BIOLOGICAL RESULTS OF THE SNELLIUS EXPEDITION XXX

THE FORAMINIFERA COLLECTED IN 1929 AND 1930 IN THE EASTERN PART OF THE INDONESIAN ARCHIPELAGO

by

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With 10 plates

Introduction

Of the bottom material collected by the Snellius-Expedition 78 samples contained Foraminifera. Many of these samples were extremely small, since they were gathered by means of piston core samplers; some were larger, as they were collected by means of a dredge; others were samples in shallow water at beaches or reefs. All samples were fixed in formaldehyde, so that after the 40 years they remained in store before they were studied, rests of protoplasma were seldom preserved. The numerous plankton samples, preserved in formaldehyde or in alcohol, did note contain planktonic Foraminifera; obviously the small amount of $CaCO_3$ in the samples caused the dissolution of the tests.

The planktonic Foraminifera are not described here, as planktonic forms of the Pacific Ocean were already studied by Parker (1962) and by Todd (1965). Planktonic specimens from several of the localities are preserved in cardboard slides, but, as they do not belong to the bottom fauna, they were not considered ecologically. Several slides are preserved containing the planktonic fauna of a sample as a whole.

462 species of Foraminifera were found in the bottom samples; they are alphabetically enumerated in a list with the station numbers or localities in which they were discovered. Of each species the material from each separate locality was placed into a cardboard slide. These slides, 1200 in number, forming the total collection of Foraminifera of the Snellius-Expedition, are now stored in the Rijksmuseum van Natuurlijke Historie at Leiden, Netherlands.

53 species are described and mostly figured; 14 of these are new, the others were described because their systematic positions could be better ascertained,

or because they were not described in one of my former papers on the Foraminifera of the area, or since some characteristics were not yet known. My previous papers on the eastern Indonesian seas (Hofker, 1927, 1930, 1931, 1933, 1951, 1968) are mentioned in the list of references; references are restricted to the most important ones, in the text as well as in this list. The figures were designed by means of a camera lucida from specimens in ricinus-oil.

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Species described in this paper; the new species are marked with an asterisk (*):

Bottom samples collected by HMS "Snellius" from which Foraminifera were extracted:

9 N of Jamdena (Tanimbar Islands)
23 Ambon, Hitoe, Bay of Amboina
28 N of Halmaheira, Sepi, Morotai, 75 m, temp. 24°C
31 Flores, Rioeng
34 Lembeh, Point Minahassa, Lembeh Strait, 2°54'S 118°22'E, 1506 m, temp. 3.6°C
38 Ende, Flores
44 S of Maratoea, E Borneo, 2°N 118°41'E, 369-400 m, temp. 10°C
48 Celebes Sea, 2°35'N 121°29'E, 5485 m, temp. 3.3°C
50 NE of Paleleh, 1°17'N 122°04'E, 1682 m, temp. 3.6°C
52 Celebes Sea, 3°18'N 122°33'E, 5020 m, temp. 2.8°C
53 Celebes Sea, NW of Mindanao, 2°11'N 124°02'E, 4973 m, temp. 3.3°C
59 Moro Gulf, 6°45'N 122°30'E, 513 m, temp. 7°C
60 Basilan Strait, 6°47'N 122°16'E, 72 m, temp. 33°C
60* Moro Gulf, 6°57'N 121°52'E, 85 m, temp. 28°C
64 Sulu Sea, 7°14'N 121°01'E, 4321 m, temp. 3.1°C
65 Sulu Sea, 7°29'N 120°08'E, 3950 m, temp. 3.8°C
75 Celebes Sea, 3°29'N 120°45'E, 4742 m, 3.3°C
80 NW of Obi Latoe, 1°06'S 126°46'E, 4586 m, temp. 1.8°C
82 NE of Obi Major, S of Halmaheira, 1°14'S 128°11'E, 958 m, 4.9°C
85 Ceram Sea, W of Misool, 1°45'S 129°09'E, 1496 m, temp. 6.6°C
87 NW of coast Ceram, 3°06'S 130°38'E, 510 m, temp. 7°C
88 NE of Ceram, 3°02'S 130°52'E, 527 m, temp. 7.7°C
91 SW of Pisang Islands, 2°45'S 131°21'E, 216 m, temp. 15°C
92 Baam, 4°37'S 131°46'E, 615 m, temp. 6.8°C
107 Arafoera Sea, 8°10'S 132°19'E, 354 m, temp. 10°C
117 S of Sarmata, 9°21'S 128°58'E, 522 m, temp. 7.2°C
123 Timor Sea, 10°14'S 126°36'E, 459 m, temp. 8.4°C
126 Timor Sea, E of Roti, 10°31'S 128°51'E, 378 m, temp. 9.4°C
169 Sangeang, 8°07'S 129°04'E, 545 m, temp. 7°C
178 W of Benteng, 7°02'S 119°51'E, 2693 m, temp. 3°C
180 Flores Sea, 7°47'S 120°09'E, 5045 m, temp. 2.8°C
181 Flores Sea, NW of Flores, 8°05'S 120°14'E, 2799 m, temp. 3°C
182 NW point Flores, 8°14'S 120°17'E, 857 m, temp. 5.1°C
185 S of Makassar, SW point Celebes, 5°51'S 119°22'E, 587 m, temp. 6.4°C
186 SE of Salajar, 6°17'S 120°34'E, 1386 m, temp. 3.8°C
187 SE of Salajar, 6°16'S 120°45'E, 3065 m, 3.6°C
189 Gulf of Bone, 4°59'S 121°03'E, 1829 m, temp. 3.2°C
190 Gulf of Bone, 4°42'S 121°22'E, 1374 m, temp. 3.6°C
193 Between Ratoeata and Kakabia, 6°34'S 122°27'E, 1656 m, temp. 3.3°C
208 N of Toekan Besi, 5°05'S 124°13'E, 3523 m, temp. 2.7°C
209 Banda Sea, SW of Boeroe, 4°16'S 125°18'E, 4080 m, temp. 1.8°C
212 Between Boeroe and Manui, 3°33'S 124°32'E, 4951 m, temp. 1.8°C
214 NE of Manui, 3°22'S 123°21'E, 2969 m, temp. 2.8°C

215 Between Manui and Taliaboe, 2°52'S 123°48'E, 4751 m, temp. 1.8°C
226 Lifamatola, 1°48'S 126°33'E, 432 m, temp. 8°C
231 S of Ambon, 3°53'S 128°02'E, 1061 m, temp. 4.2°C
233 SE of Ambon, 4°21'S 128°16'E, 1728 m, temp. 3.3°C
236 Banda Sea, 5°52'S 129°56'E, 3564 m, temp. 2.7°C
237 Banda Sea, N of Seroea, 6°02'S 130°03'E, 3135 m, temp. 2.8°C
241 Banda Sea, 6°29'S 128°03'E, 4841 m, temp. 1.8°C
242 NW of Damar, 6°56'S 128°24'E, 3358 m, temp. 2.5°C
244 Banda Sea, SW of Lucipara Islands, 5°53'S 120°51'E, 2588 m, temp. 2.8°C
246 SE of Goenong Api, 6°57'S 126°24'E, 4378 m, temp. 1.5°C
248 Banda Sea, 5°55'S 125°35'E, 2663 m, temp. 2°C
251 S of Boeroe, 4°16'S 126°39'E, 5145 m, temp. 3.3°C
254 Banda Sea, S of Ambelau, 4°21'S 127°23'E, 4048 m
255 Manupa Street, 3°47'S 127°27'E, 3185 m, temp. 2.8°C
257 S of Obi Major, Boeroe Sea, 2°10'S 127°32'E, 2700 m, temp. 2.8°C
269 Nenoesa Islands, 4°36'N 127°11'E, 524 m, temp. 7.4°C
276 Halmaheira Sea, 1°34'N 129°42'E, 4313 m, temp. 1.7°C
283 N of Doi, Lododa Islands, 2°21'N 127°46'E, 576 m, temp. 7.7°C
291 SE of Talaud Islands, 3°29'N 126°23'E, 2484 m
292 Moluccan Sea, SW of Talaud Islands, 3°29'N 126°38'E, 2410 m, temp. 1.8°C
301 Celebes Sea, SW of Mindanao, 4°47'N 124°16'E, 5138 m, temp. 3.3°C
302 Celebes Sea, 4°53'N 121°30'E, 4386 m
322 NW of Baam, 4°23'S 131°10'E, 3281 m, temp. 2.8°C
324 SW of New Guinea, 3°43'S 132°15'E, 2106 m, temp. 2.5°C
326 Ceram Sea, N of Ceram, 2°47'S 128°48'E, 457 m, temp. 8°C
334 N of Soela Islands, 1°09'S 125°18'E, 2706 m, temp. 2.4°C
338 Moluccan Sea, E of Halmaheira, 0°37'N 124°49'E, 1470 m, temp. 3°C
344 Moluccan Sea, W of Halmaheira, 1°43'N 126°40'E, 2446 m, temp. 1.8°C
350 Halmaheira Sea, 1°05'N 129°36'E, 2525 m, temp. 2°C
354 NW of Misool, 1°09'S 129°11'E, 546 m, temp. 3.7°C
369 NW of Babar, 7°24'S 129°17'E, 4545 m, temp. 1.5°C
370 Between Sermata and Babar, 8°00'S 129°11'E, 1625 m, temp. 3.3°C
373 Between Romang and Damar, 7°29'S 128°02'E, 2660 m

Some other samples were taken into consideration also:

Transect W of Sorong; coll. J. Hofker
Coast of Flores; coll. J. Hofker
Bay of Jakarta, Java; coll. J. Hofker
South China Sea, N. Borneo; depth 75 m; coll. Schönau
Batoe Daka, Tomini Gulf, Celebes; coll. J. H. F. Umbgrove
Sanoer, Bali, Lesser Sunda Islands; coll. W. C. van Heurn
Laboean, northeastern Borneo; coll. L. D. Brongersma
Island Wakde, off north coast of New Guinea, 1°56'S 139°01'E; coll. L. D. Brongersma
Deli, Sumatra, outer buoy, depth 34 m; coll. F. P. C. M. van Morkhoven
Singora, Malaysia, coll. J. Hofker

Alphabetic list of the species found in the sea-floor samples collected by HMS "Snellius" in the eastern part of the Indonesian Seas with the numbers of stations mentioned in the foregoing list in which they are found:

Adercotrema glomeratum (Brady) : 276, 370
Alabamina tubulifera (Heron-Allen & Earland) : 59, 60

Virgulina rotundata Parr: 189
Virgulina schreibersiana Czjek: 64, 107
Virgulina subdepressa Brady: 187

TEMPERATURE AND DISTRIBUTION OF FORAMINIFERA

In my paper on primitive agglutinated Foraminifera (Hofker, 1972: 92) I came to the conclusion that "temperature is a more important factor than depth". This was found in the Snellius stations also. *Lagenammina pacifica* was found in the stations 59 (temp. 7°C), 92 (temp. 6.8°C) and 324 (temps. 2.5°C); *Bathysiphon rufescens* St. 269, temp. 7.4°C; *Bathysiphon rufus* St. 117, temp. 7.2°C, St. 276, temp. 1.7°C, St. 369, temp. 1.5°C; *Crithionina hispida* St. 189, temp. 3.2°C; *Hormosina globulifera* St. 52, temp. 2.8°C; *Hormosina spiculifera*, St. 338, temp. 3°C; *Hyperammina adunca* St. 338, temp. 3°C; *Hyperammina* (*Saccorhiza*) *atlantica* St. 52, temp. 2.8°C, St. 212, temp. 1.8°C, St. 214, temp. 2.8°C, St. 242, temp. 2.5°C, St. 246, temp. 1.5°C, St. 292, temp. 1.8°C and St. 338, temp. 3°C; *Hyperammina carpenteri* St. 209, temp. 1.8°C; *Hyperammina* (*Saccorhiza*) *ramosa* St. 209, temp. 1.8°C, St. 334, temp. 2.4°C, St. 369, temp. 1.5°C; *Hyperammina vagans* St. 117, temp. 7.2°C; *Loeblichopsis spiculifera* St. 187, temp. 3.6°C; *Marsipella cylindrica* St. 28, temp. 24°C and St. 354, temp. 7.7°C; *Marsipella elongata* St. 52, temp. 2.8°C and St. 338, temp. 3°C; *Psammosphaera parva* St. 236, temp. 2.7°C; *Reophax aglutinans* St. 85, temp. 6.6°C, St. 117, temp. 7.2°C, St. 189, temp. 3.2°C, St. 354, temp. 7.7°C; *Reophax scorpiurus* St. 31, coast, temp. 25°C, St. 88, temp. 7.7°C, St. 117, temp. 7.2°C, St. 236, temp. 2.7°C, St. 214, temp. 2.8°C; St. 242, temp. 2.5°C, St. 254, temp. 7.7°C; *Rhabdammina abyssorum* St. 214, temp. 2.8°C, St. 236, temp. 2.7°C; *Saccamina sphaerulata* St. 236, temp. 2.7°C, St. 244, temp. 2.8°C, St. 248, temp. 2°C and St. 324, temp. 2.5°C. These temperatures agree, with few irregularities, quite well with those found in 1972 for quite different areas.

But the same can be said about the temperatures in which other Foraminifera are found. I came to the following list:

Chilostomella oolina	average	temp.	3.1°C	(4 stations)
Favocassidulina favus	,,	,,	4°C	(3 ,,)
Laticarinana pauperata	,,	,,	5°C	(13 ,,)
Sigmoilina schlumbergeri	,,	,,	5.1°C	(7 ,,)
Ceratobulimina pacifica	,,	,,	5.5°C	(11 ,,)
Globobulima pacifica	,,	,,	5.5°C	(4 ,,)
Globobulimina elongata	,,	,,	5.1°C	(4 ,,)
Valvotextularia milletti	,,	,,	6.7°C	(10 ,,)
Hoeglundina elegans	,,	,,	6.0°C	(11 ,,)
Robertinoides oceanicus	,,	,,	6,4°C	(5 ,,)
Hyalinea baltica	,,	,,	6.3°C	(6 ,,)

Pullenia subcarinata	„	„	6.8°C	(8	„)
Ehrenbergina albatrossi	„	„	6.2°C	(4	„)
Ehrenbergina pacifica	„	„	7.2°C	(5	„)
Streblus moroensis	„	„	7.0°C	(9	„)
Bolivinopsis bulbosus	„	„	7.1°C	(5	„)
Angulogerina bradyi	„	„	7.6°C	(4	„)
Angulogerina ornata	„	„	10.0°C	(3	„)
Cancris auriculus	„	„	10.2°C	(3	„)
Cancris oblongus	„	„	8.8°C	(5	„)

All species of this list were found in water deeper than 250 m, where light does not penetrate in most cases; they lack zooxanthellae.

Species living in depths from 0 to about 100 m may have zooxanthellae and moreover they live in much higher temperatures. Often they are living in the coral-reef environment, or in a more muddy environment. Such populations were found then. Another population of Foraminifera was found in a transect off Sorong, New Guinea, depths 5 to 34 m; here 34 species were found which differ greatly from those of the western part of the Bay of Jakarta. In the following tables the difference in species of these two localities is noted; the one locality in the western part of the archipelago, the other in the eastern

JAKARTA (corals and mud)
Amphistegina radiata
Asterorotalia pulchella
Baculogypsinoides spinosus
Bdelloidina aggregata
Biarritzina proteiformis
Bigenerina nodosaria
Carpenteria utricularis
Calcarina spengleri
Clavulina pacifica
Dendritina striatopunctata
Discogypsina vesicularis
Elphidium batavum
Flintina bradyi
Gypsina plana
Heterostegina curva
Miniacina miniacea
Nummulites complanatus
Parrellinum hispidulum
Placopsilina bradyi
Planorbulinella larvata
Pseudorotalia schroeteriana
Quinqueloculina kerimbatica
Quinqueloculina bicarinata
Quinqueloculina curta
Quinqueloculina bidentata
Reophax scorpiurus
Rotalidium concinnum
Sagenina frondescens
Schlumbergerina areniphora
Sphaerogypsina globularis
Spiroloculina communis
Textularia kerimbaensis
Triloculina tricarinata
Triloculina rupertiana
Valvotextularia foliacea
Valvotextularia (Textulariella) rugulosa

SORONG (mud and sand)
Alveolinella quoyi
Amphistegina madagascarensis
Anomalinella rostrata
Amphistegina lessonii
Asterorotalia annectens
Cellanthus craticulatus
Clavulina difformis
Clavulina pacifica
Cymbaloporetta bradyi
Elphidium crispum
Eponides repandus
Heterostegina depressa
Heterostegina heterosteginoides
Miniacina miniacea
Nubecularia divaricata
Neoeponides broeckiana
Nummulites complanatus
Nummulites venosus
Orbitolites variabilis

Pararotalia defrancei
Parellinum hispidulum
Peneroplis planatus
Pyrgo denticulata
Quinqueloculina lamarckiana
Quinqueloculina quadrilateralis
Quinqueloculina parkeri
Quinqueloculina granulocostata
Schlumbergerina areniphora
Sigmoidella elegantissima
Spiroloculina corrugata
Triloculina tricarinata
Textularia barkeri
Textulariella rugulosa

Among 34 to 36 species, only 7 are found in both localities. Why these large differences in faunae? With the fauna from the Key Islands (Hofker, 1933), the fauna from Sorong has not much in common, but the Mortensen Expedition collected much material in deeper water. With the fauna from the Key Islands that of Sorong has the following species in common: *Heterostegina heterosteginoides, Nummulites complanatus, Nummulites venosus, Miniacina miniacea, Alveolinella quoyi, Cellanthus craticulatus, Eponides repandus, Heterostegina depressa, Textulariella rugulosa.*

In St. 34, North coast Ambon, the following species were observed: *Elphidium batavum, Amphistegina madagascarensis, Miliolinella circularis, Quinqueloculina parkeri, Textularia agglutinans, Sphaerogypsina globulus, Quinqueloculina polygona, Rosalina globularis.*

In St. 34, Lembeh Strait, NE Minahasa, following species were collected: *Calcarina spengleri, Pararotalia defrancei, Spirolina acicularia, Peneroplis planatus, Peneroplis pertusus, Ammonia catesbyana, Vertebralina striata, Quinqueloculina parkeri, Ammonia koeboeensis, Reussella weberi, Neoconorbina patelliformis.*

St. 28, 65 m, temp. 24.7°C, contained the species: *Rotalidium concinnum, Pseudorotalia schroeteriana, Reophax dentaliniformis, Marsipella cylindrica, Cancris auriculus.*

In St. 60, 85 m, temp. 22°C, the following species were found: *Amphistegina radiata, Alabamina tubulifera, Bolivina limbata, Discorbis vesicularis, Dyocibicides biserialis, Eponides repandus, Elphidium batavum, Mississippina concentrica, Orbitolites variabilis, Planorbulinella larvata, Quinqueloculina granulocostata, Quinqueloculina pseudoreticulata, Rosalina globularis, Rectobolivina bifrons, Ammonia catesbyana, Sporadotrema mesentericum, Siphogaudryina spihonifera, Spiroplectammina fistulosa, Spiroloculina communis, Textulariella rugulosa.*

In a sample, collected by Umbgrove, at Batoe Daka, Togian Islands, Gulf of Tomini, the following species were found: *Calcarina hispida, Calcarina spengleri, Elphidium batavum, Eggerella affinis, Heterostegina depressa, Orbitolites variabilis, Peneroplis planatus, Planorbulinella larvata, Quinqueloculina granulocostata, Sphaerogypsina globulus, Spiroloculina angularis, Textulariella rugulosa.*

These samples together give the foraminiferal fauna as found in shallow water of high temperature in the eastern part of the Indonesian Archipelago, if we include herein the species which is found especially on the coasts of Flores and Bali, *Schlumbergerella floresiana.*

The richest samples were found in depths from 200-700 m; three of these are chosen here for a comparison of the species that they contain. The far richest sample is from St. 59, in the Moro Gulf, SW of Mindanao; St. 91 is the shallower locality with depth 216 m, whereas St. 92 is much deeper, 651 m. St. 91 and St. 92 are from the sea W of New Guinea. St. 91 contained 39 species; St. 92 41 species, whereas St. 59 118 species. Of the 41 species of St. 92, 18 are also represented in St. 59, whereas of the 39 species found in St. 91, only 4 species are found in St. 59 also; St. 91 and 92 have in common 5 species. Though St. 91 and 92 are found in the same sea, the difference of the faunae must be sought in the difference in temperatures; in St. 91 it was 15°C, in St. 92 it was 6.8°C. The much larger similitude of the faunae in St. 92 and St. 59 certainly is due to the nearly equal temperatures, resp. 6.8°C and 7.0°C. St. 117 has 14 species in common with St. 92, which has practically the same temperature, but only 6 with St. 91, which has quite a different temperature. It has 8 species in common with St. 59, with the same temperature as in St. 117. The following lists will give an idea about the similarities and the differences in these rich stations (the richest populations are found in depths from 200-700 m, with temperatures around 6 to 7°C):

St. 91, 216 m, 15°C
(Pisang Islands)

Ammonia moroensis
Angulogerina ornata
Astacolus insolutus
Asterorotalia annectens
Bolivina barbata
Bolivina porrecta
Bolivina robusta
Cancris oblongus
Cassidulina pacifica
Cibicides margaritiferus
Cibicides praecinctus
Clavulina bradyi
Clavulinoides indiscretus
Dentalina bradyensis
Dentalina setanaensis
Dimorphina peregrina
Gyroidina neosoldanii
Hoeglundina elegans
Lamarckina scabra
Lamarckina toddae
Lenticulina denticulifera

St. 92, 651 m, 6.8°C
(Baam)

Aluvigerina cushmani
Ammonia moroensis
Baggina philippinensis
Bigenerina irregularis
Bolivina quadrilatera
Bolivinopsis bulbosus
Bulimina auriculata
Bulimina rostrata
Cassidulina laevigata
Dentalina filiformis
Dimorphina peregrina
Euuvigerina aculeata
Euuvigerina peregrina
Gavelinonion glabratum
Globobulimina pacifica
Gyroidina neosoldanii
Hoeglundina elegans
Hyalinea baltica
Lagenammina pacifica
Lenticulina denticulifera
Martinottiella primaeva

St. 91, 216 m, 15°C
(Pisang Islands)

Lenticulina calcar
Lenticulina costata
Lenticulina papilloechinata
Lenticulina submamilligera
Massilina arenaria
Neoconorbina pacifica
Nodosaria pauciloculata
Nodosaria vertebralis
Nonionella subturgida
Pararotalia calcar
Planularia australis
Pseudonodosaria annulata
Quinqueloculina lamarckiana
Reophax ammobaculatiformis
Saracenaria latifrons
Siphogenerina raphanus
Siphogenerina tropica
Siphonina tubulosa

St. 59, 513 m, 7°C
(Moro Gulf)

Alabamina tubulifera
Aluvigerina schencki
Ammobaculites agglutinans
Ammobaculites calcareus
Ammonia moroensis
Amphicoryna hirsuta
Amphicoryna sublineata
Amphistegina radiata
Anomalina glabrata
Anomalina polymorpha
Bigenerina nodosaria
Bolivina albatrossi
Bolivina earlandi
Bolivina hantkeniana
Bolivina karreriana
Bolivina limbata
Bolivina quadrilatera
Bolivina robusta
Bolivina spinescens
Bolivina tortuosa
Bolivina vadescens
Bolivinopsis bulbosus
Bulimina pagoda
Buliminella subtenuis
Buliminoides williamsoni
Calcarina hispida
Carpenteria balaniformis
Cassidulina laevigata
Cassidulina subglobosa

St. 92, 651 m, 6.8°C
(Baam)

Nodosaria emaciata
Parafrondicularia helenae
Planulina wuellerstorfi
Pseudoclavulina crustata
Pseudoclavulina juncea
Pullenia subcarinata
Pyrgo lucernula
Pyrgo sarsii
Rectobolivina dimorpha
Reussella weberi
Robertinoides oceanicus
Sigmoilina schlumbergeri
Spirorutilus kreuzbergi
Spiroloculina tenuisepta
Textularia abbreviata
Trifarina bradyi
Valvotextularia milletti
Valvotextularia philippinensis
Virgulina complanata

St. 117, 522 m, 7.2°C
(S of Sarmata)

Ammonia moroensis
Amphicoryna sublineata
Anomalina vermicula
Anomalina colligera
Bathysiphon rufus
Bolivina compacta
Bolivina quadrilaterata
Bolivina robusta
Bulimina aculeata
Bulimina marginata
Cancris oblongus
Cassidulina crassa
Ceratobulimina pacifica
Chilostomella oolina
Cibicides margaritiferus
Dentalina filiformis
Dentalina subsoleta
Ehrenbergina albatrossi
Euuvigerina aculeata
Gyroidina neosoldanii
Hoeglundina elegans
Hyperammina vagans
Lagena gracilis
Laticarinina pauperata
Marginulina glabra
Martinottiella primaeva
Nodosaria pyrula
Planulina wuellerstorfi
Praeglobobulimina spinescens

St. 59, 513 m, 7°C
(Moro Gulf)

Cassidulinoides bradyi
Chilostomella cushmani
Chrysalidina dimorpha
Cibicides globulosus
Cibicides hyalinus (Parrelloides)
Cibicides lobatulus
Cibicides pseudoungerianus
Cibicides refulgens
Cibicides subhaidingeri
Cymbaloporella patelliniformis
Cymbaloporetta bradyi
Dentalina elegans
Dentalina pomuligera
Dentalina sidebottomi
Dimorphina peregrina
Discopulvinulina subbertheloti
Discospirina pacifica
Ehrenbergina pacifica
Fissurina bradyi
Fissurina radiatamarginata
Flintina bradyana
Frondicularia paucicostata
Gaudryina quadrangularis
Gavelinonion glabratum
Gavelinopsis praegeri
Geminospira bradyi
Glandulina laevigata
Globobulimina turgida
Hauerina fragilissima
Hauerina speciosa (Massilina)
Heronallenia applicata
Hoeglundina elegans
Hyalinea baltica
Lagena barkeri
Lagena gracillima
Lagena laevis
Lagena semistriata
Lagena striata
Lagenammina pacifica
Lenticulina limbosa
Lenticulina reniformia
Mississippina concentrica
Neouvigerina ampullacea
Neouvigerina interrupta
Neouvigerina porrecta
Nodobaculariella convexiuscula
Oolina botelliformis
Orbitolites variabilis
Paromalina bilateralis
Parvocarinina altocamerata
Patellinella inconspicua

St. 117, 522 m, 7.2°C
(S of Sarmata)

Pseudoclavulina crustata
Pseudoclavulina juncea
Pullenia subcarinata
Rectoglandulina torrida
Reophax agglutinatus
Reophax scorpiurus
Robertinoides bradyi
Sigmoilina schlumbergeri
Siphonina pulchra
Valvotextularia milletti

St. 59, 513 m, 7°C
(Moro Gulf)

Planodiscorbis rarescens
Polystomellina discorbinoides
Praemassilina arenarea
Pseudoclavulina scabra
Pullenia subcarinata
Pyrgo vespertilio
Quinqueloculina auberiana
Quinqueloculina bradyana
Quinqueloculina parkeri
Quinqueloculina pseudoreticulata
Rectobolivina dimorpha
Reophax rostratus
Reophax spiculifer
Reussella weberi
Robertinoides oceanicus
Rosalina barkeri
Sigmoilina pacifica
Sigmoilina carinata
Sigmoilina schlumbergeri
Sigmoilina sigmoidea
Sigmomorphina williamsoni
Siphonina reticulata
Spirorutilus kreuzbergi
Spiroloculina aequia
Spiroloculina angularis
Spiroloculina communis
Spiroloculina regularis
Spirorutilus denticulatus
Svratkina carinata
Textularia gramen
Trifarina bradyi
Vaginulina elegans
Valvobifarina ryukyuensis
Valvopavonina flabelliformis
Valvotextularia flintii
Valvotextularia milletti
Valvotextularia philippinensis
Valvulineria glabra

A remarkable fact remains: each sample seems to have a large number of species which do not exist in any of the other samples.

The deep-water samples once again have their specific faunae; here we have to bear in mind, that many of these deep samples consisted in very little sediment, as they obviously derived from short piston or coring tubes. Yet the results were not unsatisfactory:

St. 186, 1368 m, 3.9°C: *Anomalina globulosa, Bolivina schwageriana, Bolivina quadrilatera, Cassidulina subglobosa, Ceratobulimina pacifica, Pyrgo depressa, Globobulimina elongata, Rectobolivina bifrons, Siphogenerina raphanus, Siphotextularia aperturalis.*

St. 190, 1374 m, 3.6°C: *Bulimina aculeata, Buliminella spinigera, Cassidulina carinata, Parrelloides hyalina, Bolivina quadrilatera, Desinobulimina auriculata, Neouvigerina ampullacea, Lenticulina cultrata, Robertinoides oceanica, Pyrgo laevis, Ophthalmidium acutimargo.*

St. 338, 1470 m, 2.6°C: *Aschemonella scabra, Hormosina spiculifera, Laticarinina pauperata, Marsipella elongata, Rhabdammina irregularis, Cassidella squamosa, Ceratobulimina pacifica, Dentalina communis, Gavelinonion umbilicatulum, Hyperammina atlantica, Pullenia subcarinata, Ramulina globulifera, Sigmoilina schlumbergeri, Textularia agglutinans.*

St. 370, 1625 m, 3.3°C: *Adercotryma glomeratum, Bolivina robusta, Martinottiella millettii, Neouvigerina ampullacea, Textularia agglutinans, Trochammina globigeriniformis, Valvotextularia phillippinensis.*

St. 292, 2410 m, 1.8°C: *Astrorhiza furcata, Cribrostomoides bradyi, Globobulimina glabra, Hyperammina (Saccorhiza) atlantica, Martinottiella minuta.*

St. 344, 2446 m, 1.8°C: *Favocassidulina favus, Cyclammina cancellata, Trochammina globigeriniformis.*

St. 291, 2484 m, 1.8°C: *Astrorhiza limicola, Cystammina pauciloculata, Nodosinum gaussicum.*

St. 244, 2588 m, 2.8°C: *Cyclammina cancellata, Nodosinum gaussicum, Saccammina sphaerulata.*

St. 214, 2969 m, 2.8°C: *Chilostomella oolina, Cribrostomoides bradyi, Cyclammina cancellata, Epistominella exigua, Glomospira gordialis.*

St. 276, 4313 m, 1.7°C: *Adercotryma glomeratum, Hyalinea baltica, Nodosinum gaussicum.*

Though the calcite compensation depth is said to lie at 4000 to 5000 m depth in the central Pacific ocean, the desintegration of planktonic species was found to begin much higher (see Boltowskoy & Wright, 1976: 244); this desintegration begins at about 1600 m (St. 370) and is very distinct in depths from 2400 m on (St. 344, 292, 291, 244, 276). In these stations nearly no calcareous Foraminifera were found and all planktonic specimens showed solution features; however, in St. 214, depth 2969, several calcareous species were found together with badly attacked planktonic tests; but it is a well-known fact that benthonic species with smooth tests resist the solution by the high CO_2-solution. I believe that especially the low temperatures (below 3°C) influence the distribution of the benthonic Foraminifera here; *Cyclammina cancellata* (mostly in the *pusilla*-form), *Nodosinum gaussicum, Cribrostomoides bradyi, Cystammina pauciloculata*, etc. are typical for the fauna in these depths (see also Molengraaff, after Böggild, 1921: 98).

In depths from 1300 to 1600 m the change of the benthic fauna is already noticeable: in the stations 190, 186, 338 the species of *Cassidulina* are common, and from St. 338 to St. 370 (1470 m and 1625 m) the agglutinated species become more frequent, and the desintegration of the planktonic Foraminifera begins to be visible. Whereas in the Stations 190 and 186 the temperature is distinctly higher than 3°C, in the stations 338 and 370 it is below or just above 3°C. Low temperatures form the environment of many primitive agglutinated Foraminifera (Hofker, 1976: 90-92). In the region studied here I reach a quite similar conclusion: the lower the temperature, the more frequently agglutinated primitive Foraminifera appear.

Certain genera seem to be restricted to certain temperatures. *Cassidulina, Cassidella,* and *Cassidulinoides* live in the Caribbean in temperatures from 5 to 6°C; in the Indonesian seas they were found in temperatures from 2.5 to 7.7°C, which is comparable with what was found in the Caribbean. *Chilostomella* was found to live in temperatures from 2.5 to 13°C, but here the different species are found in different temperatures. *Bulimina* was found in temperatures ranging from 3.2 to 9.4°C. So it is obvious that *Bulimina*-species are typical for deeper water, from 300 m to 2000 m, rarely deeper. *Buliminella* occurred in temperatures from 7.7 to 3.6°C and thus is restricted to medium deep water also. However, Nörvang (1945) found many species of *Cassidulina* and *Bulimina* in shallow water around Iceland; it is obvious that temperature, not depth is the cause of the distribution. Remarkable is in this respect the distribution of *Hyalinea baltica*; this species was found in the Snellius stations in depths from 513 m to 4321 m, with temperatures from 1.7 to 7°C; around Iceland Nörvang found it in many shallow water stations. It thus forms a well-known marker for cool temperature, not for depth. *Lenticulina* and *Dentalina* are here found in relatively deep water only; the temperatures are from 5 to 7°C. In the Caribbean *Lenticulina* is found commonly in depths from 200 to 800 m; around Iceland *Dentalina* and *Lenticulina* are found in shallow water. The same can be said about the primitive agglutinated Foraminifera, found in Iceland in shallow water, where in Indonesia and in the Caribbean Sea they are found only in deeper water. All these instances point to the influence of temperature, not that of depth, on the distribution of many Foraminifera.

Very remarkable is in this respect the fauna found in St. 85 (Ceram Sea, W of Misool; 1496 m, 6.6°C):

Aluvigerina pygmaea, Bolivinopsis bulbosus, Bulimina clava, Bulimina gibba, Buliminella madagascarensis, Buliminella spinigera, Cibicides refulgens, Ehrenbergina albatrossi, Ehrenbergina pacifica, Euuvigerina peregrina, Gavelinonion glabratum, Globobulimina elongata, Sigmoidina pacifica, Gyroidina orbicularis, Heronallenia applicata, Hyalinea baltica, Lagena substriata, Laticarinina pauperata, Laticarinina altocamerata, Martinottiella milletti, Nodosaria pyrula, Oolina melo, Planodiscorbis rarescens, Planulina wuellerstorfi, Reophax agglutinans, Sigmoilina carinata, Spirorutilus kreuzbergi, Spirorutilus sagittula, Streblus moroensis, Valvotextularia milletti, Trifarina reussi, Vagocibicides maorius.

Here we deal with a deep locality, but with a fauna which is typical for a less deep environment; but the temperature is here not about 3°C (normal for such a depth), but 6.6°C, the temperature in the stations of 500 to 700 m.

St. 85 is situated just between Obi Major and Misool, in the northern part of the Ceram Sea. It contains a rich globigerina-ooze; is it possible that here a current of surface water reaches the sea-floor, or that there may be in this area a vulcanic submarine activity? The aberrant fauna in some way resembles (but in a reverse sense) the fauna found by me in the Ammontatura in the Bay of Naples (Hofker, 1932: 63), where a typical deep sea fauna was found in a depth of 250 m; here, obviously, the temperature was too low, whereas in Snellius St. 85 the temperature was too high, in respect to the depths; consequently both faunae became abnormal as to depth. This is another striking proof that the distribution of the Foraminifera is largely influenced by temperature, not by depth.

St. 85 was situated 1°45'S 129°09'E; in the same area another station is found, St. 354, 1°09'S 125°10'E (depth 546 m, temp. 3.7°C). In St. 354 the circumstances are thus reverse in respect to those in St. 85: the temperature is too low in regard to the depth. In this station the following Foraminifera were found:

Bolivina hantkeniana, Bolivina karreriana, Bolivina quadrilatera (broad form), *Bulimina rostrata, Buliminella spinigera, Cassidulina squamosa, Ceratobulimina pacifica, Chilostomella cushmani, Chilostomella oolina, Cibicides globulosus, Dentalina filiformis, Ehrenbergina albatrossi, Euuvigerina aculeata, Frondicularia boomgaarti, Gaudryina attenuata, Globobulimina glabra, Hoeglundina elegans, Laticarinina pauperata, Marsipella cylindrica, Osangularia bengalensis, Planulina wuellerstorfi, Praemassilina arenaria, Quinqueleculina parkeri, Rectobolivina dimorpha, Rectobolivina fimbriata, Reophax agglutinata, Reophax scorpiurus, Reophax spiculitestus, Robertinoides oceanicus, Valvotextularia philippinensis.*

From these 30 species 20 are typical for temperatures of 6 to 7°C, whereas 10 of them are typical for temperatures of 2 to 5°C; this means that we have here a mixed fauna as it occurred in the Ammontatura (Mediterranean), with a distinct deflection to higher temperature than was indicated for this station, but with many species corroborating this low temperature. As N of station 354 the bottom depth is similar to that found at that station, but as S from it (St. 85) the sea is much deeper, this mixed fauna of St. 354 may point to an undercurrent water from S to N. Once more we may conclude that temperature is important for the distribution of the benthic Foraminifera.

Remarkable is the fact that so many species enumerated from the tropical Pacific also occur around New Zealand (Vella, 1957; Eade, 1967), but often in smaller depths. Around New Zealand the temperature of the sea water, even in shallower water, is lower than that found in the tropics.

One would be inclined to search for geographically limited species; apart from some species such as *Textularia barkeri* (New Guinea), *Schlum-*

bergerella floresiana (limited to the coasts of Bali, Flores and Timor), *Heterostegina heterosteginoides* (restricted to the Key Islands and New Guinea) and *Nodosinum gaussicum* (found around Celebes and Halmaheira), no other species were found to be limited with certainty to distinct areas of the Eastern Indonesian Seas.

SYSTEMATIC PART

Reophax agglutinatus Cushman

Reophax agglutinatus Cushman, 1913: 637, pl. 79 fig. 6; 1932: 4, pl. 1 figs. 1-3.

The test consists invariably of one or two chambers and is built from minute globigerines throughout; it seldom exceeds a length of 0.7 mm. One would be inclined to believe the species synonymous with the much larger species *Reophax bilocularis* Flint, found in deeper water of the Atlantic and the Caribbean Sea; the latter species, however, built of two chambers also, measures about 1.6 mm and its agglutination consists of all kinds of foraminiferal tests and some sand grains. The Pacific species is very constant in size, agglutination and chamber number, and thus must be a different species. As in all real *Reophax*, the test consists of only one layer of grains, here small globigerinids.

Cushman found it in the southern Pacific, but also in the Philippine region (1921: 73), always in deeper water. In the Snellius material is was found in the stations 85 (1496 m), 117 (522 m), 189 (1829 m) and 354 (546 m); it was found thus in the same depths as those mentioned by Cushman.

Lagenammina pacifica nov. spec. (pl. 1 fig. 1)

Test pyriform, length 0.65 mm, consisting of one layer of sand grains with fairly identical shape and diameter, ending with a somewhat chitinous neck with very fine agglutination and a rounded aperture. It might be confused with *Proteonina difflugiformis* (Brady), but here the agglutination is much more irregular, as Cushman stated (1910: 42). *Lagenammina* must be very close to the genus *Reophax*, but is always found in individuals with only one chamber.

The species was found in the Snellius stations 59 (513 m), 92 (615 m) and 324 (2106 m), thus in the eastern part of the region, 122°-132° E.

Loeblichopsis spiculifera nov. spec. (pl. 1 fig. 2)

Test a straight series of about 5 chambers, only slightly increasing in size, strongly overlapping each other, and the last formed chamber with short apertural neck. Wall consisting of many sponge-spicules radially placed, with several layers forming these walls. It may be identical with *Reophax horridus* Cushman (1921: 73, pl. 18 figs. 3, 4) but the agglutination seems different. It was found in Snellius St. 187, depth 3065, temp. 3.6°C.

Nodosinum gaussicum (Rhumbler)

Arnodosinum py-gaussicum Rhumbler, 1911: pl. 20 figs. 1, 2; 1913: 452.
Nodosinum gaussicum (Rhumbler), Hofker, 1930: 121, pl. 43 fig. 8, pl. 48 figs. 2, 5-8.

I described this species fully in 1930; however, I then brought it to the family Reophacidae, and Loeblich & Tappan (1964) followed me herein. But my investigations on the genus *Reophax* (1972: 37-41) showed me that all species of this genus have a wall consisting of only one layer of sand grains or other material (foraminiferal tests, sponge spiculae), whereas *Nodosinum* shows several layers of grains in the test wall (pl. 48 figs. 8-10). Therefore, this genus cannot belong to the Reophacinae Cushman; it has to be placed in the neighbourhood of the genus *Hormosina* Brady, 1879.

The species was found only in very deep water; the two localities where it was found in the Siboga material, St. 221 (depth 2798 m) and St. 223 (4591 m) prove this. In the Snellius material it was found in St. 244 (depth 2588 m), St. 276 (depth 4313 m) and St. 291 (depth 2482 m); the Siboga stations were from E. of Celebes; the stations of the Snellius Expedition were from SW of Celebes, E of Halmaheira and NE of Celebes; thus it is obvious that the range of this species is narrow and is restricted to the basins around Celebes and Halmaheira.

Remark. — The outer features of *Nodosinum* are strikingly similar to those of *Hormosina mortenseni* Hofker (1972: 62, pl. 18 figs. 6-12), but there are two fundamental differences; in *H. mortenseni* the test consists of two different layers of sand grains, the outer one consisting of coarser grains than the inner layers, and the aperture is simple; in *Nodosinum gaussicum* the test consists of sand grains of different size, irregularly spread in the wall, whereas the aperture is complex by the presence of ribs in the apertural region. But not all species of *Hormosinum* have these two layers of sand grains, see *H. ovicula* Brady (Hofker, 1972: 62, pl. 18 figs. 13-15).

Textularia barkeri nov. spec. (pl. 1 fig. 3)

Textularia trochus d'Orbigny, Brady, 1884: 366, pl. 43 figs. 15, 16, 18.
Textularia pseudotrochus Cushman, 1922: 21, pl. 5 figs. 1-3.
Textularia sp. nov., Barker, 1960: 88.

Test round in topview, flatly triangular in side view, with numerous biserial chambers with distinct slightly protruding sutures and a very fine agglutination. At the apertural side two chambers are visible, both with a flat to slightly concave surface and a distinctly bordered rectangular lip over the aperture. In section the chambers are low and broad, with thin septa and slightly thicker outer walls, which are finely agglutinated. Diameter of the rounded test about 0.75 mm, height of the cone 0.40 mm.

As Barker pointed out, this species is found solely in the coastal waters of New Guinea and has nothing to do with *T. trochus* d'Orbigny nor with the species found in the Caribbean Sea and the east coast of America, named by Cushman. *T. pseudotrochus*. So it must have a new name which is given here. Sorong.

Valvotextularia milletti (Cushman) (pl. 1 fig. 4)

Textularia sagittula var. *jugosa* Millett, 1899: 561, pl. 7 fig. 8.
Textularia milletti Cushman, 1911: 13, figs. 18, 19.
Valvotextularia milletti (Cushman), Hofker, 1951: 30, figs. 8-10.

I described this species in 1951. The present collection contains outgrown specimens of both generations, with the irregular rib-like sutures. A transverse longitudinal section is given to show why the sutures form these ribs. It was found in many stations, often abundantly, always with temperatures from 6.4°C to 7.2°C. As in all species of *Valvotextularia* the test walls show fine pores and the first chambers surround the proloculus, without forming, however, a spiral.

Spirorutilus kreuzbergi (Finlay) (pl. 1 fig. 5)

Siphotextularia kreuzbergi Finlay, 1940: 449, pl. 62 figs. 5, 6.

"Very fine sand-grains in much cement, smoothly finished, darker and coarser posteriorly. Much compressed, expanding rapidly from sharp apex at 90° for about one-third of shell, then sides subparallel. Greatest thickness (about one-third width) at half-way, bevelled in all directions to acute slightly thickened flange surrounding whole shell, a little wing-like anteriorly. About 7 pairs of chambers with small spiroplectine apex, progressively less embracing, lower parts a little bulbous, sutures deep, 20-30° from horizontal. Aperture a little rounded tube springing from flange at base of chamber. Size, 0.75 mm."

This is the accurate description of this species by Finlay. I have to point to the sipho of the aperture which is slightly areal, as in *Siphotextularia*, but also to the short spiral of chambers around the proloculus, mentioned by Finlay, and found in all specimens observed. When describing *Siphotextularia*, Finlay said: "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." (Finlay, 1939: 510). I discussed related genera (Hofker, 1976: 65) and showed that the type-species of *Siphotextularia* is a species with short initial spiral, not in the axis of the test but transversely to it, and that the test wall is porous. So there are two fundamental differences between the genera *Siphotextularia* and the new genus I erected in 1976, *Spirorutilus*. The latter genus has as it type-species *Textularia carinata* d'Orbigny, a species with an initial spiral of chambers in the plane of the test and a depressed test with a flange, and with a sutural slit-like aperture without neck. Undoubtedly the species here described has the initial spiral in the plane of the test, but with the aperture of *Siphotextularia*. However, it is questionable whether this aperture with neck is here not caused by the carinate and compressed chamber, as this carina surrounds the last formed chamber throughout. So I bring here this remarkable species, which was described by Finlay from the Upper Ihungian, Upper Tertiary; obviously the species lived up into the Recent, as it was found in three stations of the Snellius, viz. 59, 85 and 92 (513 m, 1496 m and 615 m deep respectively) always in single but well-preserved specimens.

Spirorutilus denticulatus nov. spec. (pl. 1 fig. 6)

Test elongate triangular in the microspheric form, in the megalospheric form with rounded initial end. Length of megalospheric forms 0.65 to 0.80 mm, largest breadth 0.50 mm, thickness 0.10 mm; length of microspheric form 1.40 mm, largest breadth 0.80 mm, thickness 0.20 mm. The sides form an angle of 50° and the sutures of the chambers 125°. Each chamber shows at the periphery a pointed spine. Sutures of axis and chambers not all limbate but smooth with the surface. Wall very finely agglutinated, colour greyish to yellowish. Aperture a narrow slit at the axial suture, in a small hollow. In the megalospheric tests the proloculus has a diameter of 0.07 to 0.15 mm, in the microspheric generation of 0.02 mm; it is surrounded by three chambers before the biserial chambers start, in the microspheric form by 4 chambers.

Found abundantly at Snellius St. 59 (depth 513 m, temp. 7°C).

Remark. — The species is allied to *Spirorutilus pseudocarinatus* (Cushman), but differs from it by the smooth, not limbate sutures, the lower chambers and the dents at the periphery.

Bolivinopsis bulbosa (Cushman) (pl. 1 fig. 7)

Spiroplecta bulbosa Cushman, 1911: 5, fig. 1.
Spiroplecta annectens (Parker & Jones), Brady, 1884: pl. 45 figs. 22, 23.
Spiroplectella earlandi Barker, 1960: 92.

Test in the megalospheric generation short, with large proloculus forming with a spiral of 8 chambers a "bulbous" initial part, whereas the biserial part consists of 6 biserial chamber-series at the utmost. However, the microspheric generation is much larger, beginning with a small proloculus followed by about 4 whorls of low chambers which in the outer spiral are much thicker than in the inner spirals, thus forming a concave initial part; this part is followed by 10 to 20 sets of biserially arranged chambers. In both generations the biserial chambers have strongly oblique and slightly impressed sutures. Walls very finely arenaceous, imperforate (Cushman believed them to be perforate).

Characteristic of this species is that the microspheric form is much commoner than the megalospheric one. It was found in many stations, with depths from 500 to 600 m mostly, in one sample at a depth of 1496 m. The average temperature was 6.8°C. Cushman described it from off the coast of Japan, depth about 800 m; Brady's specimens were from Torres Strait, depth about 300 m. In any case the temperature was nowhere below 6°C. In several of the stations both generations were found together, so that they obvious belong to ones species.

Valvobifarina mackinnoni (Millett) (pl. 1 fig. 9)

Bifarina mackinnoni Millett, 1900: 281, pl. 2 fig. 15.
Valvobifarina mackinnoni (Millett), Hofker, 1951: 40, figs. 16, 17.

This species was fully described by the present author in 1951; both generations were analysed, and it was shown that the microspheric generation begins with at least two series of triserially arranged chambers, before the biserially arranged chambers start. However, the specimen described obviously was not an adult one. Such an adult specimen was found among several megalospheric specimens at Snellius St. 59. It consists of 3 series of triserial chambers following the proloculus (diameter about 25 μ); these triserially arranged chambers are followed by 3 series of biserially arranged chambers, as in the specimen described in 1951; but in the specimen at hand these biserially arranged chambers are followed by chambers which are uniserial, the first two with oblique sutures, followed by three chambers with the sutures perpendicular to the axis of the test. Especially the uniserial chambers have distinct proximal spines at the periphery. The structure of the test wall is the same as described in 1951, with the peculiar knobs on the surface, many of which show the distinct pores. The walls themselves are poreless, roughly granular in structure. The aperture is a transverse slit with a breadth like that of the end chamber, with distinct thickened rim. Length of the whole test 1.2 mm.

Valvobifarina ryukyuensis (Cushman & Hanzawa) (pl. 1 fig. 8)

Bifarinella ryukyuensis Cushman & Hanzawa, 1936: 46, pl. 8 figs. 7, 8.
Pavonina ryukyuensis (Cushman & Hanzawa), Loeblich & Tappan, 1964: 563, fig. 444, 4.

A single, well preserved specimen was found at Snellius St. 59, which seems to be microspheric (proloculus diameter about 15 μ). The specimen figured by Cushman & Hanzawa was probably megalospheric, that figured by Loeblich & Tappan distinctly megalospheric. In the specimen at hand, the proloculus is followed by three rows of triserially arranged chambers, followed by 3 series of biserial chambers and ending with 4 chambers which are uniserially arranged. In the specimen from St. 59, which seems to be undamaged, the last formed chamber ends with an aperture as found in *V. mackinnoni*; Loeblich & Tappan figure the (broken) last formed chamber with many columns inside, which characteristic was not figured by Cushman & Hanzawa and is not found in the specimen at hand. It may be that this structure found by Loeblich & Tappan has something to do with propagation, and in any case is not typical. It was this peculiar structure which brought Loeblich & Tappan to the idea, that the species had to belong to *Pavonina* (*Valvopavonina*); however, the structure of the test wall with the peculiar knobs often ending with a pore, and its granular structure, moreover the forming of spines at the periphery together with the other features are those of *Valvobifarina* and not of *Valvopavonina*. The fact that in outgrown microspheric *Valvobifarina mackinnoni* the test ends uniserially, as it does in *V. ryukyuensis*, once more points to *Valvobifarina*.

This species seems to be a very rare one.

Cibicides refulgens Montfort (pl. 7 fig. 1)

Cibicides refulgens Montfort, 1808: 123, fig.
Truncatulina refulgens (Montfort), d'Orbigny, 1826: 279, pl. 13 figs. 8-11; Cushman, 1915: 30, pl. 12 fig. 2; 1921: 312, pl. 63 fig. 1.

Test flat at the dorsal side (the side where the proloculus is found), strongly convex ventrally. At the dorsal side, which is the attached side also, all chambers are visible, forming at least four coils around the small proloculus (diameter 15 μ) in all specimens found; obviously we have here the microspheric generation in deep water. In shallower water the specimens are flatter and the proloculus measures about 100 μ (North Atlantic, Ingolf-Expedition). As in many Foraminifera, obviously the megalospheric generation lives in shallower water than the microspheric one. At the flat dorsal side all chambers are visible, but the initial ones may be obscured by a thickened wall in the centre, due to the fact that the whole wall at this side is flat; later chambers reach more of the surface than the initial ones in the microspheric generation. Ventral wall relatively thick, with distinct scattered pores. The ventral chambers, of which 7 or 8 are visible, reach the centre so that no umbilical cavity is formed. They have strongly developed shoulders near the centre and thin walls with very fine pores which in older chambers seem to be closed. This dome-formed side is so high, that the ratio diameter: height is 1:0.8. Aperture at the outer margin which forms a distinct hyaline flange, whereas the dorsal chamber walls are opaque, granular; the wall of the dorsal side is more hyaline and may be radial of structure.

Cushman found the species in the Pacific in depths from 187 to 2779 m. In the Snellius material it was found commonly in St. 59, depth 513 m; 85, depth 1496 m; 126, depth 378 m; 185, depth 587 m; 283, depth 576 m. In Philippine waters it was recorded by Cushman from 58 to 1622 m; a specimen from his sample D 5469, depth 900 m, figured by Cushman pl. 63 fig. 1, has a low ventral side and is megalospheric, with proloculus diameter 90 μ. It is possible that all specimens with low dorsal side are megalospheric, and that only the microspheric specimens are high-domed.

Vagocibicides maorius Finlay (pl. 6 figs. 4-6)

Vagocibicides maoria Finlay, 1939: 326, pl. 29 figs. 148-151, 158.
Dyocibicides laevis Parr, 1950: 365, pl. 15 fig. 8.
Karreria maoria (Finlay), Eade, 1967: 54.

Large elongate specimens, dorsal side with inflated chambers and impressed sutures, ventral one flat to slightly concave; margin acute, periphery lobulate, with distinct poreless acute rim. At the dorsal adherent side all chambers visible, beginning with small proloculus followed by 2 whorls of small chambers, then the chambers becoming larger and biserially arranged. Striking is the aperture, partly visible near the axis in older biserial chambers, and distinctly visible as a rounded slightly areal opening at the flat side with a thickened border. Longitudinal section shows that the coiled chambers are somewhat built as in *Cibicides refulgens* and that the later biserial chambers are partly overlapped at their distal side by the next chambers. Pores in the ventral walls very fine and densely placed, whereas the dorsal walls are poreless. In the "*refulgens*"-part the rounded foramina are areally placed in the distal chamber walls. One very large individual seems to be microspheric with a proloculus diameter of about 20 μ; another specimen, smaller, may be megalospheric with proloculus diameter of about 50 μ.

This species was found in several specimens in Station 85, depth 1496 m, temp. 6.6°C. Found in many localities around New Zealand (Vella, 1957: 11).

Remarks. — The fine pores do not point to *Cibicides,* nor to *Dyocibicides,* but to *Cibicidina* Bandy; it was found by Parr at two stations off the coast of Tasmania, in depths of 122 and 128 m. However, we have to bear in mind that here the bottom temperatures may have been comparable to that found in Snellius St. 85. It is not the depth but the temperature which controls the occurrences of Foraminifera.

Finlay and Parr mention the species from the Miocene also.

Sigmoilina carinata nov. spec. (pl. 3 fig. 1)

Test in the common megalospheric generation elongate, slightly compressed, with small apertural neck and distinctly acute margin ;two chambers visible from the outside, with nearly invisible sutures smooth with surface, surface polished; in the rare microspheric generation more rounded, with distinct acute margin, also two chambers visible, with last formed chamber overlapping the base, and short apertural neck. Tooth simple or slightly bifurcate, often slightly protruding in the aperture.

On transverse section the megalospheric form begins with a large proloculus followed by a nummuloculine set of chambers; then a chamber is formed perpendicular to the axis of the test, envelopping the first initial part; then the sigmoid chambers start, about three at each side, of which the walls at one side strongly overlap the former chamber walls. In the microspheric generation a small proloculus is followed by two sets of quinqueloculine arrangement, followed by the sigmoid chambers, at each side 5 of them. In both generations the walls of the chambers are thin, but the overlapping chamber walls form, especially in the microspheric form, thick layers at the broad sides of the tests.

Length of both forms about 0.8 to 0.9 mm, often smaller also; width of megalospheric forms about 0.4 to 0.5 mm, of the microspheric form 0.75 mm; thickness of both forms about 0.3 mm.

This species was found commonly in Snellius St. 59, depth 513 m, temp. 7°C; St. 85, depth 1469 m, temp. 6.6°C; 185, depth 587 m, temp. 6.4°C; 283, depth 576 m, temp. 7.7°C. So it seems that this species is most common in depths between 500 and 600 m, with temperatures above 6°C and below 7.7°C; it is widespread in the eastern part of the archipelago. The microspheric generation resembles *Sigmoilina sigmoidea* (Brady), but the latter lacks the carina; the megalospheric form is slenderer.

Remark. — This species in some characteristics seems to be close to the much more compressed *Sigmoilina sigmoidea* var. *compressa* Cushman (1946: 32, pl. 5 figs. 10-12).

Hauerina fragilissima (Brady) (pl. 2 figs. 4-6)

Spiroloculina fragilissima Brady, 1884: 149, pl. 9 figs. 12-14.
Hauerina fragillissima (Brady), Millett, 1898: 610, pl. 13 figs. 8-10.

Test in the adult oval to rounded, very much compressed in the later chambers, with slightly thickened central part, in the microspheric generation diameter about 1.2 mm, thickness in the centre 0.13 mm, in the periferal chambers 0.06 mm. The central part consists here of a small proloculus, diam. 25 μ, encircled by at least 5 quinqueloculine chambers. These chambers are followed by very compressed chambers, forming each about ½ coil; the last formed chamber may be larger than ½ coil. Walls extremely thin, with no ornamentation whatever. Each of the later chambers ends with a porous plate (trematophore). One specimen found was much smaller and had a proloculus with diameter 50 μ. The part with quinqueloculine placed chambers was much larger and the whole individual was similar to that shown in Brady's pl. 9 fig. 14. This must be the megalospheric generation. It is characterised by the much larger initial part, as Brady's figure shows.

The species seems to be rare; it was found in several specimens in St. 59, depth 513 m (Moro Gulf, Mindanao); Graham & Militante (1959: 35, pl. 3 fig. 9) mentioned it from the Philippines also.

Massilina speciosa (Karrer) (pl. 2 fig. 8)

Spiroloculina speciosa Karrer, 1868: 135, pl. 1 fig. 8.
Spiroloculina crenata Karrer, 1868: 135, pl. 1 fig. 9.
Hauerina speciosa (Karrer), Cushman, 1946: 5, pl. 1 figs. 13, 14.
Massilina crenata (Karrer), Graham & Militante, 1959: 36, pl. 3 fig. 12.

Test in the initial part quinqueloculine and elongate-fusiform, later chambers very compressed, two chambers in a coil as in *Massilina*. Walls of the later quinqueloculine as well as of the massiline parts undulating, which gives a peculiar pattern. Aperture an open slit with at its base a simple tooth.

Karrer illustrated this aperture with tooth, but Cushman believed to observe a cribrate aperture which, however, was never seen by me. So the species cannot belong to *Hauerina*, which always shows this "trematophore" over the aperture.

The species was found in St. 59 (several outgrown specimens) and in St. 283 (one specimen without the massiline chambers).

Cornuloculina pacifica nov. spec. (pl. 1 figs. 10; pl. 2 figs. 1-3)

Test in the megalospheric and in young microspheric specimens resembling that of *Cornuloculina inconstans* Brady from the Atlantic-Caribbean regions.

However, the Pacific specimens are stouter in test structure, with thicker plates in between the chambers and, especially in the microspheric juveniles, with more developed outer flange.

The microspheric generation begins as in the megalospheric one, viz., as a *Cornuloculina*, but in the later chambers it has invariably 3 chambers in a whorl. An outgrown microspheric specimen has the characteristics of *Discospirina*; since the name *Cornuloculina* Burbach was given in 1886 and the name *Discospirina* Munier-Chalmas in 1902, the generic name *Cornuloculina* should be used. *Discospirina* has been used in the combination *Discospirina italica* (Costa) from the Mediterranean-Atlantic-Caribbean regions (= *Ophthalmidium inconstans* Brady for the megalospheric and young microspheric forms); but transverse sections showed me that it has nothing in common with *Ophthalmidium*. The outgrown microspheric form of the Atlantic species is "*Orbitolites*" *tenuissima* Carpenter (1883: 533-558, pls. 37, 38); a very fine photograph of this generation was given by Flint (1897: pl. 52). In this photograph and on pl. 38 of Carpenter we observe the secondary septa as straight septa developing from the inner wall of each chamber and ending just before they reach the outer wall, thus leaving minute passages that communicate between the next chamberlets. In the Pacific species these secondary septa are built in a wholly different manner. Here they have their thickest parts where they begin in the middle of a chamber, gradually becoming thinner; they end at the outer chamberwall, but in the case that a next embracing chamber is formed, they continue with a pointed end in that chamber; these pointed ends are the thin septa surrounding the openings by which adjacent chamberlets communicate, which openings thus are found in the middle of the embracing large chamber and not, as in the Atlantic species, at the outer wall. In both species the chamberlets open with an aperture, thus forming a row of apertures in the extremely thin apertural face (see also Brady, 1884: pl. 15 figs. 6, 7, for the Atlantic species "*Discospirina*" *italica* (Costa)).

We may point to the fact that all known figures of "*Discospirina*" show microspheric specimens (Brady, 1884: pl. 15 fig. 7; Flint, 1897: pl. 52; Loeblich & Tappan, 1964: fig. 348) and that they all are from the Atlantic region. From the Pacific, microspheric specimens seem so far to be unknown.

The only microspheric specimen at hand is young, though the spiral part of the complex chambers is already formed. An outgrown specimen must be very large; the young specimen was found in Snellius St. 123, Timor Sea, depth 459 m, temp. 8.4°C. The "*Cornuloculina*"-part consists of the proloculus (diameter 30 μ), followed by a long spiral neck and biserial to triserial cornuloculine chambers; two chambers are added with 1 and 2 secondary septa respectively; the next chambers show 6 secondary septa, the following 16, and the next 24. No fully embracing chambers are yet formed in this individual.

Small specimens, wholly "cornuloculine", may be microspheric (proloculus diameter from 30 to 50 μ), followed by the long neck chamber and the cornuloculine chambers, whereas the much commoner megalospheric specimens have a proloculus diameter of about 90 μ, with a shorter neck chamber, followed by the cornuloculine chambers. The megalospheric and microspheric juvenile forms were found in the stations 53, 123, 185, 283; the depths all are around 500 m, with temperatures around 6 to 8° C. The Atlantic specimens known are from 800 to 3000 m depth, thus much deeper. One specimen of the Pacific specimens shows to be microspheric with at the aperture already one septum.

It seems that the two species are rare both in the Atlantic and in the Pacific regions.

Dendritina acicularia (Batsch) (pl. 2 fig. 7)

Nautilus acicularis Batsch, 1791: pl. 6 fig. 16.
Dendritina acicularia (Batsch), Hofker, 1951: 236, figs. 15-17.
Spirola cylindrica Lamarck, Albani, 1968: 101, pl. 8 figs. 1, 8.

Several tests were found at Snellius St. 34. Characteristic of the coiled part are the slightly overlapping whorls and the apertures which show the triangular shape and the basal dent, typical for *Dendritina*. In the uncoiling part the apertures become central and the dent is multiplied into a radial structure. Very typical for this species is the texture of the surface of the walls. Longitudinal costae of clear shell material are intercalated by rows of fine hyaline punctate which in section and with high magnification show to be little hyaline sacs in the outer surface, possibly forming a kind of lenses for the zooxanthellae. In the coiled chamber walls the rows of punctae are simple, whereas in the uncoiling part two rows of punctae are found in between the costae, in the last formed chambers even three. In the coiled part the outer walls are simple, but in more initial parts the walls are double as each chamber is wholly surrounded by its own wall which is thickest proximally. All apertures are areal. The proloculus is followed by a neck chamber; fine pores in its wall were not observed.

The species is known to me from Aden, the Red Sea, and from Sacal, Philippines, always from shallow water; the depth of St. 34, Lembeh Strait, was also shallow.

Albani (1968) described the species from Port Hacking, New South Wales, and his figure distinctly shows the costae and the punctae; yet he determined it is *Spirolina cylindrica* Lamarck, a species from the Lutetian of the Paris Basin, which does not show any ornamentation on the surface of the test walls.

Dimorphina d'Orbigny, 1826

A genus which comprises species of the form of *Lenticulina* with always few chambers in a whorl, which may in favorable circumstances develop an uncoiling series of chambers, ending in a protruding complex aperture.

Dimorphina peregrina (Schwager) (pl. 3 figs. 3-8)

Cristellaria peregrina Schwager, 1866: 245, pl. 7 fig. 98.
Cristellaria variabilis (not Reuss), Brady. 1884: 541, pl. 68 figs. 11-16; Hofker, 1932: 16, fig. 30c, d.
Lenticulina peregrina (Schwager), Phleger & Parker, 1951: 9, pl. 4 fig. 20; Hofker, 1960: 243, fig. 71; 1976: 57, fig. 58.

The characteristics of this species are those of *Dimorphina* d'Orbigny; in the coiled specimens with 3 or 4 chambers in a whorl, and often forming an uncoiled part, with the typical protruding aperture. In the coiled part the test is compressed, with subacute to acute margin, in the uncoiled part with more rounded margin. Walls very thin and hyaline, as in most species of this genus, though in some cases I observed a secondary thickening layer of chalk over the outer walls of the last formed chambers in the coiled phase.

It is remarkable that this species is found in the coiled phase in deeper water only, where the temperature does not rise above 7°C; in those localities where the bottom temperature raised above 7°C, the uncoiled forms were found (Snellius St. 283, temp. 7.7°C; Caribbean Sea, off St. Croix, Virgin Islands, depth 300 m, temp. 8°C). This might mean that the species gets its greatest development in depths where the temperature rises above 7°C.

In Snellius St. 91, a specimen was found with the last formed chamber showing the tendency to uncoil, extending into a furcating stolon with three bifurcating branches and ending with open foramina without any trace of the radial aperture found in the normal tests. Thus this chamber very much resembles that found in the wildgrowing chambers of outgrown specimens of the Polymorphinidae (see Hofker, *Polymorphina acuta* Roemer, Foram. of the Faroës, 1930, figs. 17-20). It may be that such stoloniferous chambers serve as attachment to weeds or to shells of molluscs, as could be observed in several instances. In that case this wild-growing chamber is not an abnormal one.

Nodosaria inflexa Reuss (pl. 3 fig. 9)

Nodosaria inflexa Reuss, 1866: 131, pl. 3 fig. 1.
Dentalina inflexa (Reuss), Asano, 1956: 20, pl. 4 fig. 36, 37.

Test of medium size, proloculus with rounded apical end, followed by 3 chambers in a straight line, later chambers slightly asymmetrical so that the end of the test is slightly curved to one side (*Dentalina*). Sutures in the first chambers only slightly impressed and thus chambers only slightly inflated, in the later chambers the sutures much more impressed and the chambers becoming somewhat pyriform and more elongate. In the initial chambers the sutures are strengthened by distinct longitudinal costae which, however, do not continue over the surface of the chamber walls. Length of the undamaged individual 2.8 mm. Aperture radial, centrically placed.

Remarks. — Brady, Cushman and other authors describe and figure only incomplete tests which lack the initial part. The only figure of a complete test known to me, is that given by Asano (1956: fig. 36), but it does not show the costae, as it is too small. The species seems to be a rare one.

Amphicoryna Schlumberger, 1881

The present author proved for the first time that three generations are found in "*Nodosaria*" *scalaris* (Batsch) (Hofker, 1932: 110-116, figs. 27-29). This was confirmed by Buchner (1940: 404, pl. 1 figs. 1-19). The present author found these three generations in *Amphicoryna intercellularis* Brady (Hofker, 1969: 55, figs. 147-152; 1976: 87, fig. 87). Three other species of this genus were traced in the Snellius-collections, and in two of these the generations could be found also. Synonyms of *Amphicoryna* are listed in Loeblich & Tappan (1964: 513).

Amphicoryna sublineata (Brady) (pl. 3 fig. 11)

Nodosaria hispida var. *sublineata* Brady, 1884: 508, pl. 63 figs. 19-22.
Nodosaria sublineata, Cushman, 1921: 207, pl. 37 fig. 1.
Lagenonodosaria sublineata (Brady), Asano, 1956: 25, pl. 6 figs. 17, 18.

In the microspheric generation the species begins with an elongate proloculus with initial point, followed by about 6 "dentaline" chambers, to which several "nodosarine" chambers are added. The first chambers have no ornamentation, later chambers show distinct costae which at the proximal side of each chamber end in short spines. The apertural neck of the last formed chamber shows fine spines and ends in a crenulate aperture. The other generations are megalospheric, beginning with smaller or lager proloculi with end-spine, possibly the closing part of a last formed chamber of the microspheric form. It begins with two or three chambers without elongate neck, followed by about 4 chambers separated from each other by their necks, ending with a crenulate aperture. At the basal chamber part the distinct costae end in often long and numerous spines. The necks are ornamented by rings of very small spines.

Snellius St. 126, depth 378 m; St. 254, depth 4048 m.

Amphicoryna substriatula (Cushman) (pl. 3 fig. 10)

Nodosaria substriatula Cushman, 1917: 655; Cushman, 1921: 204, pl. 36 figs. 8, 9, pl. 52 figs. 7-9.

The microspheric generation begins with an elongate proloculus with end-spine followed by 5 "dentaline" chambers and ending with one to three more or less elongate chambers which may have necks in between. The last chamber has a neck without ornamentation or with fine longitudinal striae, with crenulate aperture. The A-generation begins with a proloculus with end-spine, followed by two or three chambers without necks in "nodosarine" succession. In all generations the walls of the later chambers of the microspheric test and all chambers of the megalospheric forms show very fine longitudinal striae which are often scarcely visible.

Snellius St. 185, depth 587 m.

Amphicoryna hirsuta (d'Orbigny) (pl. 3 fig. 12)

Nodosaria hirsuta d'Orbigny, 1826: 252, No. 7; Parker, Jones & Brady, 1871: 154, pl. 9 fig. 45.
Nodosaria hispida d'Orbigny, Brady, 1884: 507, pl. 63 figs. 12-16.
Amphicoryne hirsuta (d'Orbigny), Parr, 1950: 328.
Amphicorina hirsuta (d'Orbigny), Barker, 1960: 132.

Though of this species only megalospheric specimens were found in St. 185, it is very probable that it belongs here (see Barker's arguments).

Test beginning with megalospheric proloculus with end spine, followed by one or two "nodosarine" chambers; then the chambers, always globular or slightly pyriform, are separated by necks. End chamber with apertural neck; aperture the open end of the neck, without any trace of a toothplate. Walls of chambers and necks covered by short solid spines.

Snellius St. 185, depth 587 m.

Remarks. — The genus *Amphicoryna* is found in rather to very deep water, and has no cosmopolitic species. *A. scalaris* (Batsch) is found in the Mediterranean Sea and in the Atlantic, possibly also in the Philippines (Brady); *A. intercellularis* (Brady) is found in the Caribbean region; *A. sublineata*, *A. substriatula* and *A. hirsuta* are known from the Pacific.

Planularia australis Chapman (pl. 4 figs. 1, 2)

Planularia australis Chapman, 1941: 158, pl. 9 fig. 1.
Cristellaria tricarinella (non Reuss), Brady, 1884: 540, pl. 68 figs. 3, 4; Cushman, 1921: 230, pl. 50 fig. 3.
Cristellaria tricarinella Reuss, var. *spinipes* Cushman, 1921: 230.

This species occurs in two generations, the one much elongate and mostly with one or more spines at the initial end, the other more oval, without spines. The elongate form is always megalospheric, the oval form is microspheric. In both forms the test is very much compressed, with thickened dorsal truncate carina, but never with the three carinae as found in *C. tricarinella* from the Upper Jurassic. The chambers following the proloculus are never involute, but in the megalospheric elongate form the initial part shows thickened walls, whereas the larger part of the test remains very much compressed with parallel sides; in the microspheric form this initial thickening is not found. Since in the elongate form the later chambers nearly reach the initial spiral, they become very much elongate in the end. Sutures straight or slightly rounded. In the microspheric generation all chambers reach the initial spiral also, but since this spiral is much larger and has more chambers, the later chambers never become so elongate. The test wall is very densely porous with very fine pores, which are lacking in the apertural face and in the dorsal carina. Aperture radial, often on a slightly protruding neck.

Cushman mentions as temperatures at which the species was found 6.8 to 11.6°C. In the Snellius material it was found in St. 91, temp. 15°C; St. 44, temps. 10°C; St. 226, temp. 6°C and St. 283, temp. 7.7°C; it is obvious that this species occurs in relatively high temperatures, in depths from 152 to 576 m (see also Brady).

Frondicularia paucicostata nov. spec. (pl. 5 fig. 3)

Test slender, elongate, compressed. Sutures in between the chambers saddle-shaped. Two elongate costae near the periphery at most of the chamber walls. Aperture radial, at the end of a short apertural neck.

The species seems to be close to *F. complanata* Defrance. Station 59.

Frondicularia boomgaarti nov. spec. (pl. 5 fig. 2)

Frondicularia spec. A, Boomgaart, 1949: 84, pl. 11 fig. 1.

"Test very small, elongate, somewhat compressed and slightly tapering; periphery rounded; seven chambers, inverted V-shaped, broader than high, gradually increasing in size as added; youngest chambers inflated; sutures slightly limbate; wall smooth, transparent; aperture terminal, round, definitely extended 0.40 × 0.14 × 0.10 mm."

The species found in the Snellius stations 59, 283 and 354 measured about 0.60 and 0.90 mm, but the hyaline tests and the inflated chambers are like those of the specimens figured by Boomgaart. It is not *Frondicularia nitida* Terquem, figured by Millett (1902: 525, pl. 11 fig. 19) with its straight sides and non-depressed sutures, which species was described by Brady as *F. spathulata* Brady (1879: 270, pl. 7 fig. 5).

Paradentalina caribbeana Hofker (pl. 5 fig. 1)

Paradentalina caribbeana Hofker, 1976: 91, figs. 89-90.

Test very long and slender, beginning with chambers arranged biserially and strongly overlapping each other, as in a biserial *Polymorphina*; later chambers not so overlapping, more slender and elongate, giving rise to a "*Nodosaria*" or "*Dentalina*" in which, however, the chambers continue in an *Enantiodentalina*-like structure, elongate, biserially placed. The type-species is from the Plio-Pleistocene of Japan, but is much shorter than the specimens found in the Caribbean and in the Pacific from the Recent. The typical biserial arrangement of the earlier chambers strongly suggests that it is allied to *Polymorphina* and not to *Dentalina*, as suggested by Loeblich & Tappan (1964: 533).

Lagena barkeri nov. spec. (pl. 3 fig. 13)

Lagena spec., Barker, 1960: 118, pl. 57 fig. 32.

A small *Lagena* with distinct longitudinal costae in between the fine pores, forming beneath the apertural short neck a smooth thickened wall part with rounded backward indentations.

This species certainly is related to *Lagena* (*Oolina*?) *williamsoni* Alcock; but in the latter species the thickened wall part ending in the longitudinal costae shows a kind of honeycomb structure which in *Lagena barkeri* is missing. As the forming of an internal tube in the specimens found in the Snellius material could not be traced in ricinus-oil, it is better to place it in the genus *Lagena*.

Several specimens in Snellius St. 59.

Bolivina earlandi Parr (pl. 5 fig. 4)

Bolivina punctata Earland (non d'Orbigny), 1934: 132, pl. 6 figs. 5-7.
Bolivina earlandi Parr, 1950: 339, pl. 12 figs. 5-7.

Test slender, elongate, consisting of a large rounded proloculus in the megalospheric form, followed by 8 sets of biserial chambers. Chambers slightly inflated, about twice as long as broad; sutures curved, very oblique.

Wall smooth, hyaline, wholly pierced by fine, densely placed pores. Aperture a narrow slit perpendicular to the basal suture, slightly comma-shaped, with distinct toothplate which is sigmoid at its folded back, with a smooth border of its folded part. Parr denies the presence of this toothplate, though Chapman & Parr (1937: 92) do mention it.

The species was found in two specimens in Snellius St. 59.

Bolivina quadrilatera (Schwager) (pl. 4 figs. 3-7)

Textularia quadrilatera Schwager, 1866: 253, pl. 7 fig. 10.
Bolivina quadrilatera Wright, 1891: 475; Hofker, 1951: 102, figs. 59-62.
Bolivinita quadrilatera (Schwager) Cushman, 1927: 90; Loeblich & Tappan, 1964: 548, fig. 434, 1-3.
Bolivinita granttaylori Vella, 1957: 10; 1957: 33, pl. 8 figs. 157-159 (slender form).

Though I proved in 1951 that this species is a normal *Bolivina* in all its characteristics, and that the Cretaceous forms which were incorporated in the genus *Bolivinita* (of which *B. quatrilatera* is the type-species) cannot belong to the same genus as to which *B. quatrilatera* obviously belongs (Hofker, 1951: 109-111, fig. 64), Loeblich & Tappan (1964: 548) insist to upheld this genus with the following suggestion: "Although regarded as a synonym of *Bolivina* by Hofker, *Bolivinita*, as here understood, has a more restricted geological occurrence, and therefore its retention seems to be useful". This would mean, that many other species with a geological restriction should, only for usefulness, be given generic rank!

Moreover, the figures given by Loeblich & Tappan are somewhat misleading. There are two groups of specimens in the collections of *Bolivina quadrilatera*: one group which shows broad forms (the only group I found south of Sumatra in 1951 and of which microspheric and megalospheric generation were analysed), whereas a second group consists of slender specimens, of which group Cushman (1942: 2, pl. 1) published good figures. Both groups were found in the material of the Snellius Expedition as follows:

St. 354, depth 2706 m, temp. 7.7°C; broad.
St. 92, depth 615 m, temp. 6.8°C; broad.
St. 59, depth 513 m, temp. 7.0°C; broad.
St. 186, depth 1368 m, temp. 3.8°C; broad and slender.
St. 182, depth 857 m, temp. 5.1°C; broad and slender.
St. 117, depth 522 m, temp. 7.2°C; slender.
St. 190, depth 1374 m, temp. 3.6°C; slender.

The figures given by Loeblich & Tappan might lead to the suggestion, that the broad form is the microspheric one, and that the slender form is the megalospheric generation. This is not so: in both groups specimens occur with small proloculus and large proloculus.

The broad form, found and figured in 1951 by the present author, has three generations as may be seen from Hofker, 1951: fig. 59. It came from the Nias Deep, S of Sumatra, depths between 540 and 1440 m. Cushman (1922: 3) found the slender form in depths from 1237 to 3003 m, with temp. 2 to 4°C. As Cushman found these in 7 samples, this might mean that the slender form is found in deeper water with a low temperature, whereas the broad form is more common in slightly shallower water. No specimens of *B. quadrilatera* were found in samples shallower than 513 m, and Cushman found the species abundant at a depth of 2853 m. The broad form seems to be commoner in higher temperature (about 7°C), the slender form in lower temperature (about 5 or 4°C). The mean temperature in which the species is found is about 5°C. The broad form occurs mostly with one spine, whereas the slender form often has more than one initial spine; of both forms specimens without spine occur also.

Remarks. — If the two forms, both with microspheric and megalospheric generations be distinguished as two species, the name given by Vella cannot be used for the slender form, as he did, for just this form was figured by Schwager for his *Textularia quadrilatera*. In both forms the typical toothplates are found, characteristic for this species only, and thus they must be very close; moreover, in several localities they are found together.

Chrysalidinella dimorpha (Brady) (pl. 4 fig. 8)

Chrysalidina dimorpha Brady, 1884: 388, pl. 46 figs. 20, 21.
Chrysalidinella dimorpha (Brady), Schubert, 1908: 242.

In my work on the Foraminifera of the Siboga Expedition (Hofker, 1951: 175, fig. 110) I described a form without apical spines. Loeblich & Tappan (1964: 563, figs. 444, 7, 10) likewise figured specimens without such spines. Yet, the figures given by Brady, one of which is the type-figure of *Chrysalidina dimorpha*, show these apical spines very clearly. So, it may be that the spineless specimens belong to a species different from the type. Cushman (1942: 46, pl. 13 fig. 1) described and figured from the Pacific a species without spines, which he assigned to *C. dimorpha*. It is possible that all spineless specimens belong to a distinct species. Brady's specimens came from Hongkong and from Honolulu and both show the spines. Our specimen, here described and figured also shows these spines and thus is certainly the species described by Brady.

Test elongate, consisting of three sets of triserially arranged chambers each with two distinct spines directed towards the apical end which also shows an end-spine at the proloculus, which has an inner diameter of 40 μ. This part is followed by 10 uniserial chambers which are triangular in shape and show in the older chambers distinct but short spines directed backwards at the angles. Pores distinct, scattered. The end-chamber shows a slightly inflated plate by which it is closed, with rounded openings distinctly larger than the pores in between which some larger somewhat irregular openings are found.

Length of test 1 mm, larger breadth 0.33 mm.

Found in two specimens at St. 59.

Pleurostomella barkeri nov. spec. (pl. 5 fig. 5)

Pleurostomella sp. Barker, 1960: 106.
Pleurostomella alternans Brady, 1884: 412, pl. 51 figs. 22, 23.

The test figured by Brady is a megalospheric specimen, but is not the fossil species *P. alternans* Schwager, as Barker proved. In Snellius St. 226 a microspheric specimen was found, which is figured here. The long, slender specimen, with a length of 0.95 mm, shows a small proloculus, diam. 0.015 mm, and 7½ sets of biserial chambers, gradually increasing in length; the large oval aperture at the proximal side of the last formed chamber shows its taxonomic status. The walls are thin, finely and densely porous. Brady's specimen was from the Kei-Islands, depth 236 m; Cushman mentions *P. alternans* from only one station, east coast of Mindanao, depth 903 m; Snellius St. 226 has a depth of 432 m. It is very probable that *Pleurostomella alternans* Schwager which I found in Snellius St. 88, also belongs here.

Chilostomella Reuss, 1850

Type-species: *Chilostomella ovoidea* Reuss.

Tests fusiform to elongate subcylindrical; early stages, with a small proloculus, may have a slightly triserial chamber arrangement; those with a larger and ovoid proloculus a wholly biserial arrangement of chambers. Chambers strongly overlapping each other, especially at their proximal parts, often largely embracing. Walls in most species very thin, in some thicker and then opaque, calcareous, granular, consisting of fine irregular concentrations of calcareous matter. Pores fine, scattered over the walls, in the centre of rounded to elongate pustules; in large wall parts no other pores. Aperture a narrow curved opening at the ventral end of the last formed chamber, in many species with an, often upturned, slightly thickened rim, but this rim is missing in other species.

Characteristic is the biserial arrangement of the chambers and so are the pores that open solely in pustules distinctly raised on the surface of the walls.

The genus is mostly considered as belonging in the neighbourhood of *Allomorphina*; however, the latter genus shows toothplates at the apertures which are missing here, whereas in *Allomorphina* the pores are densely placed and do not open into pustules. The oval proloculus in megalospheric tests is not found in *Allomorphina* either. But the same scattered pores opening on pustules are found in the genus *Cassigerinella*, which shows tooth-plates, and has a biserial arrangement of the chambers also; the walls of *Cassigerinella* are radial of structure, but this characteristic has no systematic importance on the genus-level (Hofker, 1967).

Chilostomella cushmani Chapman (pl. 5 fig. 6)

Chilostomella cushmani Chapman, 1941: 177, pl. 8 fig. 9, pl. 9 fig. 6.
Chilostomella ovoidea Reuss of authors.

Test ovoid, twice as long as broad, sides fully curved. At dorsal side all chambers visible, last formed chamber covering most of ventral side, leaving only the very top of the former chamber free at one end. Aperture elongate, very narrow and running over one half of the test end, with only very weak rim.

As in *Chilostomella ovoidea* Reuss, the tests are slightly longer than broad and the aperture is much more prominent and more open. As this species is known from the Miocene, it will be better to call all recent specimens with elongate ovoid appearence *C. cushmani* and not *C. ovoidea*, as many authors did.

Chilostomella mediterranensis Cushman & Todd (pl. 5 fig. 7)

Chilostomella mediterranensis Cushman & Todd, 1949: 92, pl. 15 figs. 25, 26.

Tests of medium size, about twice as long as broad, ovoid with strongly curved sides and at both ends more sharply rounded than in *C. cushmani*. Typical is the wide open aperture with distinct well-developed thickened rim, leaving only a very small portion of the former chamber visible at the ventral side.

The species was first described from the Mediterranean, from where I examined material from the Ammontatura, Bay of Naples; moreover, it was very common in a sample off St. Croix, Virgin Islands, Caribbean Sea. Till now, it was not found in the Pacific. Specimens of the Caribbean Sea are placed in the collection of the Leiden Museum of Natural History.

Chilostomella oolina Schwager (pl. 5 fig. 8)

Chilostomella oolina Schwager, 1878: 527, pl. 1 fig. 16; Cushman & Todd, 1949: 91, pl. 15, fig. 23.

Tests elongate, about 3½ to 4 times as long as broad, with strongly rounded ends. Proloculus rounded to slightly elliptical, initial chambers often obliquely situated to the elongate axis of the tests. Last formed chamber at the ventral side ending with its narrow aperture at about 2/3 to 3/4 of the whole length. Test walls very thin, hyaline but granular in structure, smooth and shining, with fine irregular calcareous matter. Pores scattered, especially near the ends of the tests, opening on somewhat irregularly built pustules. Aperture without any trace of a thickened rim.

Though it is possible that Schwager's figure represents this species, the figure given by Cushman & Todd much better shows the form of this species.

Chilostomella grandis Cushman (pl. 5 fig. 9)

Chilostomella grandis Cushman 1917: 662; 1921: 283, pl. 57 fig. 5.

Test very stout, up to 4 mm in length, oviform, with larger breadth at about 2/3 of the test, with strongly rounded proximal ends of the chambers, of which the one last formed overlaps the larger part of the test so that only the suture of this chamber is visible. Aperture at the ventral side a moon-shaped slit with narrow but distinct rim at its border. Wall thick, opaque, with scattered pores opening on indistinct pustules.

Remarks. — The genus *Chilostomella* is known in the Recent from deeper water only. *C. cushmani* was found in the stations 59 (depth 513, temp. 7°C), 185 (depth 587 m, temp. 6.4°C), 226 (depth 432 m, temp. 8°C). *C. cushmani* is a species of median depths and a temperature of about 7°C. *C. mediterranensis* was found in the Caribbean and in the Mediterranean Seas; W of St. Croix (Caribbean) it was found at a depth of 200 m, temp. 12°C, and in the Snellius material in St. 28 (depth 180 m) and St. 19 (depth 250 m, both with temp. 13°C). It is a species which occurs in shallower waters and with the highest temperatures; in the Bay of Naples, Mediterranean, it was com-com at the Amontatura (depth 250 m). *C. oolina* occurred at Snellius stations 178 (depth 2693 m, temp. 3°C), 189 (depth 1829 m, temp. 3.2°C), 190 (depth 1374 m, temp. 3.6°C), 208 (depth 3525 m, temp. 2.7°C), 214 (depth 2969 m, temp. 3°C), 242 (depth 3358 m, temp. 2.5°C), 338 (depth 1842 m, temp. 3°C). This species thus occurs in deeper environments and at a temperature of about 3°C. *C. grandis* was found in Snellius St. 182 (depth 857 m, temp. 5.1°C); Cushman (1921: 286) mentioned it from depths of 470 to 900 m, with temp. about 4.8°C.

In agreement with my conclusion that Foraminifera are more susceptible to temperature than to depth (Hofker, 1972: 92) we find that the four living species of *Chilosomella* are distinctly bound to special temperatures: *C. mediterranensis*, 12-13°C; *C. cushmani*, 6.4-8°C; *C. grandis*, 4.8-5.1°C; *C. oolina*, 2.5-3.2°C.

Ehrenbergina pacifica Cushman (pl. 6 figs. 1-3)

Ehrenbergina pacifica Cushman, 1927 : 27, pl. 14 fig. 14-17.
Ehrenbergina albatrossi Cushman, 1933 : 94, pl. 10 fig. 8.

Two forms occur, often together, in the samples: the one short, thick, often bent to the ventral side, with the apertural face triangular with inflated chambers at the ventral side, and with short spines at each chamber in the later part of the test; the other much more elongate, with a less triangular apertural face and with large, hollow and poreless spines at each chamber. At the dorsal side both forms show the biserially arranged chambers overlapping each other at the dorsal central line, and with numerous fine striae longitudinally, often going over into series of knobs at the more initial part. In both forms the initial part is blunt, since here the biserial chambers form a spiral transversely to the axis of the test, so that the more initial chambers have their dorsal sides at the ventral side of the whole test. At the ventral side the chambers do not overlap at the central line but form with their pronounced shoulders two blunt ridges left and right of the central furrow. The pores are mostly fine, in some cases they become more distinct and more scattered in the last formed chambers. The aperture is a rounded slit with a ventral lip which is partly formed by the toothplate. Longitudinal sections show, that the elongate form with large spines, called by Cushman *E. albatrossi*, is always the microspheric form, whereas the smaller specimens with short spines are always megalospheric. I described these two forms, also with sections, in Siboga Report 3: 281-289, and described the elongate form there as the microspheric one of *E. pacifica*; the large material now at hand leaves no doubt that *E. albatrossi* is the microspheric form of *E. pacifica*.

The species was found in temperatures from 6.2 to 7.2°C.

Aluvigerina schencki (Asano) (pl. 4 fig. 9)

Uvigerina schencki Asano, 1958: 37, pl. 6 figs. 17, 18.

Test elongate and slender, with rounded chambers, the inflation of which is due to the impressed rounded sutures. The aperture of the end-chamber is slightly sunken down in the chamber, and has a distinct neck with loop-like border. On the thin walls very fine elongate striae may be found with the fine pores in between also arranged in elongate lines. In the aperture the toothplate runs down and attaches itself at the border of the former aperture with a distinct wing, thus showing that it belongs to *Aluvigerina*. The neck of the aperture never shows pores. The later chambers seem to tend to biseriality. In the individuals at hand the tests begin with a very large proloculus, whereas in the figures given by Asano the specimens seem to be microspheric with pointed initial end.

Found in several specimens in St. 59.

Lamarckina toddae nov. spec. (pl. 7 fig. 3)

Lamarckina sp. Todd, 1965 : 26, pl. 5 fig. 4.

"A single specimen, here illustrated, was found at Albatros Station H 3789, 687 fathoms, in the Marquesas Islands. Since it appears not to fit any described species, it is left unidentified. Compared with most other specimens in this genus, it is compressed and the dorsal surface is nearly flat and very little arched. The sutures are indistinct, and the umbilicus is broad and deeply depressed".

Of this species I had several specimens from Snellius St. 91, depth 216 m, temp. 15°C. The deep and open umbilical cavity is filled partly by the flat toothplate protruding from the aperture which is an open slit. The dorsal surface is smooth, and it is distinguished by this feature from the other two known recent species, *Lamarckina atlantica* and *Lamarckina scabra*; moreover, it is more slender than these two species. Also the species mentioned by Barker (1960: 188) as *Lamarckina* sp. nov. from Tahiti is not this species, since Brady's specimen shown on pl. 91 fig. 6 is much more rounded, though here too the dorsal side is flattened.

Length 0.40 mm, breadth 0.21 mm, thickness of last formed chamber 0.14 mm, of the more initial part of test 0.08 mm. Test wall thin, yellowish, finely perforate.

Remark. — In the figure given by Todd the protruding toothplate is not shown.

Heronallenia applicata nov. spec. (pl. 7 fig. 4)

Test small, nearly rounded, very much compressed, with flat ventral side and only very slightly convex dorsal one; periphery very slightly lobulate in last formed chamber, margin subacute. At the dorsal side all chambers visible, forming one spiral, with sigmoidally curved sutures of which the middle part is raised by the thickened crenulate suture of the toothplate; sutures bend backward. At the ventral side sutures smooth with the surface, strongly sigmoid, bent backward. Chambers leaving a small umbilical cavity free, about 6 chambers visible. Last formed chamber with a ventral sutural rounded aperture, from which about 4 fine striae radiate toward the periphery; border of aperture serrate at the proximal part, where the toothplate adheres to the aperture, which toothplate can be seen through the hyaline wall; the toothplate is distinctly granular. Test wall very finely porous in between the sutures, only at dorsal side, margin poreless. Wall very hyaline, radial crystalline.

Diameter of test 0.36 mm, thickness of test 0.05 mm.

The species was found in two specimens in Snellius St. 59 (depth 513 m) and in one specimen at St. 283 (depth 576 m). St. 59 is in the Moro Gulf, W of Mindanao, St. 283 is N of Halmaheira. So it seems to be restricted to the NE of the region which was explored by the Snellius Expedition. The species is not mentioned in the Monograph on the family Glabratellidae by Seiglie & Bermúdez (1965). It seems to be most closely allied to *H. lingulata* (Burrows & Holland), but differs from it in the much more sigmoid toothplate-sutures (Hofker, 1970: pl. 32 figs. 21-25) and the more circular form.

Rosalina barkeri nov. spec. (pl. 7 figs. 5, 6)

Rosalina spec. nov., Barker, 1960: 182, pl. 88 fig. 2.

Test small, diameter 0.25-0.45 mm, depending of the generation, rounded, dorsal side strongly convex, dome-like, ventral side flat, periphery slightly lobulate, margin acute. At the dorsal side all chambers visible through the much thickened wall in the centre, at the ventral side the chambers reach the centre with a thickened tenon. At the dorsal side later chambers in the microspheric generation elongate, 5 chambers in a whorl; in the penultimate whorl the chambers are not elongate, with 6-7 chambers in a whorl, with flush sutures rounded backward. In the megalospheric generation, which is much smaller, the dorsal chambers never become elongate in the end. At the ventral side the sutures are somewhat depressed and straight. Umbilicus narrow. Testwall hyaline, smooth, monolamellar, thickened at the end of the tena and in the centre of the dorsal side. Pores at the dorsal side in older chambers restricted to the peripheral parts of the chambers, distinct; this is the case also at the ventral side. In the megalospheric form the tena at the umbilical cavity are not much thickened. Aperture a narrow slit in the middle of the apertural suture. The margin is acute, poreless, forming a slight carina.

The species was found abundantly in St. 59.

Planodiscorbis rarescens (Brady) (pl. 7 fig. 2)

Discorbina rarescens Brady, 1884: 651, pl. 90 figs. 2, 3.

Test up to 1 mm, often smaller. At the dorsal side rounded convex, with 5 chambers visible, reaching the centre smoothly, with smooth sutures rounded backward, fine densely placed pores and a distinct carina formed by each of the chambers, which is poreless and sharp, slightly concave; the last chamber forms 1/3 of the test, and has a proximal rounded suture with the foregoing chamber, then forms in the middle a distinct tenon, proximally of which a narrow slit forms the aperture, not reaching the periphery. The periphery is slightly lobulate, and each chamber forms a broad rounded suture going over into the hyaline carina. The tena of the chambers leave a shallow umbilical cavity free through which the initial chambers are visible. The pores are fine, leaving the tena free.

Found in the Snellius Stations 59 (513 m, temp. 7°C), 85 (1496 m, temp. 6.6°C) and 283 (576 m, temp. 7.7°C). It is nowhere common.

Remark. — The genus is allied to *Rosalina* d'Orbigny and not to *Discorbis* as it lacks any trace of toothplates. However, the type-species of *Rosalina* has fine pores also (see Loeblich & Tappan, 1964: 584, fig. 459, 1) although here a relic protoforamen may be found, which is absent in *Planodiscorbis*. *Planodiscorbis rarescens* was also found around New Zealand, but in this colder climate in depths from 86 to 140 m.

Mississippina Howe, 1930 (pl. 8 figs. 4-6; pl. 9 figs. 1, 2)

Type-species: *Mississippina missouri* Howe, 1930.

Three genera were mentioned by Loeblich & Tappan (1964: 776, 777), *Mississippina* Howe, 1930, *Schlosserina* Hagn, 1954 and *Stomatorbina* Dorreen, 1948. Since they found aragonite in parts of the walls, they placed these genera into the Ceratobuliminidae; as they believed the dark parts in the ventral walls to be openings, apertures, the genera were placed into the subfamily Epistomininae.

Uchio (1952: 195-200) came to the conclusion that *Mississippina concentrica* (Parker & Jones) and *Mississippina missouri* Howe belong to a single genus, *Mississippina*.

The present author (Hofker, 1956: 180-182) came to the conclusion that *Mississippina* and *Stomatorbina* are synonyms, and to the same conclusion came Hornibrook (1961: 114-116).

Hofker (1963: 157-160) found that *Mississippina binkhorsti* (Reuss), known from the late Santonian up into the Danian and the *G. umcinata* zone of the Paleocene, must belong to the same genus as *M. concentrica*. He showed that the finer structure of a primary wall, the inner one, consists of aragonitic material enclosing much fine foreign material (and thus must be considered as being partly agglutinated) and that at the periphery, at the sutures and at the tena this wall is covered by secundary clear fibrous radial calcite. There are no real pores anywhere, and the pores believed to exist in parts of the walls are the ends of fine crystals of the test wall material.

At the ventral side the sutures show a distinct indentation, the protoforamen followed proximally by a large tenon which may continue to the distal peripheral end of the suture. Beneath this tenon is found the slit-like deuteroforamen. From the protoforamen a toothplate runs into the lumen of the chamber connecting it with the deuteroforamen in the septum with the next chamber. In sections this toothplate can be seen as a forking part of the ventral wall, just as is found in true *Discorbis*. These structures of the test without any doubt point to *Discorbis* (or *Discopulvinulina* Hofker), and in the neighbourhood of this genus *Mississippina* has to be placed.

Special attention had to be given to the so-called extra-apertures found in the final tenon of *Schlosserina*; Hagn (1954: 18) believed that *Schlosserina* differs from *Stromatorbina* in having a more complex foraminal system and more clear test material on the dorsal side (the latter characteristic consists mainly in a more or less extensively covering of the test sutures by the fibrous calcite); moreover he writes that the interior of the test is subdivided by secondary septa (by which Hagn obviously means the toothplates occurring in both *Mississippina* and *Stomatorbina*). The genus *Schlosserina* was believed to be very close to *Mississippina*.

Transverse sections revealed that only few of the specimens have these openings in the last formed tenon, but that they are not real openings. They are small pockets formed by the primary wall towards the inner side which do not open into the chamber itself. What the meaning of these pockets is, is not clear, but they seem to be connected with the toothplate; in any case, there are no extra apertures and thus they cannot form a base to separate this species form the genus *Mississippina*; the species, from the Eocene of Bavaria, has to be called *Mississippina asterites* (Gümbel).

In all four species studied here, *M. binkhorsti*, *M. torrei*, *M. concentrica* and *M. asterites*, the "dark peripheral" areas at the ventral side are formed only by the primary wall which appears here at the surface, consisting of agglutinated aragonitic material, which is more soluble than the fibrous calcitic material, which covers the sutures, periphery and tena. It is obvious that some authors considered these dark areas to be real openings, thus giving rise to the belief that they were peripheral ventral extra foramina.

Mississippina concentrica seems to be identical with *Mississippina missouri* so that the correct name of the type-species of *Mississippina* is not *M. missouri* Howe, but *M. concentrica* (Parker & Jones). It is the species which is found in the Eocene up into the Recent, as Hornibrook showed for New Zealand (1961: 116).

When we observe the sections given here of the four species studied, we come to the conclusion that all four belong to the same genus, as the inner structures are practically identical.

Mississippina concentrica (Parker & Jones) occurred in the Snellius material in St. 59 (depth 513 m, temp. 7°C), St. 60 (depth 72 m, temp. about 25°C) and St. 283 (depth 576 m, temp. 7.7°C). West of St. Croix, Virgin Islands, Caribbean Sea, it was common in a depth of 270 m, temp. about 10°C.

Around Mallorca, Mediterranean, it occurred in depth from 95 to 115 m. Cushman had it from off Japan (depth 79 to 108 m, temp. 22°C) and from the Philippines (depth 60 m, temp. 24°C). It seems to be wide-spread in tropical and subtropical environment, mostly in temperate water. *Mississippina binkhorsti* was found in the relatively shallow and tropical sea of the type-Maestrichtian, but also in the somewhat cooler and possibly slightly deeper type-Danian of Denmark. "*Stomatorbina torrei*" (Cushman & Bermúdez) was found from Eocene to Recent in temperate waters of New Zealand (Hornibrook, 1961: 115). "*Schlosserina*" *asterites* (Gümbel) from the Eocene Cementchalk of Häring was found in deeper water but, obviously, in a more or less tropical environment.

We may conclude that the genus *Mississippina* as a whole is typical for tropical to subtropical environment, and occurred and occurs mostly in not too deep water.

Laticarinina Galloway & Wissler, 1927

Type-species: *Pulvinulina repanda* var. *menardii* subvar. *pauperata* Parker & Jones.
Synonym: *Parvicarinina* Finlay, 1940; type-species: *Truncatulina tenuimargo* var. *altocamerata* Heron-Allen & Earland.

There are two species which occur in deeper water in the Recent, viz. *Laticarinina pauperata* (Parker & Jones) and *Laticarinina altocamerata* (Heron-Allen & Earland). *L. pauperata* is found in the Snellius-material in many deeper localities in depths from 522 to 3523 m, with an average temperature of 5.4°C; *L. altocamerata* is much rarer and found in depths from 513-1496 m, with an average temperature of 7°C.

Laticarinina pauperata (Parker & Jones) (pl. 7 fig. 7)

Pulvinulina repanda var. *menardii* subvar. *pauperata* Parker & Jones, 1865: 395, pl. 16 figs. 50, 51.
Pulvinulina pauperata (Parker & Jones), Brady, 1884: 696, pl. 104 figs. 3-11.
Pellatispira pauperata, Cushman, 1927: 176, pl. 6 fig. 13.
Laticarinina pauperata, Wiesner, 1931; Cushman & Todd, 1941: 103, pl. 24 figs. 10-12; 1942: 15, pl. 4 figs. 1-6; Hofker, 1951: 408, figs. 283-285.
Laticarinina crassicarinata Cushman & Todd, 1942: 18, pl. 4 figs. 11, 12.
Laticarinina halophora (Stache), Hornibrook, 1961: 119, pl. 14 figs. 300, 303, 304.

L. pauperata is a rounded to oval depressed species with a broad marginal and mostly thin carina. The carina is of radial structure, each chamber forming a part of it. At the dorsal side the chambers (in outgrown specimens forming two loosely coiled spirals) are seen as oval bulbs without apertural openings; the walls are more or less glassy, with densely placed very fine pores. The broad carina shows more or less distinct sutures running strongly backward and overlapping each other at the rim of the carina; the carina is poreless, thin. In well preserved specimens the carina of the last formed chamber is overlapped at its distal end by a hook-shaped part which is not the carina of the last formed chamber but of the next one, preformed by the protoplasm which obviously streamed out from the last formed chamber, forming a plate with a rounded border ending in the hook and at the margin running backward over the carina of the last formed chamber.

At the ventral side, chambers are more bulbous; they show two openings, at least in the last formed ones: one of these openings, placed at the distal side, forms an elongate slit, the deuteroforamen (all former deuteroforamina are covered by the proximal part of a next chamber and forming the foramina by which the chambers communicate) and the other opening is found at the umbilical ends of the chambers, often with a slightly thickened lip, very narrow and inconspicuous, it is the protoforamen. From that protoforamen the preformed plate with the hook emerges, running over the deuteroforamen which adheres to it with its sides. So, when a next chamber is formed, its ventral part is formed below the plate, whereas its dorsal part is formed dorsally to it; the communication between the two halves of the chamber being formed by the indentation forming the hook. Whereas the porous dorsal and ventral walls of the chambers are radial in structure, the plate, now partly dividing dorsal and ventral parts of them, is more granular in structure, at least within the chambers. All characteristics of the plate are thus those of a real toothplate. Preformed toothplates are a rule in Foraminifera; toothplates are mostly formed before the building of the outer wall of a new chamberwall. Outer parts of toothplates are less common, but they are found in *Lamarckina*, Epistomariidae, *Asterorotalia*, *Asterigerina*, *Lamellodiscorbis*, *Globobulimina*. Here the carina is built by the toothplates of the chambers.

Cushman placed this species among the Cibicidae; I showed in 1951 that this is impossible; Loeblich & Tappan (1964: 580) placed it with the Discorbinae. The monolamellar walls may support this indication. *Neoconorbina*, *Lamellodiscorbis*, *Discopulvinulina*, *Discorbis*, all typical Discorbinae, monolamellar, biforaminal, often possess toothplates or reduced toothplates. So the placing by Loeblich & Tappan seems to be correct.

Remark. — Dr. L. B. Holthuis (Rijksmuseum van Natuurlijke Historie, Leiden) wrote to me that Art. 45 C of the Code of Zool. Nomenclature runs: "Infrasubspecific forms are excluded from the species-group and the provisions of the Code do not apply to them". *Pulvinulina repanda* var. *menardii* subvar. *pauperata* is such an infraspecific form, and thus the name *Laticarinina pauperata* (Parker & Jones) has no nomenclatural value.

However, Finlay (1940: 467) already mentioned that "the well-known and world-wide specific name *pauperata* ("*Pulvinulina repanda* var. *menardii* subvar. *pauperata*" Parker and Jones, 1865) must apparently be replaced. "He pointed out that Stache had described from New Zealand Eocene *Robulina halophora* (Stache, 1864: 248, pl. 23 fig. 28) and thus this must be the name of this species, as it seems identical with the species described by Parker & Jones, as well as with the figures given by Brady as *Pulvinulina pauperata* Parker & Jones (Brady, 1884: 696, pl. 104 figs. 3-11). This proposition was followed by Barker (1960: 214) and by Hornibrook for the species from the Eocene to Recent (Hornibrook, 1961: 119, pl. 14 figs. 300, 303, 304). However, the figures given by Hornibrook show that this Eocene form is slightly different from the Recent one, since the protoforamina in the Eocene form are much more conspicuous than they are in the Recent specimens. Only if it could be established that there is one genus of *Laticarinina* from Eocene to Recent, this name should be given to the Recent specimens also and the nomenclatural puzzle would be solved elegantly. In the collections of the Rijksmuseum, Leiden, all specimens bear the common name *Laticarinina pauperata* (Parker & Jones); this name might be changed into *Laticarinina halophora* (Stache), as Barker did already.

Laticarinina altocamerata (Heron-Allen & Earland) (pl. 8 fig. 1)

Truncatulina tenuimargo Brady var. *alto-camerata* Heron-Allen & Earland, 1922: 9, pl. 8 figs. 24-27.

Parvicarinina altocamerata (Heron-Allen & Earland), Finlay, 1940: 467, pl. 62 figs. 31, 33, 34; Hornibrook, 1961: 118, pl. 14 figs. 296, 299-302, 305.

Laticarinina altocamerata (Heron-Allen & Earland), Loeblich & Tappan, 1964: 580, fig. 457, 4.

Test smaller than in the foregoing species, round, dorsal side with strongly inflated chambers in two whorls with deep sutures rounded backward; periphery slightly lobulate in the last formed chambers, margin with distinct keel but not so broad as in *L. pauperata*, all chambers visible; ventral side flat or slightly concave, only the last whorl of chambers visible, with deuteroforamen somewhat inconspicuous at the margin, and umbilical distinct protoforamina at the ends of elongate prolongations of the chamber walls. On both sides the chambers are separated from each other by the keels (or toothplates) which begin at the protoforamina, run through the chambers leaving the proximal part free, where the dorsal and ventral halves of the chambers communicate, and forming the keels of the chambers. The most distinct difference with *L. pauperata* is found in the distinct protoforamina and the narrow keels. Walls finely porous, hyaline, radial in structure, but toothplates with keels distinctly granular. The ventral umbilical part is closed by irregular secondary chalk growth.

The ventral test structure may be compared with that of *Biapertorbis* Pokorny (1956: 262; protoforamen umbilical, deuteroforamen nearly marginal, filled umbilicus).

Svratkina carinata nov. spec. (pl. 8 fig. 2)

Test small, diameter 0.35 mm, round, lenticular, with acute margin. At the dorsal side all chambers visible, forming about 4 whorls, with sutures rounded strongly backward, finely crenulate; at the ventral side 7 chambers visible which reach the centre, without umbilical cavity, but in the centre concave, due to inflated middle part of chambers. Wall thin, hyaline, monolamellar, structure calcareous radial. Pores fine, somewhat scattered, at dorsal side only near the periphery, at ventral side near the periphery but also near the centre, leaving the middle part of each chamber free. Pores reaching the surface on small pustules. Aperture an elongate slit beginning at the centre of the ventral wall, ending near the periphery, but with a prominent dent or lip, followed at the peripheral side by a distinct open lobe of the aperture and with a smaller dent near the periphery.

This remarkable species seems to be close to *Svratkina australensis*, but with an aperture which resembles that of *Eponidella.* The aperture also shows some resemblance to that of *Alabamina tubulifera* (Heron-Allen & Earland); the latter species may form large pores opening in pustules, but here in later chambers several pores are surrounded by outgrowths of the walls. Typical for our species is the acute margin. It seems that all these species are in a way allied to each other, as well as to *Osangularia venusta* (Brady) with its lip of the aperture and its crenulate dorsal sutures; but in real *Osangularia* the pores do not open on pustules and the aperture is different, whereas pores are restricted to the dorsal side.

The species was found in many specimens in station 59 only.

Gavelinonion glabratum (Cushman) (pl. 8 fig. 3)

Anomalina glabrata Cushman, 1924: 39, pl. 12 figs. 5-7; Todd, 1965: 49.

Test rounded, planispiral, with rounded margin and smooth periphery; diameter 0.80 mm. About 12 chambers visible, with distinct slightly raised sutures rounded backward and smooth shining surface. Walls pierced by distinct, somewhat scattered pores. Chambers themselves not reaching the centre, but here the umbilical cavity is obscured by the distinct tena of the chambers, forming lips as in typical *Gavelinonion.* Below these lips the chamber lumina open into the umbilicus. Aperture a halfmoon-shaped opening at the margin, flanked by the openings of the chamber lips. On horizontal section the septa are simple, but the outer walls may be double by overgrowing extensions from younger chambers. The outer wall of the last formed chamber is simple, so that the species is monolamellar, though thickening of walls may occur secondarily. On transverse section the whole test is planospiral. Found in St. 59, 85, 92, 372.

Remark. — Loeblich & Tappan (1964: 761) believed that *Gavelinonion* is a synonym of *Melonis* de Montfort; however, this latter genus lacks any traces of umbilical lips, a feature typical for *Gavelinella* as well as *Gavelinonion* to those species which show the tendency to a planospiral structure, but with lips at the umbilical cavities. Todd observed, that "Specimens are recognized by their nearly planispiral coiling, evolute on one side and involute with a deep, open umbilicus at the other side. The dense punctation distributed equally on both dorsal and ventral side also serves to distinguish the species". It is not an *Anomalina* as in this genus pores are mostly restricted to one side; moreover, the lips are never found in *Anomalina*.

Ammonia Brünnich, 1772

Type-species: *Nautilus beccarii* Linnaeus.

Macfadyen used (1940: 281-282) the genus-name *Streblus* for the group of species around *Nautilus beccarii* Linné, showing that Fischer de Waldheim (1817: 449) not only designated Linné's species as the type-species for his genus *Streblus*, but also figured it: "*Streblus* (a Streblos, tortuosus, Tab. XIII, f.5 a, magnitudo naturali; b, aucta)" and gave the generic characteristics. So, Fischer de Waldheim's designation satisfied all the Rules of Nomenclature.

It was Davies (1932: 412) who showed for the first time that the genus *Rotalia* in which *Nautilus beccarii* Linné was placed at that time, could not be used for it. Macfadyen showed that when d'Orbigny (1826: 275) brought this species described by Fischer de Waldheim to his genus *Turbinella*, No. 40, d'Orbigny was misled by the word "*tortuosa*", which is the latin translation of the Greek *Streblos* and not a species name, calling it *Turbinella tortuosa* which thus was a mythical species, which fact was already recognized by Sherborn (1893-1896: 380, footnote). See, however, Smout (1954: 45).

Finlay, when discussing a new species of *Streblus*, *S. aoteanus* Finlay, argued that Parr (1940: 461) pointed out to him that *Rotalia beccarii* had to be named *Streblus beccarii*, since the genotype of *Rotalia* was *Rotalia trochidiformis* Lamarck and that the selection of *Streblus* was the most suitable name for species like *Nautilus beccarii* Linné, a selection made by Macfadyen.

Frizzel & Keen (1949: 106-108) pointed out that there was a yet older name available, viz. *Ammonia*, proposed by Brünnich (1772: 246), also with the type species *Nautilus beccarii* Linné, and Winckworth (1945: 116) brought this name in discussion in the Bull. zool. Nomenclature. However, it lasted till 1950 before the Commission gave its opinion (Bull. zoological Nomenclature, 4: 307-315).

Ammonia beccarii was long used as a collective name for many very constant and very different species; the only real *Ammonia beccarii* is the large and flat species found at the beaches of the Adriatic Sea (Lido of Venice, Rimini) and other shallow localities in the Mediterranean and at the beaches of the northern East Atlantic (France, Belgium, Holland, England). All other references to this species have to be regarded with the utmost doubt. So, Schnitker (1974: 217-223) tried to prove that at least 5 species are but ecological varieties of this species. However, the figures given show that they are well-known species of *Ammonia*, but not *Ammonia beccarii*. The species of *Ammonia* are very susceptible to all kinds of circumstances in which they are living (temperature, salinity, depth, etc.) and each species is bound to these circumstances. In the former Zuiderzee (Netherlands) I found that *Ammonia flevensis* (Hofker) occurred in the silty southern part of that sea with low salinities, whereas *Ammonia batavas* (Hofker) was typical for the sandy northern part with higher salinities (Hofker, 1954). The same was observed in the Piscadera Bay, Curaçao, where in the sandy mouth *Ammonia advena* (Cushman) and *Ammonia parkinsoniana* (d'Orbigny) occurred, whereas *Ammonia compactus* (Hofker) was found in the muddy bay itself (Hofker, 1971).

Ammonia catesbyana (d'Orbigny) (pl. 9 fig. 3)

Rosalina catesbyana d'Orbigny, 1839: 99, pl. 4 figs. 22-24.
Streblus catesbyanus (d'Orbigny), Bermúdez, 1952: 72; Hofker, 1964: 93, figs. 232, 235; Hofker, 1971: 21, pl. 66 figs. 6-10, pl. 67 figs. 1, 2.

The most typical characteristics, already discussed by the present author, are lobulate periphery, the open umbilicus surrounded by the pointed ends of the chambers which ends always are covered by fine pustules and the nearly invisible protoforamina at the ventral sutures. The toothplates are distinct running from the protoforamen to the inner border of the deuteroforamen, forming a short septal flap along the ventral inner wall. It is a species of shallow water with temperate to tropical temperature.

The form found in the stations 34 and 60 with 7 or 8 chambers in the last whorl is intermediate between *Ammonia catesbyanus* and *A. tepidus* (Cushman).

Ammonia koeboeensis (LeRoy) (pl. 9 fig. 4)

Rotalia beccarii var. *koeboeensis* LeRoy, 1939: 255, pl. 6 figs. 13-15.

Test compact with thick walls, dorsal and ventral sides equally convex, with about 10 chambers in the last formed whorl; periphery slightly lobulate, margin subacute. Chambers at the dorsal side all visible, with slightly rounded sutures bending strongly backward; at the ventral side sutures distinct, radial, with a slight proximal indentation marking the protoforamen. Umbilicus large, filled by one single calcareous knob flush with the surface. On section the walls are thick, with fine pores, at the dorsal side forming rounded pore fields, at the ventral side leaving large rounded tena free. Toothplates thin, with short flaps along the inner ventral walls. Deuteroforamina half-moon-shaped, as is also the aperture.

In the collections of the Rijksmuseum van Natuurlijke Historie, Leiden, the species is found as *Rotalia* sp. from the localities Pasir Poetih (E. Java), Toeban, Rembang (N. Java) and the south coast of Madoera. It was found by me in Snellius St. 23 and 34. It is a species typical for the surf, which may account for its thick walls. It may be closely allied to *Ammonina beccarii* var. *sobrina* (Shupack).

Ammonia moroensis nov. spec. (pl. 9 fig. 5)

Rotalia beccarii (not Linnaeus), Cushman, 1921: 345, pl. 70 fig. 3.
Rotalia inflata (not Seguenza), Takanayagi, 1955: pl. 2 fig. 18.

Test small, compact, with strongly convex dorsal side and not so convex ventral one. Periphery slightly lobulate in all chambers, margin rounded. At the dorsal side all chambers visible, with straight to rounded slightly depressed sutures running backward and pore fields leaving a small proximal part of the wall free. At the ventral side only the last formed whorl visible; about 8 chambers visible, with distinct rounded protoforamina at the straight radial sutures. The whole umbilical part is filled by chalk knobs which are formed by the poreless tena of the chambers which nearly reach the umbilical centre. These calcareous knobs of the ventral centre are the most conspicuous feature of the test. Transverse sections reveal that the toothplates are rather small and leave a toothplate canal free which forms the umbilical spiral canal. Most of the umbilical cavity is filled up by the knobs of the tena. Pores very fine.

Sofar this is the only known *Ammonia* typical for deeper water; it was found in the Snellius collection in depths from 200 to 615 m, with temperatures in average of 7°C. Cushman found it in many stations of the Philippine region, mostly in deep water also.

Rotalidium Asano, 1936

This genus forms such large protoforamina which are perpendicular to the sutures, that the toothplates divide the umbilical parts of the chambers from the marginal parts so that two separate compartments are formed. The umbilical ventral parts are called the chamberlets and these have apertures which are separated from the main deuteroforamina also. So one of the typical features of the genus is that in the apertural face two apertures are visible, the original deuteroforamina and the foramina of the chamberlets, ventrally placed from the main ones. Loeblich & Tappan (1964: 607) do not separate this genus from *Ammonia*.

In the collections two species can be distinguished.

Rotalidium japonicum (Hada) (pl. 10 fig. 1)

Rotalia japonica Hada, 1931 : 137, fig. 93.

Tests relatively small, round, dorsal and ventral sides equally convex, periphery very slightly lobulate, margin rounded to subacute. At the dorsal side all chambers visible, about 4 whorls of them, in the last formed coil the chambers distinctly elongate, with slightly rounded sutures, slightly impressed, rounded backward, with fine but distinct pores covering the whole wall. At the ventral side the chambers consist of the main chamber and the chamberlet, two fields of pores in the walls indicating them, separated by a poreless region, a prolongation of the distinct and deep protoforamina which are found perpendicularly to the sutures. This poreless region is formed by the suture of the large toothplate with the ventral chamber wall. On transverse section the toothplates are found at the middle of the whole chamber complex and the rounded foramina of the main chambers and chamberlets are seen in each "chamber". The chamberlets nearly completely fill the umbilical hollow.

This beautiful species was found in the Snellius Stations 126 and 85, depths and temperatures resp. 378 m, 9.4°C and 1496 m, 6.6°C.

Rotalidium concinnum (Millett)

Rotalia annectens (Parker & Jones) var. *concinna* Millett, 1904: 505, pl. 10 fig. 7.
Rotalidium concinnum (Millett) Hofker, 1968: 28, pl. 9 figs. 8-17, pl. 10 figs. 1-3.

This species was fully described and figured by the present author (Hofker, 1968). It is found in the collections of the Leiden Museum from Jakarta and from Singora, Gulf of Siam.

Asterorotalia Hofker, 1950

Type-species: *Asterorotalia inflata* (Millett).

In this genus the tena of the chambers are placed umbilically from the protoforamina, and with the sutures at the ventral sides they form a canal, opening towards the margin; thus the protoforamina are not visible from the outside.

Asterorotalia inflata (Millett)

Rotalia schroeteriana Parker & Jones, var. *inflata* Millett, 1904: 504, pl. 10 fig. 5.
Asterorotalia inflata (Millett), Hofker, 1951: 504, fig. 342; 1971: 27, pl. 71 figs. 6-7, pl. 69 figs. 3, 5, 6.

This species was fully described by the present author (Hofker, 1951); it was found at the outer buoy, Deli, Sumatra, depth 34 m.

Asterorotalia pulchella (d'Orbigny)

Rotalia pulchella d'Orbigny, 1839: 92, pl. 5 figs. 16-18.
Rotalia pulchella (d'Orbigny) Hofker, 1927: 37, pl. 12 figs. 1-3.
Rotalia trispinosa Thalman, 1933: 280, pl. 12 figs. 1-3.
Asterorotalia pulchella (d'Orbigny) Hofker, 1951: 505, figs. 343-344; 1968: 27, pl. 8 figs. 1-7; 1971: 25, pl. 69 figs. 1, 2, 4, pl. 70 figs. 1-8, textfig. 32.

This species was fully discussed by the present author (Hofker, 1951, 1971); it was found in the Bay of Jakarta and at Singora, Gulf of Siam, depth 18 m, always in muddy environment.

Asterorotalia annectens (Parker & Jones) (pl. 10 figs. 3, 4)

Rotalia annectens Parker & Jones, 1865: 387, 422, pl. 19 fig. 11; Millett, 1904: 505, pl. 10 fig. 7.
Streblus gaimardi (d'Orbigny) var. *compressiuscula* Barker, 1960: 220.

Test round, dorsal side flattened, ventral side truncate-conical. Periphery slightly lobulate as at the sutures it shows indentations; margin acute, with poreless rim (as in all species of *Asterorotalia*). Dorsally sutures straight and spiral suture with many irregular pustules. At the ventral side visible parts of sutures impressed, largely covered by somewhat irregularly formed plates ending in open slits at about 2/3 of the suture, directed towards the margin. Umbilicus filled with irregular calcareous bossess. Aperture a half-moon-shaped slit at the basal suture of the last formed chamber.

Found at Snellius Station 91, NE Ceram, depth 216 m, and at Sorong, New Guinea, depth 34 m.

Pseudorotalia Reiss & Merling, 1958

Type-species: *Rotalia schroeteriana* Parker & Jones.

In *Pseudorotalia* the toothplates of the chambers form elongate septal flaps which run underneath the ventral radial sutures, giving rise to canals with side-canals opening in the sutures; moreover, there are umbilical canals, the ends of the septal flap canals. The toothplates themselves form a spiral canal in the umbilical cavity.

Pseudorotalia schroeteriana (Parker & Jones)

Rosalia schroeteriana Parker & Jones, in: Carpenter, Parker & Jones, 1862: 212, pl. 4 fig. 3, pl. 13 figs. 7-9; Hofker, 1927: 39, pl. 18 fig. 19, pl. 21 figs. 1, 2, 7, 11, 13.
Pseudorotalia schroeteriana (Parker & Jones), Reiss & Merling, 1958: 13, pl. 1 figs. 15-17, pl. 2 fig. 1; Hofker, 1971: 31, pl. 75, pl. 74 fig. 1-11; 1968: 30, pl. 10 figs. 4-18.

The species is sufficiently analysed by the present author. I examined material from the Bay of Jakarta, the outer buoy, Deli, Sumatra and Singora, Gulf of Siam.

Pseudorotalia catilliformis (Thalmann) (pl. 10 fig. 2)

Rotalia catilliformis Thalmann, 1934: 437, pl. 11 figs. 1-3.

Test lenticular, with slightly lobulate periphery and strongly rounded margin. At the dorsal side all chambers visible, chambers rounded, with many pustules at the radial and spiral sutures. At the ventral side sutures straight, slightly impressed, with a row of about 9 toothplate-openings and an umbilicus filled with calcareous matter pierced by toothplate canals. The species very much resembles the microspheric form of *P. schroeteriana*, but the megalospheric specimens have the lenticular form also.

It was common in the material from China Sea, North Borneo, depth about 70 m.

Polystomelloides discorbinoides Yabe & Hanzawa (pl. 10 fig. 5)

Polystomella (Polystomelloides) discorbinoides Yabe & Hanzawa, 1923: 99.

Material was send to the author by Dr. Uchio, one specimen from the type-locality, several more from a sea cliff facing Mano Bay, Sawane-machi, Sado-gun, Niigata-ken, Japan, Sawane-Formation, Late Pliocene. In St. 59, depth 513 m, many specimens were found.

In my paper on Notorotaliinae, 1969, I wrote: "*Polystomellina* has a trochoidal form resembling *Elphidium* in many repects", and "I consider that neither *Parrellina* nor *Notorotalia*, which obviously belong together, have much in common with *Faujasina* or *Polystomellina*". This in respect to the placing by Loeblich & Tappan (1964: 642) of *Notorotalia* in the synonymy with *Polystomellina.*

The tests of *Polystomellina* show a convex side in which the chambers of the last formed whorl do not reach the centre and in a clarifier the initial coils may be seen here through the thickened hyaline central part; the other side is flat with the chambers reaching the centre so that no former coils are visible. The periphery is round, smooth and the margin is acute. At the dorsal side the last formed whorl consists of 9 to 12 chambers with slightly depressed sutures curving backward; at the flat ventral side, the sutures are depressed and are strongly curved. At both sides the sutures are overlapped by poreless hyaline and massive bridges between which deep furrows resemble the sutural toothplate-foramina found in between the retral processes in *Elphidium*; but these grooves do not penetrate into the chambers. On transverse section the chamber walls of the flat side overlap those of former chambers and the umbilicus is not formed, but between these wall-parts in the centre and those of a former coil narrow cavities are formed which are closed by the folding toothplates which are distinctly granular in structure. At the dorsal side the chamber walls of later chambers do not overlap the centre but leave part of the walls of former whorls free; here too tiny toothplates may be seen and the walls in the centre are distinctly thickened in the initial whorls. There is no trace of any kind of septal flaps running underneath the sutures as they are found in *Notorotalia, Parellina* or *Elphidium*. The toothplate-structure thus is that found in *Nonion* and in some primitive species of *Elphidiononion*, whereas in the asymmetrical *Faujasina*, an asymmetrical *Elphidium*, there are sutural septal flaps.

Transverse tangential sections reveal that the structure of the test at the sutures is identical with that found in *Elphidiononion*, and that underneath the bridges formed the canal is build by the chamberwalls themselves, bending in to form the grooves, and not by a septal canal within the chamber lumen.

So *Polystomellina* is not allied to *Notorotalia*, nor to *Elphidium*, but is an asymmetrically formed *Elphidiononion*. This conclusion is strengthened by the apertural conditions, as the aperture is formed by a small row of sutural rounded openings and by several areal rounded openings in the septum. Walls and septa are monolamellar. The outer walls are characterised by a multitude of fine pores, in between which are found small pustules all over the walls; in connection with the primitive state of the toothplates there are no toothplate canals in the sutures, nor are there canals running from a spiral canal through the umbilical parts of the chamber walls, as was found in *Elphidium* and in *Notorotalia*. So it is impossible that *Notorotalia* is a synonym with *Polystomellina*, as Loeblich & Tappan (1964: 642) believed.

REFERENCES

ALBANI, A. D., 1968. Recent Foraminifera from Port Hacking, New South Wales. — Contr. Cushman Found. For. Res., 19 (3) : 85-119.

Asano, K., 1956. The Foraminifera from the adjacent seas of Japan, collected by S.S. Soyo-Maru, 1922-1930. Pt. 1, Nodosariidae. — Sci. Repts. Tohoku Univ., Sendai, Japan, (2) (Geol) 27: 1-55.

——, 1958. Idem. pt. 4, Buliminidae. — Ibid., 29: 1-41.

Barker, R. W., 1960. Taxonomic notes on the species figured by H. B. Brady in the Report on the Foraminifera dredged by HMS. Challenger. — Soc. Econ. Paleont. and Mineral., spec. publ., 9; i-xiii, 2-240.

Batsch, A. J. G. L., 1791. Sechs Kupfertafeln mit Conchilien des Seesandes, gezeichnet etc. (Jena).

Bermúdez, P. J., 1952. Estudio systematico de los Foraminiferos rotaliformes. — Venezuel. Minist. Minas hidrocarb., Bull. Geol., 2 (4): 1-230.

Boomgaart, L., 1949. Smaller Foraminifera from Bodjonegoro (Java): 1-175. (Thesis, Utrecht).

Boltowskoy, E. & R. Wright, 1976. Recent Foraminifera: 1-515. (Junk, The Hague).

Brady, H. B., 1879. Notes on some of the reticularian Rhizopoda of the Challenger Expedition; 2, Additions to the knowledge of porcellaneous and hyaline types. — Quart. Journ. Micro. Sci., (n.s.) 19: 261-299.

——, 1884. Report on the Foraminifera dredged by HMS Challenger during the years 1873-1876. — Zool., 9: 1-814.

Brünnich, M. T., 1772. Zoologiae fundamenta: 1-253.

Buchner, P., 1940. Die Lagenen des Golfes von Neapel und der marinen Ablagerungen auf Ischia. — Nova Acta Leopoldina, (n. ser.) 9 (62): 363-560.

Carpenter, W. B., 1883. On an abyssal type of the genus Orbitolites. — Trans. Roy. Soc. London: 531-573.

Carpenter, W. B., W. K. Parker & T. R. Jones, 1862. Introduction to the study of the Foraminifera. — Ray Soc. Publ.: 1-319.

Chapman, F., 1941. Report on foraminiferal sounding and dredgings of the F.I.S. "Endeavour" along the continental shelf of the south-east coast of Australia. — Trans. Roy. Soc. South Australia, 65 (2): 145-211.

Chapman, F. & W. J. Parr, 1937. Foraminifera of the Australasian Antarctic Expedition 1911-1914. — Sci. Repts., Australas. Ant. Exped., (C, Zool. & Bot.) 1, (2): 1-190.

Cushman, J. A., 1910. New arenaceous Foraminifera from the Philippine Islands. — Proc. U.S. Nat. Mus., 42: 227-230.

——, 1911. A Monograph of the Foraminifera of the North Pacific Ocean; pt. 2, Textulariidae. — U.S. Nat. Mus., Bull., 71 (2): 1-108.

——, 1913. New Textulariidae and other arenaceous Foraminifera from the Philippine Islands and contiguous waters. — U.S. Nat. Mus., Proc., 44: 633-638.

——, 1917. New species and varieties of Foraminifera from the Philippines and adjacent waters. — U.S. Nat. Mus., Proc., 51: 651-662.

——, 1921. Foraminifera of the Philippines and adjacent seas. — U.S. Nat. Mus., Bull., 100 (4): 1-488.

——, 1922. Shallow water Foraminifera from Tortugas region. — Carnegie Inst. Washington, Publ., 311: 1-85.

——, 1924. Samoan Foraminifera. — Ibid., Publ., 342: 1-75.

——, 1927. American Upper Cretaceous species of Bolivina and related species. — Cushman Lab. For. Res., Contr., 2 (4): 85-91.

——, 1927a. Recent Foraminifera from the west coast of America. — Univ. California, Scripps Inst. Oceanogr., Bull. (techn. ser.) 1: 119-188.

——, 1932. The Foraminifera of the tropical pacific collections of the "Albatross" 1899-1900, pt. 1, Astrorhizidae to Trochamminidae. — U.S. Nat. Mus., Bull., 161: 1-84.

——, 1933. Some new recent Foraminifera from the Tropical Pacific. — Cushman Lab. For. Res., Contr., 9 (4): 77-95.

——, 1942. The Foraminifera of the tropical pacific collections of the "Albatross" 1899-1900, pt. 3, Heterohelicidae and Buliminidae: 1-66.

CUSHMAN, J. A., 1946. The genus Sigmoilina and its species. — Cushman Lab. For. Res., Contr., 22 (2): 29-45.

——, 1946. The genus Hauerina and its species. — Cushman Lab. For. Res., Contr., 22: 2-15.

CUSHMAN, J. A. & S. HANZAWA, 1936. New genera and species of Foraminifera of the Late Tertiary of the Pacific. — Cushman Lab. For. Res., Contr., 12 (2): 45-48.

CUSHMAN, J. A. & R. TODD, 1941. The structure and development of Laticarinina pauperata (Parker & Jones). — Cushman Lab. For. Res., Contr., 17 (4): 103-105.

——, 1942. The recent species of Laticarinina. — Ibid., 18 (1): 14-20.

——, 1949. Species of the genus Chilostomella and related genera. — Ibid., 25 (4): 84-99.

DAVIES, L. M., 1932. The genera Dictyoconoides Nuttal, Lockhartia nov. and Rotalia Lamarck; their type species, generic differences, and fundamental distinction from the Dictyoconus group of forms. — Roy. Soc. Edinburgh, Trans., 56 (2) (20): 485-505.

EADE, J. V., 1967. A checklist of Recent New Zealand Foraminifera. — New Zealand Departm. Sci. and Industr. Res., Bull., 182: 9-70.

EARLAND, G. A., 1934. Foraminifera, pt. III, the Falkland sector of the Antarctic (excluding South Georgia). — Discovery Reports, 7 (27): 138.

FINLAY, C., 1939. New Zealand Foraminifera: Key species in stratigraphy, No. 3. — Trans. Roy. Soc. New Zealand, 69 (3): 309-329.

——, 1940. New Zealand Foraminifera, Idem, No. 4. — Ibid., 69 (4): 448-472.

FISCHER DE WALDHEIM, 1817. Adversaria zoologica. — Soc. Impér. Nat. Moscou, Mém., 5: 375-471.

——, 1819. Adversaria zoologica, 2: 1-114. (Moscou).

FLINT, J. M., 1897. Recent Foraminifera. — Rep. U.S. Nat. Mus., 1897: 249-349.

FRIZZEL, D. L. & A. M. KEEN, 1949. On the nomenclature and generic position of Nautilus beccarii Linné (Foraminifera, "Rotaliidae"). — Journ. Paleont., 23: 106-108.

GRAHAM, J. J. & P. J. MILITANTE, 1959. Recent Foraminifera from the Puerto Galera area, northern Mindoro, Philippines. — Stanford Univ. Publ. Geol. Sci., 6 (2): 1-170.

HADA, Y., 1931. Report of the biological survey of Mutsu Bay. No. 19. Notes on the recent Foraminifera from Mutsu Bay. — Tokohu Imp. Univ., Sci. Repts., (4) 6 (1): 45-148.

HAGN, E., 1954. Some Eocene Foraminifera from the Bavarian Alps and adjacent areas. — Contr. Cushman Found. For. Res., 5 (1): 14-20.

HERON-ALLEN, E. & A. EARLAND, 1922. Protozoa, pt. 2, Foraminifera. — British Antarctic ("Terra nova") Exped., 1910, (Zool.) 6 (2): 25-268.

HOFKER, J., 1927. The Foraminifera of the Siboga Exped. Tinoporidae, Rotaliidae, Nummulitidae, Amphisteginidae. — Siboga Exped., Mon., 4 (a) (1): 1-78.

——, 1928. On Faujasina d'Orbigny. — Cushman Lab. For. Res., Contr., 4: 80-83.

——, 1930. The Foraminifera of the Siboga Exped. Families Astrorhizidae, Rhizamminidae, Reophacidae, Anomalinidae, Peneroplidae. — Siboga Exped., Mon., 4 (a) (2): 79-170.

——, 1930. Notizen über die Foraminiferen des Golfes von Neapel, I. Spiroplectammina sagittula (Defrance) und Quinqueloculina annectens (Schlumberger). — Pubbl. Staz. Zool. Napoli, 10 (3): 365-406.

——, 1930. Foraminifera. — Zool. of the Faroës, 2 (a): 1-21.

——, 1932. Notizen über die Foraminiferen des Golfes von Neapel, III. Die Foraminiferen der Amontatura. — Pubbl. Staz. Zool. Napoli, 12: 61-144.

——, 1933. Foraminifera of the Malay Archipelago. — Vidensk. Medd. Dansk Naturh. Foren., 93: 71-167.

——, 1951. Recent Peneroplidae, pt. 1, continued. — Journ. Roy. Microsc. Soc., 71 (13): 223-239.

——, 1951. The toothplate-Foraminifera. — Archiv. Néerlandaises Zool., 8: 235-372.

HOFKER, J., 1951. Foraminifera of the Siboga Exped. Foraminifera dentata. — Siboga Exped. Mon., 4(a) (3) : 1-513.

——, 1954. Foraminifera. — Veranderingen in de flora en fauna der Zuiderzee. (thans IJselmeer) na afsluiting in 1932: 74-89.

——, 1956. Foraminifera dentata, Foraminifera of Santa Cruz and Thatch Island, Virginia Archipelago, West-Indies. — Spolia Zool. Mus. Haun., 15: 1-237.

——, 1959. Les Foraminifères des craies tuffoides de Charente et Dordogne de l'Aquitaine, France du Sud-Ouest. — Comptes rendus Congr. Soc. Savantes, Paris: 252-368.

——, 1963. The finer structure of Mississippina binkhorsti (Reuss, 1862) and its bearing on the taxonomic position of Mississippina. — Natuurhist. Maandblad, Limburg, 52: 157-160.

——, 1964. Foraminifera from the tidal zone in the Netherlands Antilles and other Westindian islands. — Studies Fauna Curaçao and other Caribbean Islands, 21 : 1-119.

——, 1967. Hat die feinere Wandstruktur der Foraminiferen supragenetische Bedeutung? — Palaeont. Zeitschr., 41 : 194-198.

——, 1968. Foraminifera from the Bay of Jakarta, Java. — Bijdragen tot de Dierkunde, 37: 11-59.

——, 1969. Recent Foraminifera from Barbados. — Studies Fauna Curaçao and other Caribbean Islands, 35: 1-62.

——, 1969. An analysis of the subfamily Notorotaliinae (Foraminifera) Hornibrook, 1961. — New Zealand Journ. Geol. Geophys., 12: 460-483.

——, 1970. Studies of Foraminifera, pt. 2. — Publ. Natuurhist. Genootschap Limburg, 20 (1, 2) : 1-101.

——, 1971. The Foraminifera of Piscadera Bay, Curaçao. — Studies Fauna Curaçao and other Caribbean Islands, 35: 1-62.

——, 1971. Studies of Foraminifera. pt. 3. Sytematic problems. — Publ. Natuurhist. Genootschap, Limburg, 21 : 1-202.

——, 1972. Primitive agglutinated Foraminifera: 1-95. (Brill, Leiden).

——, 1976. Further studies on Caribbean Foraminifera. — Studies Fauna Curaçao and other Caribbean Islands, 49: 1-256.

HOFKER, J. Jr., 1969. On the internal structure of recent planktonic Foraminifera. — Proc. first internat. conference plankt. microfossils, Geneva, 2: 253-278.

HORNIBROOK, N. DE B., 1961. Tertiary Foraminifera from Oamaru District (N.Z.), I. Systematics and distribution. — New Zealand geological Survey, Paleont. Bull., 34 (1) : 1-192.

KARRER, F., 1868. Die Miocene Foraminiferen von Kostej in Banat. — Sitzber. Akad. Wiss. Wien, 58: 111-193.

LOEBLICH, A. R. & H. TAPPAN, 1964. Sarcodina, chiefly "Thecamoebians" and Foraminifera. — Treatise on invertebrate Paleontology, (C, Protista) 2 (1) (2): 1-900.

LEROY, L. W., 1939. Some small Foraminifera, Ostracoda and Otoliths from the Neogene ("Miocene") of the Rokan-Tapanoeli area, Central Sumatra. — Natuurk. Tijdschr. Ned. Indië, 99: 215-296.

MACFADYEN, W. A., 1940. Foraminifera in Boulder Clays from the Wellford Coast of Ireland (with a note on the generic name Streblus Fischer). — Geol. Mag., 77 (4): 276-282.

MILLETT, F. W., 1898. — Report on the Recent Foraminifera of the Malay Archipelago collected by Mr. A. Durand, pt. 3. — Journ. Roy. Microsc. Soc., 1898: 607-614.

——, 1899. Idem, pt. 6. — Ibid., 1899: 556-564.

——, 1900. Idem, pt. 8. — Ibid., 1900: 272-281.

——, 1902. Idem, pt. 13. — Ibid., 1902: 509-528.

——, 1904. Idem, pt. 16. — Ibid., 1904: 489-506.

MOLENGRAAF, G. A. F., 1921. Modern deep-sea research in the East Indies Archipelago. — Geogr. Journ., 57: 95-118.

MONTFORT, D. DE, 1808. Conchyliologie systématique et classification méthodique des coquilles, 1 : 1-lxxxvii, 1-409.

MUNIER-CHALMAS, E., 1902. Sur les Foraminifères rapportés au groupe des Orbitolites. — Soc. géol. France, Bull., (4) 2 : 351-353.

NÖRVANG, A., 1945. The zoology of Iceland, Foraminifera, 2 : 1-79.

ORBIGNY, A. D', 1826. Tableau méthodique de la classe des Céphalopodes. — Ann. Sci. Nat. Paris, (1) 7 : 245-314. Atlas.

——, 1839. Foraminifères. In: R. DE LA SAGRA, Histoire physique, politique et naturelle de l'ile de Cuba, 48 : 1-224.

PARKER, F. L., 1962. Planktonic foraminiferal species in Pacific sediments. — Micropaleont., 8 : 219-254.

PARKER, W. L. & T. R. JONES, 1865. On some Foraminifera from the North Atlantic and Pacific Oceans, including Davis Straits and Baffin's Bay. — Phil. Trans., 155 : 325-441.

PARKER, W. L., T. R. JONES & H. B. BRADY, 1871. The species founded upon the figures in Soldani's Testaceographia ac Zoophytographia. — Ann. Mag. Nat. Hist., (4) 8 : 145-179.

PARR, W. J., 1950. Foraminifera. — B.A.N.Z. Antarctic Research Exped., 1929-1931, Repts., 5 (6) : 233-392.

PHLEGER, F. B. & F. L. PARKER, 1951. Ecology of Foraminifera, Northwest Gulf of Mexico. Pt. 2, Foraminifera species. — Geol. Soc. of America, 46 : i-iv, 1-64.

POKORNY, V., 1956. New Discorbidae (Foraminifera) from the Upper Eocene Brown Pouzdrany Marl, Czechoslowakia. — Univ. Carolina, Geol., 2 (3) : 257-278.

REISS, Z & P. MERLING, 1958. Structure of some Rotaliidae. — Israël geol. Survey, Bull., 21 : 1-19.

REUSS, A. E., 1866. Die Foraminiferen, Anthozoa und Bryozoa des deutschen Septarientons. — Denkschr. Akad. Wiss. Wien, 25 : 117-214.

RHUMBLER, L., 1911. Die Foraminiferen der Plankton Expedition, I. Die allgemeinen Organitionsverhältnisse der Foraminiferen. — Ergebnisse Plankton-Exp. Humboldt Stiftung, 3 (C) : 1-331.

——, 1913. Idem, II Systematik: Arrhabdammidia, Arammodiscidia und Arnodosammidia. — Ibid., 3 (C) : 332-476.

SCHNITKER, D., 1974. Ecotypic variations in Ammonia beccarii (Linné). — Journ. Foram. Res., 4 (4) : 217-223.

SCHWAGER, C., 1866. Fossile Foraminiferen von Kar-Nicobar. — Novarra Exped., Geol., 2 : 187-268.

SEIGLIE, G. A. & P. J. BERMÚDEZ, 1965. Monografia de la familia de Foraminiferos Glabratellidae. — Geos, Caracas, 12 : 15-65.

SELLI, R. 1947. Sopra alcune Dimorphinae. — Atti Soc. Ital. Sci. Nat., 86 : 127-234.

SHERBORN, C. D., 1893. An index to the genera and species of the Foraminifera. — Smithsonian miscel. Coll., 132 : i-viii, 1-485.

SMOUT, H., 1954. Lower Tertiary Foraminifera of the Qatar Peninsula: i-ix, 1-96. (Brit. Mus. (Nat. Hist.), London).

TAKAYANAGI, Y., 1955. Recent Foraminifera from Matsukawa-Ura and its vicinity. — Contr. Instit. Geol. Pal. Tohoku Univ., 45 : 18-52.

THALMANN, H. E., 1933. Zwei neue Vertreter der Foraminiferen-Gattung Rotalia Lamarck 1804, R. cubana nom. nov. und R. trispinosa nom. nov. — Ecl. geol. Helv., 26 : 248-251.

——, 1934. Mitteilungen über Foraminiferen, I. — Ecl.geol. Helv., 27 (2) : 428-440.

——, 1960. An index to the genera and species of the Foraminifera 1890-1950. — G. Vanderbilt Found., Stanford Univ., Calif.: 1-393.

TODD, R., 1965. The Foraminifera of the tropical Pacific collections of the "Albatross" 1899-1900, pt. 4. Rotaliform families and planktonic families. — U.S. Nat. Mus., Bull., 161 (4) : 1-139.

UCHIO, T., 1951. An interesting relation between Stomatorbina Dorreen, 1948 and Mississippina Howe, 1930, Foraminifera. — Paleont. Soc. Japan, Trans. and Proc., (n. ser.) 7: 195-200.

VELLA, P., 1957. Studies in New Zealand Foraminifera, I. Foraminifera from Cook Strait, New Zealand. — Geol. Survey, Paleont. Bull., 28: 7-41.

WIESNER, H., 1931. Die Foraminiferen der deutschen Südpolar Exped. 1901-1903. — D. Südp. Exped. Drygalski, 20 (Zool. 12): 53-185.

WINCKWORTH, R., 1945. On the generic names published by Brünnich, 1772, Zoologiae Fundamenta. — Bull. Zool. Nomenclature, 1 (5): 113-116.

WRIGHT, J., 1891. Report on the Foraminifera obtained off the SW of Ireland during the cruise of the "Flying Falcon", 1888. — Roy. Irish Acad., Proc., (3) 1 (4): 460-502.

YABE, H. & S. HANZAWA, 1923. Foraminifera from the Natsukawa limestone, with a note on a new genus of Polystomella. — Japan Journ. Geol. Geogr., Trans. & Abstr., 2: 95-100.

PL. 1

Fig. 1. *Lagenammina pacifica* nov. spec., St. 92; × 33. Fig. 2. *Loeblichopsis spiculifer* nov. spec., St. 187; × 12. Fig. 3. *Textularia barkeri* nov. spec., Sorong, 34 m; × 33; section × 66. Fig. 4. *Valvotextularia milletti* (Cushman), St. 117; microspheric and megalospheric specimens × 33; longitudinal section microspheric × 33; tangential section with the pores in the side walls, × 66. Fig. 5. *Spirorutilus kreuzbergi* (Finlay), St. 59; × 66. Fig. 6. *Spirorutilus denticulatus* nov. spec., St. 59; microspheric and megalospheric specimens × 33; initial parts enlarged × 66. Fig. 7. *Bolivinopsis bulbosa* (Cushman), St. 59; microspheric and megalospheric specimens, × 66. Fig. 8. *Valvobifarina ryukyuensis* (Cushman & Hanzawa), St. 59; × 66, with aperture. Fig. 9. *Valvobifarina mackinnoni* (Millett), St. 50; microspheric specimen × 66, with aperture. Fig. 10. *Cornuloculina pacifica* nov. spec., St. 59; microspheric young specimen × 66.

PL. 2

Fig. 1-3. *Cornuloculina pacifica* nov. spec. 1, St. 123; microspheric specimens with many complex chambers × 33. 2, St. 59; microspheric specimen with in the last formed chamber one secondary septum formed already × 33. 3, St. 59; probably adult megalospheric specimen × 33. Figs. 4-6. *Hauerina fragilissima* Brady. 4, St. 59; microspheric × 33. 5, Idem; both in visual section. 6, Idem; megalospheric specimen, same locality, × 33. Fig. 7. *Dendritina (Spirolina) acicularia* (Batsch), St. 34; specimen and total sections × 33; section of test wall × 200; section of initial part × 66. Fig. 8. *Massilina* (not *Hauerina*) *speciosa* (Karrer), St. 59; × 66, with visual section.

PL. 3

Figs. 1, 2. *Sigmoilina carinata* nov. spec., St. 59. 1, total specimen × 33; section × 66; microspheric specimen. 2, megalospheric specimen enlargements idem. Figs. 3-8. *Dimorphina peregrina* (Schwager). 3, 4, two specimens, St. 185; visual section × 66. 5, 6, two specimens, off St. Croix, Caribbean Sea, with uncoiling chambers; visual sections, × 66. 7, St. 185; × 33. 8, St. 92; specimen with abnormal end chamber; × 66. Fig. 9. *Nodosaria inflexa* Reuss, St. 269; × 33. Fig. 10. *Amphicoryna substriatula* (Cushman), St. 185; microspheric and megalospheric specimens × 33. Fig. 11. *Amphicoryna sublineata* (Brady), St. 92; microspheric and megalospheric specimens; × 33. Fig. 12. *Amphicoryna hirsuta* (d'Orbigny), St. 226, 283, 59; × 33. Fig. 13. *Lagena barkeri* nov. spec., St. 59; × 66.

PL. 4

Figs. 1, 2. *Planulina australis* Chapman, St. 226. 1, megalospheric; × 33. 2, microspheric; × 33. Figs. 3-7. *Bolivina quadrilatera* (Schwager). 3, St. 182; slender form, megalospheric × 66. 4, St. 59; slender form, microspheric × 66. 5, St. 182; broad form, megalospheric × 66. 6, St. 182; broad form, microspheric × 66 (all with the peculiar toothplates). 7, St. 182; slender form, apertural face × 66. Fig. 8. *Chrysalidinella dimorpha* (Brady), St. 59; × 66. Fig. 9. *Aluvigerina schencki* (Asano), St. 59; × 66.

PL. 5

Fig. 1. *Paradentalina caribbeana* Hofker, St. 185; × 66. Fig. 2. *Frondicularia boomgaarti* nov. spec., St. 59; × 66. Fig. 3. *Frondicularia pauciloculata* nov. spec., St. 59; × 66. Fig. 4. *Bolivina carlandi* Parr, St. 59; × 66; with the toothplates. Fig. 5. *Pleurostomella barkeri* nov. spec., St. 226; × 66. Fig. 6. *Chilostomella cushmani* Chapman, St. 226; × 66; wall part with pores × 200. Fig. 7. *Chilostomella mediterranensis* Cushman, off St. Croix, depth 300 m, × 66; wall part with pores × 200. Fig. 8. *Chilostomella oolina* (Schwager), St. 190; × 66, wall part × 200. Fig. 9. *Chilostomella grandis* Cushman, St. 182; × 33.

PL. 6

Figs. 1-3. *Ehrenbergina pacifica* Cushman, St. 269. 1, microspheric specimen known as *E. albatrossi* Cushman; × 33; spines, seen in ricinus-oil, × 200. 2, × 66, with longitudinal section × 83. 3, megalospheric specimen, with section with toothplates, × 66. Figs. 4-6. *Vagocibicides maorius* Finlay, St. 85. 4, microspheric specimen × 33. 5, megalospheric specimen × 33. 6, longitudinal section through megalospheric specimen × 66.

PL. 7

Fig. 1. *Cibicides refulgens* Montfort, St. 59; × 66. Fig. 2. *Planodiscorbis rarescens* (Brady), St. 59; × 66. Fig. 3. *Lamarckina toddae* nov. spec., St. 91; ×66. Fig. 4. *Heronallenia applicata* nov. spec., St. 59; whole individual × 66; region at the aperture × 200; visual section showing the connection between aperture and granular toothplate × 200. Figs. 5, 6. *Rosalina barkeri* nov. spec., St. 59. 5, megalospheric specimen × 66. 6, microspheric specimen × 66. Fig. 7. *Laticarinina pauperata* (Parker & Jones), St. 338; ventral side with protoforamina, toothplate forming carina and the deuteroforamen, × 33; dorsal side without foramina, × 33.

PL. 8

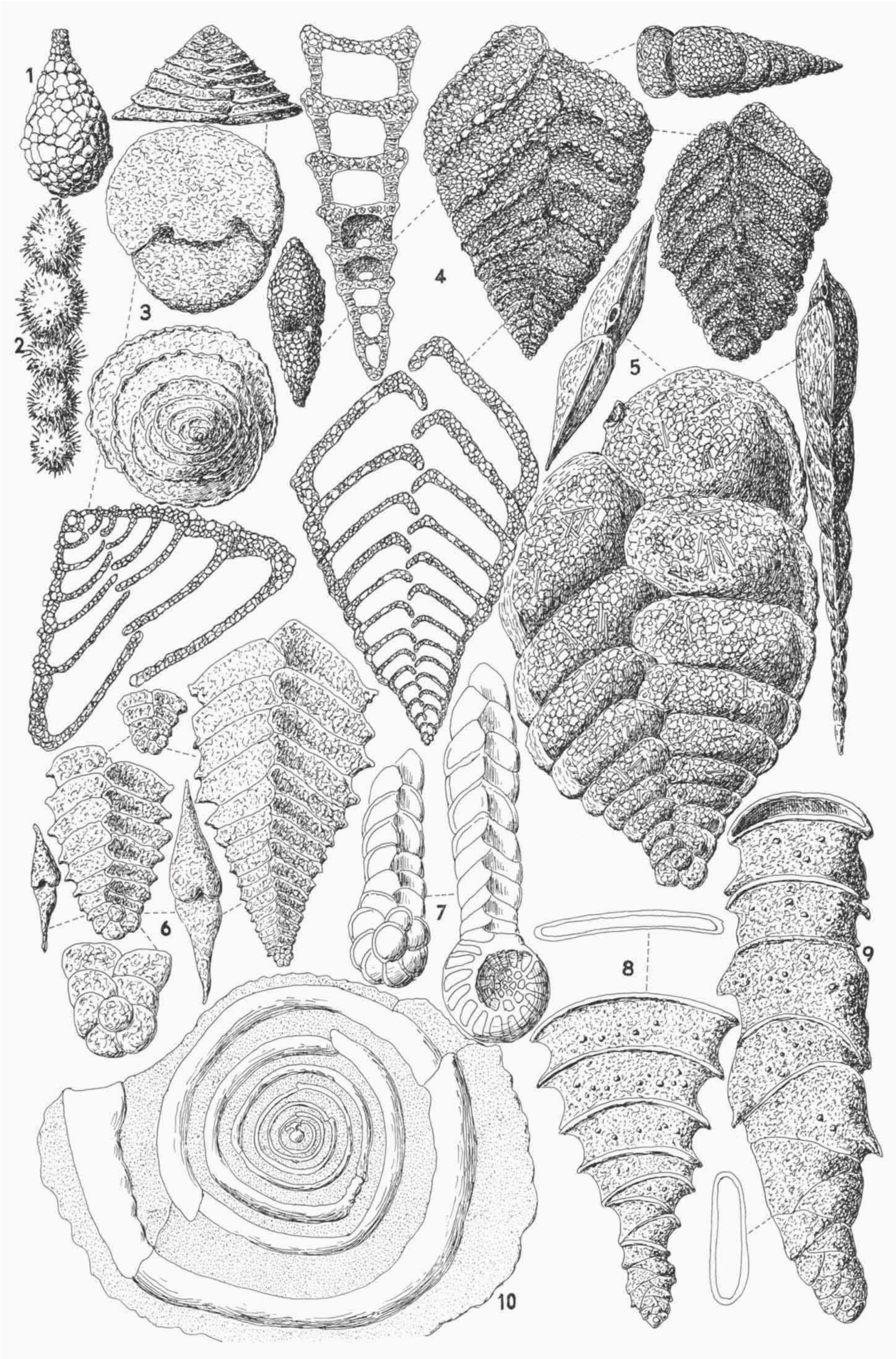
Fig. 1. *Laticarinina altocamerata* (Heron-Allen & Earland), St. 88; ventral side with deteuroforamen and protoforamina, with the toothplates forming carina × 33. Fig. 2. *Svratkina carinata* nov. spec., St. 59; total test × 66, with apertural face of another specimen also; aperture and pores on pustules × 200; pores × 400. Fig. 3. *Gavelinonion glabratum* (Cushman), St. 59; × 33; horizontal and transverse section × 66. Fig. 4. *Mississippina concentrica* (Parker & Jones), St. 60; section with the granular aragonitic and hyaline calcareous wall parts, with the granular toothplates, × 66. Fig. 5. *Mississippina torrei* (Cushman & Bermúdez), Otaian Stage, Calunni, South Island, New Zealand; × 33; section × 40. Fig. 6. *Schlosserina (Mississippina) asterites* (Gümbel), Cementchalk, Häring, sample Hofker 1212; × 33, ventral side; section × 66; section of ventral pockets enlarged × 66.

PL. 9

Fig. 1. *Schlosserina (Mississippina) asterites* (Gümbel), same locality as pl. 8 fig. 6; dorsal side × 33. Fig. 2. *Mississippina binkhorsti* (Reuss), Maestrichtian, quarry Curfs, South Limburg; total test × 33; transverse section × 66; two sections made in succession, tangentially, showing toothplate within chamber and toothplate beginning at protoforamen, × 33. Fig. 3. *Ammonia catesbyana* (d'Orbigny), St. 24; × 66. Fig. 4. *Ammonia koeboeensis* (LeRoy), St. 34; × 66, section × 83. Fig. 5. *Ammonia moroensis* nov. spec., St. 59; × 66.

PL. 10

Fig. 1. *Rotalidium japonicum* (Hada), St. 126; × 66, section × 83. Fig. 2. *Pseudorotalia catelliformis* Thalmann, China Sea, N. Borneo, 75 m; megalospheric; × 33. Fig. 3, 4. *Asterorotalia annectens* (Brady), St. 91. 3, microspheric × 33. 4, megalospheric × 33. Fig. 5. *Polystomelloides discorbinoides* Yabe & Hanzawa, St. 59; × 66; wall part with bridges over suture, section of initial part and tangential transverse section × 200.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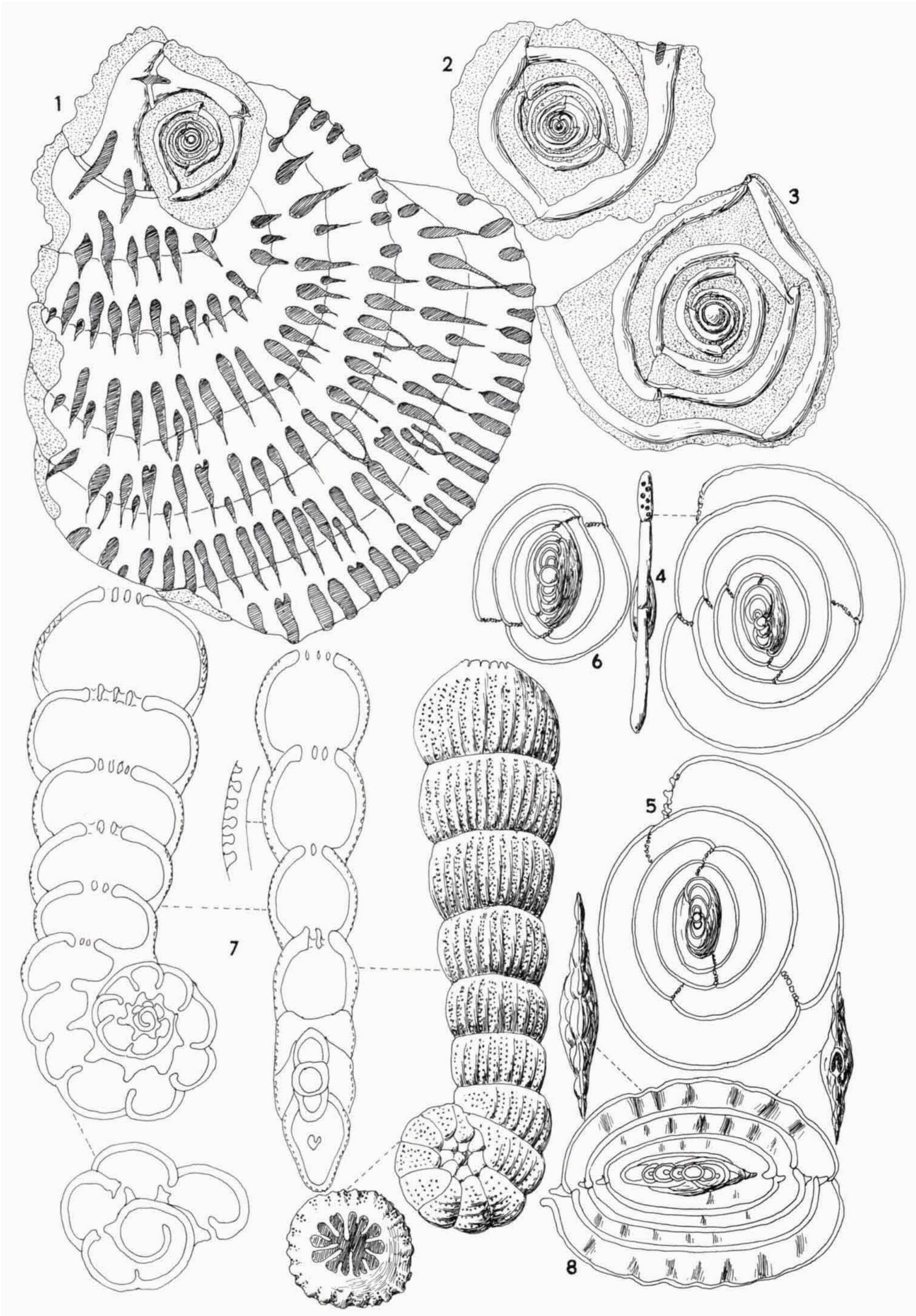
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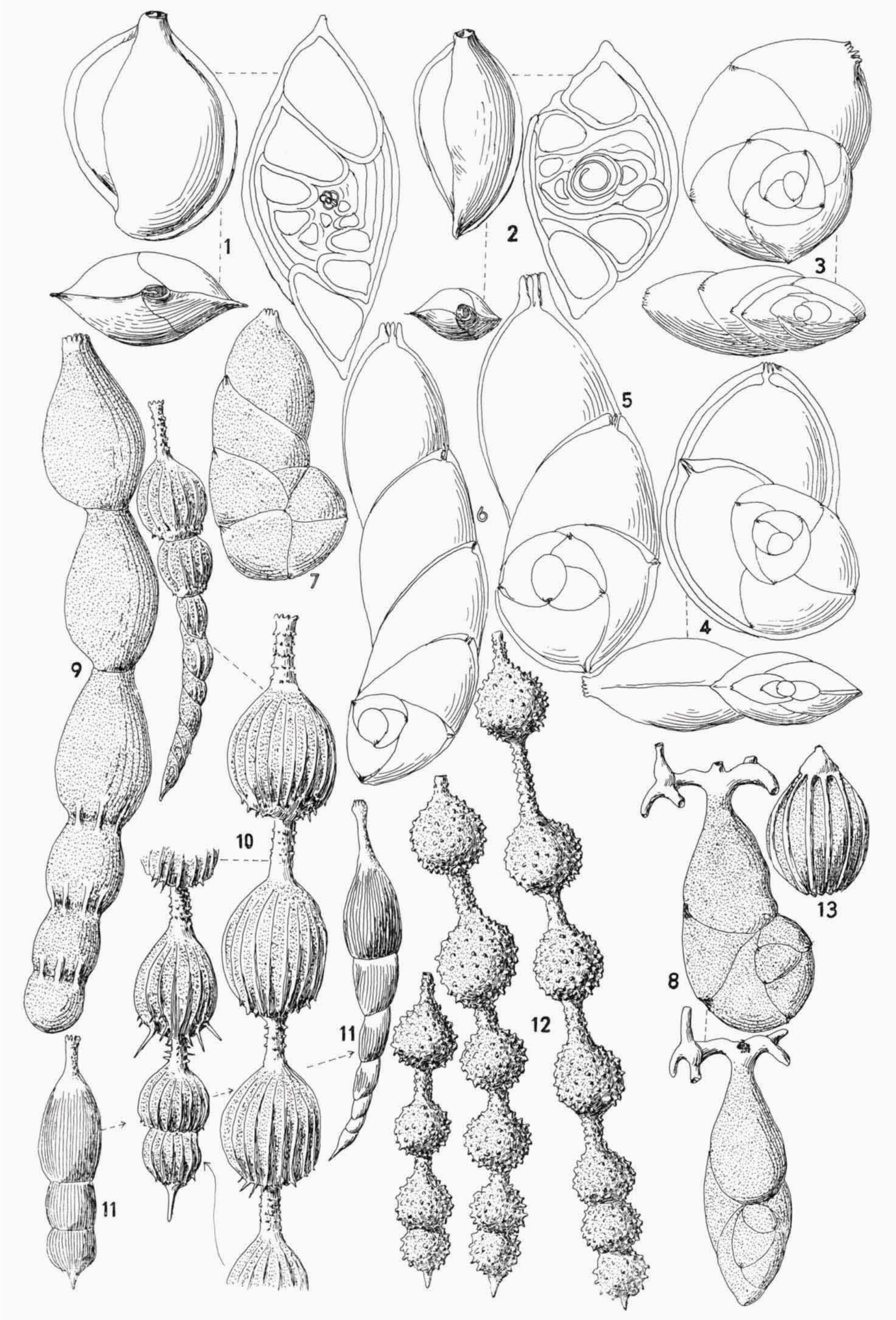
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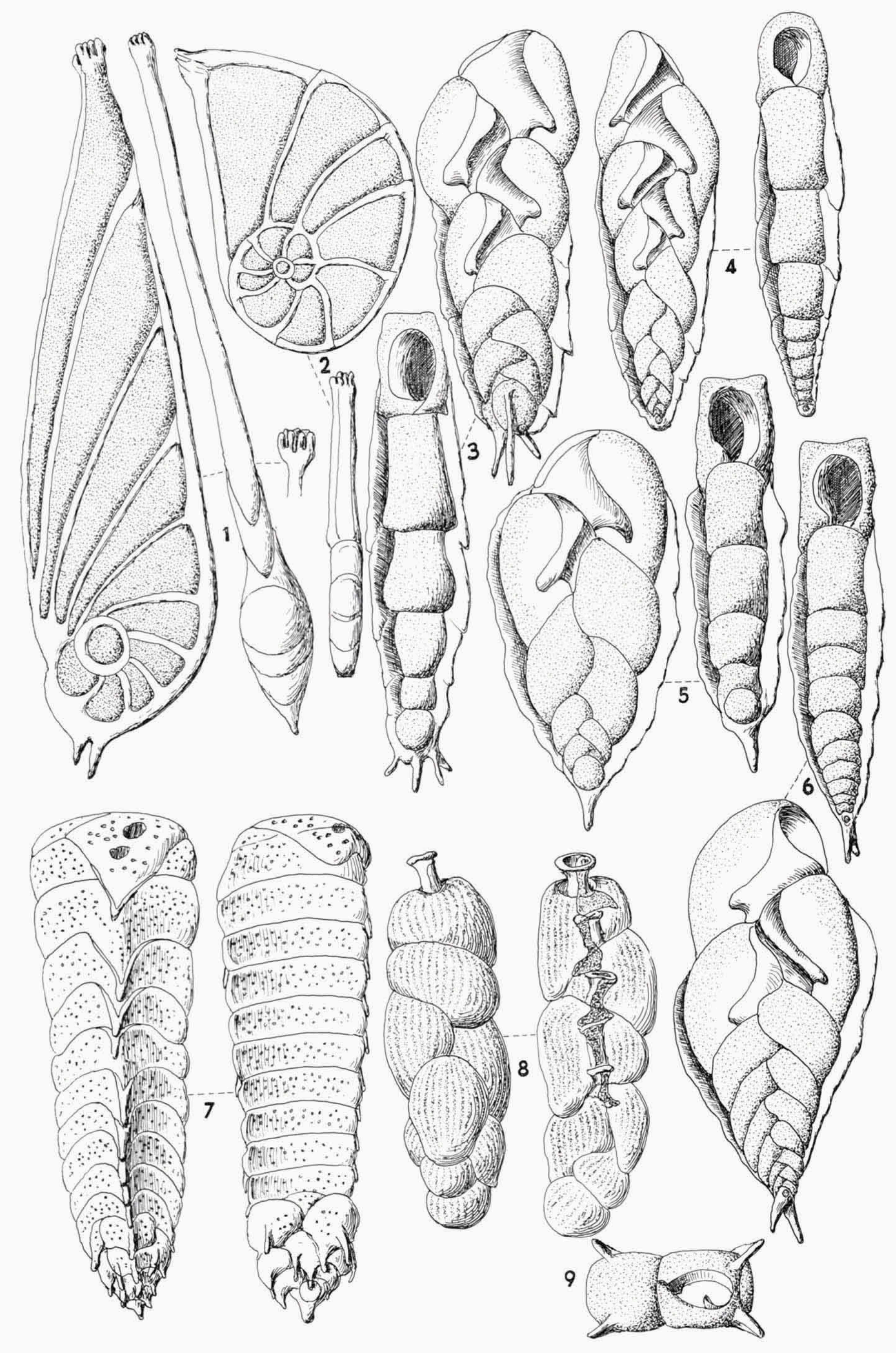
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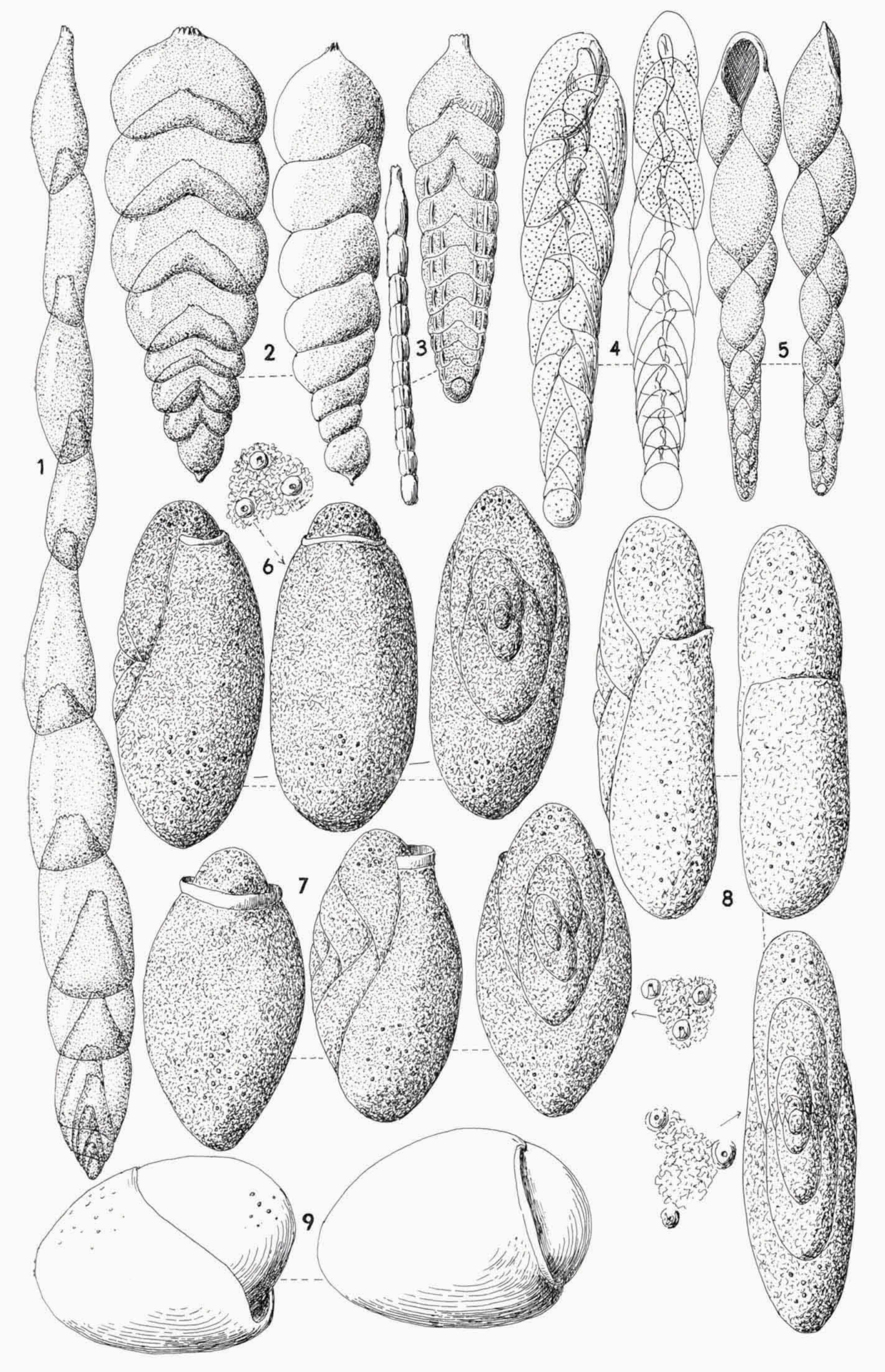
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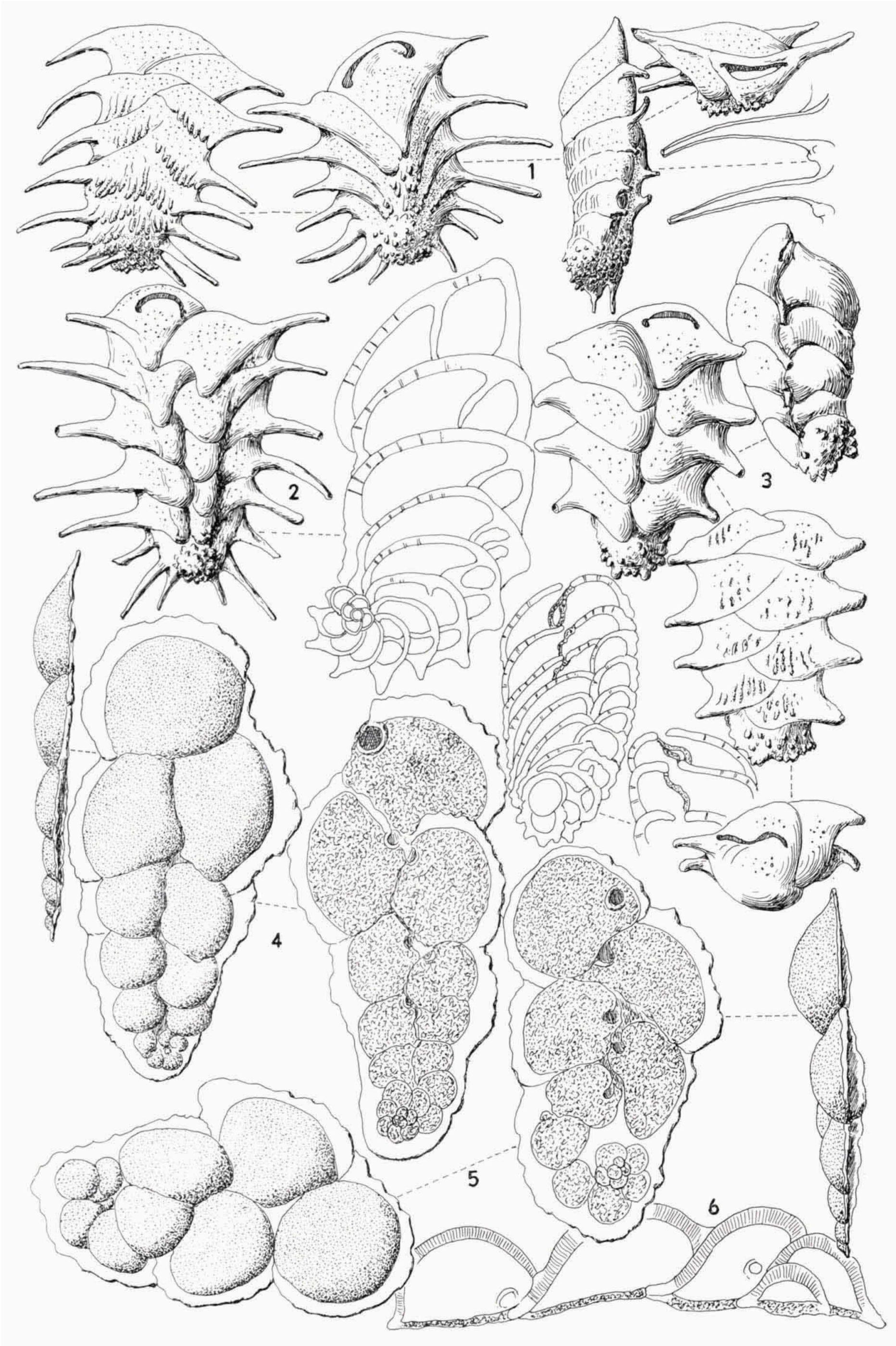
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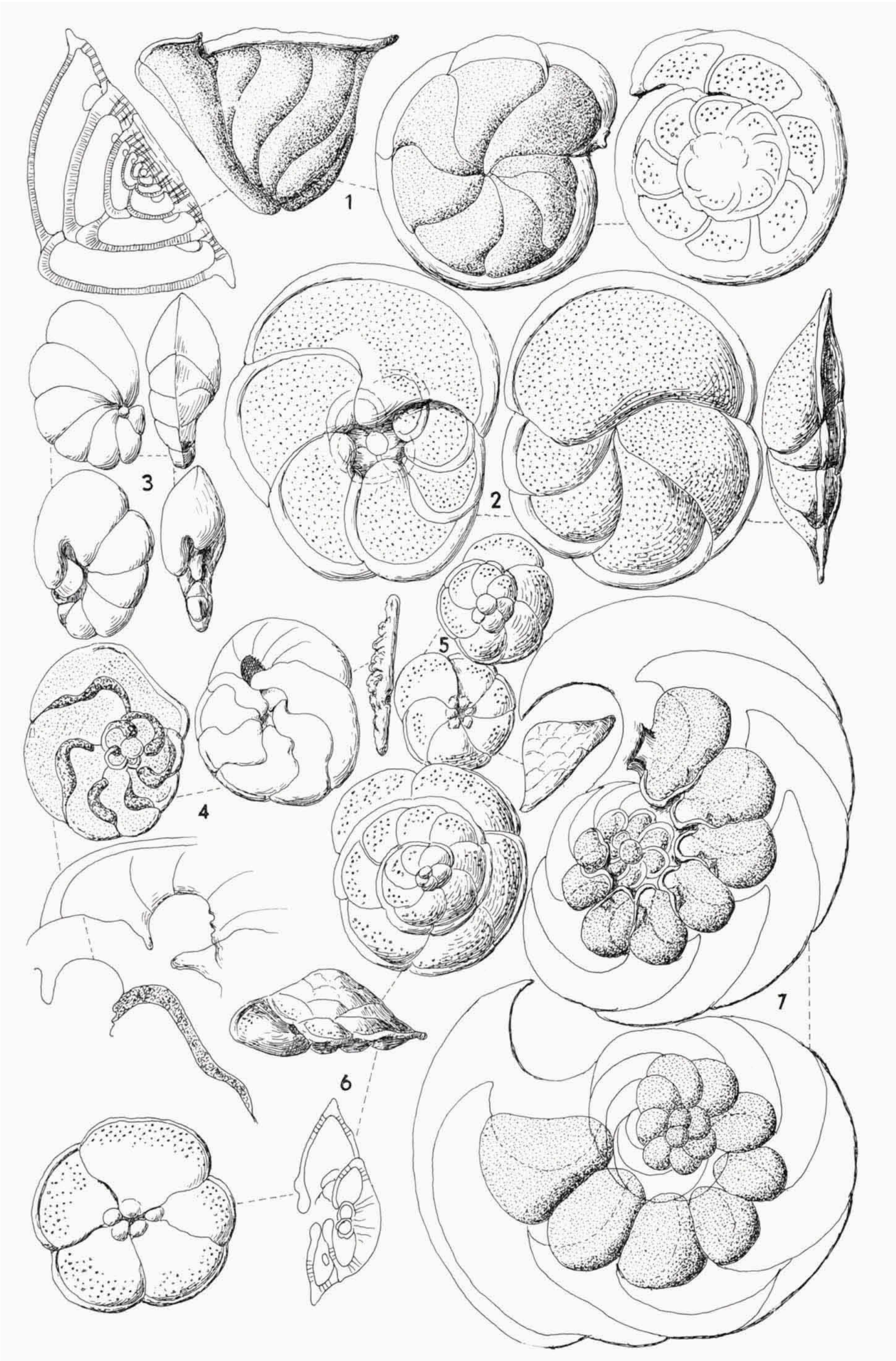
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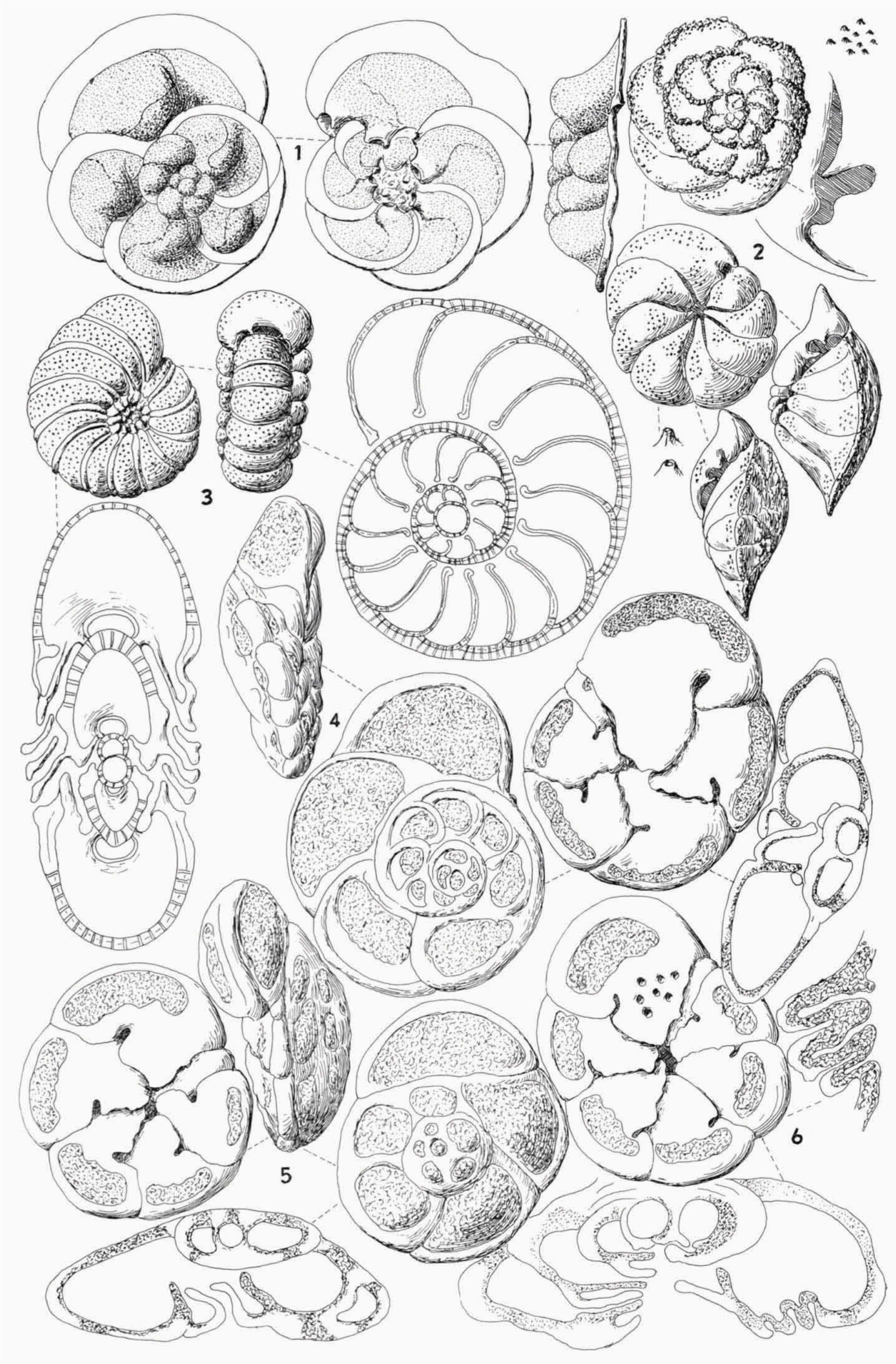
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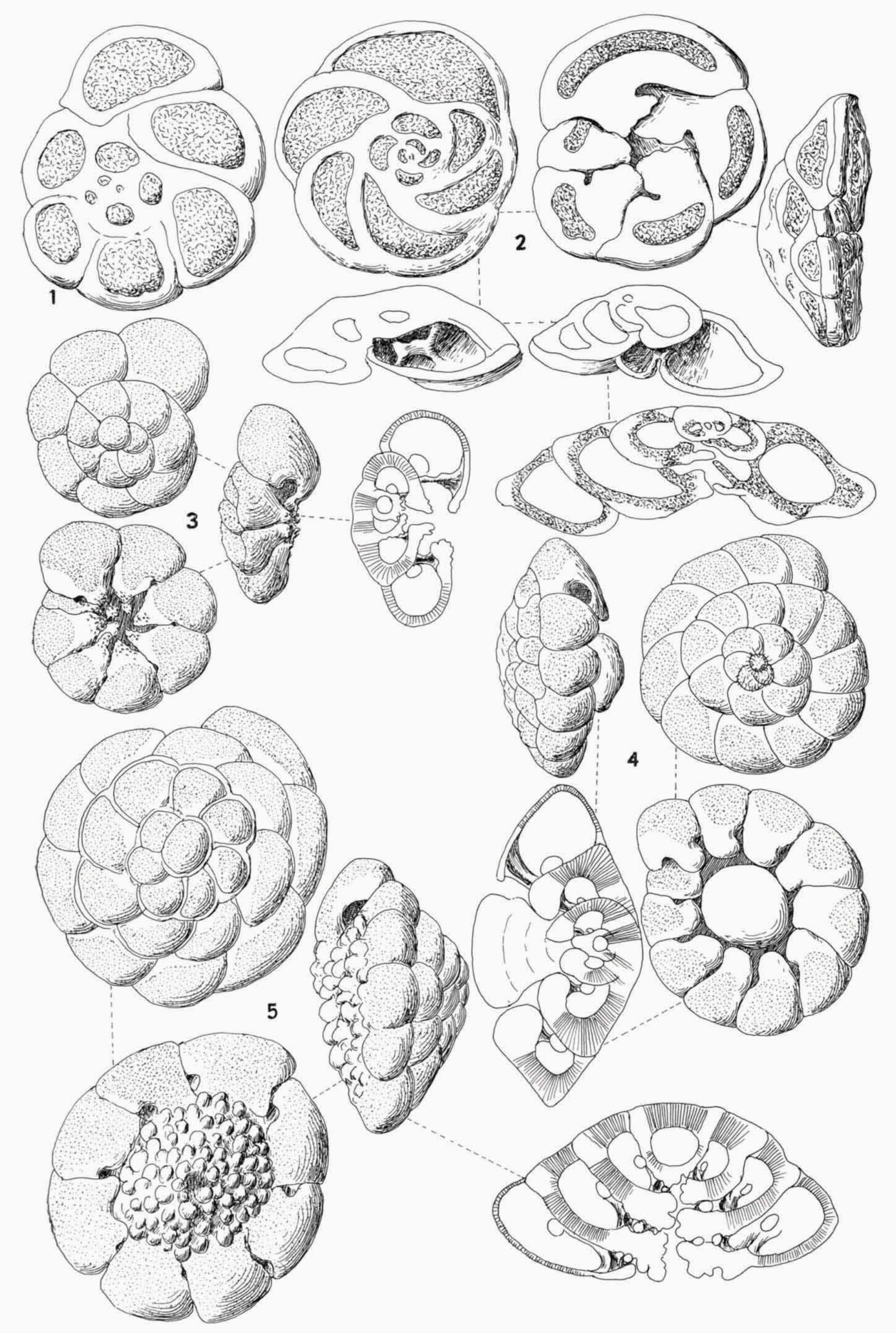
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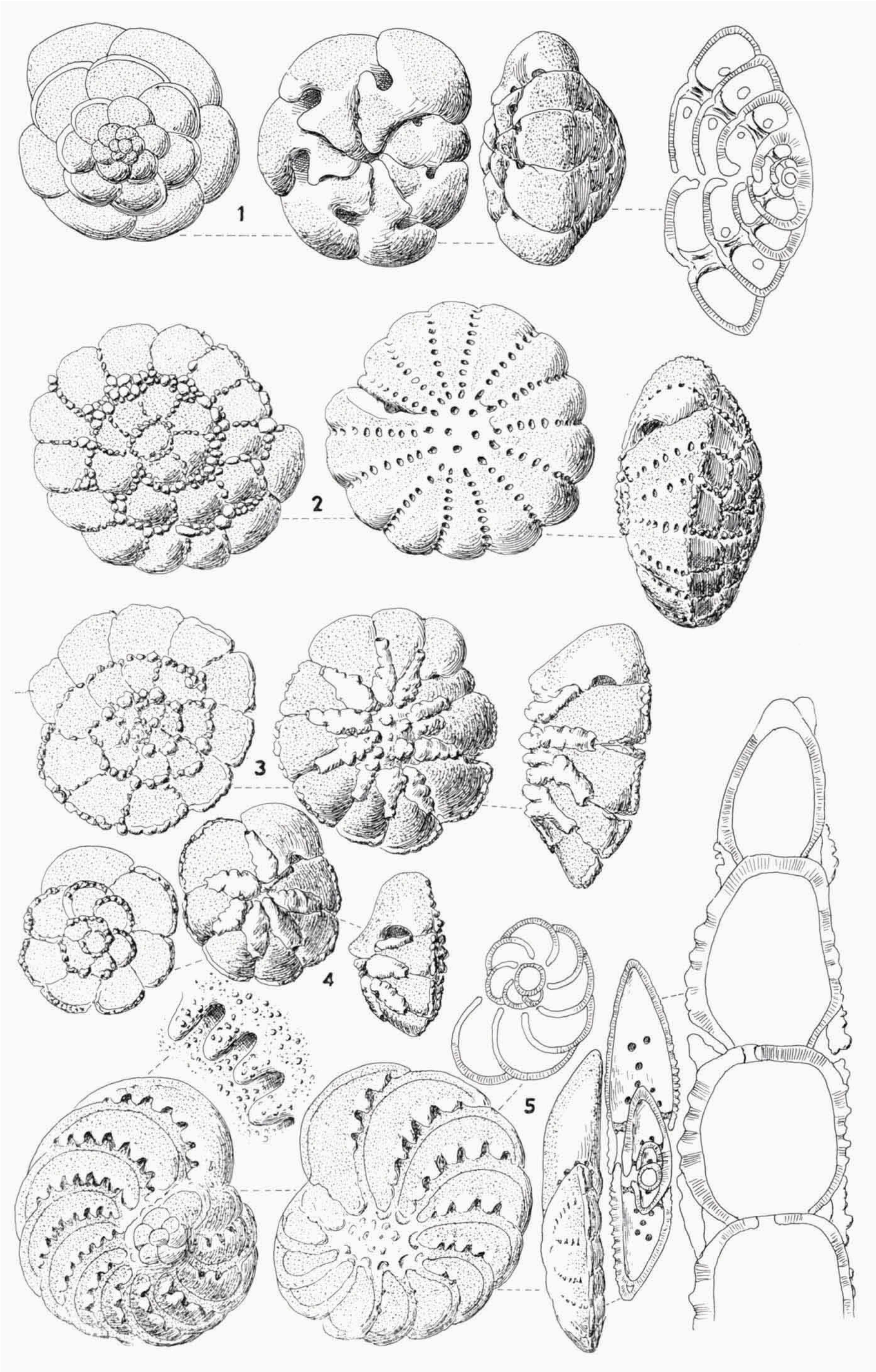
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