in a coil, with the last formed chambers tending to become uncoiled (see Fig. 125).

CUSHMAN & TODD (1944, p. 74–75) described *Vertebralina striata* as the only species and recorded it from Mediterranean and the Pacific (Fig. 126). *Nodobaculariella*, a genus which in some ways resembles *Vertebralina*, but actually greatly differs, is known from recent localities in the tropical area of the Atlantic (*N. atlantica* Cushman & Hanzawa); most recently species of this genus are found in the Pacific.

In 1922 CUSHMAN described *Articulina mexicana* from Florida (p. 70, pl. 11 fig. 7–8). This species is a deep-water form. It occurred abundantly in the sample off St. Croix, depth 800 m. But it is not an *Articulina,* since the latter genus begins as a *Triloculina.* The outer characteristics resemble those of *Vertebralina,* but the aperture is not bent towards one side and the two sides of the tests are similar and not convex and flat. Moreover, the inner structure, revealed on transverse sections, is quite different. For this species a new genus is necessary.

The characteristics of the genus are those of the type-species: *Articulina mexicana* Cushman.

Test equally built on both sides, in the coiled part chambers strongly overlapping, about three chambers visible forming the last formed coil, with in well-developed specimens up to two chambers uncoiling in a straight line. Wall with more or less distinct fine striae running longitudinally over the surface of each chamber. Aperture an elongate narrow slit with slightly distinct border curling outward, especially at the sides of the chambers. Margin of the test sharp, often slightly keeled. A section parallel to the broad side of the test reveals a proloculus with long neck chamber, followed by several coils consisting of three chambers. This neck-chamber is seen on transverse section also, but then the following chambers are placed distinctly in a sigmoidal arrangement, till at the end some chambers may become spiroloculine. This arrangement differs greatly from that found in *Vertebralina,* hence the name of the new genus. As in *Sigmoilina* the chambers adhere to only one of the sides of a former chamber, and have strongly overlapping walls.

Vertebrasigmoilina mexicana (Cushman) Fig. 130

Articulina mexicana CUSHMAN, 1922, p. 70, pl. 11 fig. 7–8.
Articulina spec., SEIGLIE, 1970, fig. 27–28.

With the characteristics of the genus.

Common in a sample off Habana, 2–5 fath.; abundant W. of St. Croix, 180 and 800 m, moreover found at Thatch Island, 15–22 m, Saba (Sta. 1432), and Antigua (1540A).

Orbitolites (Amphisorus) hemprichii (Ehrenberg)
Fig. 131, 161–162

This species was already treated by me as *Orbitolites marginalis* Lamarck (1952, p. 109), and as *O.* (*Amphisoris*) *hemprichii* (Ehrenberg) (1964, p. 52; 1971, p. 50). From the samples studied now many specimens could be gathered, and 173 individuals showed well-developed initial parts.

The microspheric generation is very rare (among 190 specimens only one microspheric specimen could be traced for certain). It begins with a small proloculus with an inner diameter of 16 µ; this chamber was followed by about 7 spiral chambers which were followed by numerous small more irregularly arranged chambers. Then larger chambers started in clock-counter clockwise arrangement. The total specimen measured 1.1 mm; it was not fully adult and consequently brood-chambers failed.

In the megalospheric generations the more or less globular proloculus is followed by a large neck-chamber which more or less encircles the proloculus; this neck-chamber is followed by one large first chamber, then a row of two and a row of four chambers are found, before the smaller irregularly arranged chambers start. There are two main groups of proloculus-diameters: one of 52–64 µ, another of 70–86 µ, with some rare specimens showing proloculi which are larger yet, up to 115 µ. The specimens with average proloculus diameter of 58 µ show, after the first rows of larger chambers, some rows of irregularly arranged smaller chambers, soon followed by larger chambers which may or may not be arranged in clock-counter-clock-wise pattern. These chambers are followed by more voluminous chambers, arranged in circular rows; they have thinner walls, with radially placed walls in between and with a height of about 100 µ. Then several rows are found at the outside of the test in which the radial walls of the chambers are missing or are only poorly developed, the so-called brood-chambers, with a radial diameter of about 120 µ. In several of such large individuals, with a total diameter of 3–4 mm, still a multitude of embryons were found. These embryons invariably had very large proloculi (diameters about 86 µ), without the neck-chamber. Always, when the proloculus of the mother-individual measured about ± 58 μ, the embryons had a proloculus with diameter of 86 μ. Obviously the mother-individual belonged to the A_1-generation, whereas the embryons were of the A_2-generation (see Fig. 161).

Several individuals of the A_1-generation showed two initial parts (plurivalent specimens). In one specimen from Sta. 1532, Barbuda, the two embryons are opposite; the rows of first chambers are mingled together to form an irregular network of small chambers; in a second specimen from Sta. 1666, Curaçao, the two embryons are situated similarly and thus the two short spirals of large initial chambers are properly developed. In both individuals no clock-counter-clockwise structures are developed.

The embryons found in the brood-chambers of the A_1-individuals give rise to the A_2-generation. Individuals of this generation show relatively small later chambers in distinct clock-anticlock-wise patterns and they never show the development of brood-chambers, even in large individuals, as they do not form embryons by schizogony, but microspores by gamogony. WINTER (1907) showed that in *Peneroplis pertusus*, allied to *Orbitolites*, microspores fuse and form the proloculus of the microspheric form (see Fig. 162).

So, in *Orbitolites* (*Amphisorus*) *hemprichii* (Ehrenberg) the life-cycle has to be similar to that found in *Peneroplis*. WINTER showed that the gamonts of *Peneroplis* have larger proloculi than are found in the schizonts (see also the reproduction of WINTER's figure in LOEBLICH & TAPPAN, 1964, p. 79, fig. 44). In how far *Peneroplis pertusus* has two agamont A-generations, was found by the author in 1952, (p. 349, fig. 29). In any case, *Orbitolites* (*Amphisorus*) *hemprichii* is here shown to be trimorphic. And so it will be obvious that in some samples we find mainly specimens of the A_1-generation, in other this generation is mingled with specimens of the A_2-generation, whereas there are also populations with only the A_2-generation, viz. sta. 834, Barbuda.

Found now in the Florida Keys (Table 1), Cayman Islands (common, Table 2), Puerto Rico (1919/A), Thatch Island, St. Croix (1405), St. Martin and Antigua (Table 5), Barbuda (Table 6), La Désirade (1437/8), Tobago, Bonaire (Lac, Table 9), and Curaçao (Spaanse Water, Table 10).

Planorbulina d'Orbigny

This genus is characterised by an early set of spirally arranged chambers, which may or may not be trochospiral, followed by chambers with two foramina, one at the proximal, and one at the distal side of each chamber, provided with more or less distinct lips. As soon as these chambers appear, the original spiral growth is terminated, as two adjacent chambers often form a third one. The chamber walls and the septa in the first spiral chamber are distinctly monolamellar, in the later spiral chambers an indistinct basal layer of granular material is covered by a more hyaline lamellum. In this case the pores are narrowed in the granular part of the wall and widen towards the surface. In the biforaminal chambers later in the tests the walls seem to be double, since here the granular "lamellum" is found in the middle of the wall. From the granular lamellum inward the pores in these chambers are widening towards the inner surface of the walls and attain their narrowest part at the granular lamellum. Obviously this granular lamellum is the primary wall, which in the primary chambers is not covered; in later chambers it is covered by a hyaline thickening at the outside and in the last formed chambers it is covered at the inside again. The structure of the pores proves that the walls in the biforaminal chambers are not bilamellar in the sense given by SMOUT and REISS, and that the genus is monolamellar in origin. The structure of the walls is microgranular. At the ventral side of the overlapping chambers two slit-like extra apertures are found.

Type species: *Planorbulina mediterranensis* d'Orbigny (Fig. 132).

All species with a single layer of chambers around an initial spiral, with later chambers forming two foramina as in *Cymbaloporetta*, may form a single genus: *Planorbulina*; all later chambers show the secondary doubled walls. In the Caribbean four species occur: *P. caribbeana* n. sp., *P. acervalis* Brady, *P. mabahethi* Said, and *P. retinaculata* Parker & Jones. The latter species is the type-species of *Planorbulinoides* Cushman, but since the only difference lies in the later chambers becoming separated from each other at their sides, I believe that this characteristic is not important enough to justify a genus. CUSHMAN defines his genus as: "Test attached, in early stages similar to *Planorbulina* but later chambers spreading, becoming elongate and more or less separated to form a network; apertures in the early stages as in *Planorbulina*, later several ones on the sides of the chambers, with very short necks". In *Planorbulina mediterranensis* at the ventral side the chambers also develop such extra foramina, just as in *Cymbaloporetta* (see HOFKER, 1960, p. 254, fig. 129); this characteristic is also found in the type-species of *Planorbulina*, and so *Planorbulinoides* is synonymized with *Planorbulina*.

Planorbulina caribbeana n.sp. Fig. 133

Planorbulina mediterranensis (not d'Orbigny), CUSHMAN, 1922, p. 45, pl. 6 fig. 1–2; CUSHMAN, 1931, p. 129, pl. 24 fig. 5–8; HOFKER, 1969, p. 135, fig. 429; SCHNITKER, 1969 ("*P. mediterranensis*"), pl. 15 fig. 2–4.

Comparison with true *Planorbulina mediterranensis* from the Mediterranean shows many differences which are important enough to separate the two species:

P. mediterranensis – Pore-index: 3–3 (× 500); thickness of wall: 5 mm (× 375); vental chambers strongly overlapping, in structure found as in *Cymbaloporetta*; triangular; dorsal side very flattened, with rounded chambers; individuals relatively large with angular margin; apertures at ventral side. – In shallow water only (Fig. 132).

P. caribbeana – Pore-index: 2–3.5 (× 500); thickness of wall: 2.5 mm (× 375); ventral chambers scarcely overlapping, not resembling *Cymbaloporetta*, in form of trapezia; dorsal side with convex chamber walls, later chambers elongate; individuals small with rounded margin; apertures marginal. – In deeper water, not in the tidal zone (Fig. 133).

The species was found in the sample W of St. Croix, depth 800 m and 180 m, between Tortola and Jost van Dyke, and at Congo Bay, Bahamas.

Planorbulina acervalis Brady — Fig. 134

Planorbulina acervalis BRADY, 1884, p. 657, pl. 92 fig. 4; FLINT, 1897, p. 328, pl. 72 fig. 7j; CUSHMAN, 1922, p. 45, pl. 6 fig. 3; CUSHMAN, 1931, p. 130, pl. 25 fig. 1; HOFKER, 1964, p. 85, fig. 217–219.

The following details may be added to my 1964 description of this common, flat species. Pore-index: 4–2.5 (× 500); the ventral side shows convex chamberwalls, the dorsal side is very flattened; the spiral following the proloculus is short, the later chambers become irregular in shape and may overlap at the ventral side; the later chambers, especially those at the periphery have many apertures at the ventral side on short necks; the later walls are "double".

Found in samples from the Florida Keys (Table 1), Grand Cayman (Rum Pt), Puerto Rico (1419), Barbuda (1532, 1535), Montserrat (1542), Guadeloupe, Dominica, Martinique and Barbados (Tables 7–8), Bonaire (Table 9).

Planorbulina mabahethi Said — Fig. 135

Planorbulina mabahethi Said, 1949, p. 44, pl. 4 fig. 26.

This species from the Red Sea occurs in the Northern Caribbean also. Characteristic are the large chambers at the periphery, the mainly excentric initial spiral, the large conspicuous pores with papillae in between, and the thick, opaque walls, due to a thick primary granular lamellum. The megalospheric proloculus is followed by a planospiral set of chambers with thick outer walls but with monolamellar septa. After about 8 chambers the first biforaminal chamber is formed. Later many chambers are biforaminal, but also monoforaminal chambers are found, especially in the vicinity of the initial spiral. The specimens described by SAID are obviously young ones, as he speaks of only one foramen per chamber. The foramina are rounded openings, provided with a distinct neck which surrounds the opening from all sides, so that they become slightly areal. On section the walls of the later chambers show a thick primary wall consisting of granular material (it may be called agglutinated, thickness about 4 μ), with an outer and an inner more hyaline lamellum.

The pores which are very large (pore-index 2–5 (× 500)), show their narrowest part at the primary lamellum and consequently the later chamber walls are not bilamellar in the sense of SMOUT and REISS.

Found in samples from the Florida Keys (Table 1), Bimini (1151), Cuba (off Habana, 2–5 fath.), Grand Cayman (Rum Pt), Jamaica (1683), St. John (1407, 1408), Thatch Island (14–16 fath.), St. Martin (830), Barbuda (1531), La Désirade (1437), Dominica (1546), Martinique (1439), Bonaire (Table 9), Curaçao (Table 10).

Planorbulina retinaculata Parker & Jones Fig. 136

Planorbulina retinaculata PARKER & JONES, in CARPENTER, PARKER & JONES, 1862, p. 209; PARKER & JONES, 1865, p. 380, textfig.; LOEBLICH & TAPPAN, 1964, fig. 558.
Planorbulinoides retinaculata (Parker & Jones), CUSHMAN, 1928, p. 6; 1931, p. 132.

Test large, in the centre at the ventral side overgrown by extra chambers, at the dorsal attached side flat. Here the initial chambers are visible. Initial chambers forming a flat, nearly planospiral whorl of monoforaminal chambers, followed by rounded chambers as in *P. mediterranensis*, succeeded by more wild-growing chambers as in *P. acervalis*, often with two or even more foramina, at the periphery with elongate chambers projecting from the main test which are fan-shaped at their ends and have openings in between. In the Caribbean specimens these chambers are not so wild-growing as in the type-specimen. Walls smooth, thin (transverse diameter about 4 μ), with relatively fine pores (pore-index 4–1.5 (× 500). In the initial spiral the walls and septa are simple, in the later biforaminal chambers they are "double", with a thin primary wall in between the two hyaline lamellae. Margin of the test acute.

Though CUSHMAN (1931, p. 133) states that the species is confined to the Indo-Pacific, it was found commonly in the Caribbean region: Puerto Rico (1419A), Barbuda (1532), Montserrat (1542), Guadeloupe, La Désirade and Marie-Galante (Table 7). Not found in samples from the Leeward Group.

Sporadotrema rubrum (d'Orbigny) Fig. 137

Planorbulina rubra D'ORBIGNY, 1926, p. 280, no. 4; FORNASINI, p. 44, pl. 2 fig. 3.
Gypsina rubra (d'Orbigny), HERON-ALLEN & EARLAND, 1915, p. 725, pl. 53 fig. 35–37; CUSHMAN, 1931, p. 137.
Sporadotrema rubrum (d'Orbigny), HOFKER, 1927, p. 21, pl. 7, pl. 8 fig. 8.

Test attached to shell-fragments, often in hollow parts. Colour pinkish. Test consisting of a single layer of chambers, beginning with a long spiral, the later chambers growing in different directions. Chambers of the initial spiral with only one foramen at the base of the chambers, later forming a foramen more distally as well. Later chambers often irregularly formed and somewhat spreading. The outer chamber walls are provided with knobs and sharp protuberances between the pores, thick, at the ventral (exposed) side consisting of two lamellae separated by an hyaline primary wall, at which the pores are constricted. Walls very thick, especially the outer lamella. Pores very large (pore-index 1–6 ($\times$ 500)); most pores open directly at the outside, but in very thick walls the pores found in the inner hyaline lamella may fuse at the primary wall into one opening running to the outside, as in *Sporadotrema*. Chambers provided with an inner pseudochitinous lining.

Though several characteristics point to *Planorbulina*, the colouring, the pseudochitinous inner lining in all chambers, the shape and the fusing of pores, the long spiral with monoforaminal chambers, point to *Sporadotrema*; as I pointed out in 1927, the species seems to be a primitive *Sporadotrema*. Through this species the genus may be closely related to *Planorbulina*.

Occurring in samples from Dominica (1546), Marie-Galante and Martinique (Table 7), in considerable numbers, apparently in a very restricted area. CUSHMAN (1931, p. 137) found the species at a depth of 15 fathoms and in few specimens in 33°38′ N and 77°36′ W, east coast of North America. Most records are from the tropical Pacific.

THE SPECIES AROUND **Gypsina** CARTER

A second group of attached species are those around *Gypsina*. They do not form a distinct spiral of initial chambers, at least not in the A_2-generation, but a cluster of three or more chambers which in 1927 the author called the "raspberry-type"; the chamberwalls are always relatively thin and consist of a basal granular primary wall covered at the outside by a more hyaline part; these two parts in the test walls are never distinctly separated. The pores are distinct but in most cases finer than in *Planorbulina*; they do not show the constriction in the middle of the pores as found in *Planorbulina*. Moreover, the chambers in the later part of the tests are not rounded but distinctly flattened. Only the outer sides of the chambers show pores, the radial walls are poreless. In these radial walls foramina connect adjacent chambers. In some species a horizontal layer of chambers occurs, which may be compared to the median chambers of some groups of larger Foraminifera. They show rounded outer walls and may be compared with the chambers of *Planorbulina*. In one species, *Planogypsina squamiformis*, all chambers show this form.

The species belonging to this group are *Planogypsina squamiformis* (Chapman), *Gypsina plana* (Carter), *Discogypsina vesicularis* (Goës), and *Sphaerogypsina globulus* (Reuss), in as far as they occur in the Caribbean region.

Planogypsina squamiformis (Chapman) Fig. 138

Gypsina vesicularis var. *squamiformis* Chapman, 1901, p. 200, pl. 19 fig. 15.
Planogypsina squamiformis (Chapman), Bermúdez, 1952, p. 124.

Test large and flat, thickest in the centre, consisting of severa- layers of chambers; initial chambers not visible on the flat side; chambers irregularly placed and later chambers elongate. Areal foral mina between the chambers. Proloculus with two other chambers forming a "raspberry", two later chambers resembling auxiliary chambers. Then chambers are formed surrounding the embryon, and chambers which have a long axis in radial direction. On transverse section the initial part is seen within the test with chambers added on both ventral and dorsal sides. Often two foramina are seen in a radial wall of a chamber, which may be sutural or areal. The chambers have a poreless margin and furthermore pores in the dorsal and the ventral walls. The pore-index is 3–3 (× 500); the chamberwalls show the typical structure of the group around *Gypsina*: an inner granular layer gradually changing into the outer hyaline, crystalline radial wall.

The species is known to me from samples off Habana, Cuba, depth 4–7 m, Congo Cay, Thatch Island, 14–16 fath., between Tortola and Jost van Dyke, 36 m, and St. Croix, 800 m. So it seems to be restricted to the Northern part of the area.

Discogypsina vesicularis (Parker & Jones) Fig. 139

Orbitolina vesicularis PARKER & JONES, 1860, p. 31, No. 5.
Tinoporus vesicularis (Parker & Jones), GOËS, 1882, p. 104.
Discogypsina vesicularis (Parker & Jones), SILVESTRI, 1937, p. 156; HOFKER, 1968, p. 21, pl. 5 fig. 1–9.
Gypsina vesicularis (Parker & Jones), CARTER, 1877, p. 173; BRADY, 1884, p. 718, pl. 101 fig. 9–12; HOFKER, 1927, p. 9, pl. 3.
Gypsina discus Goës, BURSCH, 1947, p. 40, fig. 15, 20, pl. 3 fig. 2, 4, 13, 17, 21, pl. 5 fig. 6–7.

Tests mostly attached, shaped like a flat mount, or dome-shaped, or more or less lenticular. In all forms the test at the outer surface shows more or less angular chambers with thick, slightly protruding walls in between and with distinct pores in the chamber walls. In transverse section there is a proloculus surrounded by some initial chambers, three of them forming the "raspberry", with some additional chambers; all forms show a horizontal layer of chambers which are distinct from all other chambers by having a poreless distal wall, whereas the dorsal and ventral walls may have pores. From this layer rows of chambers develop which are placed perpendicularly to the dorsal or ventral surfaces. These later chambers show several foramina leading to adjacent chambers of other rows, as illustrated in pl. 15 fig. 4 of the monograph of CARPENTER, PARKER & JONES (1862). Only the flattened roofs of the lateral chambers show pores, whereas in the mediane chambers only the walls distal to the proloculus have pores. The pore-index is 2–3.5 (× 500). In some cases the "raspberry" of the initial chambers shows 4 chambers, one of them much larger than the other ones;

mostly two auxiliary chambers are found, before the relatively small chambers surrounding the embryon are formed (on horizontal section). The walls of the embryon are often thick, and the chambers adjacent to the proloculus have two or three foramina. Each chamberwall (but for the walls separating the "raspberry"–chambers) are of the *Gypsina*-type, viz. with basal granular primary wall going over in the hyaline outer layer of the wall.

Some specimens were sent to me by BERMÚDEZ from off Habana, depth 2–5 fath. The species was found very commonly in a sample from Marie-Galante (Table 7); less specimens occurred in samples from Barbuda (Table 6) and Curaçao (Table 10).

Gypsina plana (Carter) Fig. 140

Polytrema planum CARTER, 1876, p. 211, pl. 13 fig. 18–19.
Gypsina plana (Carter), CARTER, 1877, p. 172; LINDSEY, 1913, p. 45–51; HOFKER, 1968, p. 22, pl. 5 fig. 22–27.
Gypsina inhaerens (Schultze), HOFKER, 1933, p. 130, fig. 29, fig. 10–12.

Test very large in some instances, spreading over all kinds of substrates. They are polyembryonic, as I stated in 1933. The embryons consist of a cluster of chambers (raspberry-type) in the megalospheric forms, (1933, pl. 5 fig. 10). The tests consist of polygonal chambers seen from the surface, surrounded by hyaline thickened wall parts protruding from the surface. These chambers are arranged in rows perpendicular to the surface, in some cases with hyaline pillars between the rows. Only the walls parallel to the surface are provided with pores, pore-index 2–2.5 ($\times$ 500). In the walls of the low and relatively small chambers at least four foramina lead to adjacent chambers. As *G. plana* is the type-species of *Gypsina*, it is obvious that the idea that no foramina occur in *Gypsina*, as LINDSEY believed, is an error. The side-walls of the chambers are poreless. Wall structure typical for all species around *Gypsina*, with inner granular primary lamella going over into the outer hyaline wall part. The figure given by LINDSEY and reproduced by LOEBLICH & TAPPAN, 1964, fig. 566, 3 is misleading in so far. I gave the true structure of the chambers in 1933 (fig. 29).

Found in the samples off Habana, 4–7 fathoms, Thatch Island, 14–16 fathoms (very common) and W of St. Croix, 300 m.

Sphaerogypsina globulus (Reuss) Fig. 141

Ceriopora globulus REUSS, 1848, p. 33, pl. 5 fig. 7.
Tinoporus pilaris BRADY, 1876, p. 103.
Gypsina globulus (Reuss), BRADY, 1884, p. 117, pl. 101 fig. 8; SAID, 1949, p. 44, pl. 4 fig. 24.
Sphaerogypsina globulus (Reuss), GALLOWAY, 1933, p. 108, pl. 28 fig. 13–14; HOFKER, 1968, p. 22, pl. 5 fig. 10–21; 1969, p. 135, fig. 429; 1971, p. 52, fig. 144–145.

Test more or less globular, often with one side flattened, in some cases more pyriform or elongate. At the outside the chambers are polygonal, with thin hyaline walls in between. The test begins with a typical "raspberry" of chambers consisting mostly of three chambers with a slightly thickened wall and thin inner septa. This embryonic apparatus is at all sides surrounded by a cluster of small chambers with rounded outer walls. After these chambers the rows of chambers follow with straight side walls and flat roofs. These rows are arranged perpendicular to the surface. Only the roofs parallel to the surface show the relatively fine pores, with pore-index 4–2 ($\times$ 500). Wall consisting of an inner layer of agglutinated or granular material, the primary wall, thickened at the outside by hyaline substance. In most cases the walls perpendicular to the surface are wholly granular. As the tops of these walls protrude slightly, they form the protruding walls surrounding the chambers at the surface. The foramina leading to adjacent chambers are found at the base of the chambers, which are somewhat higher than found in *Gypsina plana*.

Found in samples from Cuba, off Habana 2–5 fath., Puerto Rico (1415), Thatch Island, 25–30 m, St. Lucia (1548), and Barbados (1443).

Neoeponides antillarum (d'Orbigny) Fig. 142

Neopeponides antillarum (d'Orbigny), HOFKER, 1969, p. 143, fig. 462–469.

The author (1969) had the species, only in megalospheric specimens, from Sta. 1415, Puerto Rico, depth 90 m. These megalospheric specimens are not so convex at their ventral sides as those from off Barbados. Sections revealed that the walls have an inner primary lamella which is distinctly granular in structure. For further details see the description of 1969 and the figures given here.

Found in samples from Puerto Rico (1415), W. of St. Croix, 800 m, Dominica (1546), and Barbados (1442/3).

Pseudoeponides anderseni Warren Fig. 159

Pseudoeponides anderseni WARREN, 1957, p. 39, fig. 12–15; HOFKER, 1964, p. 101, fig. 245–250.
Helenina anderseni (Warren) SAUNDERS, 1957, p. 375, fig. 1–2.

Of this species some serial sections are given to elucidate the internal toothplate structure (compare HOFKER, 1971, pl. 72 fig. 13a–19).

Described from Bimini, Cat Key, St. Martin, Curaçao and Aruba (HOFKER, 1964). Found in many samples from Lac, Bonaire (Table 9) and Spaanse Water, Curaçao (Table 10), in more or less muddy environment.

Palmerinella palmerae Bermúdez

Palmerinella palmerae BERMÚDEZ, 1934, p. 84, fig. 1–3; HOFKER, 1958, p. 32–33 fig. a–e.

This species was analysed by the author in 1958. The thick-walled, planospiral test has in the last formed whorl 12–14 chambers with distinct sutures; the chambers are overlapping on both sides but leave free the umbilical part. In the long chambers the toothplate divides the lumina in several parts; in more initial chambers it is a simple plate which is folded, but in later chambers it forms several folds. It adheres to the proximal walls of the chambers, with many openings at its attached part which form secondary openings in the proximal walls. These openings have thickened borders. The pores in the outer walls are very distinct and wide.

BERMÚDEZ (1952, p. 93) placed this species in the Planulinidae, but it cannot belong to this group, as it shows toothplates. HOFKER believed it to be close to the Ceratobulimidae. LOEBLICH & TAPPAN (1964) removed it to the Epistomariidae; probably it forms a genus rather allied to *Elphidioides*, a genus from the Eocene of North America (Jackson-Formation), however, it lacks the secondary chamberlets of that genus. It is known from the Miocene on.

Mentioned by TODD & BRÖNNIMANN (1957) from the eastern Gulf of Paria. Common in the sample from Habana, 2–5 fathoms; also found in the Spaanse Water, Curaçao (1639).

Rotorbinella Bandy

Allied to *Discorbis*, but differing from the latter in having a central calcareous knob in the ventral umbilicus. Typical are: the close-coiled tests, the last formed chambers bending slightly to the ventral side, a deuteroforamen which is ventral, sutural and slit-like and a protoforamen at the ventral suture separated from the deuteroforamen by a distinct tenon, more or less bending towards the protoforamen, and by the filling in the umbilicus.

Type-species: *Rotorbinella colliculus* Bandy, 1944.

LOEBLICH & TAPPAN (1964, p. 572) incorporated this genus into *Discorbis*, disregarding the always present umbilical knob.

In 1964 the author described several species belonging to *Rotorbinella* from the tidal zone of the Antilles: *R. conica* Hofker, *R. mira* (Cushman), *R. granulosa* (Heron-Allen & Earland) and *R. rosea* (d'Orbigny), all with the characteristics mentioned above. In 1963 he analysed the type-species of *Discorbis*, *D. vesicularis* Lamarck, and it was worthwhile to analyse the finer structure of the tests of *Rotorbinella*, to establish its position as assumed by LOEBLICH & TAPPAN, especially in respect to eventual toothplates connected with the protoforamen, as *D. vesicularis* possess them. In 1964 the author made thin sections transversely but these did not reveal the toothplates distinctly; but in thicker sections and, moreover, in thick horizontal sections, the toothplates could be observed.

Rotorbinella mira (Cushman) Fig. 145

Discorbis turbo BRADY (not d'Orbigny), 1884, p. 642, pl. 87 fig. 8.
Discorbis mira CUSHMAN, 1922, p. 39, pl. 6 fig. 10–11; 1931, p. 25, pl. 5 fig. 5–6.
Rotorbinella mira (Cushman), HOFKER, 1964, p. 107, fig. 258–260.

Slight grinding, removing the thick dorsal calcareous covering, shows the initial coils. In a thick vertical section the toothplates are seen as simple folded plates of granular calcareous matter, running from the protoforamen towards the axial part of the slit-like deuteroforamen and leaving free an opening between the central plug and the poreless tena which are thickened in older chambers. In thick horizontal sections the toothplates, especially in the last formed chambers, are fastened at the distal sides of the simple septa and run towards the protoforamen. The protoplasm may run through the deuteroforamen over the toothplate towards the next chamber, but also through the fold of the toothplate towards the protoforamen.

It is obvious that these structures of the toothplate and the simple septa show that this species is closely allied to *Discorbis* but differs from his genus in several respects.

Found in samples from the Florida Keys (Table 1), Grand Cayman (1689A), Jamaica (1678), Puerto Rico (1419/A), St. Croix (1405/6), St. Martin (1429), Barbuda (Table 6), Antigua (1540A), La Désirade and Martinique (Table 7), St. Vincent (1549), Barbados (1553), Bonaire (Table 9), Curaçao (Table 10). Previously mentioned by HOFKER (1964) from several additional localities, incl. Aruba, Ave de Barlovento, St. Eustatius and New Providence.

Rotorbinella granulosa (Heron-Allen & Earland) Fig. 144

Discorbina valvulata (d'Orbigny) var. *granulosa* HERON-ALLEN & EARLAND, 1915, p. 695, p. 52, fig. 1–6; BERMÚDEZ, 1935, p. 203.
Rotorbinella granulosa (Heron-Allan & Earland), HOFKER, 1964, p. 108, fig. 262.

In this species with its extremely thick walls which are very hyaline and calcareous radially, the toothplates are much reduced. In the last formed chambers they can be seen in transverse sections as slender folded plates with granular texture running from the poreless tenon to the ventral border of the protoforamen, leaving free a small opening with the central umbilical plug; horizontal sections through the middle of the test show the simple septa, the deuteroforamina and, with high magnification, the yellowish pseudochitinous layer covering the septa and the chamber walls. But in horizontal sections near to the ventral side of the chambers the toothplates, distinctly differing from the hyaline test walls by their granular structure, can be detected running from the septa towards the central plug and bordering the tiny protoforamina below the long tena which partly cover the sutural depressions.

Found in samples from the Cayman Islands and Jamaica (Table 2), St. Martin (1428), Barbuda (1532), Montserrat (1542), Guadeloupe, La Désirade, Martinique and Grenada (Tables 7–8). Mentioned by Hofker (1964) from Aruba, Klein Bonaire, Tobago, St. Martin, Bimini and Cat Key.

Rotorbinella rosea (d'Orbigny) Fig. 143

Rotalia rosea d'Orbigny, 1826, p. 272, no. 7, Modèles no. 36; 1839, Cuba, p. 72, pl. 3 fig. 9–11; Cushman, 1931, p. 62, pl. 13 fig. 5.
Truncatulina rosea (d'Orbigny), Brady, 1884, p. 667, pl. 96 fig. 2.
Rotorbinella rosea (d'Orbigny), Bermúdez, 1952, p. 75; Hofker, 1964, p. 109, fig. 263–265.

Most specimens are coiling to the left, but rare ones coil to the right. Tangential grinding shows the initial spiral beneath the very thick dorsal covering. In contrast with what was found in many other Foraminifera, the rare right-coiling specimens did not begin with a small proloculus; in both forms the proloculi have a diameter of about 30 μ. However, in the right-coiling specimens the number of chambers is larger than in the left-coiling ones. Specimens with equal diameter, when left-coiling, show about 23 chambers in total, whereas right-coiling specimens showed 28 chambers. Possibly in the genus *Rotorbinella* reproduction takes place as described for *Rotaliella* and *Rubratella* (plasmogamy) and no microspores are formed so that the microspheric generation cannot be found in this group (Grill, 1968, p. 391–405).

The toothplates are much reduced but are found as tiny plates in transverse section in older chambers quite close to the umbilical plug, running from the thick tena towards the axial borders of the deuterforamina. Only in the last formed chambers they are separated from the central plug by a distinct canal, as here the plug is not yet secondarily thickened. Horizontal sections show these toothplates forming a proximal covering of the simple septa near to the border of the deuteroforamen and a slightly sigmoid part near the central plug so that this plug is surrounded by a number of these sigmoid toothplates equal to the number of chambers observed, just as found in many species of *Streblus*.

Found in samples from the Cayman Islands and Jamaica (Table 2), St. Croix (180 m), Puerto Rico (1419A), St. John (1407), St. Martin, Saba, Barbuda and Antigua (Tables 5–6), Guadeloupe, La Désirade, Marie-Galante and Martinique (Table 7), St. Vincent, Barbados, Grenada and Tobago (Table 8) and Bonaire (Lac, Table 9), but not in the Spaanse Water, Curaçao. Mentioned by HOFKER (1964) from several additional localities, incl. Aruba, Curaçao, Islote Aves, St. Eustatius, St. Barts, New Providence and Bimini.

GLABRATELLIDAE

Two species of *Glabratella* were found in samples from the North Coast of Cuba: *Glabratella brasiliensis* Boltovskoy and *Glabratella makinoi* (Uchio). Both have the typical features of the genus: a central opening at the ventral side, which is an umbilicus in which all chambers open with their tiny apertures and which, in well-preserved specimens, is closed by a small sieve-plate, small knobs on the ventral walls radiating in rows from the centre to the periphery, all chambers visible at the dorsal side. All other initial chambers have thin simple walls and septa, but the outer walls are thickened by secondary growth and the pores piercing these walls. One of the species, *G. brasiliensis*, is figured in this paper (Fig. 146), both were figured and fully described in HOFKER, 1971 (p. 29–30, pl. 32 fig. 5–12). No toothplates occur.

Another species-group is known as *Siphoninoides*. Till now this genus was placed in the Siphonininae by many authors, but the inner features prove that they belong in the Glabratellidae. The peculiarly shaped sieve-plate on the umbilical opening in *Siphoninoi-*

des echinata (Brady) was the reason why it was placed near *Siphonina*, but analysis of the inner structure proved that it has nothing in common with *Siphonina* but shows the characteristics of *Glabratella*. This species was fully described in HOFKER, 1971 (p. 32–33) and figured on p. 133; these figures are reproduced here. There is little doubt as to the taxonomic status of this species (Fig. 147) which was found in the sample off La Habana, depth 2–5 fathoms.

Also another species belonging to *Siphoninoides* was found in this sample; it is described below.

Siphoninoides glabra (Heron-Allen & Earland) Fig. 148

Truncatulina glabra HERON-ALLEN & EARLAND, 1915, p. 711, pl. 52 fig. 41–47.
Siphoninoides glabra (Heron-Allen & Earland), BERMÚDEZ, 1935, p. 211.

Test more or less globular with three to four chambers in the last formed embracing whorl. Sutures slightly depressed, surface smooth, pores distinct and somewhat scattered. Aperture a small half-circular opening at the basal suture of the last formed chamber, in many specimens covered by an irregular sieve-plate. Early chambers only visible in sections, with very thin porous simple walls; only the last formed chambers possess at their outside a secondarily thickened wall. It is not certain wether the genus *Siphonidia* Seiglie, 1965, with the type-species *Siphonidia aurantiata* Seiglie, belongs in the close vicinity of *Siphoninoides glabra* or not. The fact that SEIGLIE (1965, p. 12) stated that *S. glabra* shows plates covering the aperture top, would point in the direction that this characteristic of *Siphonidia* is not restricted to the type-species of *Siphonidia*; but the lack of knowledge about the inner structure of this type-species renders the genus *Siphonidia* doubtful. Moreover, the occurrence of these sieve-plates in other Glabratellidae, *Glabratella* as well as *Siphoninoides*, shows that this characteristic is not restricted to this group of species. The globular form of *Siphonidia aurantiata* Seiglie and of *Siphoninoides glabra* (Heron-Allen & Earland) might lead to the supposition that both species are very closely related or even identical.

Found in the sample off Habana, 2–5 fathoms deep.

Neocarpenteria candei (d'Orbigny) Fig. 149

Truncatulina candei d'Orbigny, 1839, p. 88, pl. 3 fig. 6–8.
Cibicides candei (d'Orbigny), Bermúdez, 1935, p. 220.
Neocarpenteria candei (d'Orbigny), Bermúdez, 1952, p. 126.

Test flat and spreading, the thickest part in the middle, dorsal side flat, ventral non-attached side slightly convex. The margin of the test is keeled with crenulations and is poreless. The pores in the walls are numerous but not fine, distinct, they are found at both sides of the test. At the flat dorsal side all chambers are visible, with strongly curved and not depressed sutures; at the ventral side the chambers of the last formed coil are visible only; they are slightly inflated with depressed sutures which are sigmoidally curved and in the centre the chambers form a narrow open umbilicus. The aperture of the last formed chamber is an open crescent-like slit, sutural, not reaching the umbilical hollow nor the margin. On transverse section the open umbilicus is seen, whereas the outer walls on both sides are double; however, on horizontal section the septa are formed by the inner lamellum only so that the doubling of the walls is due to a secondary thickening. The structure of the walls is granular, but the keel seems to be more hyaline, not crystalline. The first chambers have single walls, like the proloculus on horizontal section.

When we compare the structure of this species with *Carpenteria balaniformis* Gray or with other species of *Carpenteria* (see Hofker, 1969, p. 63–72) the differences are striking: in *Carpenteria* there are no real doubled outer walls, and no pores in the dorsal, flat sides, the apertures always opens at the centre of the ventral, convex side of the test.

On the other hand, the species *Neocarpenteria candei* cannot belong in the vicinity of *Cibicides*, for in that genus, though in many species the walls are double, also the septa (see, however, Hofker, 1967 and 1968) and the apertures are always marginal, even growing over to the spiral side.

Bisaccium imbricatum Andersen Fig. 150

Bisaccium imbricatum ANDERSEN, 1951, p. 32, fig. 2; LOEBLICH & TAPPAN, 1964, p. 746, fig. 612, 2; HOFKER, 1971, p. 38–39, fig. 38, pl. 78 fig. 16–21, pl. 76 fig. 3, 5–6.

Test planispiral, symmetrical. Periphery rounded, slightly lobulate in the last formed chambers. Chambers slightly inflated; last formed whorl with about 8–9 chambers. Foramina between the chambers a marginal slit, but in undamaged specimens concealed by the toothplate. Toothplate granular (whereas the chamberwalls are hyaline) as in *Astrononion*. Toothplate beginning at both ends of the apertures (foramina), forming a complicated folded part with an extension running from this folded part along the inner side of the left and right chamberwalls towards an opening in the central part of each chamberwall on both sides, which is a narrow slit; this extension forms a suture in the wall which can be seen externally, running from the side-suture distalward to the open slit. The folded part of the toothplate runs through a sutural opening of the chamberwall, reaches the outside of the test and forms a gutter over the side-sutures on both sides of the test, ending with an opening near the margin, just as is found in *Astrononion*. At the last formed chamber both gutters, supported by the toothplate-foramen of both sides, form a thin plate covering the marginal part of the apertural face and render the true aperture invisible. The whole toothplate, the inward and external parts, forms a structure which closely resembles the toothplate of *Cushmanella*. Outer and inner parts of the toothplate are distinctly granular. In penultimate chambers the external plate of the toothplate is absorbed, but the inner extension remains in all chambers. This extension has not been described by ANDERSEN, nor was it figured by LOEBLICH & TAPPAN, though they picture some of the toothplate-foramina as fine slits. On a series of tangential sections (Fig. 150g, 1–4) through this inner part of the toothplate, the extension may be clearly observed (see also Fig. 150c). Horizontal section shows that walls and septa are simple, as in real *Nonion* and *Astrononion*.

The systematic place of *Bisaccium* is well understood by LOEBLICH & TAPPAN: close to *Astrononion*; the similarity in the form of the toothplates of *Bisaccium* and *Cushmanella* clearly show the relationship of both.

Found by ANDERSEN along the Louisiana Coast; common in the sample sent by BERMÚDEZ from the North Coast of Cuba, off Habana, depth 2–5 fathoms.

EPIPHYTIC FORAMINIFERA ON HALIMEDA IN THE LAC OF BONAIRE

Adhered to the segments of *Halimeda* in the Lac of Bonaire, many species of Foraminifera occur. Common are *Discopulvinulina floridana* (Cushman), *Discopulvinulina valvulata* (d'Orbigny), *Neoconorbina orbicularis* (Terquem), *Planorbulina mabahethi* Said; rare is *Sporadotrema rubrum* (d'Orbigny). Moreover three new species which were not yet traced elswhere, occur here abundantly; they seem to belong to the genus *Nodobacularia*, in so far they show a miliolid initial part followed by a set of pyriform chambers; they differ from known species of this genus because they possess one flat side which adheres to the substratum. They are described here as *Nodobacularia minuta* n.sp., *Nodobaculariab onairensis* n.sp. and *Nodobacularia sageninaeformis* n.sp.

Many segments of *Halimeda* are more or less covered by the branching thin pipes of *Cornuspiramina antillarum* (Cushman), a species which is closely allied to *Nodobacularia* and which could be analysed here also, in more detail.

In the Lac of Bonaire as well as in the Spaanse Water of Curaçao a not so common species was found of the genus *Placopsilina*; it is smaller than the Pacific form (HOFKER, 1968, p. 14, pl. 1 fig. 6–12), more irregular in growth, with much coarser agglutination. It could be identified as *Placopsilina confusa* Cushman.

So the total of epizoic foraminiferal species on *Halimeda* amounts to 10, a rich biocoenosis, in the Lac obviously restricted to *Halimeda*.

Nodobacularia Rhumbler, 1895

The description of this genus by LOEBLICH & TAPPAN, 1964 (p. 455) runs: "Test attached, consisting of globular proloculus followed by single coil of 2 or rarely 3 chambers which may not be discernable except in section, later portion uniserial, with chambers or chamber cavity pyriform in outline; wall calcareous and imperforate, and incorporating occasional sand grains; aperture at open tubular end of final chamber".

This description agrees well with the three species described here. However, perhaps the genus *Webbina*, as redefined by LOEBLICH & TAPPAN in 1955, is so very close to this description, that it may be identical with it. For there are only two instances known of this redefined genus *Webbina*, viz. the one named *Webbina rugosa* by D'ORBIGNY in 1839 (p. 126) and figured by LOEBLICH & TAPPAN, 1964 (p. 446, fig. 338, 10) and another one, also named *W. rugosa*, from the island of Teneriffe, in D'ORBIGNY, 1846 (pl. 21 fig. 11–12). This specimen consists of only three chambers, all pyriform, and is typically flattened on the attached side; possibly it is not a complete specimen, with the miliolid part lacking. In this case it is quite possible that *Webbina* d'Orbigny, 1846 (1839?) and *Nodobacularia* Rhumbler, 1895 are identical genera, and then *Webbina* has priority. The specimen as figured by LOEBLICH & TAPPAN, 1964, from the D'ORBIGNY-collection cannot be a perfect specimen, since the first chamber is pyriform and cannot be the proloculus.

BARTENSTEIN & BRANDT described some species which they assembled in a new genus, *Pseudonubecularia* Bartenstein & Brandt, 1949, described and figured more exhaustively in 1951, from the Lower Cretaceous; however, it is not certain that these species belong here, though they mention an initial part with some chambers enrolled around the proloculus; LOEBLICH & TAPPAN, 1964 (p. 455) enlist *Pseudonubecularia* as synonym with *Nodobacularia*. RHUMBLER (1911, pl. 9 fig. 17) figured a specimen attached to a shell which seems to be very close to our species described below, however, in the text he mentions this specimen as a kind of *Ophtalmidium*.

Nodobacularia minima n.sp. Fig. 151

Small tests with a miliolid initial part consisting of a small proloculus with diameter about 20 μ, followed by two or three enveloping chambers without dents, followed by some pyriform small chambers irregularly spiralled or in zig-zag position, and later several larger pyriform chambers in a straight or irregular succession. In several specimens ramifying was observed. Total length of test never more than 0.65 mm, often less. Test wall smooth, dorsal side of chambers inflated, ventral attached side flat. Dorsal wall relatively thick, ventral wall very thin.

Occurring on *Halimeda* in the Lac of Bonaire (Table 9).

Nodobacularia bonairensis n.sp. Fig. 152

Test large, length up to 2.5 mm, consisting of a miliolid initial part with a proloculus with diameter up to 80 μ, followed by 3–6 miliolid chambers without teeth; then 3–4 half globular chambers encircle the miliolid part; this is succeeded by a long chain of pyriform chambers with flat attached side and flatly inflated dorsal side. In some specimens the test is ramifying into two branches. Each pyriform chamber at the dorsal side has ramifying elongate and somewhat irregular costae. Dorsal wall relatively thick, with a thin marginal keel adhering to the substrate, ventral attached wall very thin and flat. Transverse section much broader than high, elongately crescent-shaped. Wall imperforate, white. Each next chamber overlapping the slightly constricted aperture of the former one. Aperture the open end of the last formed chamber.

Occurring on *Halimeda* in the Lac of Bonaire (1561).

Nodobacularia sageninaeformis n.sp. Fig. 153

Test often very large, branching over the surface of the substrate, often very irregular, beginning with a miliolid initial part consisting of a large proloculus of oval shape, larger diameter 200 μ, followed by two encircling chambers in various directions of coiling, thick-walled. This initial part is followed by one rounded flattened chamber, and then the pyriform chambers start; the first of them encircle the initial part, and very soon the ramifying of the test begins; often in the end of the test 5–8 branches may be observed, ending with wide open nearly rounded apertures. The pyriform chambers with thick calcareous imperforate walls at the dorsal side and thin flat walls at the ventral side, show distinct keels bordering the chambers; these keels are strongly attached to the substrate. The dorsal walls show, as in many agglutinated miliolids, at their outside many irregular incorporated calcareous grains which make the sutures between the pyriform chambers nearly invisible, so that the whole test very much resembles *Sagenina*. It is very probable that BERMÚDEZ (1935, p. 148), mentioning a *Sagenina* sp. from Cuba, had this species. It is, however, an agglutinated *Nodobacularia*. Length of test up to 3.7 mm.

Commonly occurring on *Halimeda* in Lac, Bonaire (Table 9).

Placopsilina confusa Cushman — Fig. 154

Placopsilina confusa CUSHMAN, 1920, p. 71, pl. 14 fig. 6; BARKER, 1960, p. 74, pl. 36 fig. 2–3.
Placopsilina cenomana d'Orbigny, BRADY, 1884, p. 315, pl. 36 fig. 2–3; HERON-ALLEN & EARLAND, 1932, p. 341, pl. 7 fig. 25.

Test attached, consisting of many chambers which are half-globular, broader than long, with straight sutures in between, aperture a narrow slit. The tests are often coiled in the beginning, and are never straight but serpentine. Wall distinctly agglutinated with sand grains (*P. bradyi* from the Pacific shows very fine sand grains) with fine pores in between. Sutures distinct, depressed. Colour yellowish grey.

Occurring in Lac, Bonaire (Table 9) on *Halimeda*.

Cornuspiramia antillarum Cushman Fig. 155

Nubecularia antillarum CUSHMAN, 1922, p. 58, fig. 7–8.
Cornuspiramia antillarum (Cushman), CUSHMAN, 1928, p. 158; HOFKER, 1964, p. 31, fig. 36.

Test beginning with a central proloculus encircled by one long spiral chamber, of somewhat more than one spiral as in *Cornuspira*, followed by a long branching tubular part which in the end shows constrictions as if pyriform chambers are added. The test wall may remain smooth or there may be incorporation of calcareous grains. The walls are thin, the ventral walls are flattened with the substratum, the dorsal walls are inflated. One individual may cover a surface of many square centimeters, but we cannot speak of the length of the test, as the beginning is always found in the centre of it. Colour white.

Commonly occurring in Lac, Bonaire (Table 9), on *Halimeda*; also found in Puerto Rico (1423A), Antigua (1540A) and La Désirade (1437).

ELPHIDIONONION IN THE RIVIÈRE SALÉE OF GUADELOUPE

In the samples from Guadeloupe, Rivière Salée, an abundance of *Elphidiononion* occurred, obviously belonging to different species. Together with *Elphidium lanieri* (d'Orbigny) they form the bulk of the Foraminifera there. They are characterised by very thin walls as they occur in environments with low salinity after rains. Four species were found: *E. discoidale* (d'Orbigny), already exhaustively analized in HOFKER, 1971a (p. 26, fig. 71–84) from the Piscadera Bay, Curaçao, *E. mexicanum* Kornfeld, *E. kugleri* (Cushman & Brönnimann) and a new species, *E. elegantum.*

Elphidiononion mexicanum (Kornfeld) Fig. 156

Elphidium incertum (Williamson) var. *mexicanum* KORNFIELD, 1931, p. 89, pl. 16 fig. 1; CUSHMAN, 1939, p. 57, pl. 16 fig. 3; PARKER, PHLEGER & PEIRSON, 1953, p. 8, pl. 3 fig. 24–25; PHLEGER, 1954, p. 639, pl. 2 fig. 5–6.
Elphidium sp. C, TODD & BRÖNNIMANN, 1957, p. 40, pl. 7 fig. 15.

Test relatively large (diameter about 0.7 mm), very compressed, with only very slightly lobulate periphery in the last formed chambers. Sutures hardly depressed, curved. Chambers nearly reaching the umbilicus. Sutures with many poreless and massive bridges. Wall thin, finely and densely porous, smooth, often shining, vitreous lustre, often with a mother-of-pearl glow when dry, 10–12 chambers in the last formed whorl. Aperture consisting of a row of circular openings at the base of the apertural face, flanked by the two toothplate-foramina. Often several secondary rounded openings are found in the poreless part of the apertural face. In transverse section the septal flaps of the toothplates are seen along the sides of the chambers but they never fuse at the margin as they do in *Elphidium.*

Found in samples from Virginia Key (1408), Grand Cayman (Rum Pt.), Guadeloupe (Table 7), and Margarita (1447).

Elphidiononion kugleri (Cushman & Brönnimann) Fig. 157

Cribroelphidium kugleri CUSHMAN &BRÖNNIMANN, 1948, p. 18, pl. 4 fig. 4.
Elphidium kugleri (Cushman & Brönnimann), TODD & BRÖNNIMANN, 1957, p. 39.

Test resembling that of *E. poeyanum* (d'Orbigny), but there are constant differences. In *E. kugleri* the number of chambers is always 6–7; the margin is strongly rounded, the periphery is very distinctly lobulate, the sutures are straight and radiate, strongly depressed, so that the chambers make an inflated impression. Poreless sutural bridges visible at one side no more than 7, umbilical cavity distinct, showing central ends of former whorls. The walls are translucent, smooth and shining, and extremely thin.

In apertural view the last formed chamber shows a poreless part in which the sutural row of rounded apertures as well as some areal ones are found. At both sides of the sutural row of apertures the larger toothplate-foramina are seen. The septal flaps of the toothplates in transverse sections do not fuse at the margin. The depressed sutures are bridged by poreless massive pillars. All these characteristics are those of the genus *Elphidiononion*, and it may be that this species is more a brackish-water variety of *E. poeyanum.*

Found abundantly in the Rivière Salée of Guadeloupe (Table 7).

Elphidionion elegantum n.sp. Fig. 158

Elphidium sp. A, TODD & BRÖNNIMANN, 1957, p. 40, pl. 7 fig. 13.

Test small, biconvex, compressed, with 11–13 chambers visible which leave a large umbilical cavity. Margin rounded to sub-acute, perphery slightly lobulate in the last formed chambers, sutures straight, radiate, slightly depressed, with 5–6 massive and poreless bridges. Walls thin, smooth, very finely and densely porous, with a granular structure. Septa simple, curved. Apertural face with one sutural row of rounded apertures. Septal flaps not fusing at the margin. Diameter of tests about 0.4 mm, thickness 0.15 mm.

Found in the Rivière Salée of Guadeloupe (1543A).

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Fig. 1. *Rhabdammina abyssorum* Carpenter. – Off St. Croix, depth 800 m (× 8).
Fig. 2. *Rhabdammina linearis* Brady. – Off St. Croix, 800 m (× 8).
Fig. 3. *Rhabdammina triangularis* (Earland). – Off St. Croix, 800 m (× 8).
Fig. 4. *Psammosphaera parva* Flint. – Off St. Croix, 800 m (× 33).
Fig. 5. *Psammosphaera flinti* Hofker. – Off St. Croix, 800 m (× 22).
Fig. 6. *Psammosphaera testacea* Flint. – Off St. Croix, 800 m (× 22).
Fig. 7. *Reophax scorpiurus* Montfort. – Off St. Croix, 800 m (× 33).
Fig. 8. *Reophax bilocularis* Flint. – Off St. Croix, 800 m (× 28).
Fig. 9. *Reophax compressus* Goës. – Off St. Croix, 200 m (× 22), from two sides.
Fig. 10. *Reophax spiculifer* Brady. – Off St. Croix, 300 m (× 33), 2 specimens.
Fig. 11. *Nouria atlantica* (Cushman). – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 12. *Pelosina variabilis* Brady. – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 13. *Hyperammina elongata* Brady. – Off St. Croix, 800 m (× 8), from two sides.
Fig. 14. *Hyperammina laevigata* Wright. – Off St. Croix, 800 m (× 16).
Fig. 15. *Hyperammina friabilis* Brady. – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 16. *Hyperammina adunca* (Brady). – Off St. Croix, 800 m (× 16).
Fig. 17. *Hyperammina spiculifera* Lacroix. – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 18. *Hyperammina distorta* Cushman. – Off St. Croix, 800 m (× 16).
Fig. 19. *Hyperammina (Saccorhiza) caribbeana* Hofker. – Off St. Croix, 800 m, 2 specimens.

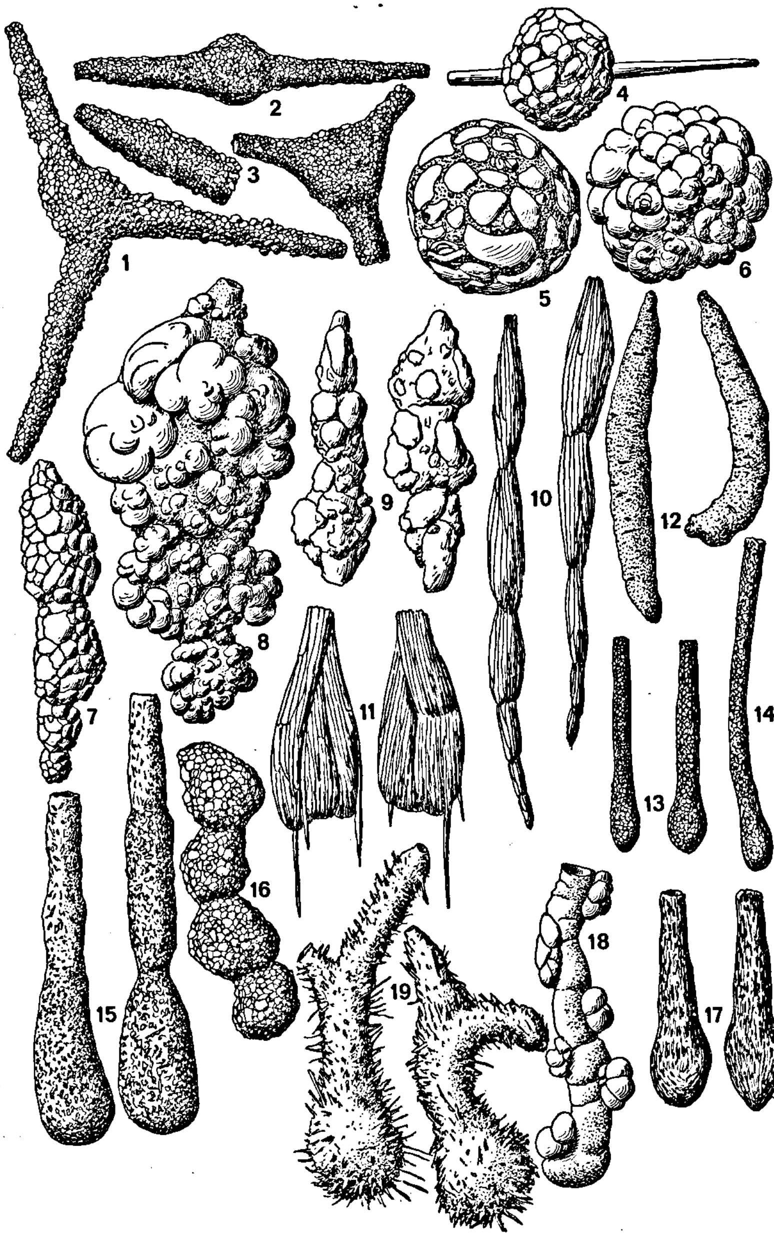
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Fig. 20. *Hyperammina (Tolypammina) vagans* Brady. – Off St. Croix, depth 300 m (× 33).
Fig. 21. *Ammodiscus turbinatus* (Cushman). – Off St. Croix, 800 m (× 22), from two sides.
Fig. 22. *Lituotuba lituiformis* (Brady). – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 23. *Hormosina mortenseni* Hofker. – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 24. *Hormosina ovicula* Brady. – Off St. Croix, 800 m (× 8), 2 specimens.
Fig. 25. *Hormosina spiculifera* Hofker. – Off St. Croix, 800 m (× 22).
Fig. 26. *Hormosina hispidula* (Cushman). – Off St. Croix, 800 m (× 16).
Fig. 27. *Ammolagena clavata* (Parker & Jones). – Off St. Croix, 800 m, 2 specimens. (× 8).
Fig. 28. *Crithionina hispida* Flint. – Off St. Croix, 800 m (× 8), from two sides.
Fig. 29. *Bathysiphon rufus* de Folin. - Off St. Croix, 800 m (× 8).
Fig. 30. *Technitella melo* Norman. – Off St. Croix, 800 m (× 22).
Fig. 31. *Technitella erinaceus* Hofker. – Off St. Croix, 800 m (× 16).
Fig. 32. *Marsipella elongata* Norman. – Off St. Croix, 800 m (× 16), 2 specimens.
Fig. 33. *Marsipella cylindrica* Brady. – Off St. Croix, 800 m (× 16).
Fig. 34. *Marsipella cervicornix* Hofker. – Off St. Croix, 800 m (× 16).
Fig. 35. *Marsipella rustica* (Heron-Allen & Earland). – Off St Croix, 800 m (× 33), 4 specimens

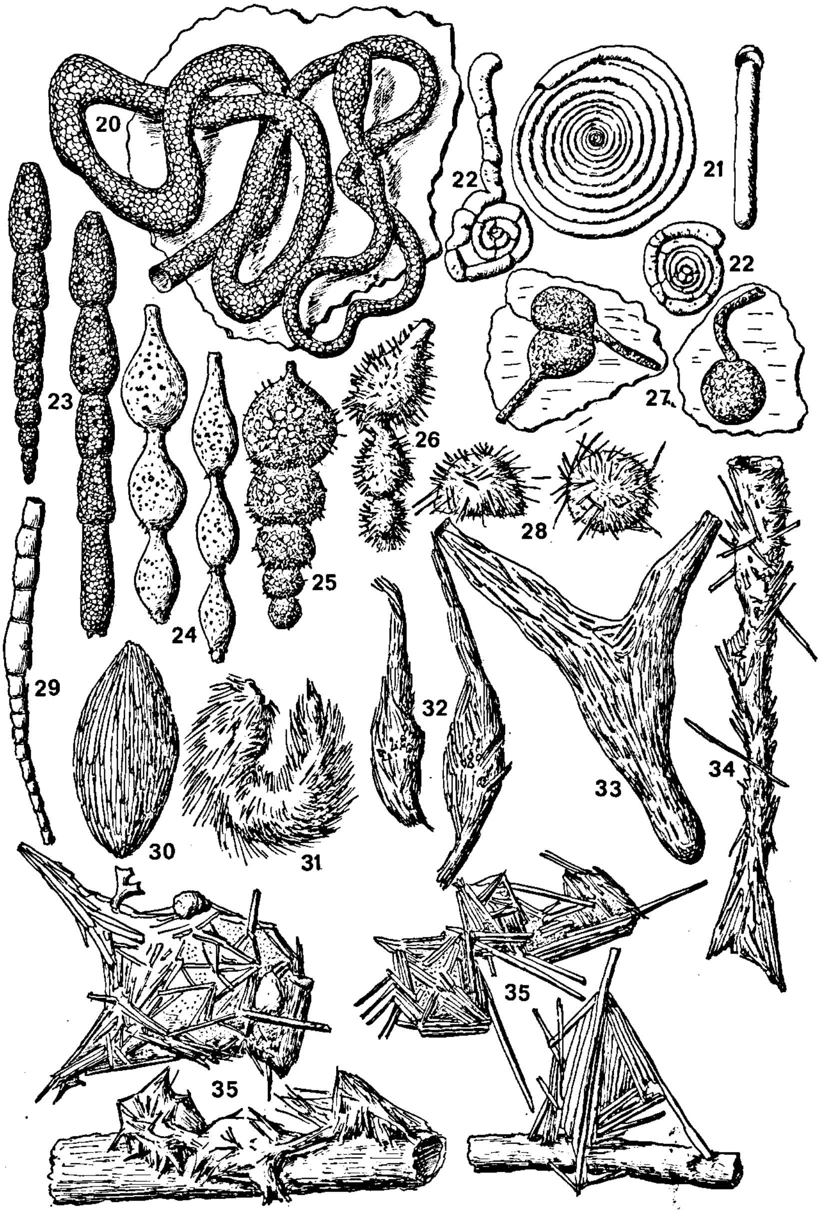
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Fig 36 *Textularia parvula* Cushman – Off St. Croix, depth 300 m (× 70), 2 specimens.

Fig. 37. *Gaudryina flintii* Cushman. – Off St. Croix, 800 m, A-generation; a: B-generation; b: 4 successive transverse sections through apical end of B-generation; c: apical end of B-generation (all × 14); d: horizontal section through A-specimen (× 33).

Fig. 38. *Cribrostomoides bradyi* Cushman. – Off St. Croix, 800 m, A-generation (× 16); a: longitudinal section through B-specimen; b: transverse section through A-specimen; c: longitudinal section through A-individual (all × 33).

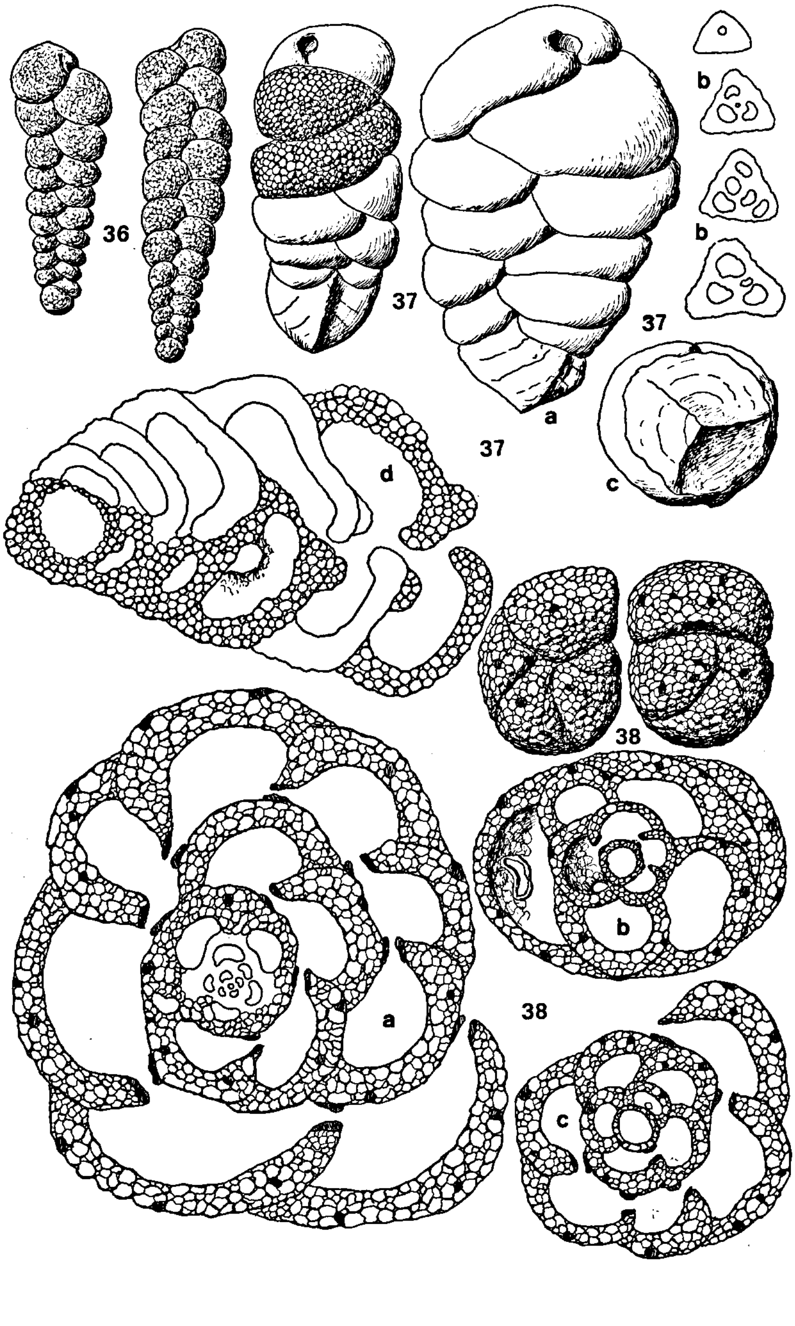
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Fig. 38. *Cribrostomoides bradyi.* – **d**: B-specimen from two sides (× 16).

Fig. 39. *Discammina compressa* (Goës). – Off St. Croix, depth 800 m, A-generation from two sides (× 22); **a**: horizontal section, showing the chitinous lips round the apertures (× 33); **b**: B-specimen from two sides (× 22); **c**: horizontal section through this specimen (× 33); **d**: initial part of B-specimen (× 65).

Fig. 40. *Cyclammina cancellata* Brady. – Off St. Croix, 800 m, B-generation; **a**: A_1-generation, known as *Cycl. pauciloculata* Cushman; **b**: A_2-generation, known as *Cycl. pusilla* Brasy (all × 14).

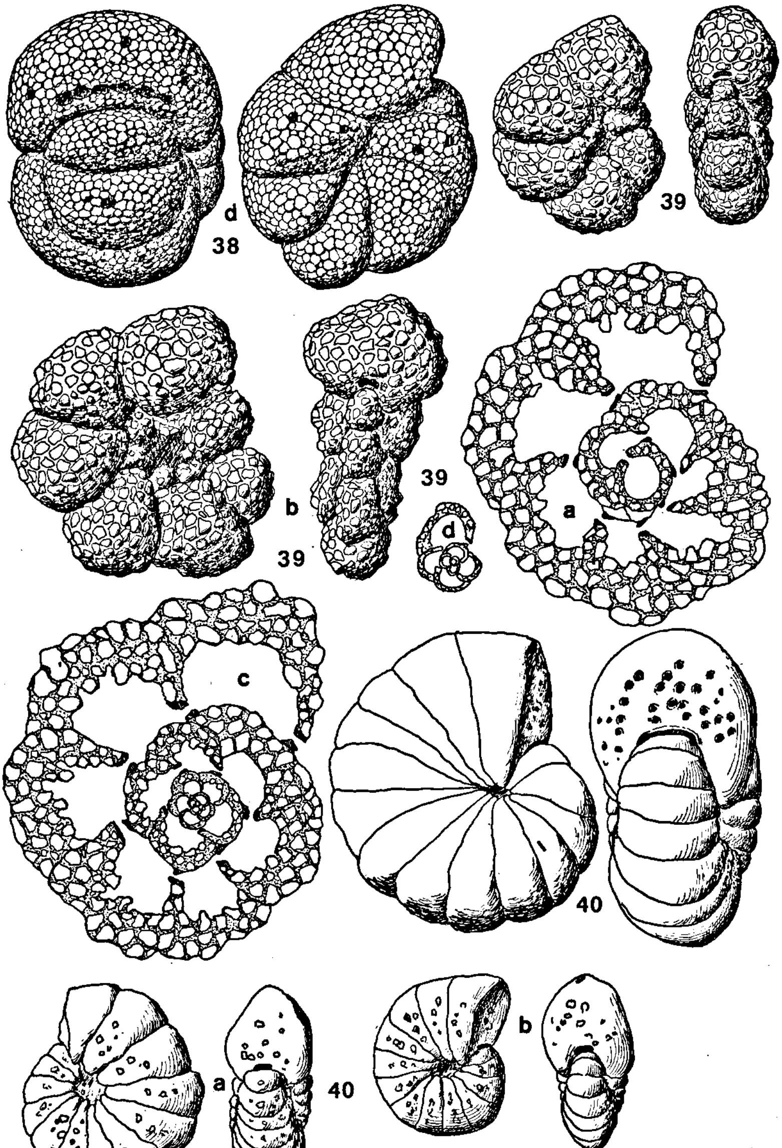
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Fig. 40. *Cyclammina cancellata.* – c: central part in section of B-generation; d: central part of A_1-generation; e: section through whole test of A_2-generation (all × 70).

Fig. 41. *Ammobaculites agglutinans* (d'Orbigny). – England off Falmouth, type-locality, whole test and longitudinal section, showing agglutinated septa (× 33).

Fig. 42. *Ammoscalaria pseudospiralis* (Williamson). – Skudenaes, Stavanger, Norway, whole test and longitudinal section showing the pseudochitinous septa (× 33).

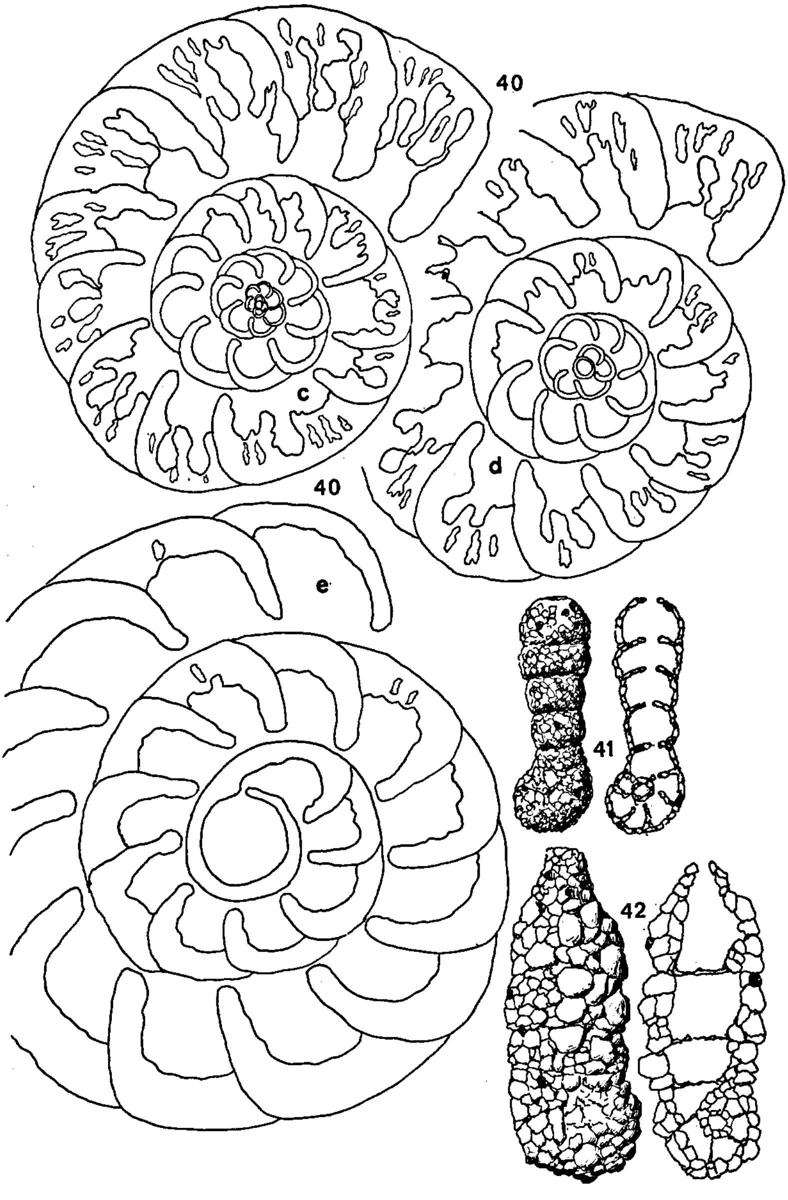
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Fig. 43. *Ammobaculites josephi* Acosta. – Margarita, Punta de Piedras, Sta. 1447, whole test in two different views; a: longitudinal section, proving it to be a real *Ammobaculites* with wholly agglutinated septa (× 50).

Fig. 44. *Ammotium cassis* (Parker). – N. Alaska, 3 miles off Point Barrow base camp, depth 36.6 m (coll. Loeblich Jr.), whole test; a: section, showing that the septa are wholly agglutinated (× 33).

Fig. 45. *Ammoscalaria morenoi* (Acosta). – Puerto Rico, Sta. 1422, whole test from two sides (× 31); a–c: tests showing the variation in form (× 31); d: view on the rounded aperture (× 33); e: longitudinal section, showing the pseudochitinous septa (× 70); f: transverse section, showing the planispiral coiling (× 70).

Fig. 46. *Trochammina inflata* (Montagu). – St. Martin, Devils Hole swamp, Sta. 542, whole individual from three sides (× 70); a: section through initial part with large proloculus, coiling to the left (× 125); b: section through initial part with small proloculus, coiling to the right (× 125); c: section through wall in initial part, showing that it is simply agglutinated (× 170); d: part of horizontal section through later chambers, showing the doubly agglutinated walls (× 125); e: horizontal section near the ventral side, showing foramina (× 50); f: part of section taken from d (× 170); g: transverse section through individual which was living when sampled, showing the protoplasm and some of the loop-shaped foramina (× 70).

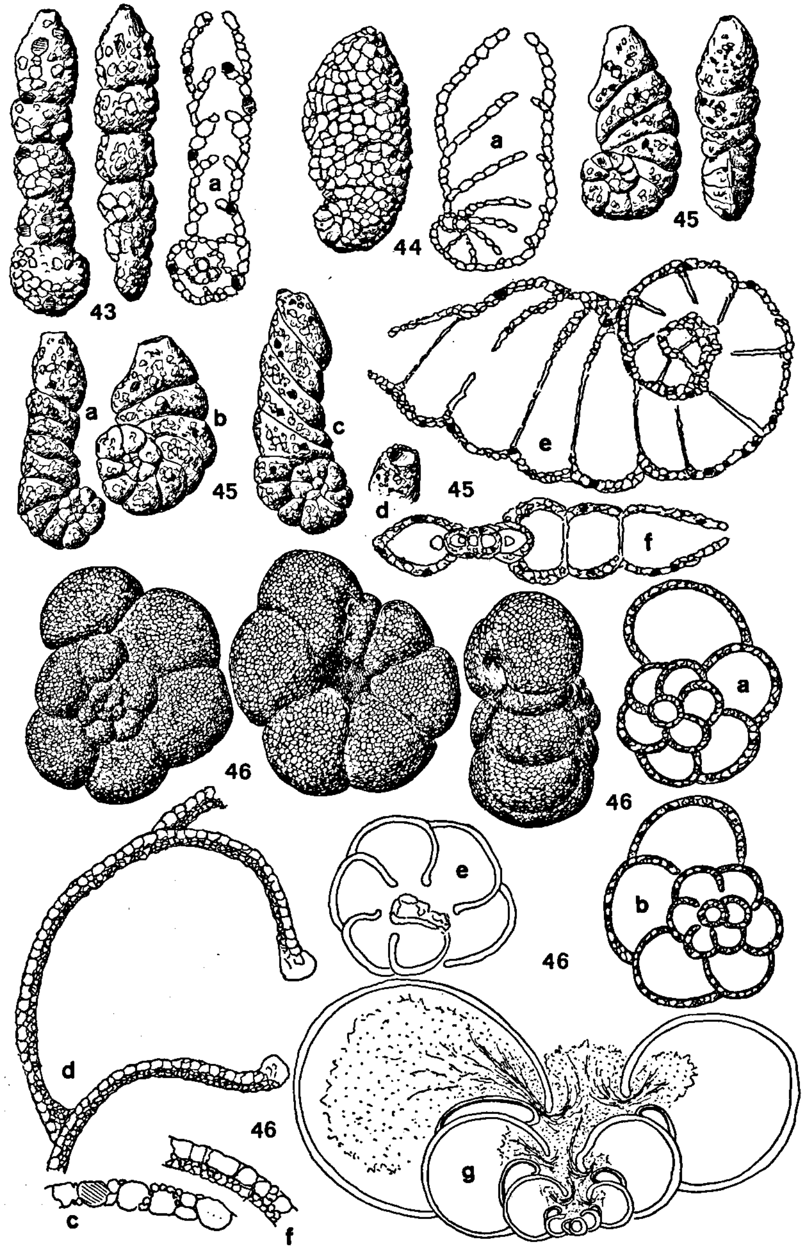
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Fig. 47. *Valvotextularia affinis* (Fornasini). – Off St. Croix, depth 300 m, the real type-species of *Valvotextularia*, total test from three sides (× 70); a: initial end showing the three chambers with which it begins.

Fig. 48. *Siphotextularia wairoana* Finlay. – New Zealand, Nukumaruan Stage, Locality N115/657, Waikua Valley, road above railtunnel (material sent by Hornibrook), type-species of *Siphotextularia*, total test from three sides, showing pores in between the fine agglutination (× 70); a: initial chambers, clarified specimen showing the first three chambers (× 70); b: part of section, with the foramen towards the second chamber and the pores in the walls (× 200); c: total longitudinal section (× 70); d: part of walls (× 200); e: transverse section showing the angles at the compressed sides (× 70).

Fig. 49. *Valvotextularia agglutinans* (d'Orbigny). – Off St. Croix, 300 m, A_2-specimen (× 33); a: A_1-specimen (× 33); b: B-specimen (× 33); c: section through B-specimen with the pores in the walls (× 70); d: section through A-specimen (× 70).

Fig. 50. *Valvotextularia calva* (Lalicker). – Off St. Croix, 300 m, B-generation (× 40); a: initial part of A_1-individual (× 170); b: initial part of B-individual (× 170).

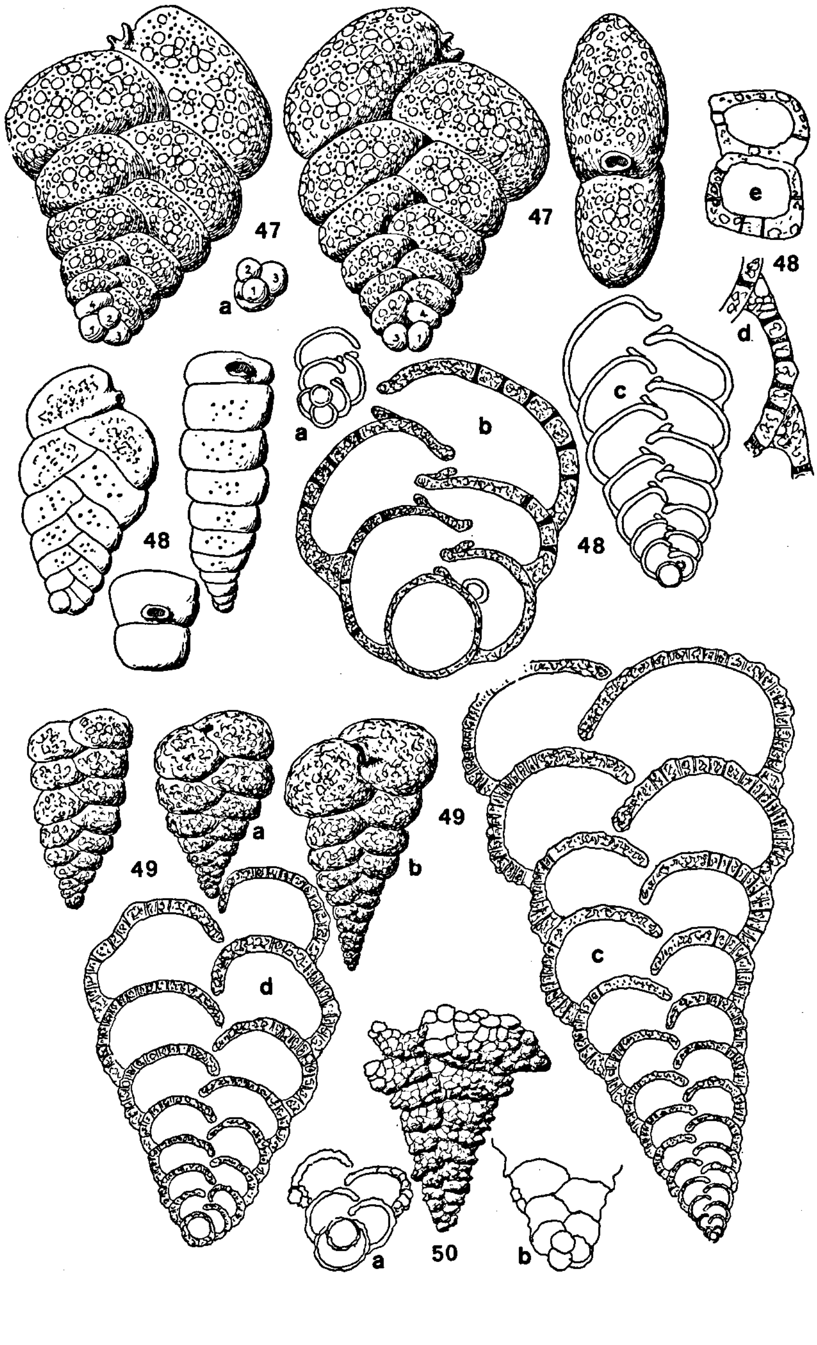
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Fig. 50. *Valvotextularia agglutinans*. – c: A_2-generation, from two sides (× 40); d: A_1-individual (× 40); e: longitudinal section through A-specimen (× 160).

Fig. 51. *Dorothia curta* (Cushman). – Off St. Croix, depth 800 m, A_1-specimen from two sides; a: A_2-specimen from two sides; b: B-specimen; c: B-specimen from two sides (all × 14); d: initial part of B-individual, showing the pores in the walls (× 160); e: longitudinal section of A-specimen (× 27); f: part of wall, section showing the pores (× 27).

Fig. 52. *Dorothia scabra* (Brady). – Off St. Croix, 800 m, microspheric specimen (× 14); a: another microspheric specimen (× 14); b: megalospheric specimen from three sides (× 22); c: another specimen.

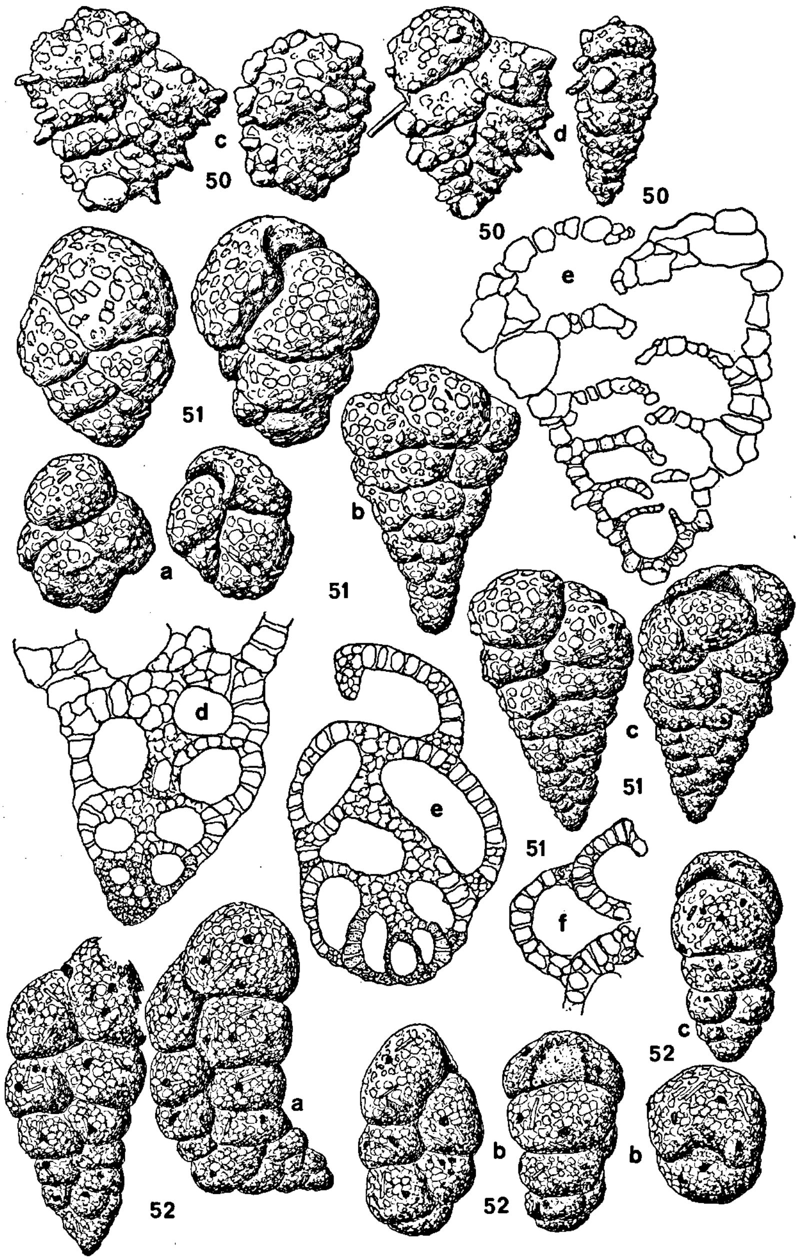
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Fig. 52. *Dorothia scabra.* – d: section through megalospheric specimen, showing pores in the walls (× 33); e: section through microspheric specimen (× 27).

Fig. 53. *Trochammina globeriniformis* (Parker & Jones). – Off St. Croix, depth 800 m, individual from two sides (× 70); a: transverse section (× 70); b: part of wall of later chamber, showing the two layers of agglutination, typical for *Trochammina* (× 125).

Fig. 54. *Tritaxis siphonifera* (Cushman). – Off St. Croix, 800 m, test attached agglutinated substance to shell of Brachiopode (× 21); a: section showing some foramina (× 33); b: individual from three sides (× 33); c: transverse section (× 70).

Fig. 55. *Lenticulina calcar* (Linnaeus). – Off St. Croix, 300 m, three individuals with different sizes of proloculi, as seen in clarifier (× 27); c: specimen, probably microspheric, from two sides (× 27); d: another specimen (× 27); e: part of section through test, showing pores in base of hollow spine and the secondary chamber below the aperture (× 160); f: another foramen (× 160).

Fig. 56. *Lenticulina echinata* (d'Orbigny). – Off St. Croix, 800 m, test from two sides (× 16); a: horizontal section, showing the simple foramina (× 16).

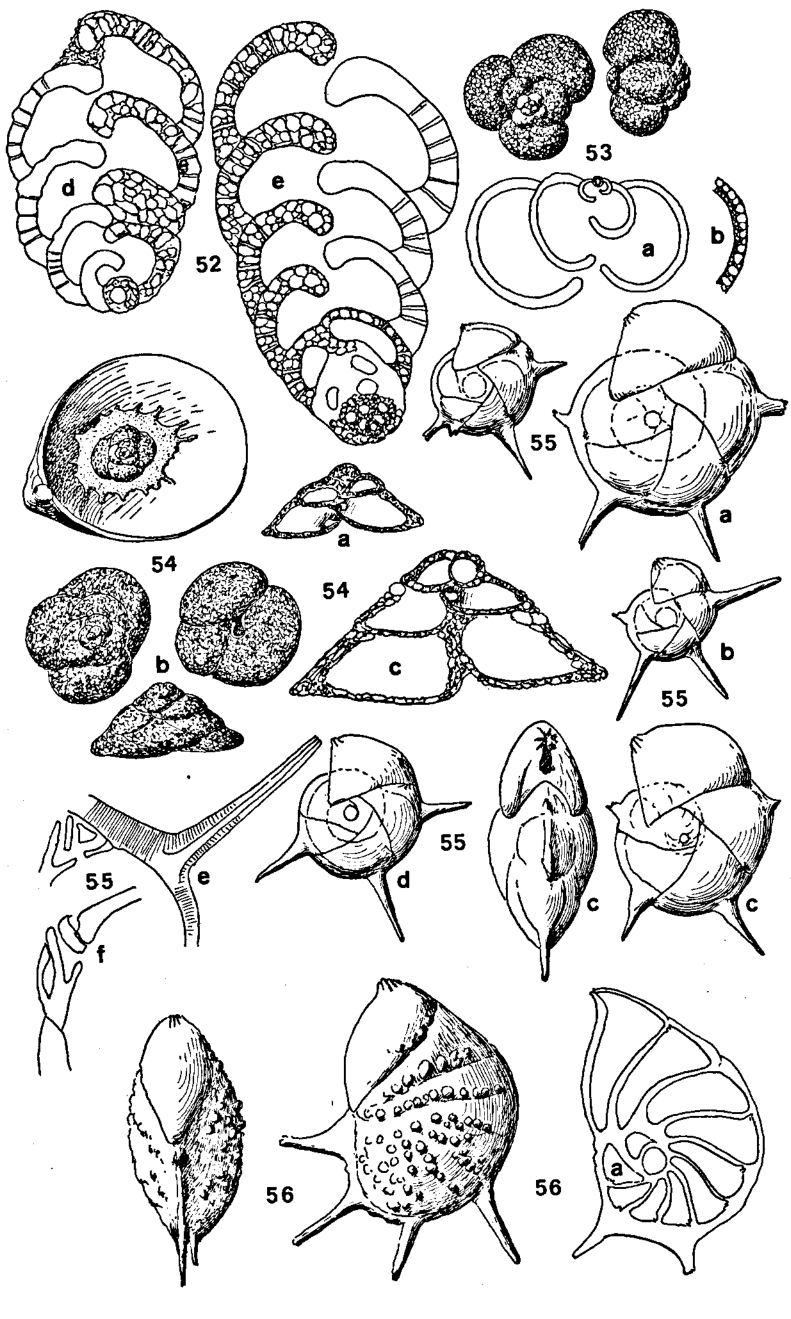
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Fig. 57. *Lenticulina subaculeata* Cushman. – Off St. Croix, depth 800 m, four tests with large proloculus; a: adult megalospheric test from two sides; b: microspheric test (all × 27).

Fig. 58. *Lenticulina peregrina* (Schwager). – Off St. Croix, 300 m, test from two sides (× 57); a: 5 tests (× 27).

Fig. 59. *Lenticulina novangliae* (Cushman). – Off St. Croix, 800 m, B-individual from two sides (× 27); a: A_1-specimen (× 27); b: A_2-specimen from two sides (× 27); c: part of section with some apertures (× 53); d–f: central parts of sections of resp. B, A_1 and A_2 generations (× 53); g: another individual (× 27).

Fig. 60. *Lenticulina iota* (Cushman). – Off St. Croix, 800 m, microspheric specimen (× 27).

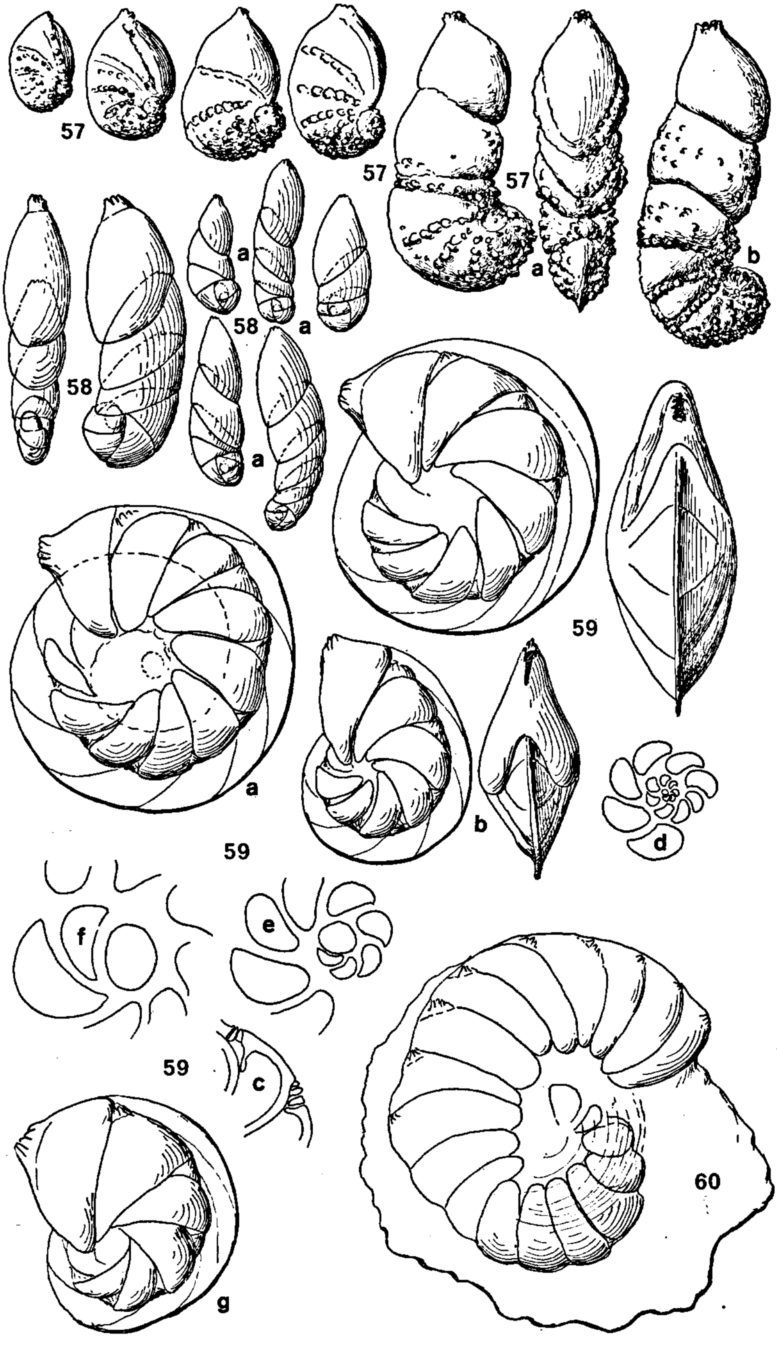
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Fig. 61. *Vaginulina mexicana* (Andersen). – Off St. Croix, depth 300 m, 2 specimens from two sides (× 27).

Fig. 62. *Vaginulina insolitus* (Schwager). – Off St. Croix, 300 m, 3 specimens, one of them from two sides (× 27).

Fig. 63. *Vaginulina spinigera* Brady. – Off St. Croix, 800 m, initial end of A_2-specimen, in clarifier; a: initial end of B-specimen, in clarifier; b: total specimen of A_2-generation; c: specimen of A_1-generation (all × 14).

Fig. 64. *Saracenaria latifrons* (Brady). – Off St. Croix, 800 m, specimen from two sides (× 27).

Fig. 65. *Saracenaria caribbeana* nov. spec. – Off St. Croix, 800 m, specimen from three sides (× 14).

Fig. 66. *Saracenaria italica* Defrance. – Off St. Croix, 300 m, specimen from two sides (× 14).

Fig. 67. *Dentalina bradyensis* (Dervieux). – Off St. Croix, 300 m, 2 specimens from two sides (× 27).

Fig. 68. *Dentalina communis* d'Orbigny. – Off St. Croix, 300 m (× 33).

Fig. 69–71. *Dentalina* cf. *communis* d'Orbigny. – Off St. Croix, 300 m (× 33).

Fig. 72. *Nodosaria albatrossi* Cushman. – Off St. Croix, 300 m, young specimen (× 33).

Fig. 73. *Lenticulina crepidula* (Fichtel & Moll). – Off St. Croix, 300 m, specimen from two sides (× 33).

Fig. 74. *Frondicularia* spec. – Off St. Croix, 300 m, individual from two sides (× 65).

Fig. 75. *Fissurina lucida* (Williamson). – Off St. Croix, 300 m, specimen from two sides (× 33).

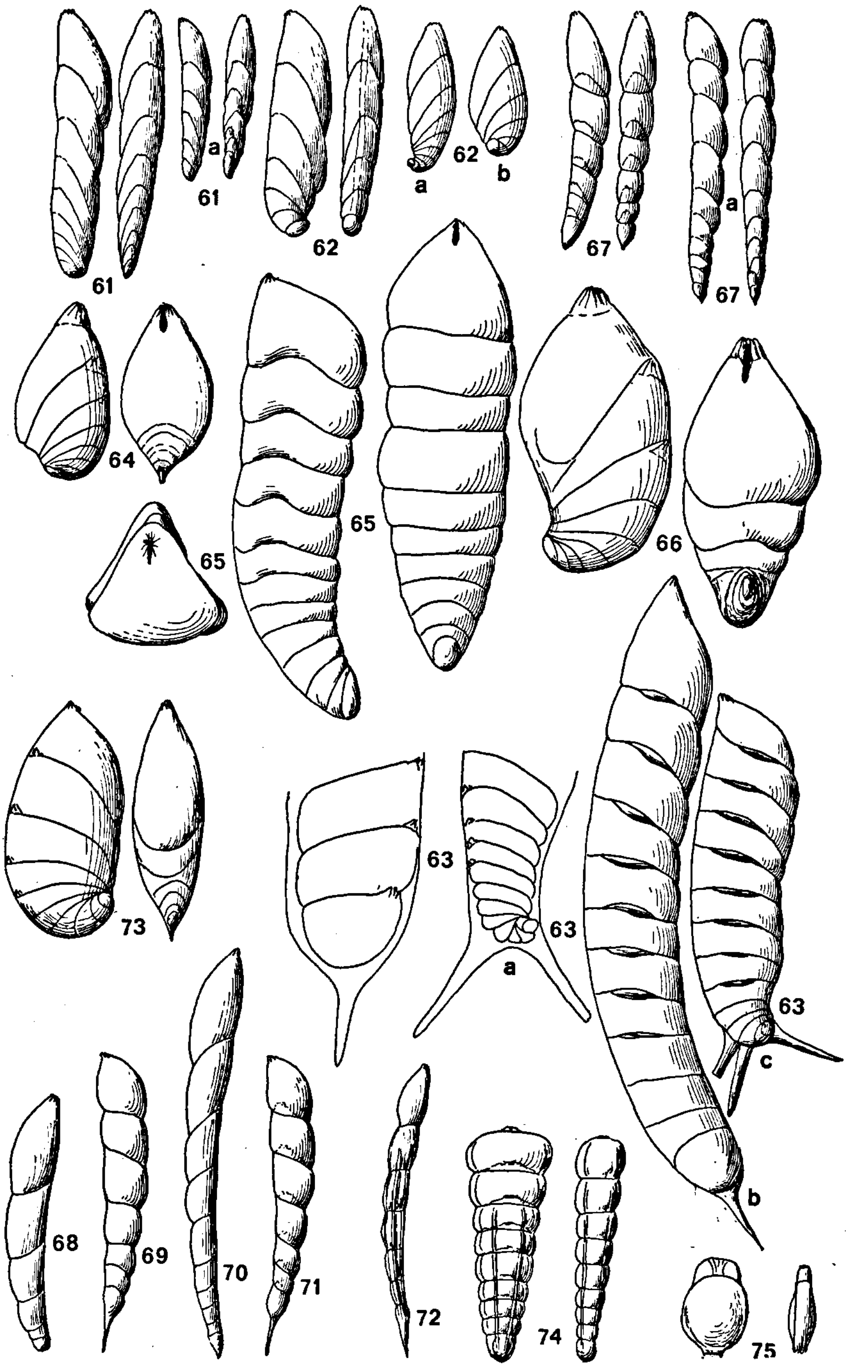
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Fig. 76. *Frondicularia robusta* Brady. – Off St. Croix, depth 800 m, specimen from two sides (× 65).

Fig. 77–78. *Frondicularia compressa* (Costa). – Off St. Croix, 300 m (× 22); 78: specimen from off St. Croix, 800 m (× 33).

Fig. 79. *Frondicularia sagittula* van den Broeck. – Off St. Croix, 800 m, adult microspheric specimen (× 27); a: small, but probably young microspheric specimen (× 27); b: larger microspheric specimen (× 27); c: megalospheric young specimen (× 27); d: megalospheric specimen (× 27); e: aperture of megalospheric specimen (× 54); f: megalospheric specimen (× 27); g: initial end of microspheric specimen (× 60).

Fig. 80. *Lagena elongata* (Ehrenberg). – Off St. Croix, 800 m (× 33).

Fig. 81. *Nodosaria subsoluta* Cushman. – Off St. Croix, 800 m, large megalospheric specimen; a–b: small megalospheric specimens with smaller proloculi (A_1-generation); c: microspheric specimen (all × 14).

Fig. 82. *Nodosaria proxima* Silvestri? – Off St. Croix, 800 m (× 33).

Fig. 83. *Nodosaria flintii* Cushman. – Off St. Croix, 300 m (× 22).

Fig. 84. *Nodosaria* cf. *albatrossi* Cushman. – Off St. Croix, 300 m (× 33).

Fig. 85. *Nodosaria obliqua* (Linnaeus). – Off St. Croix, 300 m (× 22).

Fig. 86. *Nodosaria pyrula* d'Orbigny. – Off St. Croix, 300 m, three broken specimens (× 33).

Fig. 87. *Amphicorina intercellularis* (Brady). – Off St. Croix, 300 m; a: microspheric specimen, 3 megalospheric (× 33).

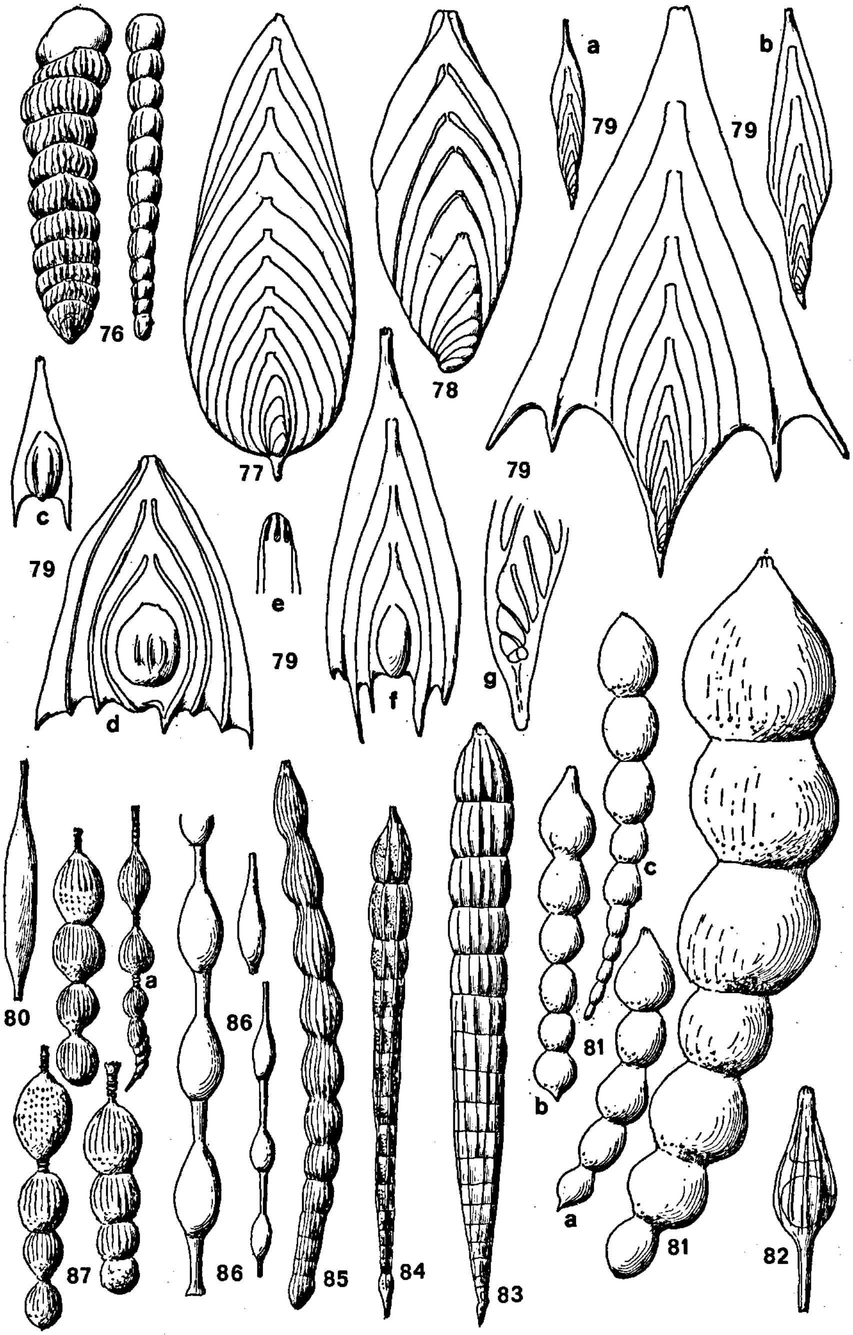
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Fig. 88. *Oolina globosa* (Montagu). – Off St. Croix, depth 800 m, specimen with two chambers, possibly reproduction.

Fig. 89–90. *Paradentalia caribbeana* nov. spec. – Off St. Croix, 300 m, two specimens, 89 possibly microspheric.

Fig. 91. *Sporadogenerina proteiformis* Flint. – Off St. Croix, 800 m (× 33).

Fig. 92. *Ramulina globulifera* Brady. – Off St. Croix, 800 m (× 33).

Fig. 93. *Lingulina seminuda* (Hantken). – Off St. Croix, 800 m, from two sides (× 14).

Fig. 94. *Cyclogyra carinata* (Costa). – Off St. Croix, 800 m, total specimen (× 22); a: central part in clarifier (× 65).

Fig. 95. *Cornuloculina inconstans* (Brady). – Off St. Croix, 300 m, adult specimen (× 33); a: apertural face (× 65); b: same specimen in clarifier, megalospheric (× 65); c: microspheric specimen in clarifier (× 65).

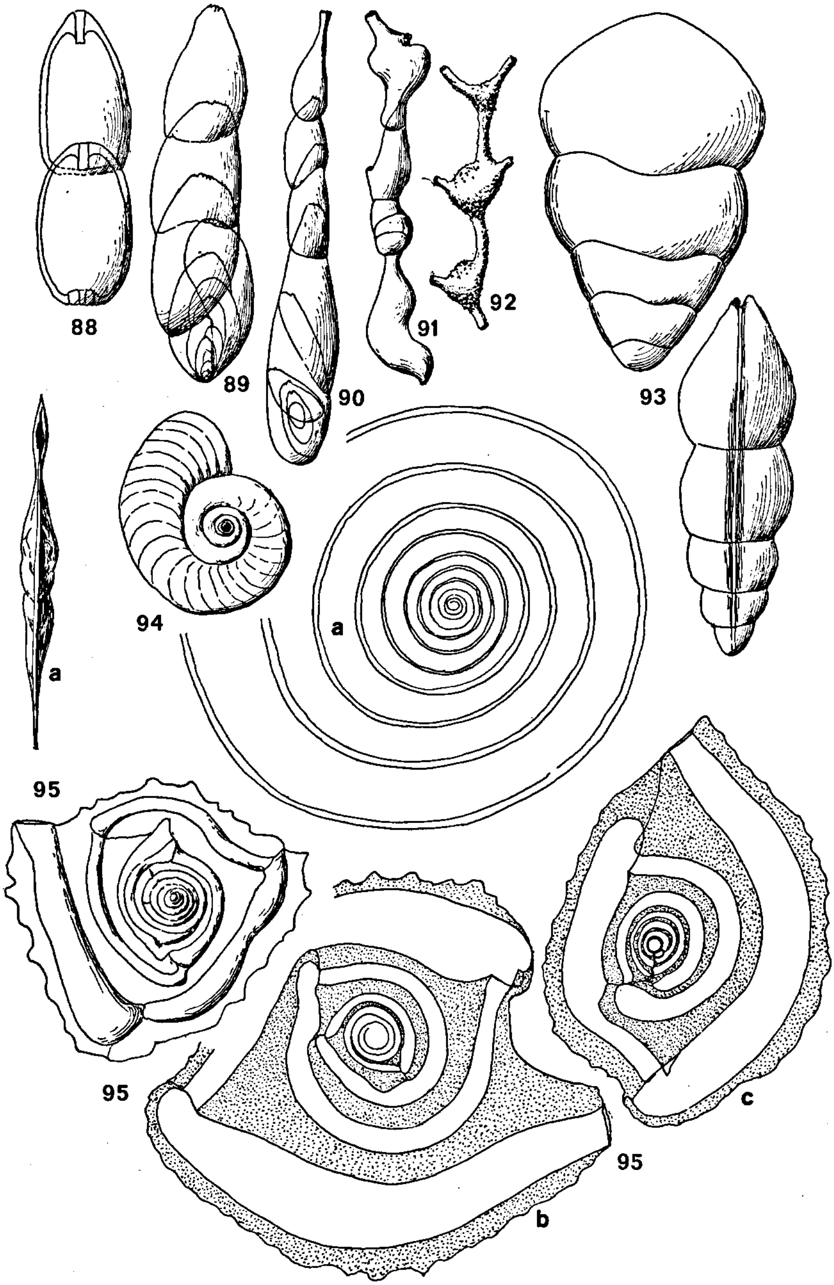
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Fig. 96. *Nummuloculina fragilis* (Le Calvez). – Mediterranian, Coast of Delos, specimen in clarifier (× 65).

Fig. 97. *Nummuloculina irregularis* (d'Orbigny). – Off St. Croix, depth 800 m, megalospheric specimen from three sides (× 33); a: partly ground down specimen, showing inner chamber surrounding the initial chambers (× 22); b: longitudinal section of megalospheric individual (× 65); c: transverse section of such a specimen (× 65); d: microspheric specimen from two sides (× 22); e: section through aperture showing, the initial spiral in transverse section, microspheric (× 65); f: part of section, transverse to the aperture, microspheric, showing the initial spiral in horizontal section (× 65); g: specimen opened from aside, microspheric (× 22); h: small microspheric specimen (× 22).

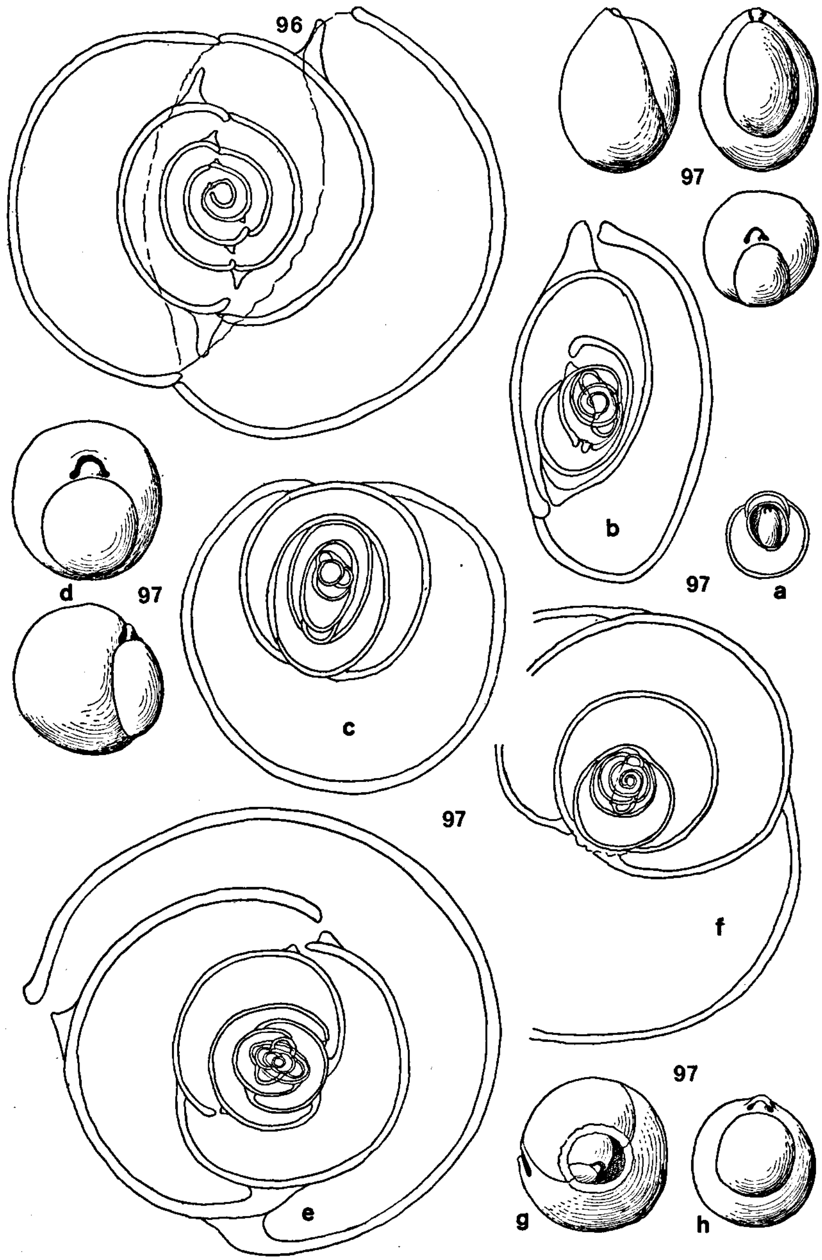
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Fig. 98. *Pyrgoella sphaera* (d'Orbigny). – Off St. Croix, depth 800 m, several specimens (× 22); a: section through the aperture, showing the nummuloculine chambers in the initial part in transverse section, whereas the later chambers are sectioned longitudinally (× 65) – North Atlantic, Ingolf Sta. 118; b: microspheric specimen (× 14); c: section through the initial chambers, megalospheric (× 65); d: section transversely through the aperture, showing the nummuloculine first chambers following the proloculus (× 65); f: section through a specimen from Ingolf Sta. 118, initial chambers (× 125); g: section through centre of microspheric specimen from Ingolf Sta. 118 (× 65); h: central part of megalospheric specimen in a clarifier (× 160).

Fig. 99. *Planispirinoides bucculentus* (Brady). – a: North Atlantic, Ingolf Exp. Sta. 32; – b: Off St. Croix, depth 800 m.

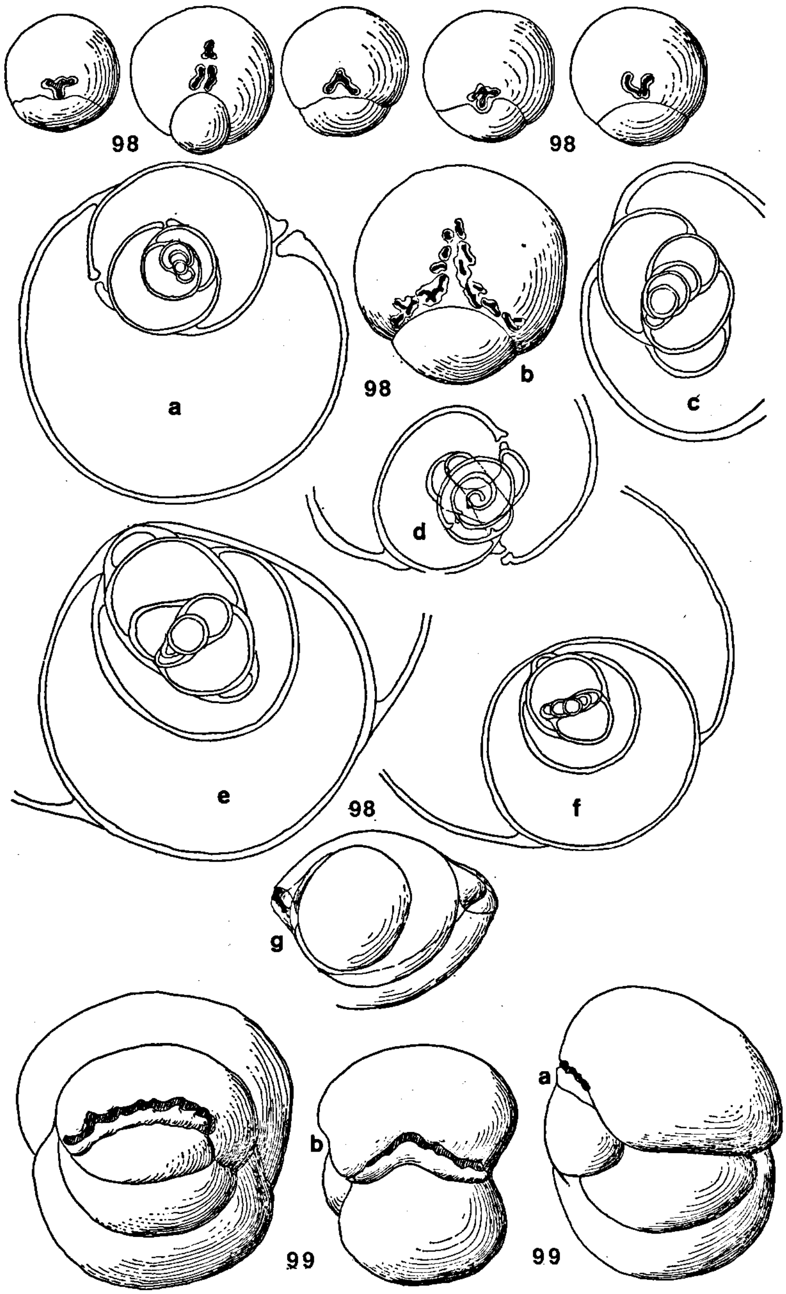
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Fig. 99. *Planispirinoides bucculentus.* – Off St. Croix, depth 800 m, c: young specimen showing that more initial chambers have an aperture with distinct rounded lip; d: section through this specimen, the nummuloculine chambers transversely sectioned (× 65); e: initial part of same section (× 165); f: section through aperture of later chambers, showing that the nummuloculine chambers are arranged transversely to this section (× 50); g: central part (× 165); h: section through central part in the plane of the nummuloculine chambers, also showing the beginning of the chamber perpendicular to these chambers (× 165); i–j: outgrown specimen from St. Croix, 800 m (× 22); k: transverse section through initial part, showing the end of the perpendicular chamber (× 125).

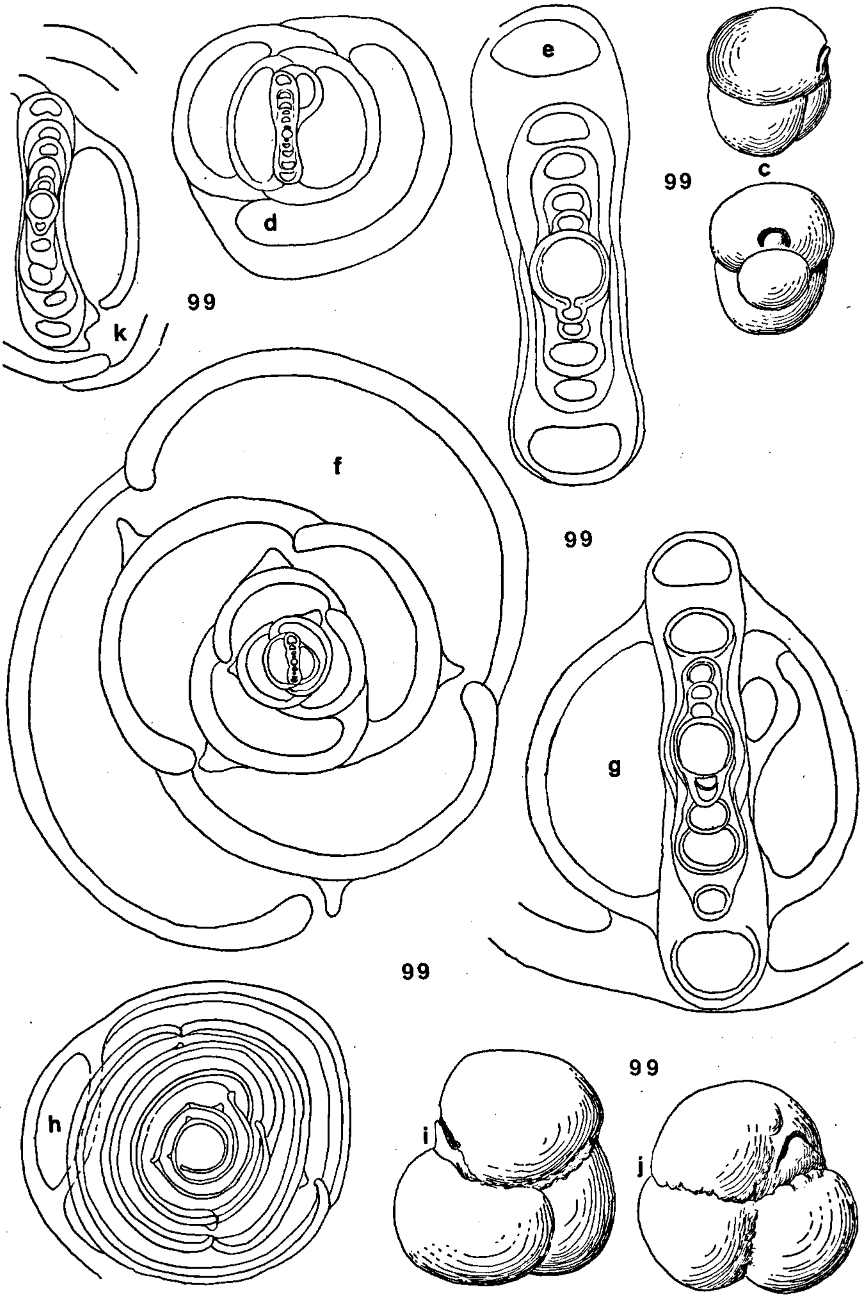
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Fig. 99. *Planispirinoides bucculentus.* – 1: section through the plane of the nummuloculine chambers, with the perpendicular chamber (× 165).

Fig. 100. *Cribropyrgoides aspergulum* (Schlumberger). – Caribbean Sea, depth unknown, Mortensen Sta. 18; total specimen from two sides (× 22); a–d: successive sections through this specimen, showing that the number of openings of the apertural plate decreases in the more initial chambers and that in the chamber surrounding the embryonic part the aperture is that of a *Miliolinella* or *Nummuloculina* (× 16); e–f: sections through two different microspheric specimens (e × 33, f × 65).

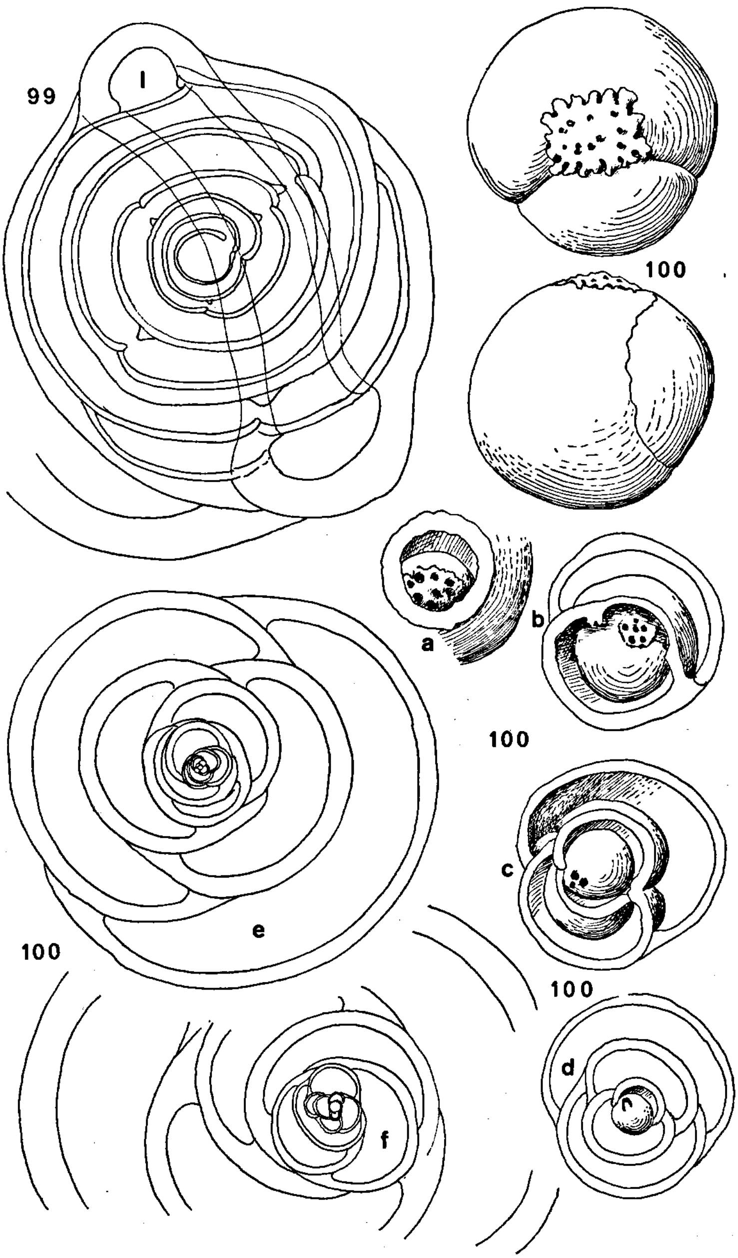
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Fig. 100. *Cribropyrgoides aspergulum.* – g: specimen from the same sample, but now megalospheric, showing a third chamber, and hitherto known as *Involvohauerina globularis* Loeblich & Tappan, from two sides (× 22); h: section through this individual, through the apertures of the last formed chambers, and showing the megalospheric proloculus followed by some nummuloculine chambers (× 65).

Fig. 101. *Miliolinella subrotunda* (Montagu). – Off St. Croix, depth 800 m, test from three sides, microspheric (× 22); a: transverse section through this specimen (× 65); b: megalospheric specimen from three sides (× 22); c: transverse section through this specimen, showing the initial nummuloculine chambers and the succeeding chamber which is cut transversely two times (× 165).

Fig. 102. *Miliolinella semicostata* (Wiesner). – Saba, Sta. 1432, specimen from three sides; c: transverse section, showing the nummuloculine first chambers (× 165).

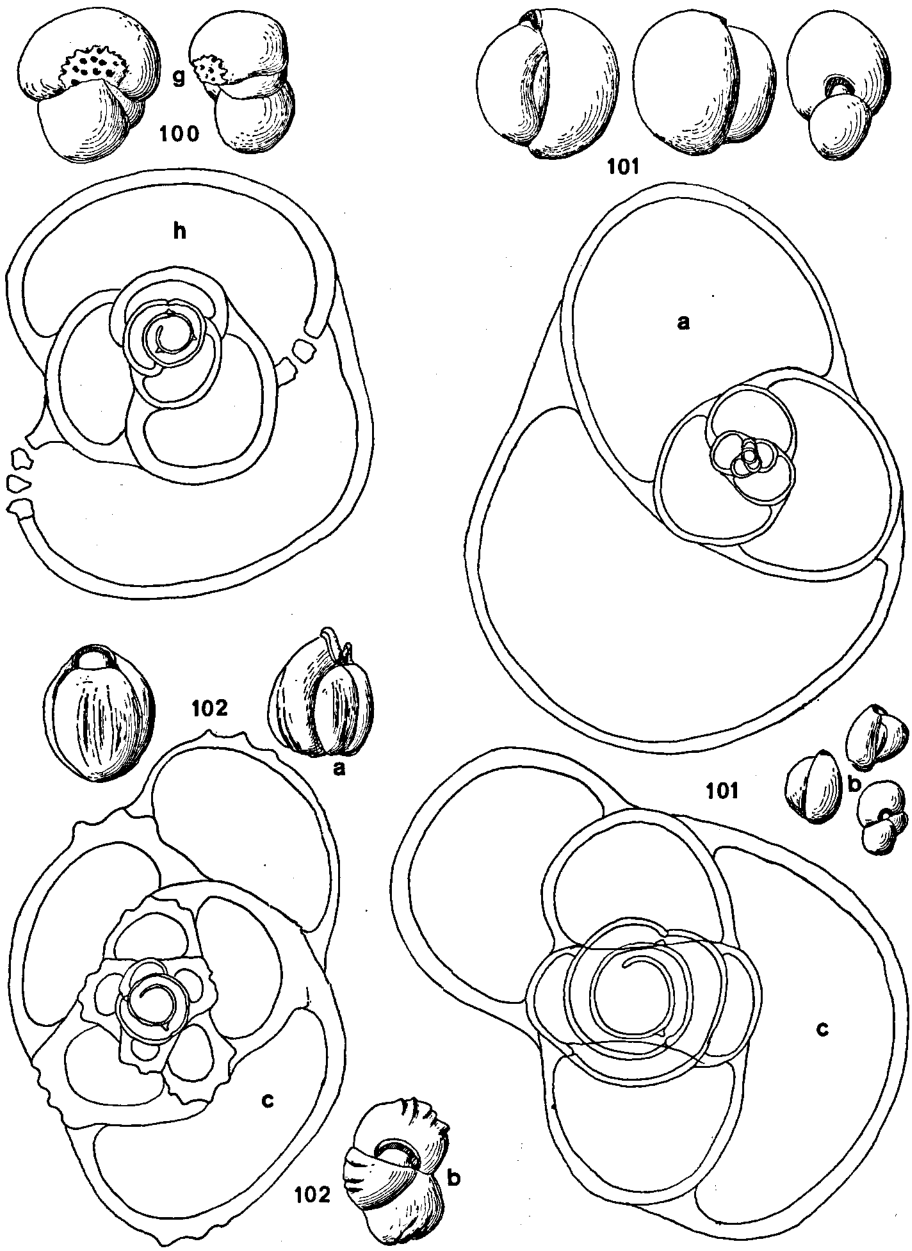
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Fig. 103. *Miliolinella circularis* (Bornemann). – Caribbean Sea, Mortensen Sta. 18, depth unknown, microspheric specimen from three sides (× 22); a: section (× 65); b: megalospheric specimen from three sides, same sample (× 22); c: section, showing nummuloculine initial chambers and the perpendicular neck-chamber (× 65). – Off St. Croix, depth 800 m; d: transverse section through very young specimen (× 165).

Fig. 104. *Miliolinella suborbicularis* (d'Orbigny). – Off St. Croix, 800 m, total specimen from two sides (× 33); a: section, showing nummuloculine first chambers (× 125); b: another specimen, with much larger proloculus (× 165).

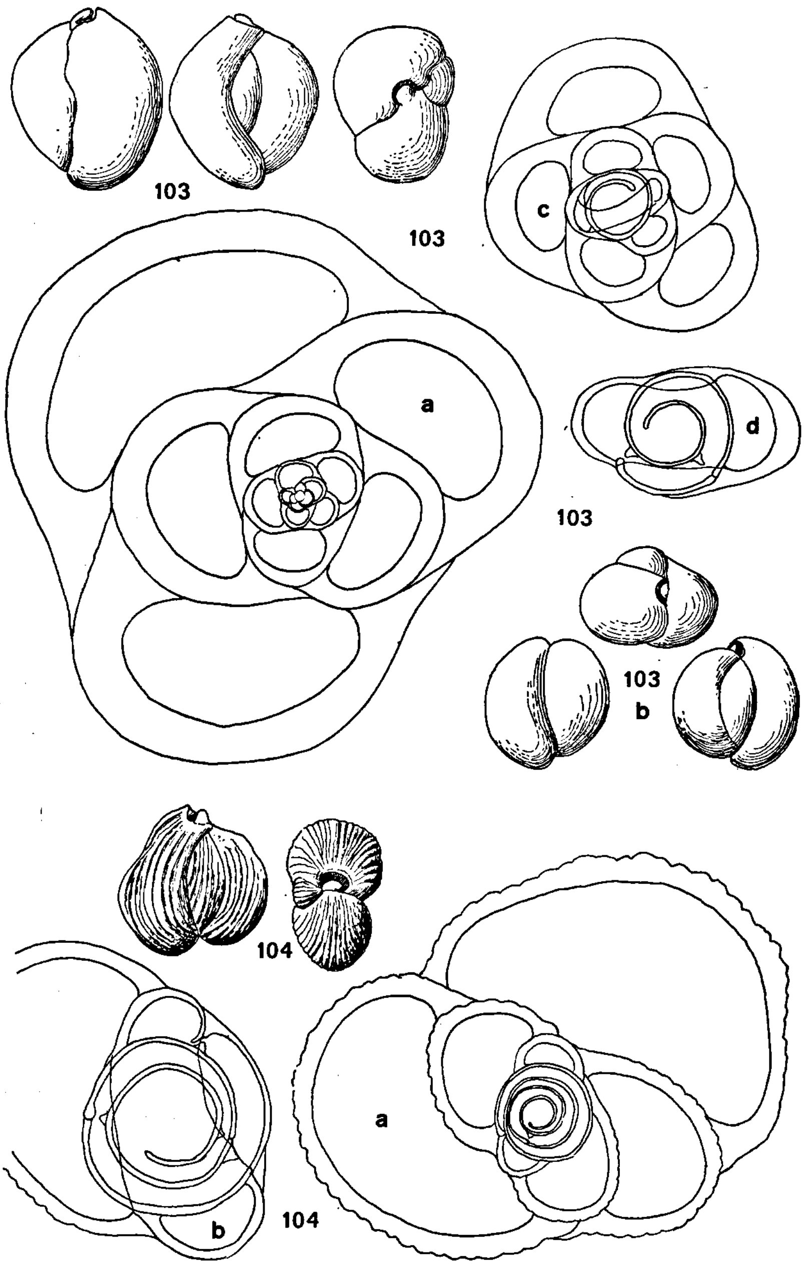
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Fig. 105. *Miliolinella labiosa* (d'Orbigny). – Bahía de Habana, section of megalospheric specimen, showing the nummuloculine first chambers and the perpendicular neck-chamber sectioned two times (× 165).

Fig. 106. *Pseudopyrgo globulus* (Bornemann). – Off St. Croix, depth 800 m, microspheric specimen from two sides, showing the peculiar lip (× 22); a: megalospheric specimen (× 22); b: transverse section, microspheric specimen with some nummuloculine chambers, followed by a large number of "biloculine" chambers which also are nummuloculine, a perpendicular chamber which is followed by the typical biloculine chambers of the adult which are arranged perpendicularly to the initial "biloculine" chambers (× 65); c: megalospheric specimen with nummuloculine initial chambers (× 165); d: megalospheric specimen of the A_2-generation, showing the totally biloculine arrangement (× 33).

Fig. 107. *Pseudopyrgo subsphaerica* (d'Orbigny). – Off St. Croix, 800 m, possibly microspheric (or A_1) specimen, from two sides (× 22); a: megalospheric specimen (× 22).

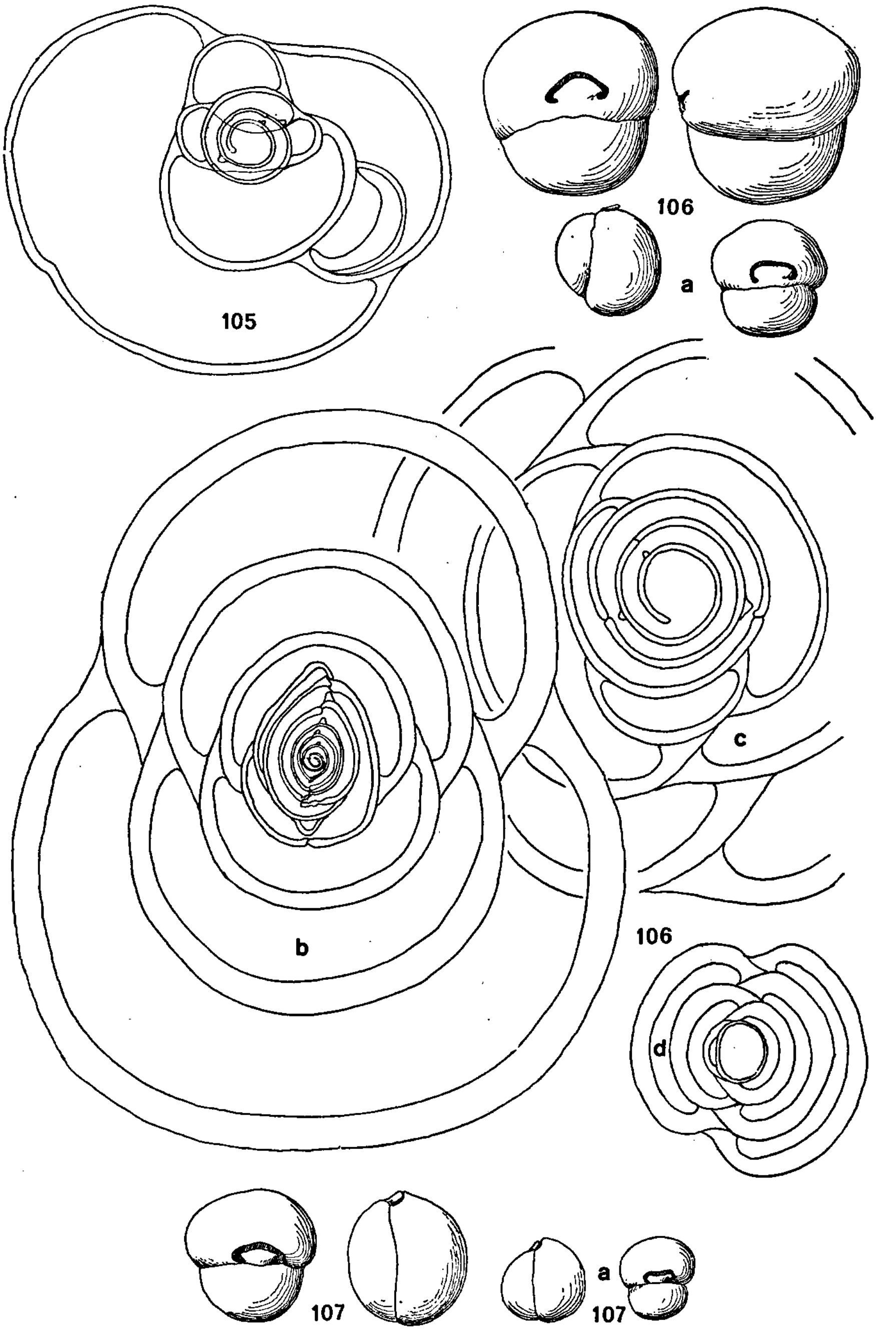
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Fig. 107. *Pseudopyrgo subsphaerica.* – b: section through megalospheric specimen, showing the few nummuloculine chambers following the proloculus and the perpendicular chamber (× 165); c: same section (× 33).

Fig. 108. *Pseudopyrgo eburnea* (d'Orbigny). – Barbuda, Great Lagoon, Sta. 1433, specimen with a third chamber scarcely visible; a: another specimen with three chambers at the outside; b: specimen with only two chambers visible (all × 22); c: section through individual with three chambers visible, with relatively large proloculus (× 65); d: specimen with two chambers sectioned, with much smaller proloculus (× 65); e: central part of section d, showing the nummuloculine chambers and the perpendicular chamber (× 65); f: a specimen not wholly ground down, with the typical aperture over the chamber surrounding the central part (× 22).

Fig. 109. *Pyrgoides striolatus* (Brady). – Off St. Croix, depth 800 m, microspheric specimen (× 22). – Cuba off Habana, depth 2–5 fathoms; a: probably A_1-specimen (× 33).

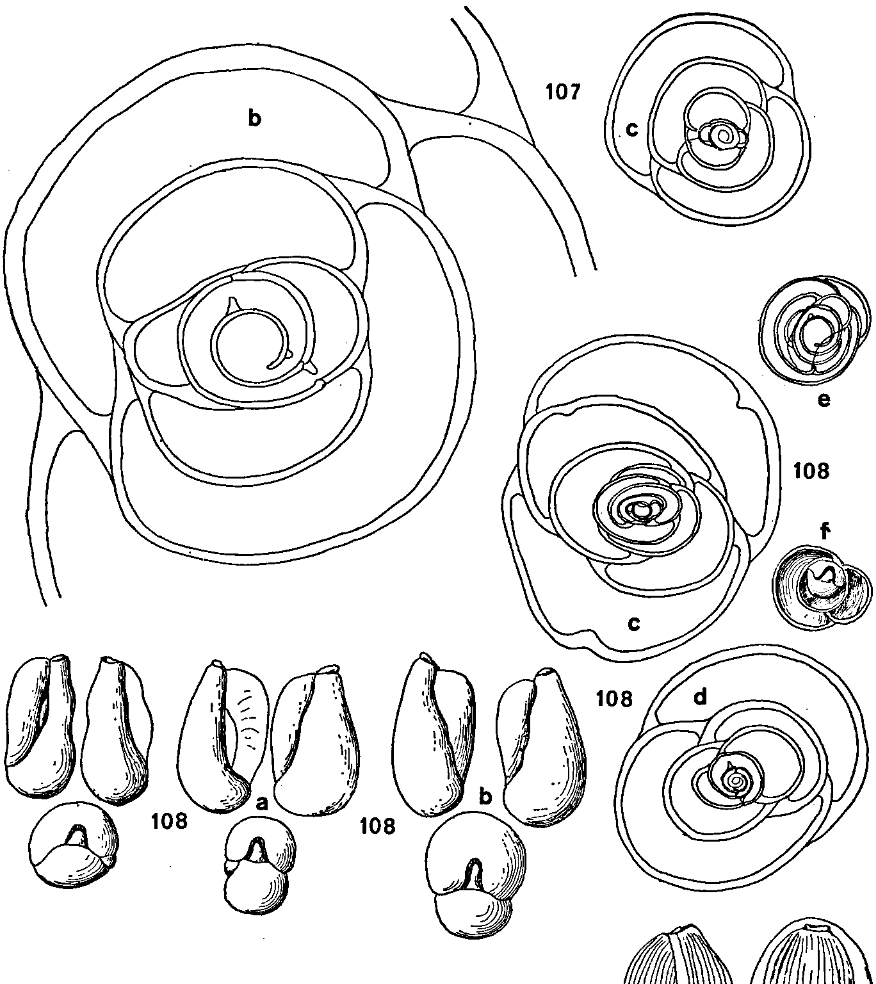
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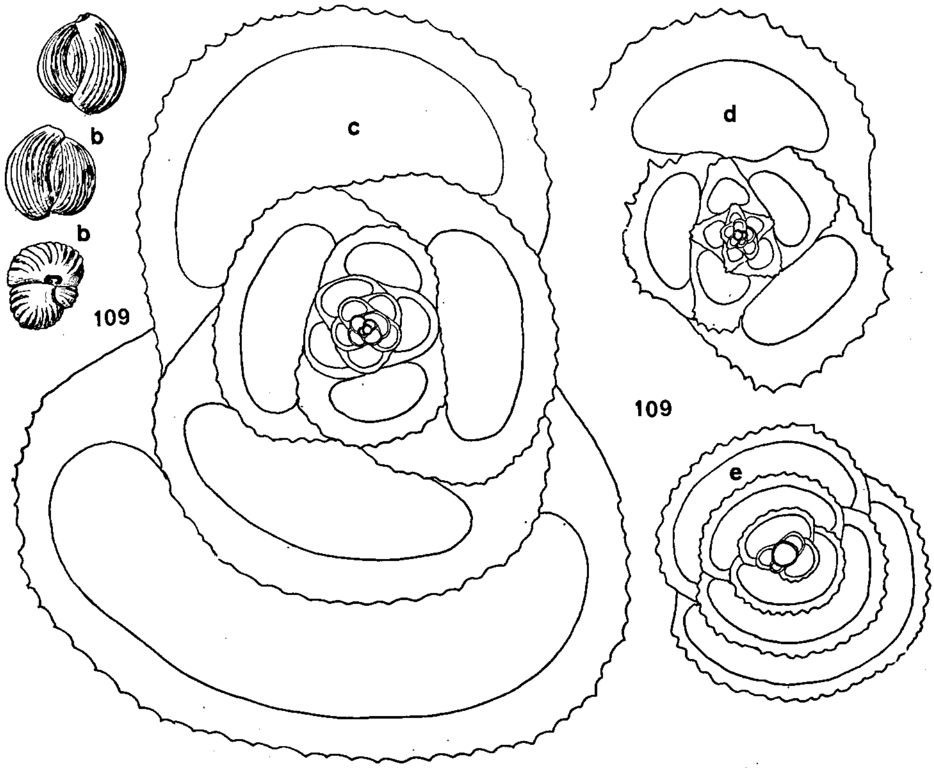
Fig. 109. *Pyrgoides striolatus*. – Off St. Croix, depth 800 m; b: small megalospheric specimen (× 22); c: section through large microspheric specimen (× 65); d: section through small microspheric specimen (× 65); e: section through specimen a (× 65).

Fig. 110. *Pyrgo comata* (Brady). – Off St. Croix, 800 m; megalospheric specimen (× 22); a: section through this specimen (× 65); b: microspheric specimen (× 15); c: section through this microspheric specimen (× 33); d: central part of section c (× 65).



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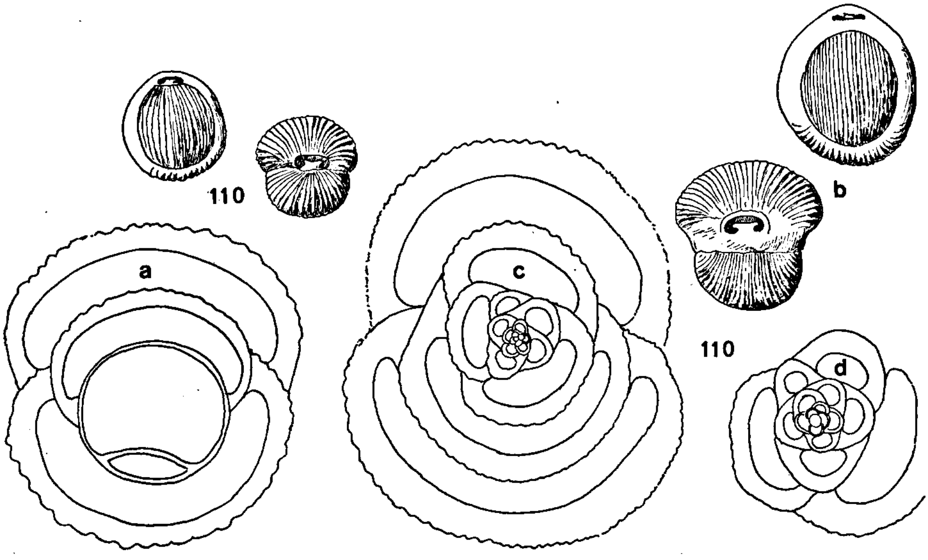

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Fig. 110. *Pyrgo comata.* – e: very large microspheric specimen (× 22); f: section of specimen e, showing that the plane of the initial whorls is not that of the later whorls (× 50); g: small megalospheric specimen (× 22); h: section (× 65).

Fig. 111. *Pyrgoides denticulatus* (Brady). – Cuba, off Habana, depth 2–5 fathoms, large specimen (× 22); a: section through this specimen, which shows to be microspheric, but is wholly triserial in the initial part (× 65). – Florida, Soldiers Key, Sta. 1413; b: small specimen (× 22); c: section through this specimen, which is megalospheric (× 65). – Off St. Croix, depth 800 m; d: small specimen (× 229); e: section through this specimen, megalospheric (× 65).

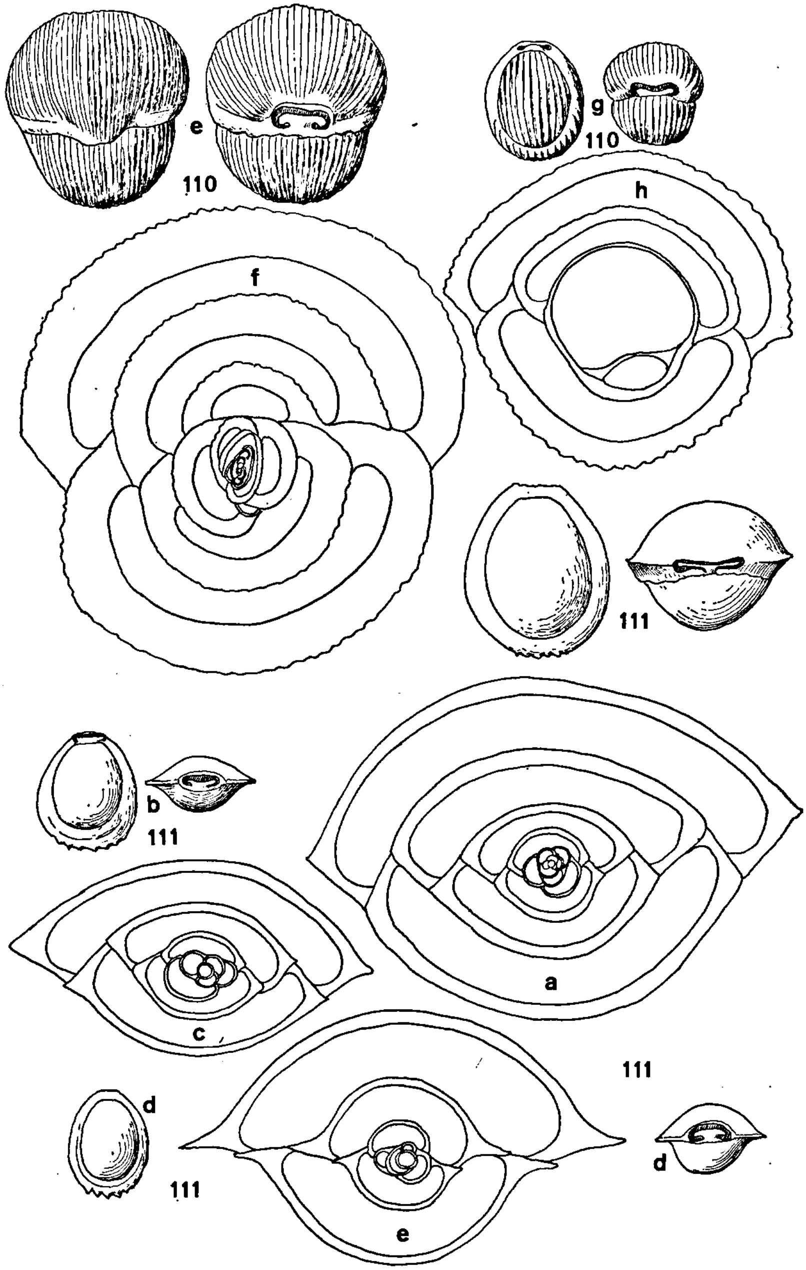
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Fig. 112. *Pyrgo fischeri* (Schlumberger). – Off St. Croix, depth 800 m, test from two sides; a: test partly ground down; b: transverse section; c: another test, much smaller (all × 22); d: section of this test (× 65).

Fig. 113. *Pyrgo depressa* (d'Orbigny). – Off St. Croix, depth 800 m, test from two sides (× 22); a: section through this test (× 65); b: another test (× 22); c: section of this test (× 50).

Fig. 114. *Quinqueloculina seminula* (Linnaeus). – Italy, Rimini (type-locality), coast of Adria; microspheric specimen (× 22); a: section through this specimen (× 65); b: megalospheric specimen (× 22); c: section through this specimen (× 65).

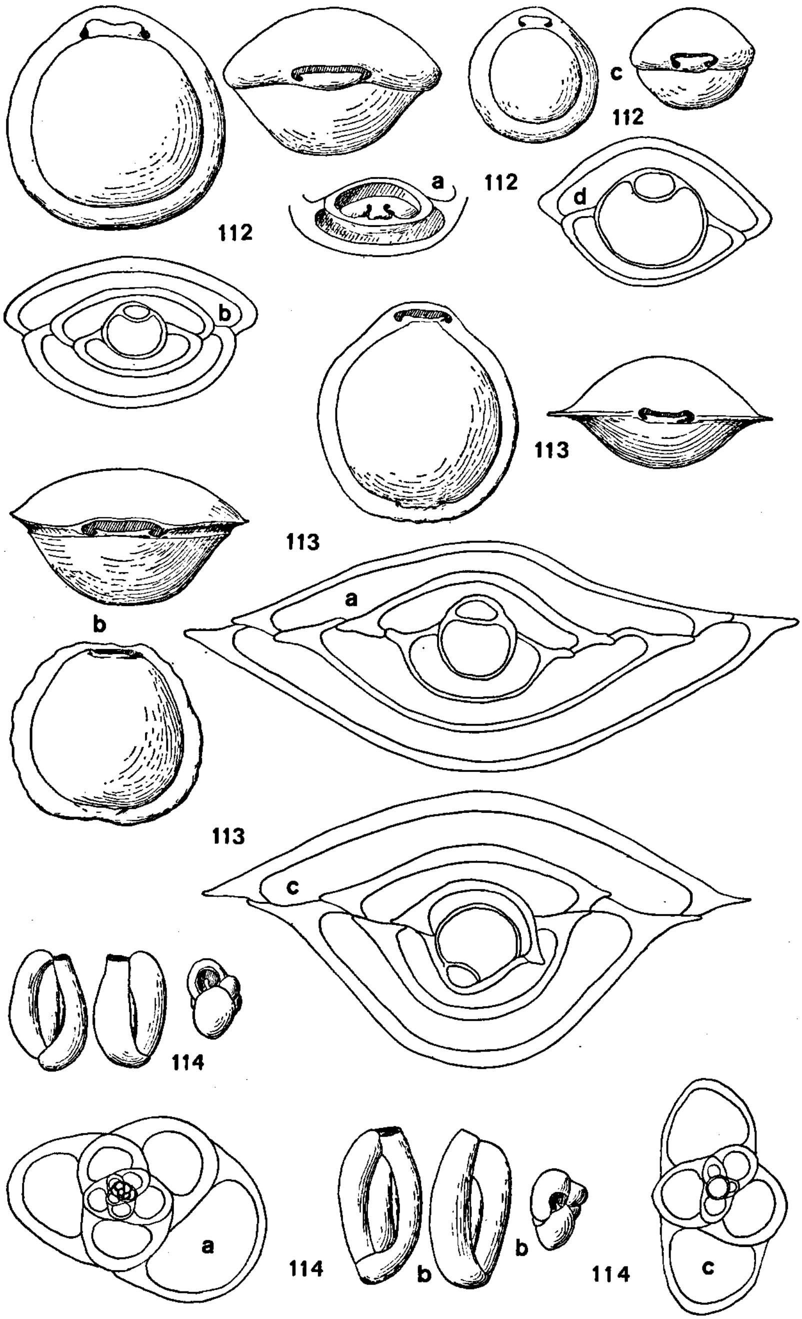
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Fig. 115. *Quinqueloculina candeiana* d'Orbigny. – St. Croix, depth 800 m, microspheric test from three sides (× 22); a: section through this specimen (× 65); b: megalospheric test from three sides (× 33); c: section through this specimen (× 65).

Fig. 116. *Quinqueloculina lamarckiana* d'Orbigny. – St. Croix, 800 m, megalospheric test from three sides (× 22); a: section through this test (× 65); b: microspheric specimen from three sides (× 22); c: section through this test (× 65).

Fig. 117. *Quinqueloculina auberiana* d'Orbigny. – St. Croix, 800 m, microspheric test from three sides (× 22); a: section through this test (× 65); b: Majorca, Mediterranean, megalospheric test from three sides (× 22).

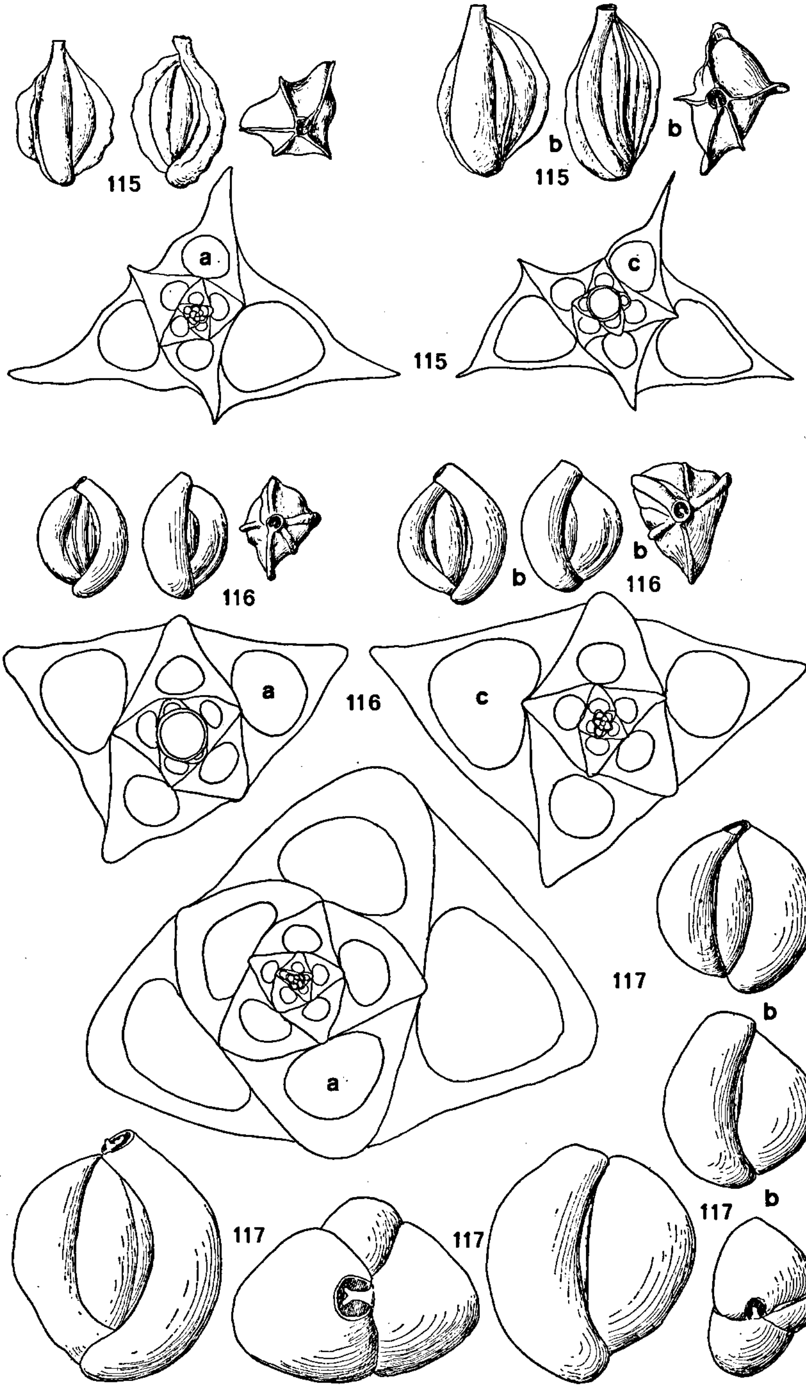
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Fig. 117. *Quinqueloculina auberiana*. – c: Majorca, transverse section through same test b, obviously an A_1-specimen. d: St. Croix, 800 m, megalospheric test from three sides (× 33); e: section through this test with its large proloculus (× 65).

Fig. 118. *Quinqueloculina cruziana* n. sp. – St. Croix, depth 800 m, microspheric test from three sides (× 22); a: section through this test (× 65); b: megalospheric test from three sides (× 22); c: section through this test (× 65).

Fig. 119. *Quinqueloculina poeyana* d'Orbigny. – Puerto Rico, Bahía Fosforescente, Sta. 1423B, test from three sides; a: another test; b: abnormal test (all × 33); c: transverse section (× 65).

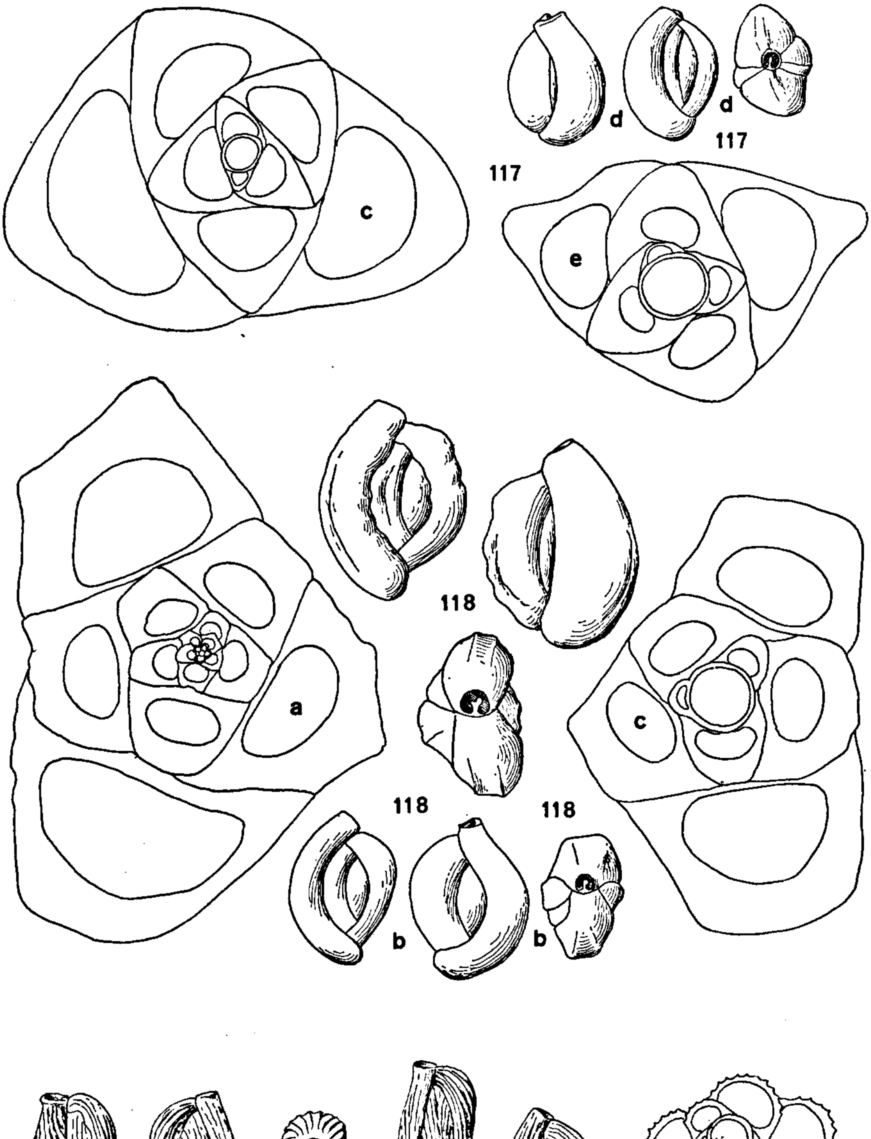

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Fig. 120. *Quinqueloculina carinata* d'Orbigny. – Cuba, off Habana, 2–5 fathoms deep, large test from five sides (× 22); a: section through this test (× 65); b: St. Croix, 800 m, individual from four sides (× 22); c: section through this test (× 65).

Fig. 121. *Massilina gualtieriana* (d'Orbigny). – St. Vincent, Sta. 1549, test from three sides (× 22); a: section (× 65). b: St. Kitts, Sta. 1397, test from three sides (× 22); c: section through this test (× 33).

Fig. 122. *Massilina protea* Parker. – Bonaire, Lac, Sta. 1602, specimen with smooth surface from three sides (× 70); a: transverse section, showing triserial initial part.

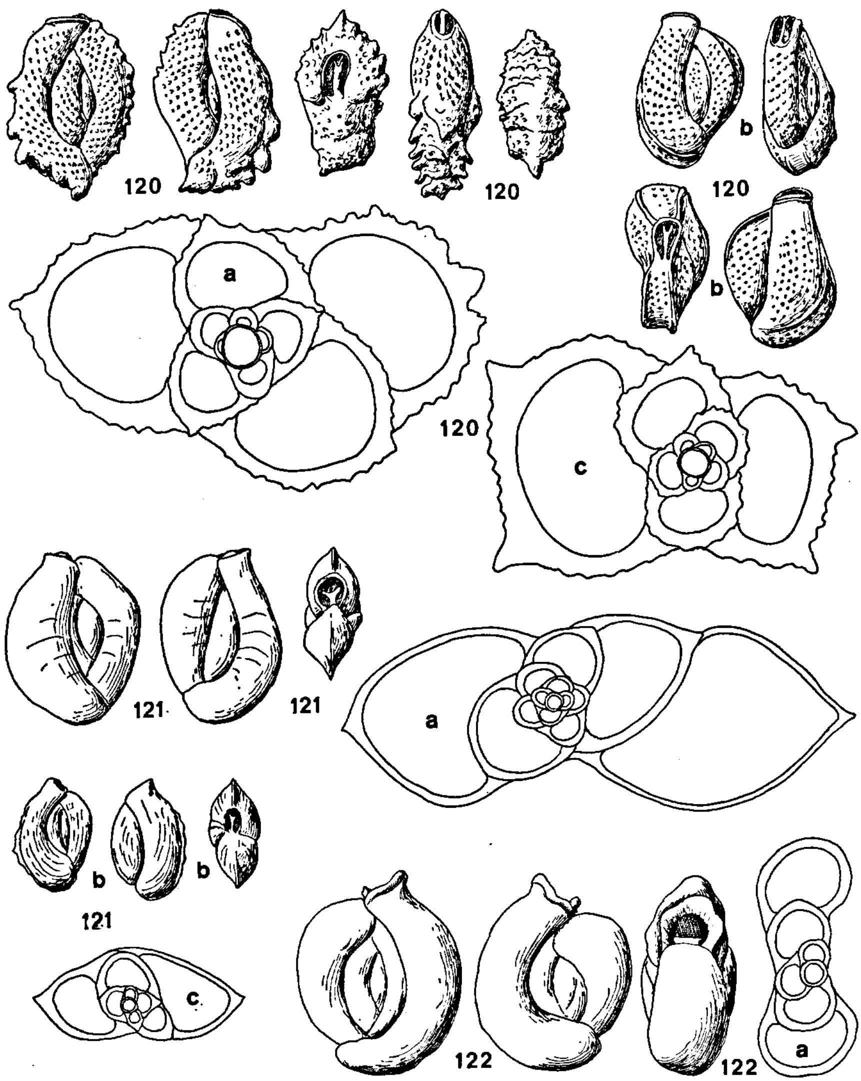
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Fig. 122. *Massilina protea.* – b: test with longitudinal costae from three sides; c: transverse section, showing quinqueloculina initial arrangement of chambers; d: more irregularly formed test (× 33).

Fig. 123. *Dentostomina bermudiana* Carman. – St. Croix, depth 300 m, megalospheric specimen from three sides (× 16); a–c: successive sections, showing the development of the apertural structure (× 16); d: transverse section through this specimen (× 65); e: microspheric specimen from three sides (× 16); f: transverse section through this specimen (× 65).

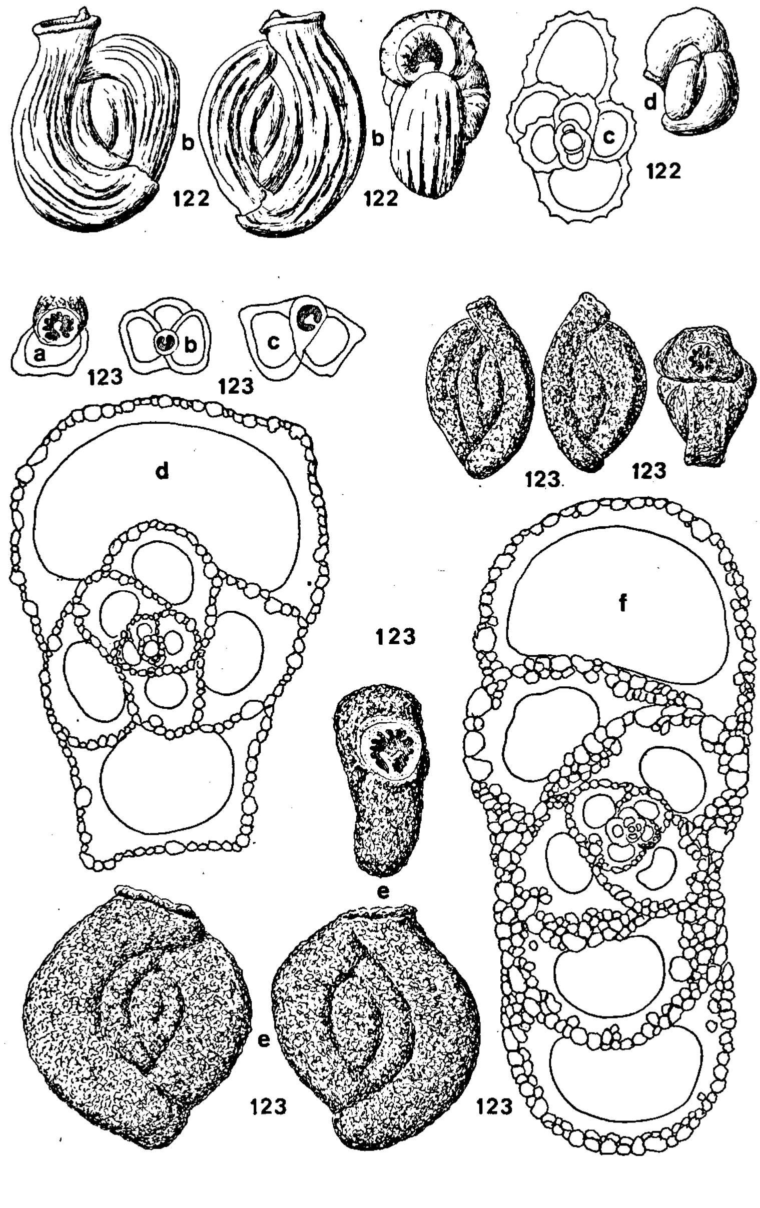
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Fig. 124. *Triloculina bradyana* Cushman. – St. Croix, depth 800 m, test from three sides (× 33); a: section showing that this specimen is a *Triloculina* (× 65).

Fig. 125. *Vertebralina striata* d'Orbigny. – Mediteranean, coast of Delos (the species is not known from the Caribbean), test from three sides (× 22); a: transverse section (× 65).

Fig. 126. *Triloculina tricarinata* d'Orbigny. – St. Croix, 800 m, large microspheric specimen from 3 sides, characterised in the adult by a circular tooth in the aperture (× 16); a: teeth in a microspheric specimen in later and in earlier chamber (× 33); b: apertural view of adult megalospheric specimen (× 15); c: central part of transverse section of microspheric specimen (× 30); d: same section, initial chambers (× 160); e: transverse section through megalospheric individual (× 16).

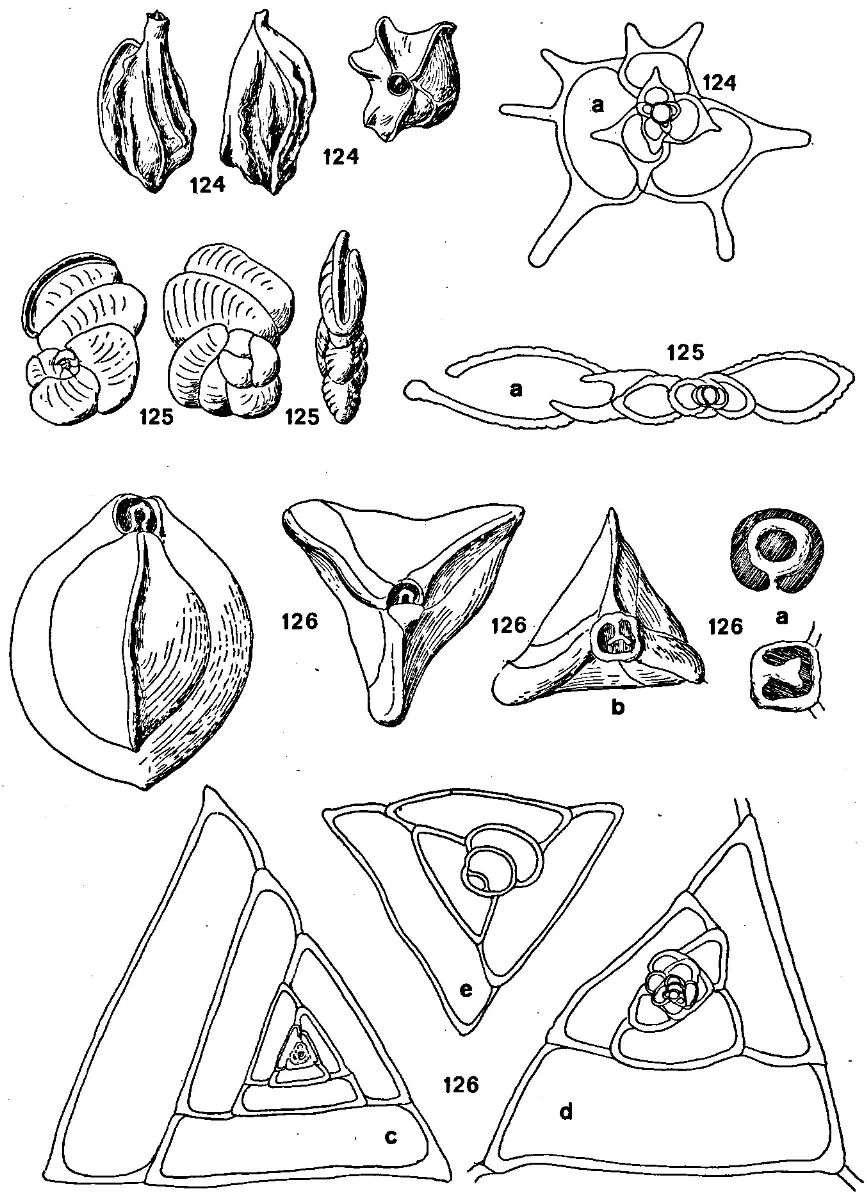
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Fig. 127. *Sigmoilina sigmoidea* (Brady). – St. Croix, depth 180 m, two individuals (× 33); a–b: sections (× 65).

Fig. 128. *Sigmoilina schlumbergeri* Silvestri. – St. Croix, 800 m, test from three sides (× 22); a: section of this test (× 65); b: another specimen (× 22); c: section (× 65).

Fig. 129. *Schlumbergerina occidentalis* (Cushman). – St. Croix, 800 m, flat test, whole test from three sides, and trematophore (× 22); a: section (× 65).

Fig. 130. *Vertebrasigmoilina mexicana* (Cushman). – St. Croix, 300 m, whole test, dry state and in clarifier (× 27); a: section (× 65); b: total elongate test (× 22); c: section (× 65); d: longitudinal section through end-chamber, showing that both lips of the aperture are similar in length (× 65).

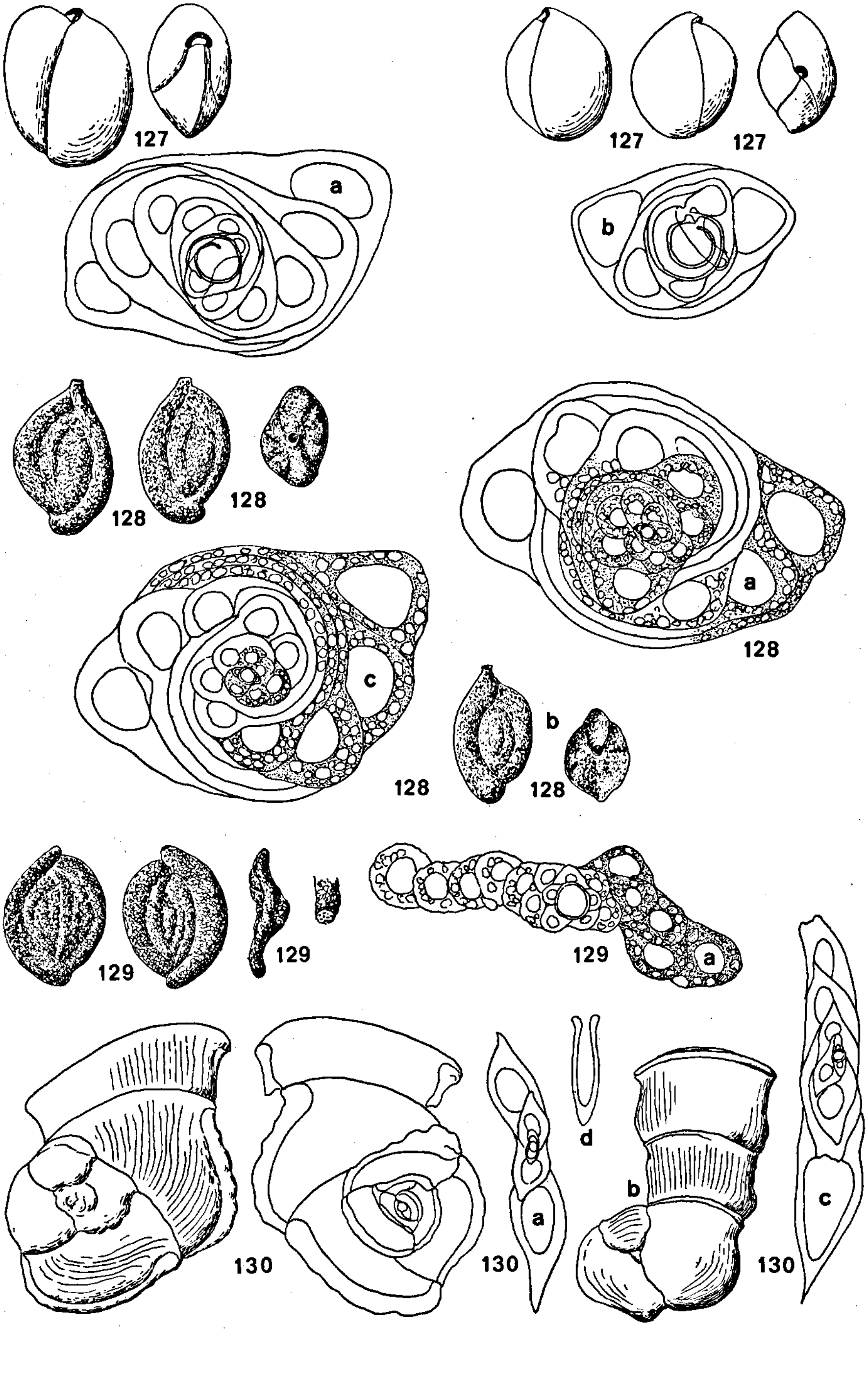
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Fig. 131. *Orbitolites* (*Amphisorus*) *hemprichii* (Ehrenberg). – Barbuda, Great Lagoon, Sta. 1532, a & e, Sta. 834, c; Curaçao, Awa di Oostpunt, Sta. 1666, b & d; North Bimini, Sta. 495, f. – a: Young microspheric specimen. The small proloculus (inner diameter 16μ) is followed by a somewhat irregular spiral of chambers. Later chambers show the clockwise – counterclockwise pattern. – b: Plurivalent specimen (A_1-generation) with two embryons situated in parallel direction with fully outgrown first sets of spiral chambers. Later chambers do not show the clockwise – counterclockwise pattern. Only the central part is figured. – c: Part of full-grown specimen of the megalospheric A_2-generation, showing the large proloculus with an inner diameter of 81 μ, the clockwise – counterclockwise pattern of later chambers and the chambers of the periphery which do not form brood-chambers. – d: Part of full-grown specimen of the megalospheric A_1-generation, showing the relatively small proloculus with an inner diameter of 58 μ, the later chambers not forming a typical clockwise – counterclockwise pattern, and the last formed circular rows of chambers which are much larger, with thin walls and which at the periphery from the circular brood-chambers, with several embryons with the A_2-proloculus, with inner diameter of 86 μ. – e: Central part of plurivalent specimen of the A_1-generation, inner proloculus diameter of 52 μ, the two embryons situated in opposite direction, with the result that the normal large spiral sets of chambers could not be developed. The clockwise – counterclockwise pattern is not developed in the later chambers. – f: Part of an A_1-individual, with inner diameter of the proloculus of 58 μ, and the more peripheral chambers arranged in circular rows which in the end change into a large brood-chamber forming the periphery. In this brood-chamber several embryons are seen of the A_2-generation, with inner proloculus diameter of 86 μ. (All figures × 57).

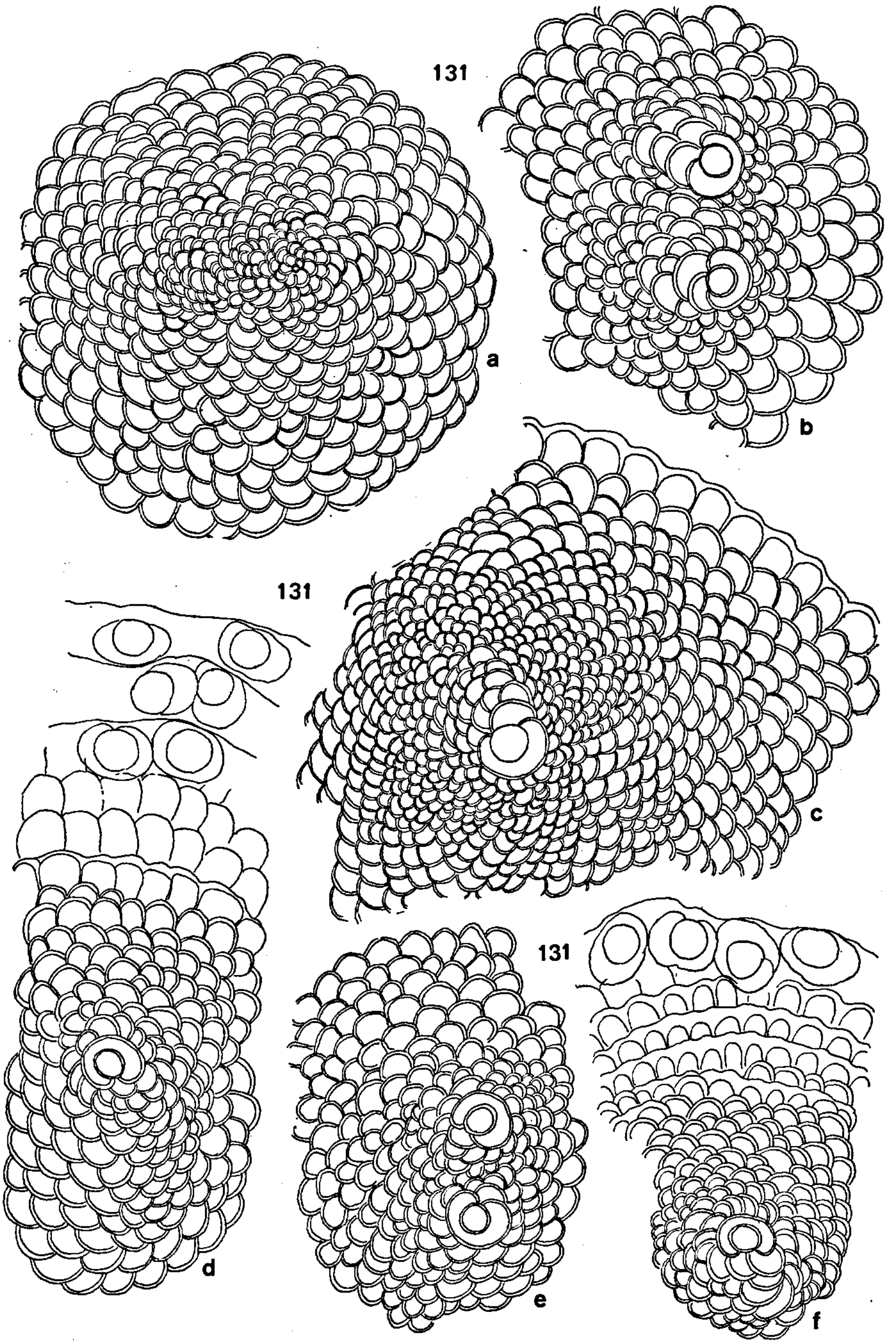
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Fig. 132. *Planorbulina medilterranensis* d'Orbigny. – Spain, east coast beach at Punta de Ifach (this species does not occur in the Caribbean), ventral and dorsal sides (× 33); a: section with inner wall of chamber with the pores (× 165); b: chamber at the periphery, ventral side (× 65); c: side view of test (× 33); d: wall sections with pores and primary wall, from more initial chamber (above) and more peripheral chamber (below) (× 200); e: transverse section (× 65).

Fig. 133. *Planorbulina caribbeana* n. sp. – St. Croix, depth 800 m, ventral and dorsal sides (× 33); a: sectioned chamber with inner wall with the pores (× 165); b: wall of peripheral chamber, section (× 165); c: more initial wall, section (× 230); d: side view of test (× 33); e: transverse section (× 65).

Fig. 134. *Planorbulina acervalis* Brady. – Florida, Elliott Key, Sta. 1414, horizontal section (× 33); a: transverse section (× 33); b: section through peripheral chamber, with foramina and pores (× 165).

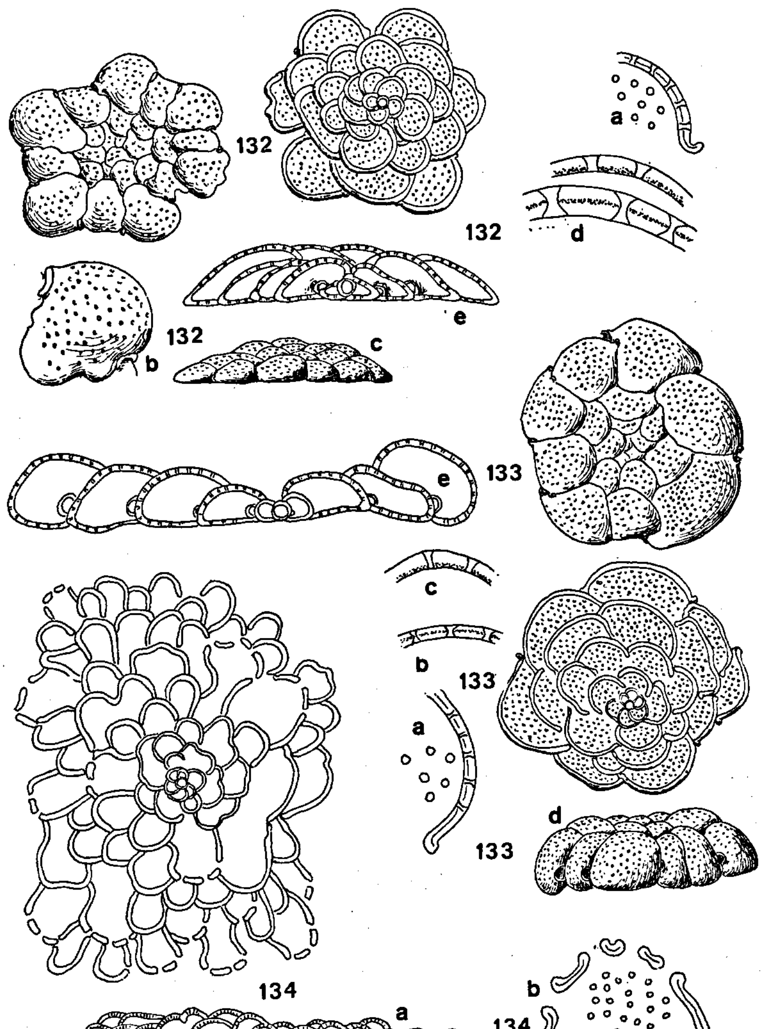
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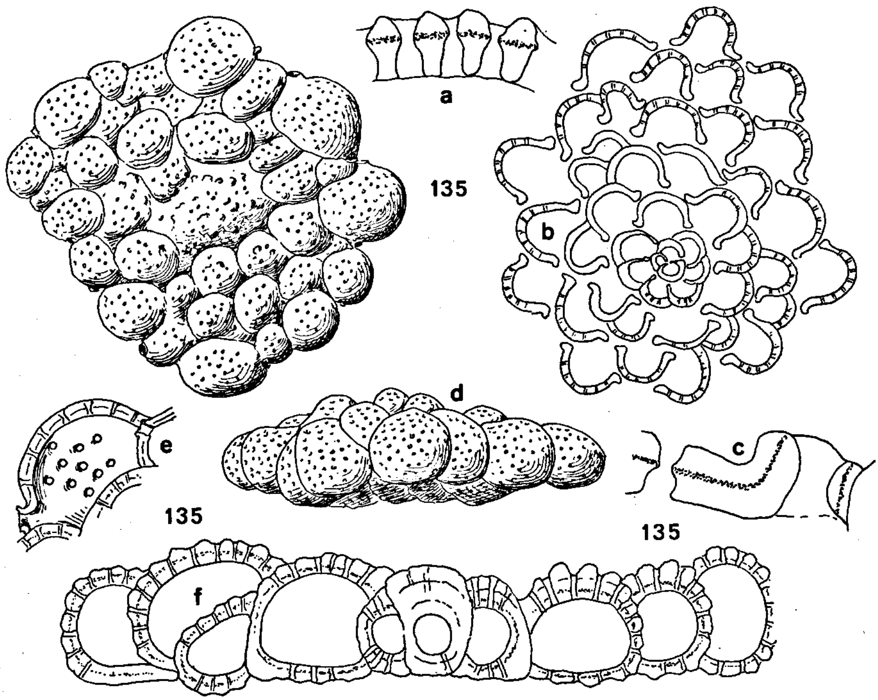
Fig. 135. *Planorbulina mabahethi* Said. – Cuba, Habana, depth 2–5 fathoms, ventral side (× 33); a: wall of peripheral chamber, showing the primary wall and the pores (× 165); b: horizontal section (× 33); c: section through wall with aperture (× 165); d: side view of test (× 33); e: section of peripheral chamber with pores from within (× 50); f: transverse section (× 65).

Fig. 136. *Planorbulina retinaculata* (Parker & Jones). – Marie-Galante, Capesterre, ventral side of total test (× 65); a: horizontal section (× 65); b: transverse section (× 65); c: section through peripheral chamber with pores from within (× 165).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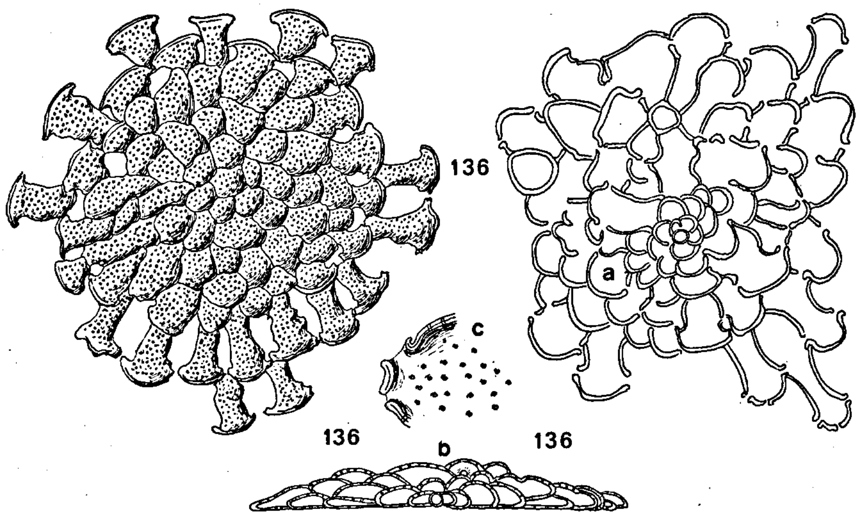
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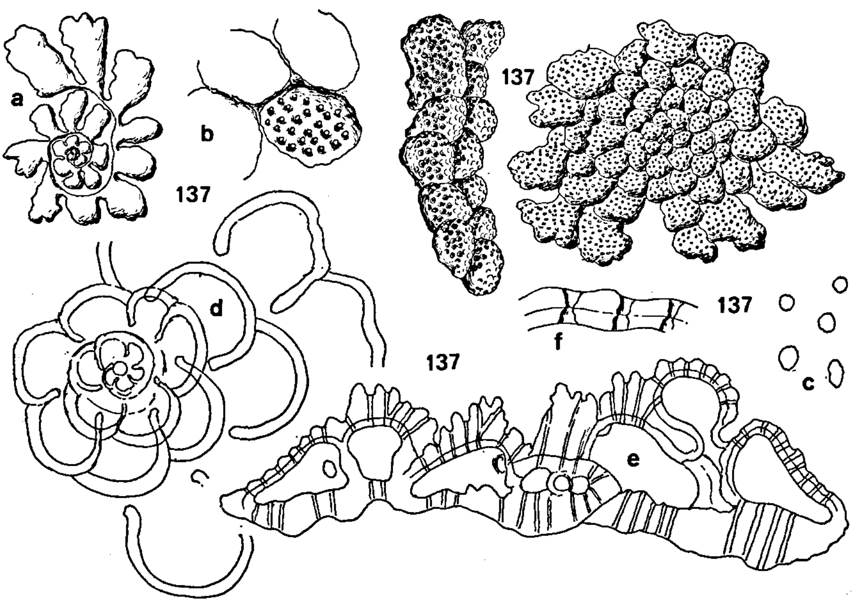
Fig. 137. *Sporadotrema rubrum* (d'Orbigny). – Marie-Galante, Capesterre, test from ventral side (× 20), and side-view (× 33); a: decalcified specimen, central part (× 33); b: some chambers with the pores (× 65); c: pores (× 165); d: horizontal section (× 65); e: transverse section (× 65); f: section through wall with pores (× 200).

Fig. 138. *Planogypsina squamiformis* Chapman. – Cuba, Habana, depth 2–5 fathoms, three sides of test (× 20); a: part of horizontal section (× 40); b: transverse section (× 65); c: section of chamber with pores at inner wall (× 165).

Fig. 139. *Discogypsina vesicularis* (Parker & Jones). – Marie-Galante, Capesterre, transverse section (× 23); a: transverse section of the initial part (× 65); b: horizontal section of initial part (× 65).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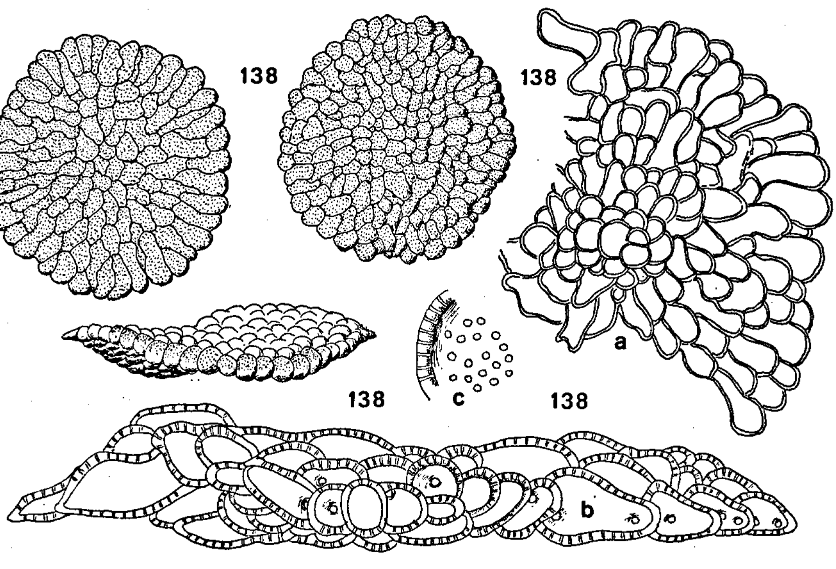
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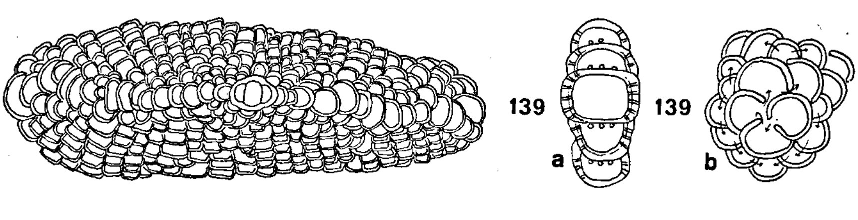
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Fig. 139. *Discogypsina vesicularis.* – c and d: test from two sides (× 12); e: horizontal section through the median chambers (× 23); f: transverse section through lateral chambers, with pores and foramina (× 165); g: initial part of horizontal section (× 65); h: transverse section through median chambers, with pores and foramina (× 165); i: part of horizontal section (× 165).

Fig. 140. *Gypsina plana* (Carter). – Cuba, Habana, a, c-h; Thatch Island, 25–30 m, Virgin Islands, b. – Specimen around root of *Rhizophora* (× 12); a: transverse section of this specimen (× 65); b: embryonic chambers (× 33); c: transverse section of chambers of first individual, with pores, primary granular wall and foramina (× 165); d: surface of test (× 65); e: part of horizontal section (× 65); f: pores (× 165); g: pillar with chamber walls (× 165); h: chambers and pillars (× 65).

Fig. 141. *Sphaerogypsina globulus* (Reuss). – Cuba off Habana, depth 2–5 fathoms, total specimen (× 33) with part of transverse section, chambers showing primary granular wall, pores and foramina (× 165).

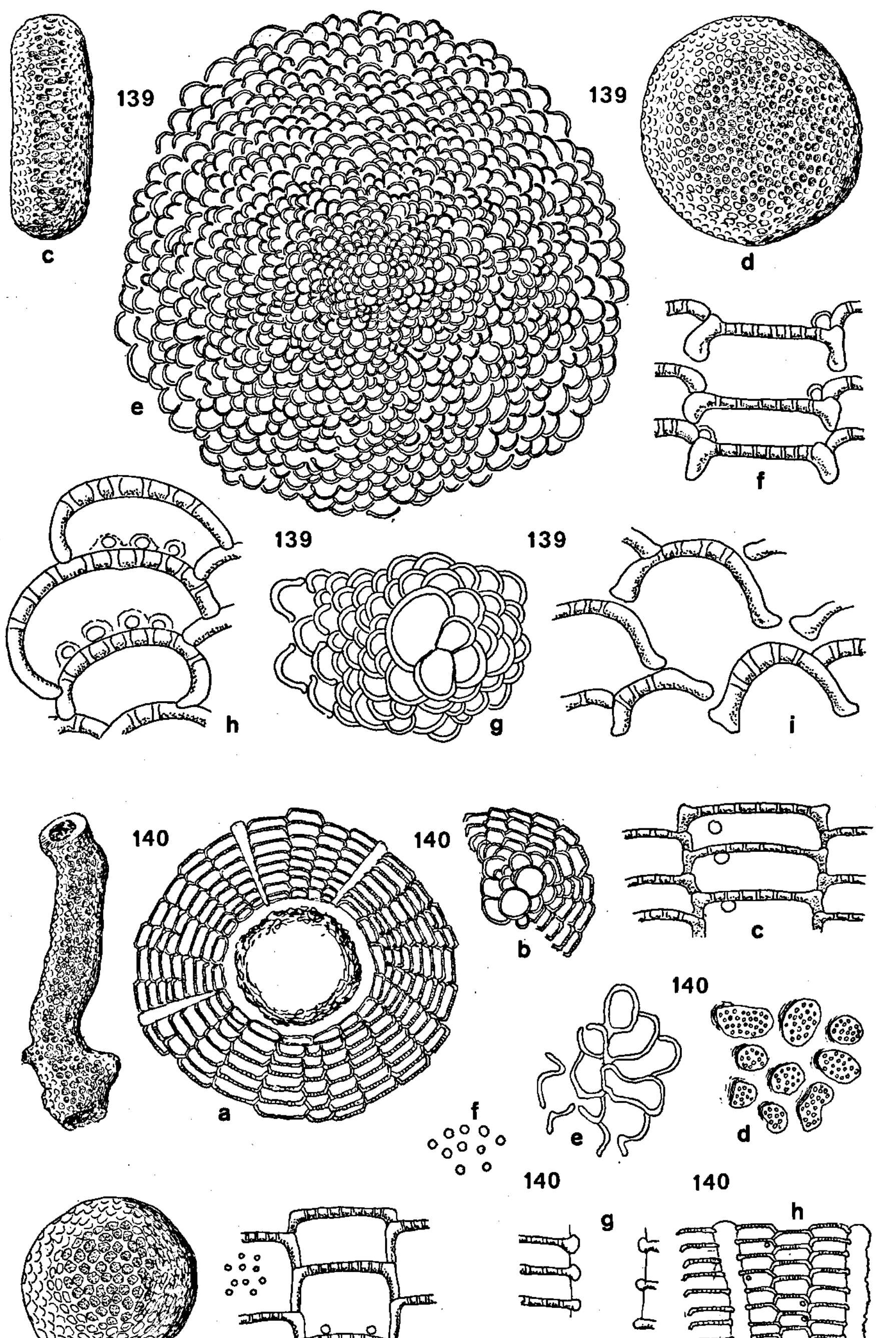
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Fig. 141. *Sphaerogypsina globulus.* – b: transverse section (× 65).

Fig. 142. *Neoeponides antillarum* (d'Orbigny). – Puerto Rico, depth 90 m, Sta. 1415, specimen from three sides (× 33); a: apertural face (× 65); b: pores (× 165); c: transverse section (× 33); d: small part of horizontal section, showing the granular primary walls (× 65).

Fig. 143. *Rotorbinella rosea* (d'Orbigny). – Bonaire, Sta. 1377, transverse section, showing the granular toothplates, which form part of the thickening of septa also, in horizontal section a (× 65).

Fig. 144. *Rotorbinella granulosa* (Heron-Allen & Earland). – Guadeloupe, Gozier beach, ventral and dorsal sides of test (× 65); a: transverse section, showing the granular toothplates (× 65); b: part of this section, with the toothplates and the toothplate-flaps over parts of the septa; c: horizontal section with toothplates (× 65).

Fig. 145. *Rotorbinella mira* (Cushman). – Bonaire, Lac, transverse section, with the granular toothplates (× 65); a: horizontal section, showing the granular toothplates with their flaps (× 65); b: part of this section, showing the toothplates over the septal foramen or deuteroforamen (d.f.), and beginning at the sutural protoforamen at the ventral side (pr.f.), all seen from the dorsal side towards the ventral wall (× 165).

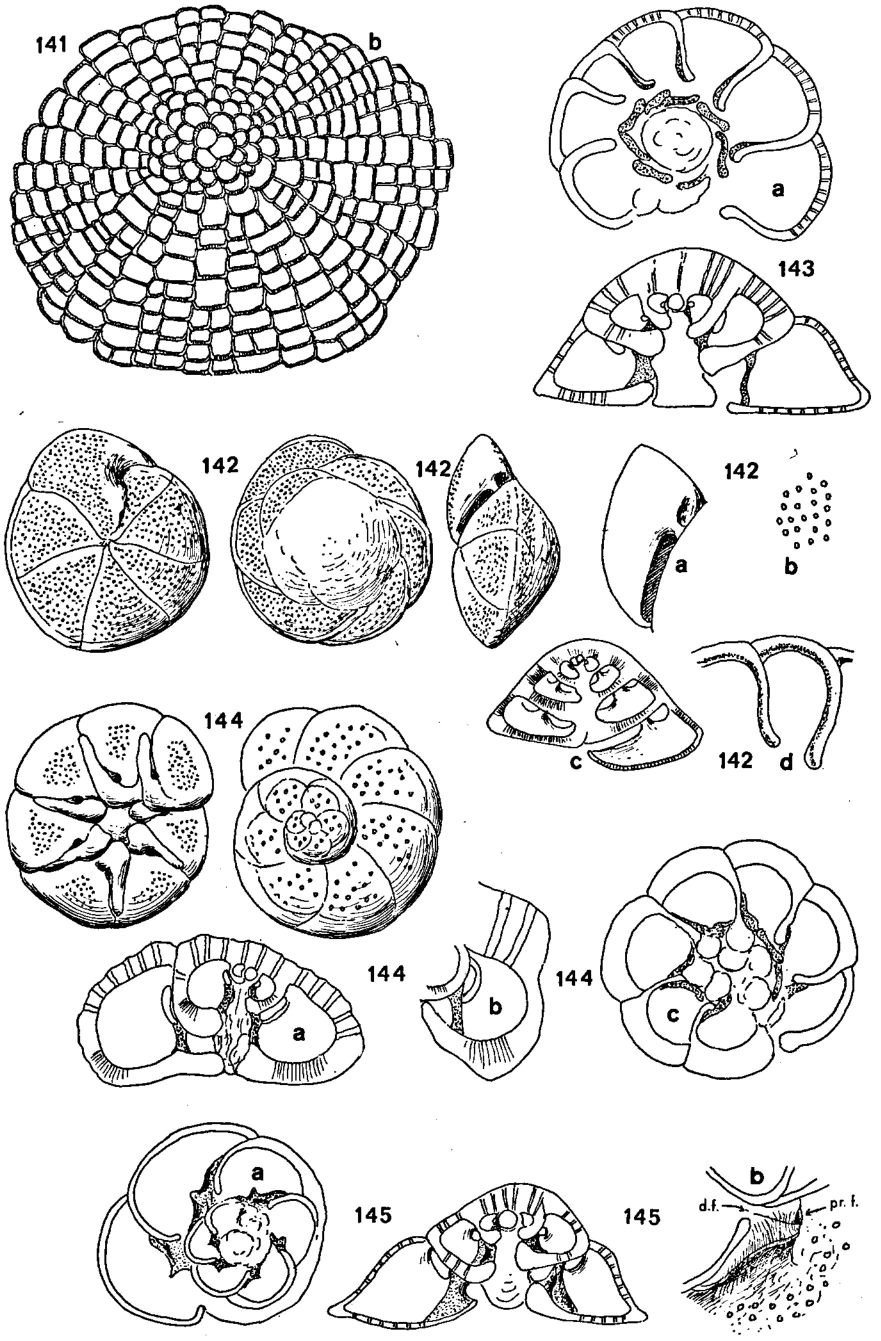
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Fig. 146. *Glabratella brasiliensis* Boltovskoy. – Cuba, Habana, 2–5 fathoms, test from three sides (× 50); a: horizontal section, showing that only the outer walls are thickened (× 65); b: transverse section, the chambers open in the ventral umbilical hollow which is closed by a fine sieve-plate (× 125).

Fig. 147. *Siphoninoides echinata* (Brady). Cuba, Habana, 2–5 fathoms, total test from four sides, the ventral umbilicus closed by a sieve-plate (× 50); a: part of horizontal section, showing that only the outer walls are thickened (× 250); b: transverse section going through the ventral sieve-plate (× 250).

Fig. 148. *Siphoninoides glabra* (Heron-Allen & Earland). – Cuba, Habana, 2–5 fathoms, specimen from two sides, and inner chambers visible in clarifier (× 65); a: another specimen, from three sides (× 65); b: transverse section, showing the inner chambers with their foramina (× 125); c: horizontal section, through the sieve-plate over the aperture and showing that only the outer walls are thickened (× 125).

Fig. 149. *Neocarpenteria candei* (d'Orbigny). – Cuba, Habana, 2–5 fathoms, specimen from three sides (× 33); a: transverse section (× 65); b: horizontal section of smaller specimen (× 65).

Fig. 150. *Bisaccium imbricatum* Andersen. – Cuba, Habana, 2–5 fathoms, total test from three sides (× 65); a: transverse section with the toothplates (× 65).

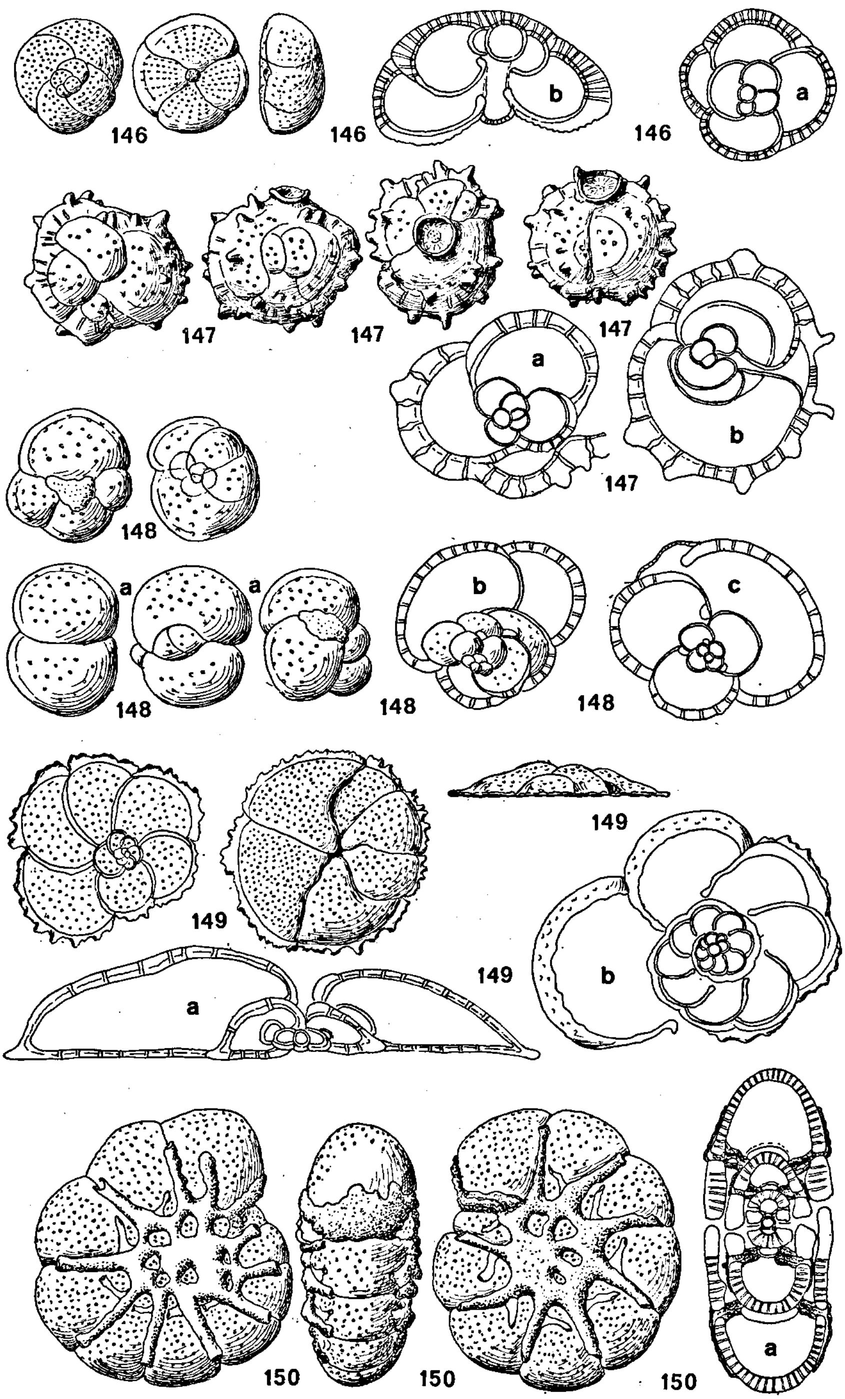
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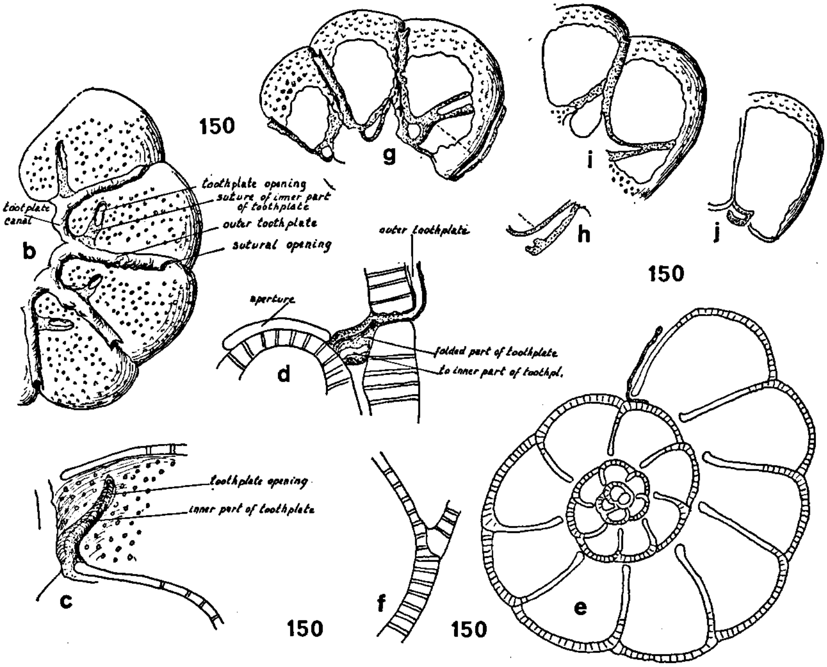
Fig. 150. *Bisaccium imbricatum.* – b: part of test with toothplate-openings and outer toothplate sutural canals (× 65); c: part of chamber from within, with toothplate and toothplate-opening (× 200); d: part of section a, showing the folded toothplate and its flap at the outside, and the opening towards the inner branch running to the areal opening (× 200); e: horizontal section (× 65); f: part of this section, showing fuse of chamber walls (× 200); g–j: series of successive sections through the toothplate (× 65).

Fig. 151. *Nodobacularia minuta* n. sp. – Bonaire, Lac, Sta. 1573 and 1653, 11 specimens, some of them branching (× 12); a: transverse section of specimen on *Halimeda* (× 125); c: longitudinal section of specimen, with the miliolid initial part (× 70).

Fig. 152. *Nodobacularia bonairensis* n. sp. – Bonaire, Lac, Sta. 1653, three specimens, two of them branching (× 12); a: total specimen, with the irregular ribs on its surface and the miliolid initial part (× 33).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suture of inner part of toothplate
outer toothplate
sutural opening
toothplate canal
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g
i
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aperture
outer toothplate
folded part of toothplate
to inner part of toothpl.
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toothplate opening
inner part of toothplate
c
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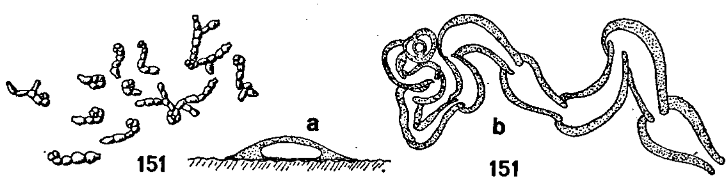
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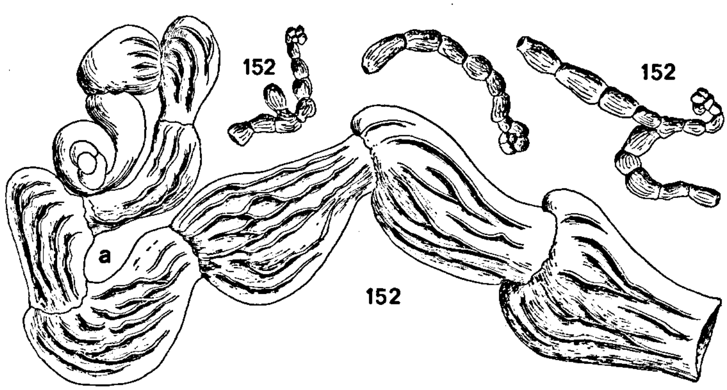
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Fig. 152. *Nodobacularia bonairensis*. – b: transverse section of a specimen attached to *Halimeda*, showing the ribs on its surface (× 70); c: longitudinal section (× 33).

Fig. 153. *Nodobacularia sageninaeformis* n. sp. – Bonaire, Lac, on *Halimeda*, Sta. 1653, two specimens with the irregular agglutination (× 12); a: transverse section, with the sand grains embedded in the calcareous wall (× 70); b: longitudinal section, with the sand grains incorporated in the keel and the miliolid initial part (× 33).

Fig. 154. *Placopsilina confusa* Cushman. – Bonaire, Lac, Sta. 1651, attached to *Halimeda*, three specimens, with an apertural view (× 33).

Fig. 155. *Cornuspiramina antillarum* Cushman. – Bonaire, Lac, Sta. 1592A, attached to *Halimeda*, horizontal section, central part, with the initial *Cornuspira*-like part; this part of the test consists of long flattened pipes and, at the periphery, of short slightly pyriform chamber-like parts.

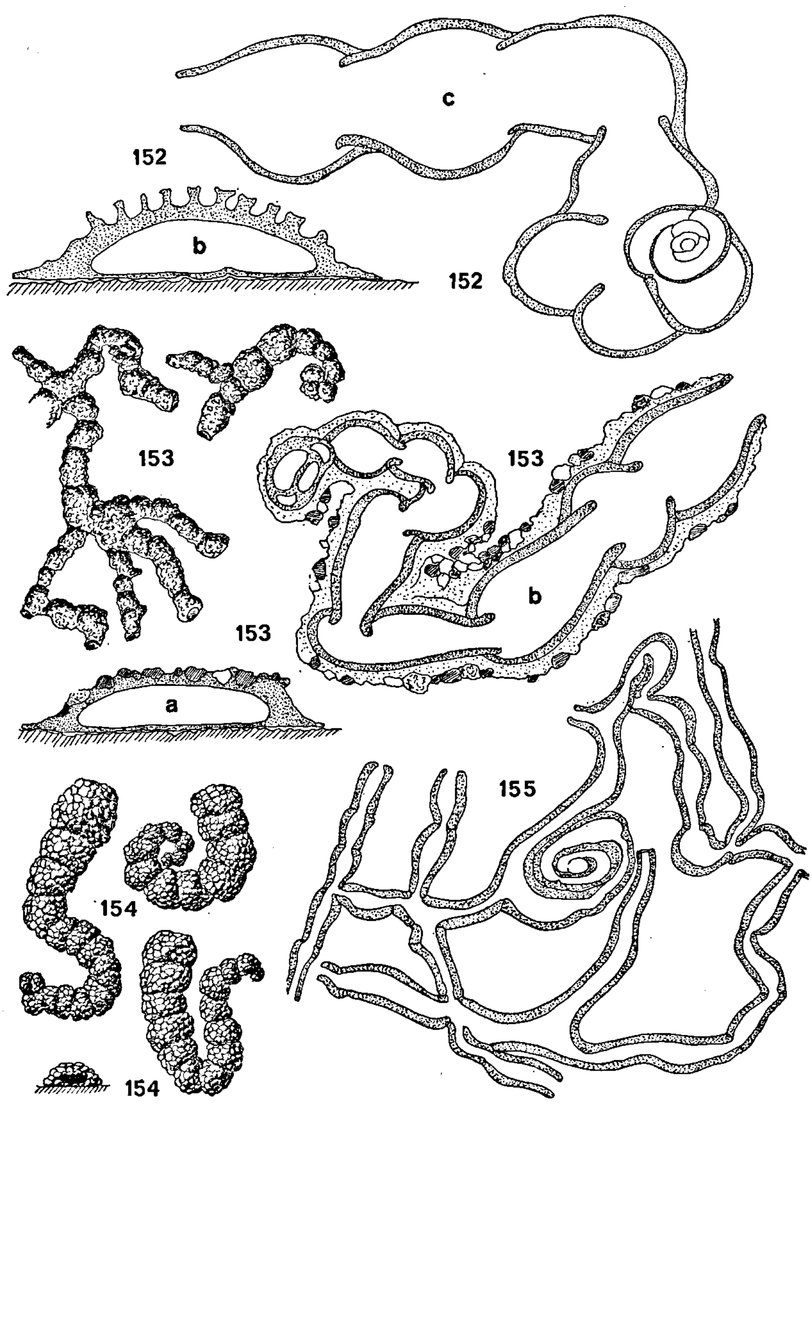
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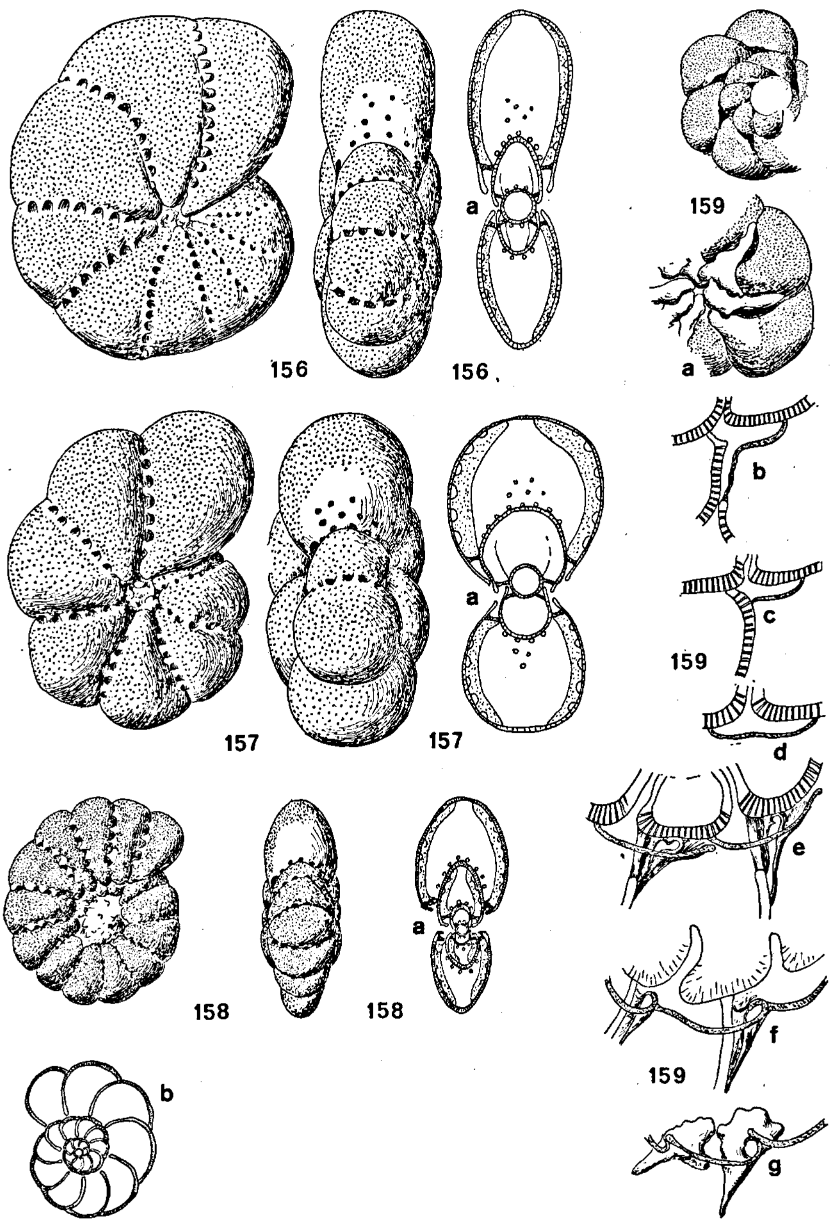
Fig. 156. *Elphidiononion mexicanum* (Kornfeld). – Guadeloupe, Rivière Salée, N. entrance, Sta. 1543A, test from two sides; a: transverse section (× 70).

Fig. 157. *Elphidiononion kugleri* (Cushman & Brönnimann). – Guadeloupe, Rivière Salée, Sta. 1543A, test from two sides; a: transverse section (× 70).

Fig. 158. *Elphidiononion elegantum* n. sp. – Guadeloupe, Rivière Salée, Sta. 1543A, test from two sides; a: transverse section (× 70).

Fig. 159. *Pseudoeponides anderseni* Warren. – St. Martin, Simson Lagoon, Great Key, part of dorsal side of test to show the dorsal sutural toothplate-foramina; a: part of ventral side, to show the tecta over the sutures and some ventral toothplate-foramina (both × 70); b–g: sections through the toothplate, beginning at the dorsal toothplate-foramen, sinking down through the toothplate (b–d), then sectioning two toothplates with their folded parts (e), further reaching the ventral toothplate-foramen (f), and in the end reaching the tecta at the ventral side (g). This series shows that the toothplate connects as a gutter the dorsal and ventral toothplate-foramina (× 200).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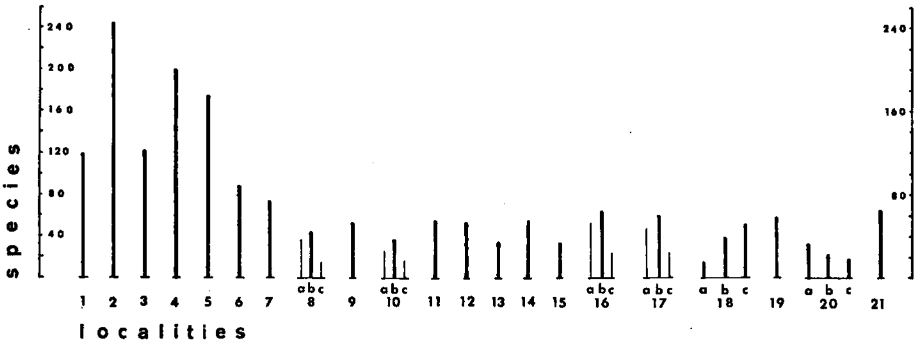

Fig. 160. Numbers of species found in samples and localities with various environments (deep and shallow water, muddy or sandy bottom).

1. Cuba, D'ORBIGNY, 1839, shore sands.
2. Cuba, bay of Matanzas, BERMÚDEZ, 1935, 2–45 m.
3. Cuba, sample off Habana, 3–9 m.
4. St. Croix, W of Frederiksted, 200–800 m.
5. Orinoco-Paria shelf, DROOGER & KAASSCHIETER, 1958, 10–100 m.
6. Barbados, W of Holetown, HOFKER, 1969, 100–200 m.
7. Antilles, HOFKER, 1964, tidal zone.
8. Curaçao, Piscadera Baai, HOFKER, 1971: a, Boca, about 5 m, sandy; b, Boca + Inner Bay; c, Inner bay, 1–5 m, muddy.
9. Florida Keys, 1–3 m.
10. Puerto Rico, near La Parguera, 1–3 m: a, Parguera, sand and mud; b, Parguera + Bahía Fosforescente; c, Bahía Fosforescente, muddy.
11. Virgin Islands, 0–25 m.
12. St. Martin to Antigua, 1–4 m.
13. Barbuda, Great Lagoon, 1–3 m.
14. Guadeloupe to Martinique, 1–2 m.
15. Dominica to Grenada, 1–2 m.
16. Bonaire, Lac, 1–6 m: a, sandy; b, total fauna; c, muddy.
17. Curaçao, Spaanse Water, 1–6 m: a, sandy; b, total fauna; c, muddy.
18. Gulf of Paria, TODD & BRÖNNIMANN, 1957, a, tidal zone; b, near-shore zone; c, off-shore zone, 1–14 m.
19. Texas, San Antonio Bay, PARKER c.s., 1953, 1–18 m.
20. Texas, Mississippi Sound, PHLEGER, 1954, 5–7 m: a, open Gulf; b, Sound; c, estuary.
21. Puerto Rico, San Juan Harbour, CUSHMAN, 1926, 1–10 m.

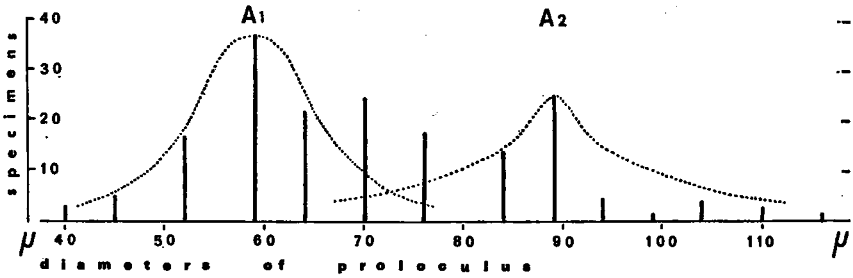

Fig. 161. Proloculus diameters of *Orbitolites hemprichii* (Ehrenberg); 172 specimens studied.

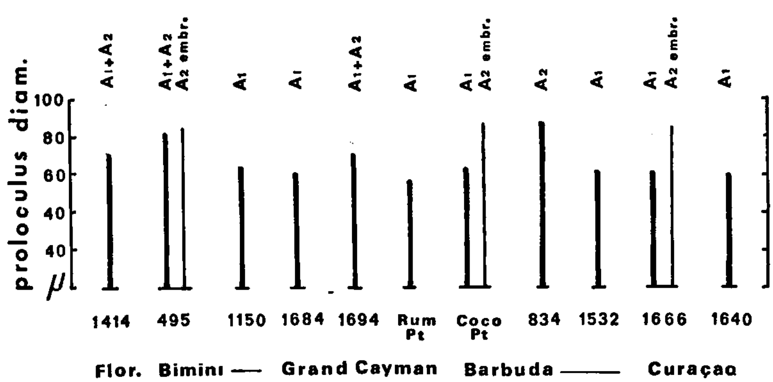

Fig. 162. Proloculus diameter averages of *Orbitolites hemprichii* in the localities studied.

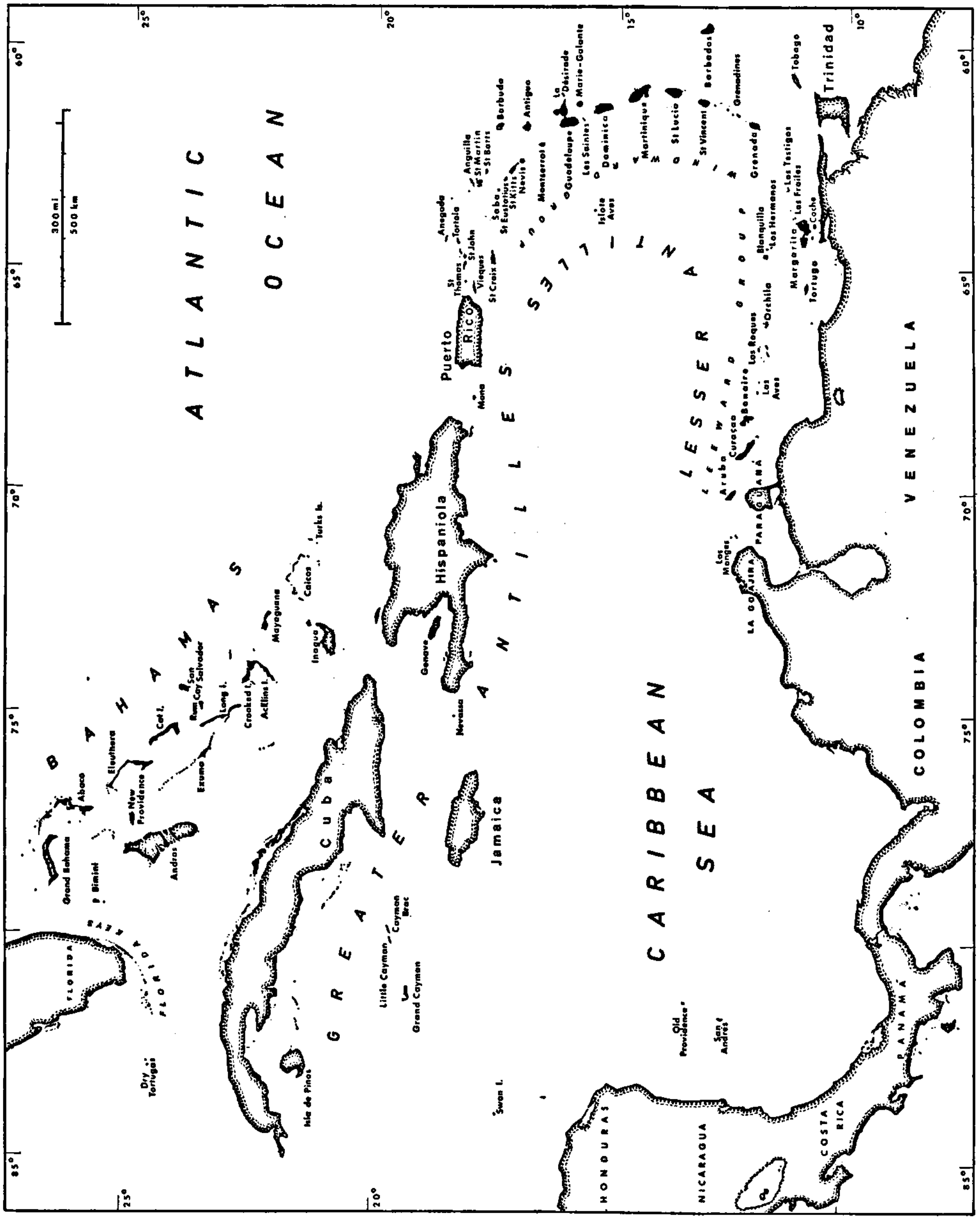

Fig. 163. Sketch-map of the CARIBBEAN REGION.

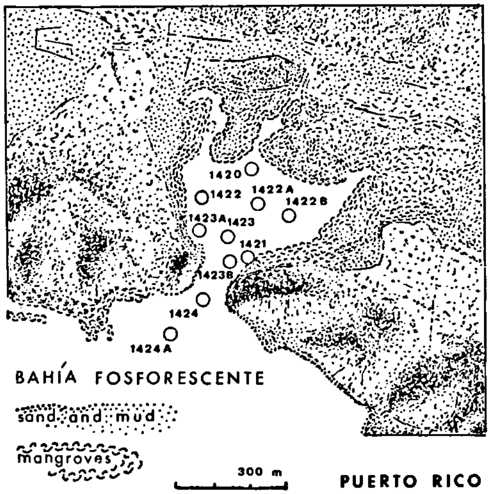

Fig. 164. Map of the BAHÍA FOSFORESCENTE, Puerto Rico, with station numbers (from an aerial photograph reproduced by ODUM, BURKHOLDER & RIVERO, 1959, p. 162.

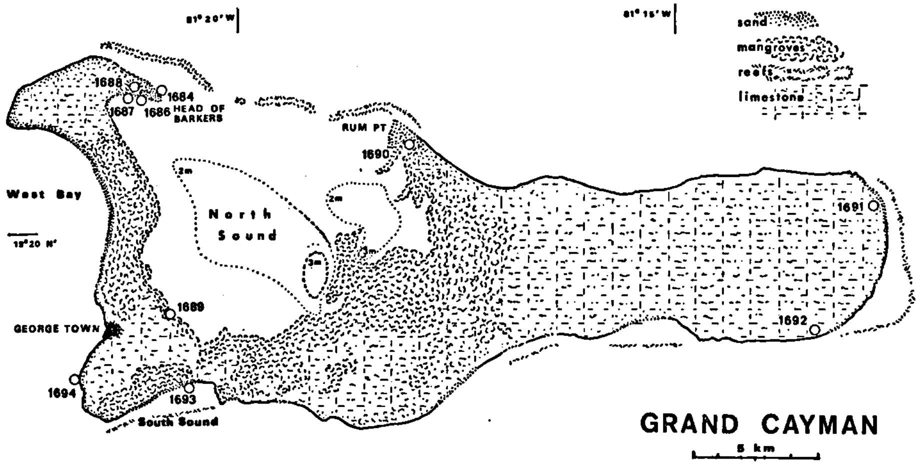

Fig. 165. Sketch map of GRAND CAYMAN, showing the localities of Foraminifera treated in this paper.

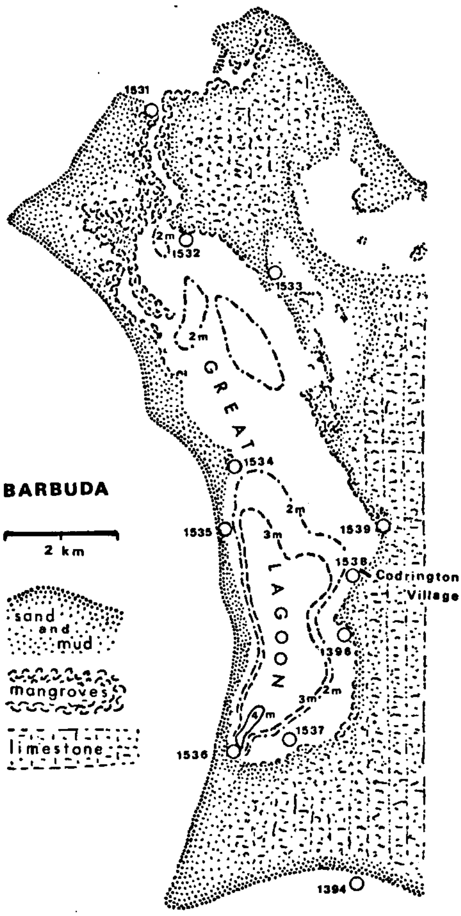

Fig. 166. Map of the GREAT LAGOON of Barbuda, showing the localities treated in this paper (adapted from BRASIER, 1975, p. 45).

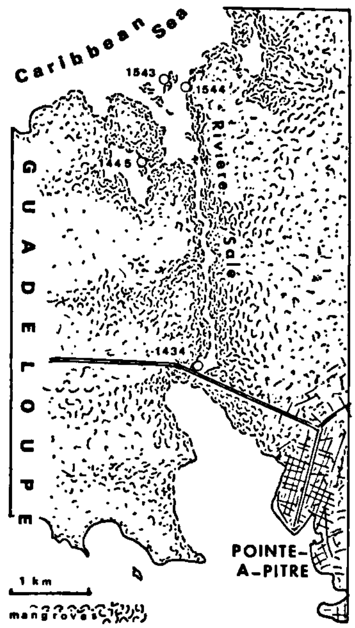

Fig. 167. Map of the Rivière Salé, Guadeloupe, with the localities studied. (1445 read 1545).

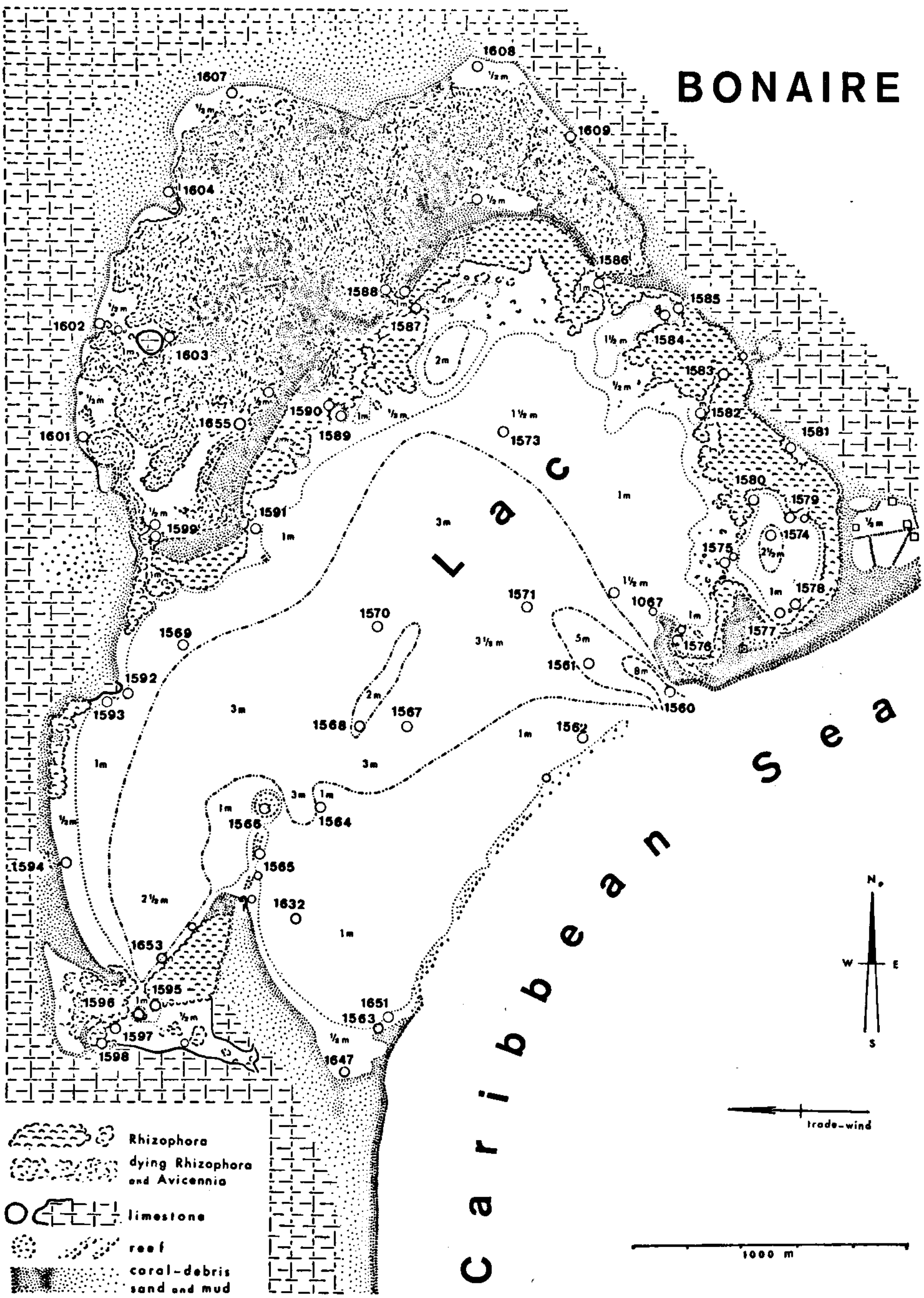

Fig. 168. Sketch-map of the LAC, Bonaire, with HUMMELINCK's localities, including those treated in this paper.

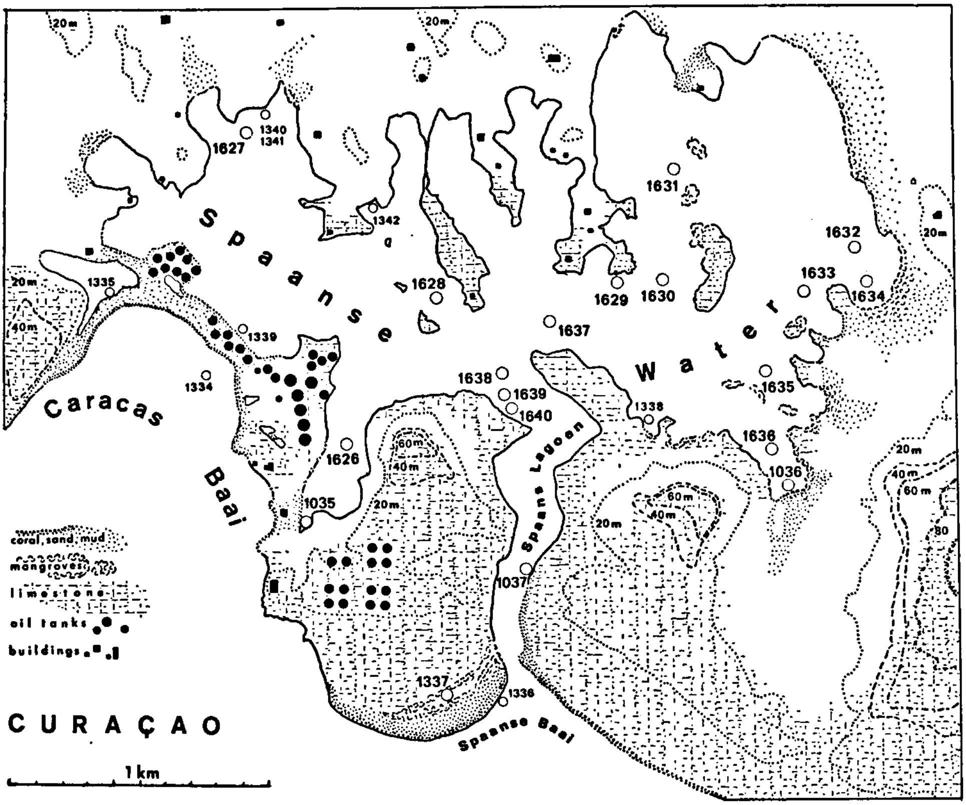

Fig. 169. Sketch-map of the SPAANSE WATER, Curaçao, with localities. (Exact situation of 1334–1336 and 1339–1342) not known.)