

MIDDLE MIOCENE GLOBIGERINAS OF ROMANIA

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Abstract. The paper is an attempt to draw up an inventory of the planktonic foraminifera from the marine Middle Miocene of Romania. The studied geological sections are situated in the Neogene basins from the eastern border of the Pannonian Depression (e.g. Caransebeş, Bega, and Zarand Basins), in Transylvania and connected basins (e.g. Haţeg Basin), in the strongly-deformed deposits from the Subcarpathians, and from the Getic Depression. 45 species belonging to 13 genera of planktonic foraminifera were described, of which one new genus (*Globospina*) and a new species (*Globospina banatica*).

The descriptions are accompanied by remarks on the stratigraphic range, many times different from their range in the open seas.

Keywords: Globigerinas, Middle Miocene, Romania.

INTRODUCTION

This paper is a tentative inventory of the planktonic foraminifera we recorded from the marine Middle Miocene deposits of Romania. Most of them, and the best preserved ones come from distal shelf-upper bathyal deposits accumulated mostly in some small basins (Caransebes, Bega and Zarand basins, see Marinescu & Popescu, 1987) from the southern part of the eastern border of the Pannonian Basin (Fig. 1). Here are situated the famous fossiliferous sites from Lăpugiu de Sus and Coştei. Abundant and well-preserved assemblages were also collected from the northern and north-western part of the Transylvanian Depression (Notelec Valley, at Nădăşel; Seaca Valley, at Popeşti; Valea cu Oase, at Chiuza), as well as from the intra-mountain basins, "gulfs" of the Transylvanian Basin (e.g. Brad-Săcărâmb Basin – at Brad and Ormindea; Zlatna-Almaşu Mare Basin, at Glod; or the Lower Strei Basin, around the towns of Haţeg and Hunedoara). We also mention the outcrops from the western Getic Depression, north and north-east of Drobeta-Turnu Severin, and the sections from the younger tectonic units of the Subcarpathians, east of Prahova Valley (the surroundings of Cîmpina; east and south of Vălenii de Munte; south and south-west of Pietroasele, Buzău District).

Many of the planktonic foraminifera described and figured in Fig. 1 originate from core samples of boreholes located around the town of Caransebeş (Balta Sărată, Zlăgniţa) or from the Upper Bega Valley Basin (Coştei, Coşava, Marginea, Făget).

SYSTEMATIC DESCRIPTION

Superfamily **GLOBOROTALIACEA** CUSHMAN, 1927

Family **GLOBOROTALIIDAE**, CUSHMAN, 1927

Genus **Clavatorella** BLOW, 1965

Clavatorella sturanii (GIANNELLI & SALVATORINI), 1976

Pl. 1, figs. 1-6.

Globorotalia sturanii GIANNELLI & SALVATORINI, 1976, p. 168, pl. 1, fig. 1.

Clavatorella sturanii (GIANNELLI & SALVATORINI). BOLLI & SAUNDERS, 1985, p. 255, text-fig. 3 a-c.

Test small to medium, with chambers trochospirally-coiled, four on the last whorl; chambers globular, almost spherical, growing rapidly in size; wall calcareous, thin, finely porulated; surface smooth, ornamented with pustules; sutures deep, radial; umbilicus narrow, deep; aperture umbilical-extraumbilical, a low arch, bordered by a thin lip.

Occurrence: rare species, recorded in Romania only from Upper Moravian (Uppermost Langhian) deposits.

Genus **Globorotalia** CUSHMAN, 1927

Globorotalia praescitula BLOW, 1959

Pl. 1, figs. 13, 14; pl. 2, figs. 1-3.

Globorotalia scitula praescitula BLOW, 1959, p. 221, pl. 19, fig. 128;

Globorotalia (Turborotalia) scitula praescitula BLOW, Popescu, 1975, p. 84, pl. 79, figs. 7, 8.

Small size test, trochospiral, biconvex; chambers triangular on the ventral side, trapezoidal on the dorsal side; sutures radial, slightly depressed, curved and limbate on the dorsal side; periphery slightly lobulate, peripheral outline subacuminate; aperture interiomarginal, bordered by a thin lip.

Occurrence: Lower-Middle Miocene from the Paratethys.

Globorotalia bykovaevae AISENSTADT, 1960

Pl. 2, figs. 8, 9.

Globorotalia bykovaevae AISENSTADT 1960 (in Subbotina, Pishvanova & Ivanova), p. 69, pl. 13, fig. 7; Popescu, 1975, p. 82, pl. 77, figs. 2-6.

Globorotalia peripheroronda BLOW & BANNER, 1966, p. 294, pl. 2, figs. 1-3.

Test trochospiral, biconvex, small sized; chambers with triangular outline on the ventral side, trapezoidal on the dorsal side, 5-6 on the last whorl; periphery slightly lobulate, peripheral outline subacuminate; sutures radial on the ventral side, strongly curved backwards at the periphery on the dorsal side; aperture interiomarginal, low, bordered by a well developed lip.

Occurrence: Lower Badenian.

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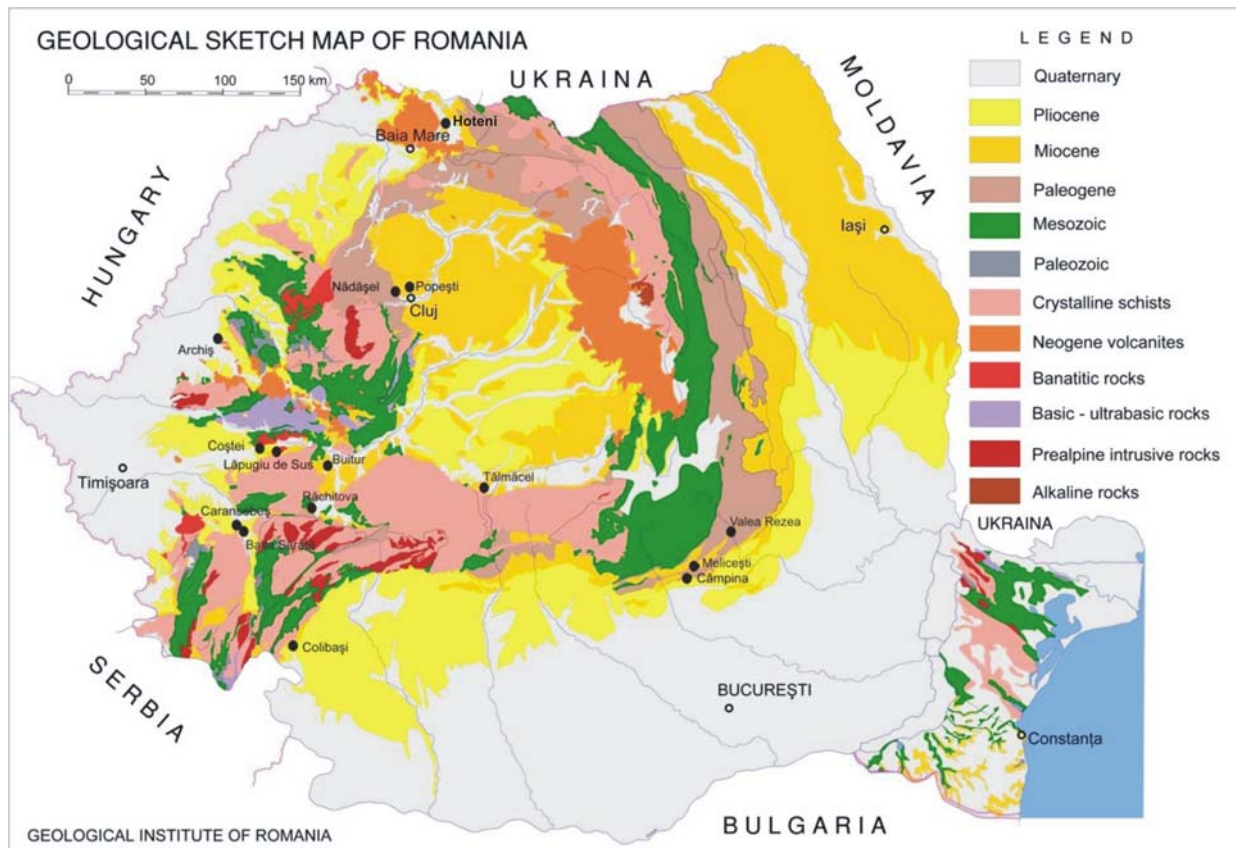


Fig. 1 - Geological sketch map with the locations of the most important fossiliferous points.

Globorotalia scitula (BRADY), 1882

Pl. 2, fig. 4.

Pulvinulina scitula BRADY, 1882 in: Tizard and Murray, Exploration of the Farøe channel during the summer of 1880, in Her Majesty's hired ship "Knight Errant." Roy. Soc. Edingurg, Proc. II (III), p. 716, figured in Brady, 1884, pl. 103, figs. 7a-c (fide Kennett & Srinivasan, 1983, p. 134)

Globorotalia (Hirsutella) scitula (BRADY). Kennett & Srinivasan, 1983, p. 134, pl. 31, figs. 1, 3-5.

Test low trochospiral, biconvex, equatorial periphery slightly lobulate, axial periphery with a keel-like rim; chambers four to five on the last whorl, increasing moderately in size as added; sutures strongly curved on the spiral side, radial on the umbilical side; surface smooth, with numerous circular pores; aperture interiomarginal, umbilical-extraumbilical, a low slit bordered by a lip.

Occurrence: Species present in the Carpathian Area only in the Lower Badenian (Moravian). It was recorded from the Transylvania Basin, the Subcarpathians, Getic Depression and on the eastern border of the Pannonian Depression.

Globorotalia transsylvanica POPESCU, 1970

Pl. 1, figs. 7-12.

Globorotalia (Turborotalia) transsylvanica POPESCU, 1970, p. 200, pl. 7, figs. 1-6; Popescu 1975, p. 84, pl. 79, figs. 1-6.

Test free, flattened, trochospiral, with a very low spire; chambers spherical; sutures radial on the ventral side, slightly curved backwards on the dorsal side; peripheral outline rounded, periphery circular; umbilicus narrow,

deep; aperture interiomarginal, arched, bordered by a prominent lip.

Occurrence: endemic species in the Paratethys, common in the Middle Badenian (Wielician).

Genus *Paragloborotalia* CIFELLI, 1982

Paragloborotalia mayeri (CUSHMAN & ELLISOR), 1939
Pl. 2, figs. 5-7; pl. 3, figs. 1-3.

Globorotalia mayeri CUSHMAN & ELLISOR, 1939, p. 11, pl. 2, fig. 2; Crescenti, 1966, p. 30, pl. 1, fig. 1.

Globorotalia acrostoma WETZEL, 1966, p. 1298, text-fig. 1.

Test compact, trochospiral, with low spire; chambers spherical, 5-6 on the last whorl; sutures depressed, radial on the ventral side, slightly curved backwards on the dorsal side; periphery circular, peripheral outline rounded; aperture interiomarginal, arched, bordered by an apertural lip.

Occurrence: Lower Badenian of the Paratethys.

Remarks: Specimens almost identical with the species described by Wetzel as "*G. acrostoma*" were recorded by us together with *P. mayeri*, in a continuous suite from specimens with more chambers on the last whorl (5-6), to specimens with four chambers.

Family PULLENIATINIDAE, CUSHMAN, 1927

Genus *Globigerinopsis* BELLI, 1962

Globigerinopsis grilli SCHMID, 1967

Pl. 3, figs. 4-6.

Globigerinopsis grilli SCHMID, 1967, p. 349, text-fig. 2

Test trochospirally coiled in the early stage, later streptospiral; chambers globular, increasing rapidly in size, four on the last whorl; sutures radial, straight, depressed; periphery rounded, peripheral outline slightly lobulate; wall calcareous finely perforated, surface with fine pits; primary aperture an interiomarginal arch, becoming spiroumbilical in the later stages, secondary sutural apertures.

Occurrence: Endemic species in the Paratethys, rare in the Middle Badenian (Wielician) deposits from the Central Paratethys.

Family **CANDEINIDAE** CUSHMAN, 1927
Subfamily **GLOBIGERINITINAE** BERMUDEZ, 1961

Genus **Globigerinita** BRÖNNIMANN, 1951

Globigerinita glutinata (EGGER), 1893

Pl. 4, figs. 1-6.

Globigerina glutinata EGGER, 1893, p. 371, pl. 13, figs. 19-21.

Globigerinita glutinata (EGGER). Kennett & Srinivasan 1983, p. 224, pl. 56, figs. 3-5.

Remarks: Common species, together with *Tenuitellinata uvula* (EHRENBERG) in the Lower Badenian deposits from Paratethys.

Globigerinita subcretacea (LOMNICKI), 1901

Pl. 4, figs. 8-13.

Globigerina (cretacea D'ORBIGNY?). Brady, 1884, p. 22, pl. 82, fig. 10. Lomnicki, 1900, pl. 1, fig. 2 (cf. Ellis & Messina, 2007).

Globigerina subcretacea LOMNICKI, 1901, p. 17.

Remarks: The specimens figured by us come from Kossovian deposits of Transylvania (Piatra and Chiuz, Bistrița-Năsăud District), the Subcarpathians of Muntenia (Chirului Valley, Prahova District) and Maramureș (Dărasca Valley, Hoteni Village), where many specimens were recorded in association with *Globigerina tarchanensis*. There are still more unsolved problems regarding the statute of the species (see Roegl, 1998).

Genus **Tenuitellinata** LI, 1987

Tenuitellinata uvula (EHRENBERG), 1861

Pl. 3, figs. 7-12.

Pyloedixia uvula EHRENBERG, 1861, pl. 2, figs. 24-25.

Globigerinita uvula (EHRENBERG). Kennett and Srinivasan, 1983, p. 224, pl. 56, figs. 6-8.

Test small, very high trochospiral; globular chambers, gradually increasing in size, 3-4 on the last whorl; wall very finely porulated, densely pustulated; sutures deep, straight, radial on the umbilical side; aperture umbilical-interiomarginal, arched, bordered by a distinct lip.

Occurrence: Miocene-Recent. In the Paratethys it was recorded from Lower Miocene and Middle Miocene deposits.

Tenuitellinata sp. cf. *T. selleyi* LI, RADFORD & BANNER, 1992

Pl. 4, fig. 7.

Remarks: A few specimens resembling *T. selleyi* (described by Li, Radford and Banner, 1992, p. 581, pl. 4, figs. 1-4) were recorded by us from the Uppermost Moravian deposits from Lupoia Valley, Archiș, Arad District.

Family **CATAPSYDRACIDE** BOLLI, LOEBLICH, & TAPPAN, 1957

Genus **Globoquadrina** FINLAY, 1947

Globoquadrina conica BRÖNNIMANN & RESIG, 1971

Pl. 6, figs. 7, 8.

Globoquadrina altispira (CUSHMAN & JARVIS) *conica* Brönnimann & Resig, n. subsp., p. 1275, pl. 22, fig. 1.

Remarks: Specimens resembling *G. rumana* Popescu, but with a conical, acuminate early part of the whorl were assigned to the species *G. conica*.

Globoquadrina dehiscens (CHAPMAN, PARR & COLLINS), 1934

Pl. 5, figs. 5-7.

Globoquadrina dehiscens CHAPMAN, PARR, and COLLINS, 1934, p. 569, pl. 11, fig. 36a-c.

Test trochospiral, medium height whorl. The species is characterized by large, deep conical pores separated by high ridges, large, deep umbilicus, four chambers on the last whorl and triangular apertural tooth.

Occurrence: Frequent in the Miocene. In Romania is present in the Lower Badenian.

Remarks: The specimens from the Middle Miocene are clearly distinct from the Lower Miocene (Aquitanian) ones by their smaller sizes, wall structure and surface and the aperture shape. The specimens from the Lower Miocene were recorded from the upper part of the Podu Morii Formation (Subcarpathians), and separated as *Globoquadrina predehiscens* BLOW & BANNER, 1962.

Globoquadrina langhiana CITA & GELATI, 1960

Pl. 5, fig. 4.

Globoquadrina langhiana CITA & GELATI, 1960, p. 1208, pl. 6, fig. 4.

Test trochospiral, with globular and rapidly increasing chambers, the last one being much larger than the previous ones; equatorial periphery moderately lobate, general shape subquadrate; the aperture is narrow, elongated and bordered by a distinct lip.

Remarks: The species is considered by Kennett & Srinivasan (1983) as a junior synonym of *G. baroemoenensis* (LEROY), 1939.

Occurrence: Frequent in Moravian deposits.

Globoquadrina praealtispira POPESCU, 1970

Pl. 5, figs. 8-11.

Globoquadrina praealtispira POPESCU, 1970, p. 196, pl. 3, fig. 7; Popescu, 1975, p. 91, pl. 78, fig. 3.

Test trochospiral, with high spire; 14-15 globular chambers, slightly flattened, closely coiled, arranged on three whorls, 3-4 on the last one; circular axial profile, subtriangular equatorial profile; sutures deep, radial; umbilicus narrow; umbilical area strongly hispid; aperture umbilical-interiomarginal.

Occurrence: Middle Miocene (Lowermost Badenian)

Globoquadrina rumana POPESCU, 1975

Pl. 6, figs. 1-6.

Globoquadrina rumana POPESCU, 1975, p. 91, pl. 63, fig. 1; pl. 66, fig. 1.

Test trochospiral, closely coiled; wall calcareous, porulated; 11-15 globular, slightly flattened chambers, arranged in 2 or 3 low whorls, 4 on the last one; umbilicus narrow with a hispid surface; aperture umbilical, interiomarginal, a straight slit, with a triangular distinct lip.

Occurrence: Lower Badenian (Langhian).

Genus **Velapertina** POPESCU, 1969

Velapertina indigena (LUCZKOWSKA), 1955
Pl. 6, figs. 9-15; pl. 7, 4-6.

Globigerinoides indigena LUCZKOWSKA, 1955, p. 152,
pl. 10, fig. 5-7.

Velapertina indigena (LUCZKOWSKA). Popescu, 1969, p.
105, pl. 1, fig. 2, pl. 2, fig. 4; Popescu, 1975, p. 95, pl. 95,
fig. 4, 5.

Test streptospirally coiled; chambers globular,
increasing rapidly in size, with a tendency to envelope the
entire test; periphery lobulate, peripheral outline circular;
sutures flush, sometimes slightly depressed; main
aperture interiomarginal, sutural and areal secondary
circular apertures.

Range: Middle Kossovian.

Remarks: Specimens with a spherical shape and with
apertural bullae arranged along the last suture, forming a
discontinuous band were described by Popescu (1969) as a
different species, *V. cingulata*.

Velapertina iorgulescui POPESCU, 1969

Pl. 7, fig. 3.

Velapertina iorgulescui POPESCU, 1969, p. 105, pl. 2,
fig. 5, 6.

Test trochospirally coiled in the early part, then tending
to become streptospiral; usually, the last chamber
(gerontic) appears as an apertural bulla; wall densely
populated, with large, conical pores (as in *Globigerinoides*,
but smaller); main aperture umbilical, as a low arch,
secondary infralaminar apertures.

Range: Lowermost Kossovian, at the level of the
„Radiolarian Shales”. The species is considered as the
first member of the phyletic lineage of the genus.

Velapertina luczkowskæ POPESCU, 1973

Pl. 6, fig. 16; pl. 7, figs. 1,2.

Velapertina luczkowskæ POPESCU, 1973 (in Popescu
& Cioflica), p. 197, pl. 8, figs. 75-77.

Test trochospiral in the early stage, later streptospiral,
with the last chamber covering almost 70 % of the test;
chambers globular, increasing rapidly in size; surface
densely populated, with pore rims bordered by high, sharp
margins conferring a rugged aspect; multiple aperture, as
circular openings at the contact between the last chamber
and the preceding ones, as well as areal apertures.

Range: Upper Kossovian.

Remarks: The species is considered as evolved in the
phyletic lineage.

Velapertina sphaerica POPESCU, 1987

Pl. 6, fig. 17.

Velapertina sphaerica POPESCU, 1987, p.161, pl. 5, fig.
11, 12.

Species similar to *V. luczkowskæ*, but with spherical
shape and only 8-10 % of the surface of the test
representing the earlier chambers as the surface of the 2-3
circles of circular sutural apertures. Circular areal
apertures also present.

Range: Uppermost Kossovian.

Remarks: Specimens which could fit into the previous
description were figured by Kennett & Srinivasan (1983)
as *Orbulina suturalis* (see pl. 20, fig. 1).

Superfamily **GLOBIGERINACEA** CARPENTER, PARKER &
JONES, 1862

Family **GLOBIGERINIDAE** CARPENTER, PARKER & JONES,
1862

Subfamily **GLOBIGERININAE** CARPENTER, PARKER &
JONES, 1862

Genus ***Globigerina*** D'ORBIGNY, 1826

Globigerina bulloides D'ORBIGNY, 1826

Pl. 7, figs. 11, 12.

Globigerina bulloides D'ORBIGNY, 1826, p. 277, model
nr. 1, 76 (fide Ellis & Messina); d'Orbigny, 1846, p. 163,
pl. 9, figs. 4-6.

Test free, trochospiral, 4 chambers on the last whorl;
chambers spherical, slightly covering the previous ones;
sutures radial, deep; aperture umbilical, a high
hemicircular arch.

Range: Oligocene-Recent. In Paratethys it is present
in the marine Lower and Middle Miocene.

Globigerina concinna REUSS, 1850

Pl. 7, fig. 13.

Globigerina concinna REUSS, 1850, p. 373, pl. 47, fig.
8.

Test of 14-15 chambers arranged in three low
whorls, with 5 chambers on the last whorl; chambers
almost spherical, separated by deep radial sutures,
increasing slowly and gradually in size; wall thin, medium
perforated; large umbilicus, open and deep; aperture
intraumbilical, arched.

Range: Kossovian (in Paratethys).

”*Globigerina*” *eamesi* BLOW, 1959

Pl. 11, fig. 12; pl. 12, figs. 1-3.

Globigerina eamesi BLOW, 1959, p. 176, pl. 9, figs.
39a-c.

Globigerina (Globigerina) eamesi BLOW. Kennett &
Srinivasan, 1983, p. 34, pl. 5, figs. 7-9.

Remarks: Rare species in our material. It was mostly
recorded from the uppermost part of the Lower Badenian
from the Lupoaia Valley section, Arad District. The
spinose aspect of the test surface and the tendency of
the chambers to become streptospirally-coiled could be
an argument for placing the species in the genus
Globospina (Popescu & Crihan this paper).

Globigerina tarchanensis SUBBOTINA & CHUTZIEVA,
1950

Pl. 8, fig. 1.

Globigerina tarchanensis SUBBOTINA & CHUTZIEVA,
1950, in Bogdanowicz, A.K. (Ed.) Micofauna SSSR,
sbornik 4, Trudy Vsesoyuznogo Neftyanogo Nauchno-
issledovatel'skogo Geologo-rezvedochnogo Instituta
(VNIGRI), n. ser., vypusk 51, p.173, pl.10, fig. 5;
Subbotina, 1953, p. 61, pl. 3, figs. 13 a,b,v; Rögl, 1998,
p. 101, pl. 32, figs. 18-22.

Test compact, trochospiral, with high whorls, five
chambers on the last whorl; sutures radial, little
depressed; umbilicus large; aperture umbilical-
interiomarginal, a low arch.

Occurrence: Kossovian, more frequent in its upper
part.

Genus ***Globigerinella*** CUSHMAN, 1927

Globigerinella obesa (BOLLI), 1957

Pl. 8, figs. 4-6.

Globorotalia obesa BOLLI, 1957, p. 119, pl. XXIX, fig.
2-3, Popescu, 1975, p. 84, pl. LXX, fig. 1;

Globigerinella obesa (BOLLI), Kennett & Srinivasan,
1983, p. 234, pl. 59, figs. 3-5 ; Rögl (In: Cicha et al.,

1998), p. 101, pl. 38, fig. 1-3.

Test low trochospiral, equatorial periphery strongly lobulate; axial periphery broadly rounded; chambers spherical, inflated, rapidly increasing in size, four to four and one-half in the final whorl; sutures radial, depressed; surface densely perforated with circular to subcircular pores and elevated circular spine bases; umbilicus large, deep; aperture a low to medium arch, interiomarginal, umbilical-extraumbilical.

Occurrence: Frequent in Lower Badenian deposits.

Globigerinella aequilateralis (BRADY), 1879

Pl. 8, figs. 2, 3.

Globigerina aequilateralis BRADY, 1879: Notes on some of the reticularian Rhizopoda of the Challenger Expedition: 2, Additions to the knowledge of porcelanous and hyaline types. Quart. Journ. Micr. Sci., n.s., vol.19, p. 285, figured in Brady, 1884, pl. 80, figs. 18-21.

Globigerinella aequilateralis (BRADY). Kennett & Srinivasan, 1983, p. 238, pl. 60, figs. 4-6.

Test trochospiral in the early stage, then almost planispiral in the adult, evolute; chambers globular, increasing gradually in size; equatorial periphery lobulate, periphery rounded; sutures deep, radial; wall finely and densely porulated; aperture arched, interiomarginal, equatorial in the adult.

Remarks: Hottinger et al. (1993) consider the species *G. aequilateralis* (BRADY) as a junior synonym of *G. siphoniphera* (D'ORBIGNY), 1839, and the „subspecies” *G. siphoniphera involuta* (CUSHMAN), 1917 as inscribing in the intraspecific morphological variability of the species *G. siphoniphera*.

Range: Miocene-Recent. In Paratethys recorded only in the Upper Langhian (Moravian).

Genus *Globigerinoides* CUSHMAN, 1927

Globigerinoides altiapertura BOLLI, 1957

Pl. 9, figs. 3, 4.

Globigerinoides triloba altiapertura BOLLI, 1957, p. 25, figs. 7a-8, text-fig. 21, No. 3.

Globigerinoides altiapertura BOLLI. Kennett & Srinivasan, 1983, p. 54, pl. 10, fig. 1; pl. 11, figs. 4-6.

Test trochospiral; equatorial periphery distinctly lobate, axial periphery rounded; wall calcareous, perforate, surface finely pitted; chambers spherical, three on the last whorl, increasing rapidly in size; umbilicus narrow, deep; primary aperture, a high, distinct arch, interiomarginal, umbilical, one supplementary sutural aperture opposite the primary aperture.

Occurrence: Lower Badenian in the Paratethys.

“Globigerinoides” apertasuturalis JENKINS, 1960

Pl. 11, figs. 9-11.

Globigerinoides apertasuturalis JENKINS, 1960, p. 352, pl. 2, figs 3a-c; Rögl, 1998, p. 102, pl. 36, figs. 11-13.

Test trochospiral, with globular chambers, three on the last whorl, increasing rapidly in size; wall calcareous, with cancellate surface, with regular subhexagonal pore pits; primary aperture a small arch, umbilical, supplementary small sutural apertures.

Remarks: Very rare species. Our specimens come from the Lupoia Valley section (Archiş, Arad District). The generic affiliation is uncertain. The test wall is not of globigerinoid type, but rather of *Globoturborotalita* type. The sutural apertures, present in the species described by Jenkins were recorded by us at some species of

Globoturborotalita, and commonly in the species *Globoturborotalita bulloidea* (Crescenti).

Globigerinoides bisphericus TODD, 1954

Pl. 8, figs. 7-9.

Globigerinoides bisphericus TODD, 1954, in Todd et al. : p.681 pl. 1, figs. 1a-c.

Remarks: Transitional species between *Globigerinoides triloba* and *Preorbulina sicana*. The last chamber of *G. bisphericus* covers almost completely the umbilicus, and along the sutures between the last chamber and the earlier ones two apertures are present.

Occurrence: Our specimens come from the Lower Badenian (Moravian).

Globigerinoides sacculifer (BRADY), 1877

Pl. 9, figs. 1, 2.

Globigerina sacculifera BRADY, 1877 in: Supplementary note on the foraminifers of the Chalk (?) of the New Britain Group. Geological Magazine London Vol. 4, no. 12, p. 535 (Figures in Brady, 1884; Rep. voy. Challenger, Zool., 9, p. 604, pl. 80, figs. 11-17; pl. 81, fig. 2; pl. 82, fig. 4) (in Kennett & Srinivasan, 1983, p. 66).

Globigerinoides sacculifer BRADY. Kennett & Srinivasan, 1983, p. 66, pl. 14, figs. 4-6.

Test trochospiral, with spherical chambers except the final one which is sac-like; three and a half to four chambers on the last whorl, increasing slowly; the last chamber can be small or elongated and elongate; sutures slightly curved and depressed; surface with regular subhexagonal pore pits; primary aperture interiomarginal, umbilical, a distinct arch bordered by a rim; prominent supplementary apertures on the spiral side.

Remarks: Specimens with sac-like final chamber are quite common in the Lower Badenian deposits. There are also rare specimens similar with *G-oides subsacculifer* CITA, PREMOLI-SILVA and ROSSI (1965), which are abundant in the lower Miocene deposits from north-east Transylvania.

Globigerinoides triloba (REUSS), 1850

Pl. 8, figs. 10-14.

Globigerina triloba REUSS, 1850, p. 374, pl. 47, fig. 11.

Globigerinoides triloba (REUSS). Popescu, 1975, p. 90, pl. 49, fig. 2; Kennett & Srinivasan, 1983, p. 62, pl. 13, figs. 1-3.

Test of medium size, trochospiral; chambers globular, increasing gradually in size, three to three and a half on the last whorl; wall densely porulated with large, conical pores, bordered by sharp interpores ridges with hexagonal outline; primary aperture interiomarginal, a slightly high arch, and one supplementary, smaller aperture, on the spiral side, at the intersection of the intercameral sutures with the spiral suture.

Range: Miocene-Recent. In the Paratethys this is a frequent species in the Lower and Middle Miocene deposits.

Genus *Globoturborotalita* HOFKER, 1976

Globoturborotalita apertura (CUSHMAN), 1918

Pl. 9, figs. 5-7.

Globigerina apertura CUSHMAN, 1918: Some Miocene foraminifera of the coastal plain of the United State. U.S.Geol.Surv., Bull. 676, p. 57, pl. 12, fig. 8 (fide Ellis &

Messina).

Globigerina (Zeaglobigerina) apertura CUSHMAN. Kennett & Srinivasan, 1983, p. 44, pl. 8, figs. 4-6.

Test compact, low trochospiral; chambers globular, increasing gradually in size, four on the last whorl; wall with medium sized pores, sutures radial, slightly curved on the spiral side; aperture umbilical, hemicircular, large, bordered by a distinct apertural lip.

Range: Miocene-Recent. In the Paratethys recorded by us only in the Upper Lower Badenian (upper part of Moravian).

Globoturbotalita bulloidea (CRESCENTI), 1966

Pl. 10, figs. 9-11; pl. 11, figs. 1-7.

Globigerinoides bulloideus CRESCENTI, 1966, p. 43, text-fig.8/3, text-fig. 9; Rögl, 1998 (in:Cicha et al), p.102, pl. 36, fig. 14,15.

Test compact, of medium size, trochospiral; chambers subspherical, four on the last whorl, increasing rapidly in size; umbilicus deep, open; primary aperture umbilical, a high, hemicircular arch, bordered by a distinct lip; 1-3 secondary apertures on the spiral side.

Range: Miocen-Pliocen. In Paratethys the species was recorded from the upper part of the Moravian.

Globoturbotalita decoraperta TAKAYANAGI & SAITO, 1962

Pl. 9, figs. 8, 9.

Globigerina druryi AKERS *decoraperta* TAKAYANAGI & SAITO, 1962, p. 85, pl. 28, figs. 10 a-c.

Remarks: Differs from *G. druryi* (AKERS) in its higher arched aperture and somewhat higher trochospirally coiled test.

Occurrence: In our samples it was recorded from Lower-Middle Badenian deposits.

Globoturbotalita druryi (AKERS), 1955

Pl. 10, figs. 1-8.

Globigerina druryi AKERS, 1955: Some planktonic foraminifera of the American Gulf Coast and suggested correlations with the Caribbean Tertiary. *Journal of Paleontology*, 29/4, p. 654, pl. 65, fig.1 (fide Ellis & Messina).

Globigerina (Zeaglobigerina) druryi AKERS. Kennett & Srinivasan, 1983, p. 46, pl. 8, figs. 7-9.

Test compact, trochospiral, medium sized; chambers globular, four on the last whorl; thick walls, with pores bordered by rectangular ridges, higher in their intersections; aperture umbilical-extraumbilical, a high arch, bordered by a prominent lip.

Occurrence: Index taxon in Paratethys for the Moravian/Wielician border or in the Tethys realm for the Langhian/Serravallian border.

Globoturbotalita woodi (JENKINS), 1960

Pl. 9, figs. 10-12.

Globigerina woodi JENKINS, 1960, p. 352, pl. 2, fig. 2.

Globoturbotalita woodi (JENKINS). Hofker, 1977.

Globigerina (Zeaglobigerina) woodi JENKINS. Kennett & Srinivasan, 1983, p. 43, pl. 7, figs. 4-6.

Test of medium size, compact, trochospiral; chambers spherical, increasing rapidly in size, four on the last whorl; wall thin, with pores bordered by polygonal ridges, with higher corners; umbilicus deep, open; aperture umbilical, an almost circular arch, bordered by a distinct lip.

Range: Miocen-Pliocen. In Paratethys occurs only in

the Lower and Middle Badenian.

Genus ***Globospina*** new genus

Type species: *Globospina banatica* n.sp.

Diagnosis: Test small to medium; chambers globular, initially trochospiral, then streptospiral; periphery rounded, peripheral outline lobulate to subcircular; sutures distinct; surface cancellate with regular subhexagonal pore pits separated by interpore ridges; large, sometimes massive cylindrical spines irregularly distributed on the surface; aperture interiomarginal with or without apertural rim or lip, may be provided with sutural secondary openings.

Etymology: arbitrary name, feminine gender.

Remarks: The primary aperture is covered by a large, well-developed chamber (bulla) with smooth, porulate surface, but preserving the most distinctive feature of the test, the long spines. Differs from *Polyperibola* LISKA, 1980 by its cancellate surface and the presence of spines.

Globospina banatica n.sp.

Pl. 7, figs. 7-10.

Test trochospirally coiled in the initial part, then streptospirally; chambers globular, strongly embracing, increasing rapidly in size as added, three on the last whorl; peripheral outline rounded, slightly trilobulated in outline; wall calcareous, perforate, surface cancellate, with large, massive, cylindrical spines, irregularly distributed; sutures distinct, slightly depressed; aperture interiomarginal, covered by a well developed ultimate chamber (bulla).

Diameter: 0.2-0.4 mm; diameter of the holotype 0.2 mm.

Remarks: Differs from *G. apertasuturalis* (JENKINS) in lacking the sutural openings, possessing larger, massive cylindrical spines and less lobulate outline.

The holotype comes from Valea Lupoaia section, Archiș, Arad District.

Range: This rare species was recorded from the Upper Langhian deposits in Banat.

Authors collection, deposited at the Bucharest University, Laboratory of Paleontology

Genus ***Turbotalita*** BLOW & BANNER, 1962

Turbotalita quinqueloba (NATLAND), 1938

Pl. 5, figs. 1-3.

Globigerina quinqueloba NATLAND, 1938, p. 149, pl. 6, figs. 7a-c.

Globigerina (Globigerina) quinqueloba NATLAND. Kennett & Srinivasan, 1983, p. 32, pl. 5, figs. 4-6.

Small sized globigerinid, low trochospire, five chambers in the final whorl, rapidly increasing as added; final chamber distinctly spinose, early chambers with reticulate ridges and pore-pits; sutures radial, depressed; aperture an elongate slit, often at the end of a flap-like extension of the final chamber.

Occurrence: Lower and Middle Miocene in the Paratethys.

Subfamily **ORBULININAE** SCHULTZE, 1854

Genus ***Praeorbulina*** OLSSON, 1964

Praeorbulina glomerata circularis (BLOW), 1956

Pl. 13, figs. 6-9.

Globigerinoides glomerosa circularis BLOW, 1956, p. 65, text-fig. 2/3, 4.

Globigerinoides transitoria BLOW, 1956, p. 65, text-fig. 2/12, 13.

Remarks: *Praeorbulina glomerosa circularis* is part of the evolutionary lineage leading to *Orbulina universa* d'Orbigny. It has an intermediate position between its immediate ancestor, *P. glomerosa glomerosa* and *Orbulina suturalis*. It differs from *P. glomerosa glomerosa* in having a circular outline and smaller and more numerous apertures along the sutures. It differs from *O. suturalis* in lacking areal apertures.

Species frequent in the Lower Badenian deposits from Romania.

Praeorbulina glomerosa curva (BLOW), 1956

Pl. 12, figs. 10-12.

Globigerinoides glomerosa curva BLOW, 1956, p. 64, text-fig. 1/9-14.

Remarks: Species with intermediate morphology between its ancestor, *Praeorbulina sicana* (DE STEFANI) and its descendant *P. glomerosa glomerosa*. It differs from *P. sicana* by its almost spherical test and by its more numerous supplementary apertures.

This subspecies was recorded by us only from the Lowermost Badenian deposits at Greceanca (Buzău District).

Praeorbulina glomerosa glomerosa (BLOW), 1956

Pl. 13, figs. 1-5.

Globigerinoides glomerosa glomerosa BLOW, 1956, p. 64, text-fig. 1/15-19; text-fig. 2/1,2.

Remarks: Differs from *P. glomerosa curva* in having more slitlike apertures along the base of the last chamber, and in the almost spherical test due to the stronger envelopment of the previous chambers.

Common in the Lowermost Badenian deposits.

Praeorbulina sicana DE STEFANI, 1950

Pl. 12, figs. 7-9.

Globigerinoides conglohatatus (BRADY). Cushman and Stainforth, 1945, p. 68, Pl. 13, fig. 6.

Globigerinoides sicana DE STEFANI, 1952, p. 9.

Globigerinoides sicana DE STEFANI. Blow, 1969, Pl. 3, figs. 10, 11.

Praeorbulina sicana (DE STEFANI). Jenkins, Saunders & Cifelli, 1981, p. 264, pl. 1, fig. 2a-c.

Test trochospirally coiled, equatorial periphery bilobate, axial periphery rounded; three chambers on the last whorls, increasing rapidly in size, with final chamber tending to overlap previous chambers; sutures distinct and depressed; surface cancellate; apertures small, sutural, four at the base of the final chamber.

Occurrence: Common in the Lower Badenian deposits from Paratethys.

Genus *Orbulina* D'ORBIGNY, 1839

„*Orbulina*” *suturalis* BRÖNNIMANN, 1951

Pl. 13, figs. 10-12.

Orbulina suturalis BRÖNNIMANN, 1951, p. 135, text-fig. IV, figs. 15, 16, 20.

Remarks: This species is an intermediate between *Praeorbulina glomerosa circularis* and *Orbulina universa*. It differs from its ancestor, *P. glomerosa circularis* by the presence of areal apertures along the sutures.

Its descendent, *O. universa*, has spherical test

composed of a single spherical chamber, with the surface densely perforated with numerous openings of two distinct sizes. Unlike it, *O. suturalis* has a test surface more like that of the genus *Praeorbulina*, and this is why we doubt the attribution of this species to the genus *Orbulina*.

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PLATES**PLATE 1**

Figs. 1-6. *Clavatorella sturarii* (GIANELLI & SALVATORINI). Valea Lupoaiiei section, Archiș, Arad District. Upper Moravian. Fig. 1, apertural detail of fig. 2; figs. 2, 4, umbilical views; fig. 3, spiral view; 5, apertural detail of fig. 6; fig.6 umbilical view.

Figs. 7-12. *Globorotalia transsylvanica* POPESCU. Valea Gemeni section, Coștei, Timiș District. Upper Moravian. Figs. 7, 10, 12, umbilical views; fig. 8, edge/spiral view; fig. 9, spiral view; fig. 11, apertural detail from fig. 12

Figs. 13, 14. *Globorotalia praescitula* BLOW. Valea Gemeni section, Coștei, Timiș District. Upper Moravian. Fig. 13, umbilical view; fig. 14, edge view.

PLATE 2

Figs. 1-3. *Globorotalia praescitula* BLOW. Valea Gemeni section, Coștei, Timiș District. Upper Moravian. Fig. 1, umbilical view; fig. 2, edge view; fig. 3 spiral view.

Fig. 4. *Globorotalia scitula* (BRADY). Valea Gemeni section, Coștei, Timiș District. Upper Moravian. Umbilical view.

Figs. 5-10. *Paragloborotalia mayeri* (CUSHMAN & ELLISOR). Borehole F5, Coșava, m 210, Moravian. Figs. 5, 8, umbilical views; figs. 6, 9, edge views; figs. 7, 10, spiral views.

Figs. 11, 12. *Globorotalia bykovae* AISENSTAT. Valea Prahovei section, Cîmpina. Moravian. Fig. 11, umbilical view; fig. 2, apertural detail.

PLATE 3

Figs. 1-3. *Paragloborotalia mayeri* (CUSHMAN & ELLISOR). Borehole F5, Coșava, m 210, Moravian. Fig. 1, umbilical view; fig. 2, edge view; fig. 3, spiral view.

Figs. 4-6. *Globigerinopsis grilli* SCHMID. Borehole 77, Zlăgănița, East of Caransebeș (eastern border of Pannonian Depression), Uppermost Moravian-Lower Wielician. Figs. 4, 5, lateral/edge views; fig. 6, spiral view.

Figs. 7-12 *Tenuitellinata uvula* (Ehrenberg). Borehole F5, Coșava, m 210, Lower Wielician. Figs. 7, 8, 10, 12 lateral-apertural views; fig.9, apertural detail of fig. 7; fig. 11, wall structure from fig.10.

PLATE 4

Figs. 1-6. *Globigerinita glutinata* EGGER. Borehole F5, Coșava, m 210, Moravian. Figs. 1, 3, umbilical view; fig. 2, detail of the apertural bulla of fig. 1; fig. 4, apertural detail of fig. 3; fig. 5, edge view; fig. 6, spiral view.

Fig. 7. *Tenuitellinata* sp. cf. *T. selleyi* LI, RADFORT and BANNER. Valea Lupoia section, Archiș, Arad District. Uppermost Moravian. Umbilical view.

Figs. 8-13 *Globigerinita subcretacea* (LOMNICKI). Fig. 8, Valea Lupoia section, Archiș, Arad District. Uppermost Moravian. Umbilical view. Figs. 9-13, Borehole F5, Coșevita, m 120, Upper Moravian; fig. 9, apertural view; fig. 10 umbilical detail of fig. 9; fig. 11, edge/spiral view; fig. 12, edge view; fig.13, spiral view.

PLATE 5

Figs. 1-3. *Turborotalita quinqueloba* (NATLAND). Valea Coșului section, Lăpușiu de Sus, Hunedoara District. Lower Badenian. Umbilical views.

Fig. 4. *Globoquadrina langhiana* CITA & GELATI. Valea Dosului section, Giurgești, Cluj District. Moravian. Umbilical view.

Figs. 5-7. *Globoquadrina dehiscens* (CHAPMAN, PARR and COLLINS). Popești Quarry, north of Cluj-Napoca. Lower Moravian. Figs. 5, 8, umbilical views; fig. 6, spiral view; fig. 7, natural transverse section in umbilical axis; fig. 9, apertural detail of fig. 8.

Figs. 8-11. *Globoquadrina praealtispira* POPESCU. Fig. 10, Borehole 5, Coșava, m 210. Upper Moravian. Lateral views. Fig. 11, Valea Gemeni section, Coștei, Timiș District; Moravian. Lateral view.

PLATE 6

Figs. 1-6. *Globoquadrina rumana* POPESCU. Borehole F5, Coșava, Timiș District. Moravian. Figs. 1, 3, 4, 6, lateral views; fig. 5, apertural view; figs. 2, 7 spiral views.

Figs. 7, 8. *Globoquadrina conica* BRONNIMANN & RESIG. Borehole F5, Coșava, Timiș District. Lateral views.

Figs. 9-15. *Velapertina indigena* (LUCZKOWSKA). Figs.12-15, Valea cu Oase, Chiuza, Bistrița-Năsăud District. Kossovian, lateral dorsal (spiral) views; fig. 14, wall detail with sutural openings of fig. 12. Figs. 9, 10 Velapertina

"cingulata"-type specimens. Valea Chirului section, Predeal-Sărari, Prahova District. Kossovian. Lateral views.
 Fig. 16. *Velapertina luczkowskiae* POPESCU. Valea Morilor section, Colibași, Mehedinți District. Kossovian. Lateral view.
 Fig. 17. *Velapertina sphaerica* POPESCU. Valea Morilor section, Colibași, Mehedinți District. Kossovian.

PLATE 7

Fig. 1, 2. *Velapertina luczkowskiae* POPESCU. Valea Morilor section, Colibași, Mehedinți District. Kossovian. Fig. 1, lateral view; fig. 2, lateral apertural view. Kossovian.
 Fig. 3. *Velapertina iorgulescui* POPESCU. Valea Chirului section, Predeal-Sărari, Prahova District. Kossovian.
 Fig. 4-6. *Velapertina indigena* (LUCZKOWSKA). Valea Morilor section, Colibași, Mehedinți District. Kossovian. Fig. 4, lateral view; figs. 5, 6, specimens with the last chambers artificially destroyed.
 Figs. 7-10. *Globospina banatica* n.sp. Valea Lupoia section, Archiș, Arad District. Uppermost Moravian-Lower Wielician. Figs. 7 (holotype), 8, lateral-frontal views; fig. 9, spiral view; fig. 10, surface wall detail of the last chamber.
 Figs. 11, 12. *Globigerina bulloides* D'ORBIGNY. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Umbilical views.
 Fig. 13. *Globigerina concinna* REUSS. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Umbilical view.

PLATE 8

Fig. 1. *Globigerina tarchanensis* SUBBOTINA & CHUTZIEVA. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Early Wielician. Umbilical view.
 Figs. 2, 3. *Globigerinella aequilateralis* (BRADY). Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Lateral views. Fig. 3, young specimen.
 Figs. 4-6. *Globigerinella obesa* (BOLLI). Borehole 77, Zlăgănița, Timiș District. Moravian. Fig. 4, umbilical view; fig. 5, apertural view; fig. 6, spiral view. Figs. 7-9. *Globigerinoides bisphericus* Todd. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Frontal views.
 Figs. 7-9. *Globigerinoides bisphericus* TODD. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Fig. 7, umbilical view; figs. 8, 9, spiral view.
 Figs. 10-14. *Globigerinoides triloba* (REUSS). Valea Gemeni, Coștei, Timiș District. Moravian. Figs. 10, 12, 13, umbilical views; fig. 14, apertural detail of fig. 13; fig. 11, spiral view.

PLATE 9

Figs. 1, 2. *Globigerinoides sacculifer* (BRADY). Valea Gemeni, Coștei, Timiș District. Moravian. Fig. 1, apertural view; fig. 2, spiral view.
 Figs. 3, 4. *Globigerinoides altiapertura* BOLLI. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Spiral views.
 Figs. 5-7. *Globoturborotalita apertura* (CUSHMAN). Valea Dosului section, Giurgești, Cluj District. Moravian. Fig. 5, 7, apertural views; fig. 6, edge view.
 Figs. 8, 9. *Globoturborotalita decoraperta* TAKAYANAGI & SAITO. Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Apertural views.
 Figs. 10-12. *Globoturborotalita woodi* (JENKINS). Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Figs. 10, 12, apertural views; fig. 11, spiral view.

PLATE 10

Figs. 1-8. *Globoturborotalita druryi* (AKERS). Valea Popii section, Vâlcelele Bune, Hunedoara District. Late Moravian-Lower Wielician. Figs. 1, 3-5, 7, 8, umbilical views; fig. 2, apertural detail of fig. 1; fig. 6, spiral view.
 Figs. 9-11. *Globoturborotalita bulloidea* (CRESCENTI). Valea Gemeni section, Coștei, Timiș District. Upper Moravian-Lower Wielician. Fig. 9, umbilical view; fig. 10, spiral view; fig. 11, wall texture of fig. 10.

PLATE 11

Figs. 1-7. *Globoturborotalita bulloidea* (CRESCENTI). Valea Gemeni section, Coștei, Timiș District. Uppermost Moravian-Lower Wielician. Figs. 1, 3, umbilical views; fig. 2, apertural detail of fig. 1; figs. 4, 6, spiral views; figs. 5, 7, detail of sutural apertures of fig. 4 and, respectively, 6
 Figs. 9-11. "*Globigerinoides*" *apertasuturalis* JENKINS. Valea Lupoia, Archiș. Fig. 9 spiral view; figs. 10, 11 umbilical views.
 Fig. 12. "*Globigerina*" *eamesi* BLOW. Valea Lupoia section, Archiș, Arad District. Late Moravian-Lower Wielician. Umbilical view.

PLATE 12

Figs. 1-3. "*Globigerina*" *eamesi* BLOW. Valea Lupoia section, Archiș, Arad District. Late Moravian. Fig. 1, 3, umbilical views; fig. 2, edge view.

Figs. 4-6. Transitional specimens between *Globigerinoides bisphericus* and *Praeorbulina sicana*. Valea Glodului section, Glod (Almașu Mare), Alba District. Early Moravian.

Figs. 7-9. *Praeorbulina sicana* (DI STEFANI). Borehole 5, Coșava, m. 205, Timiș District. Upper Moravian. Fig. 7, umbilical view; fig. 8, spiral/edge view; fig. 9, edge view.

Figs. 10-12. *Praeorbulina glomerosa curva* (BLOW). Greceanca, Buzău District. Lower Moravian. Figs. 10,11, lateral views; fig. 12, initial chambers of a naturally broken specimen.

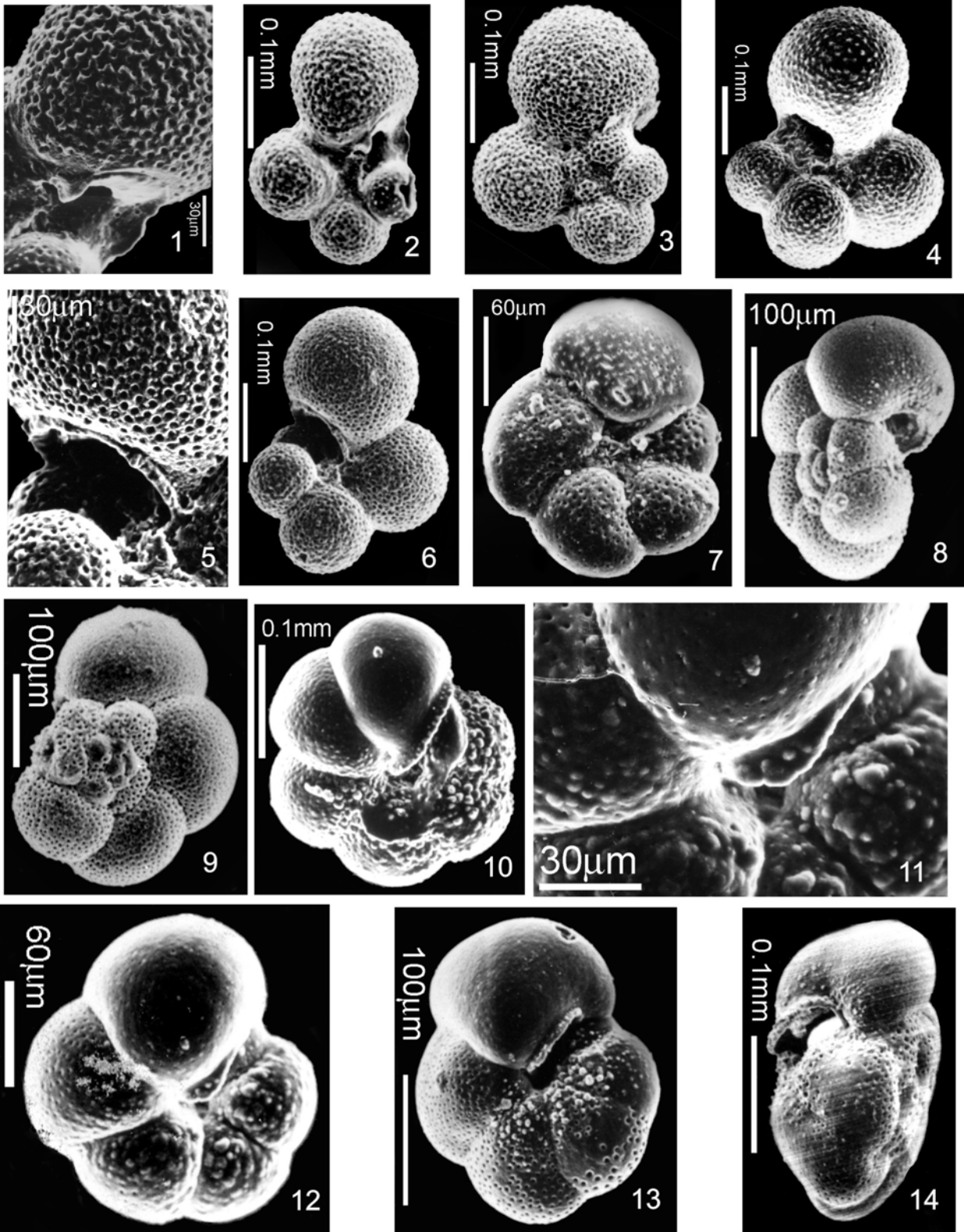
PLATE 13

Fig. 1-5. *Praeorbulina glomerosa glomerosa* (BLOW). Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Lateral views.

Figs. 6-9. *Praeorbulina glomerosa circularis* (BLOW). Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Lateral views.

Figs. 10-12. "*Orbulina*" *suturalis* (BRÖNNIMANN). Valea Coșului section, Lăpugiu de Sus, Hunedoara District. Moravian. Lateral views.

PLATE 1



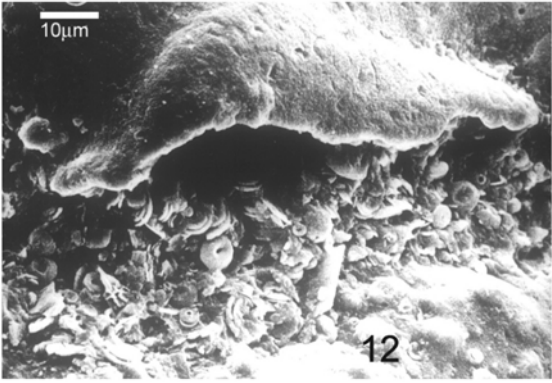
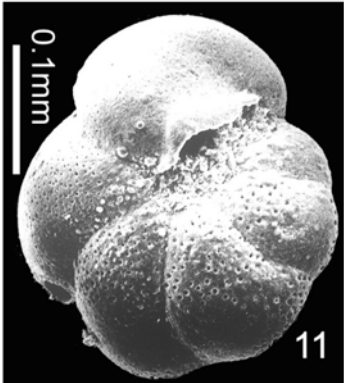
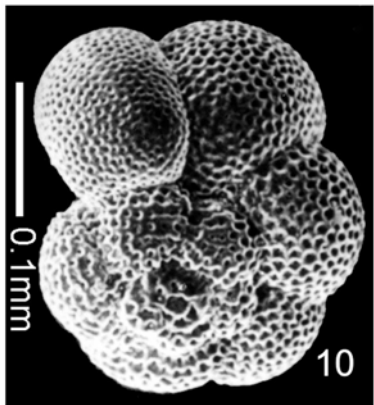
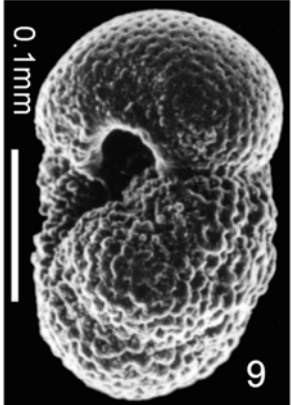
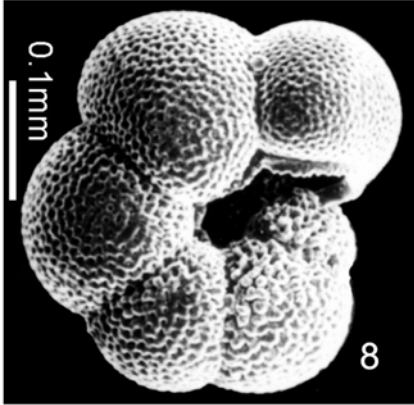
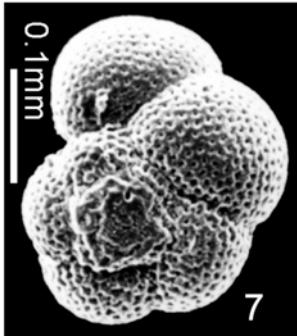
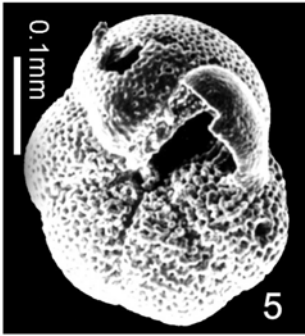
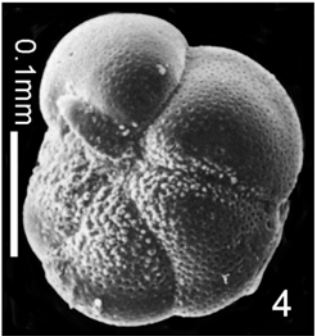
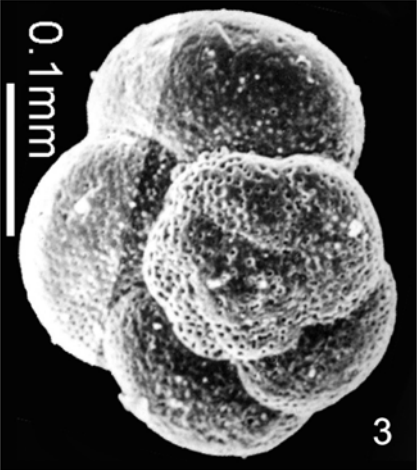
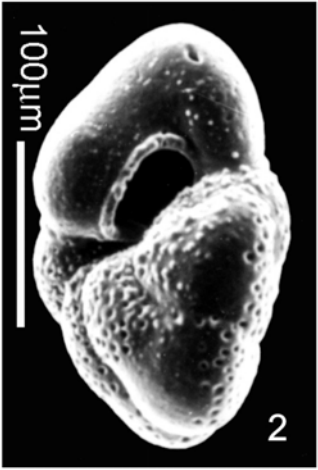
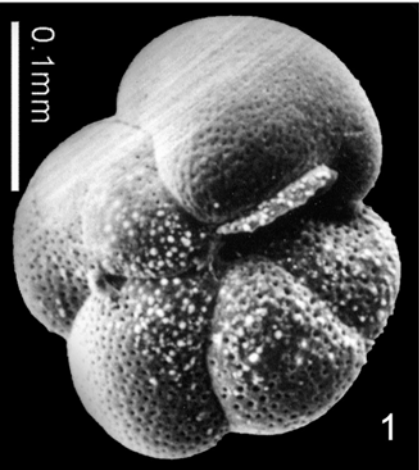
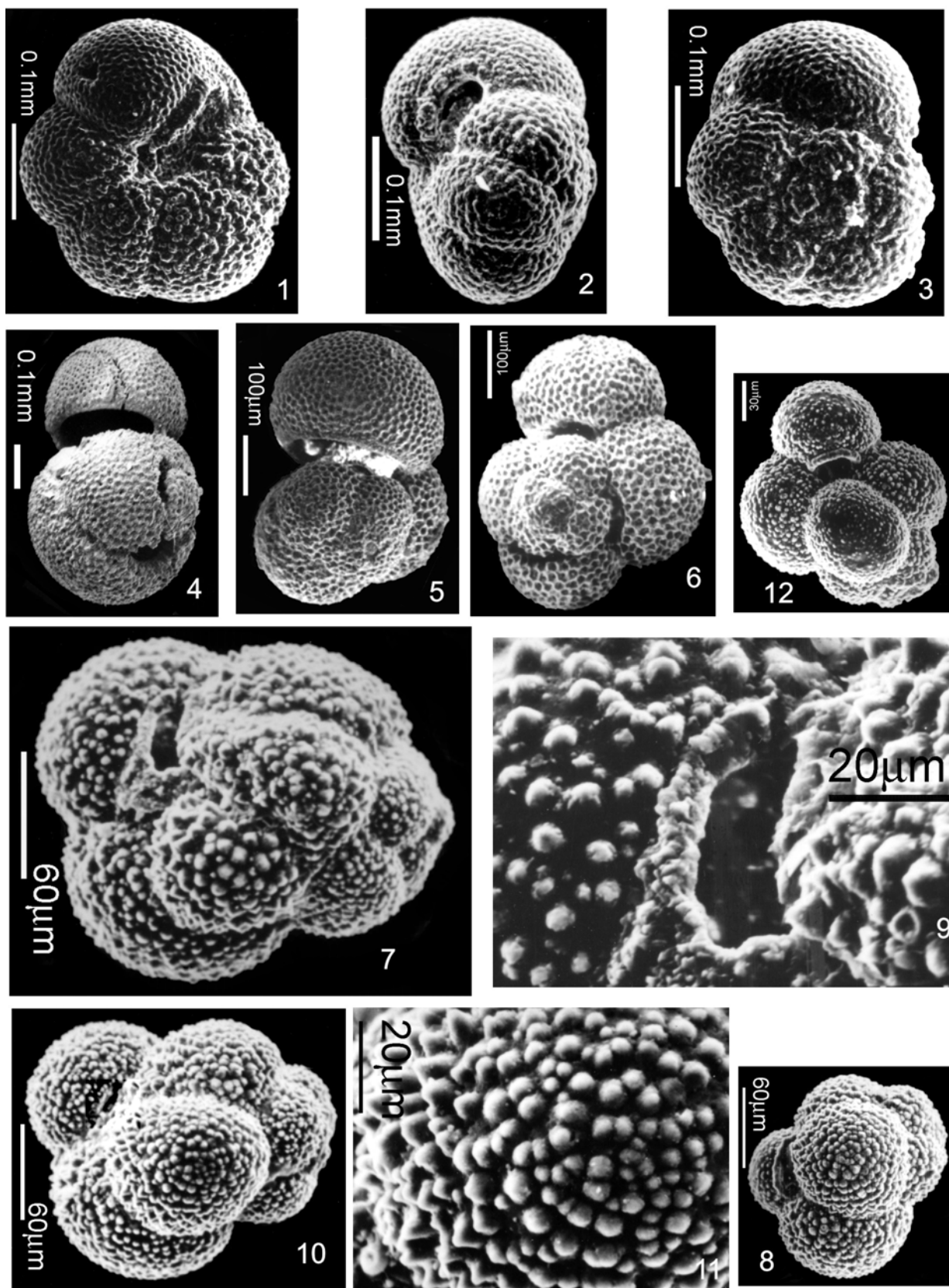


PLATE 3



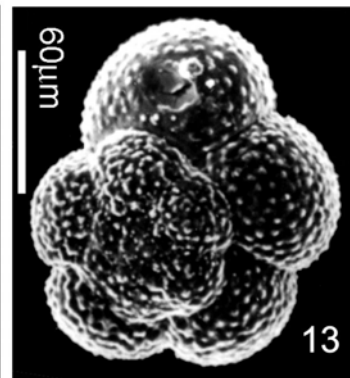
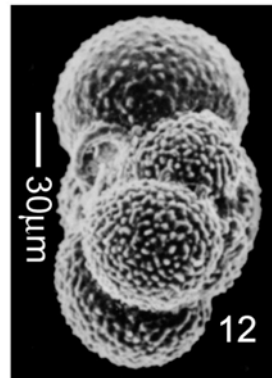
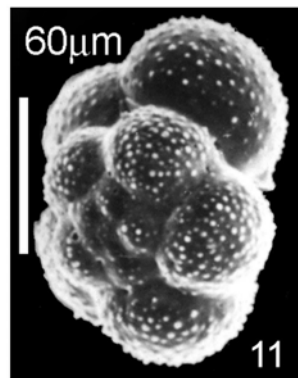
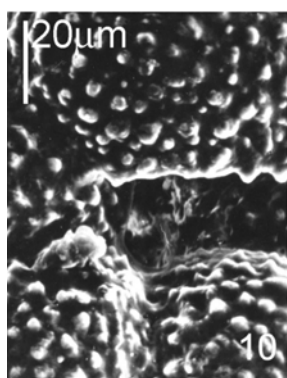
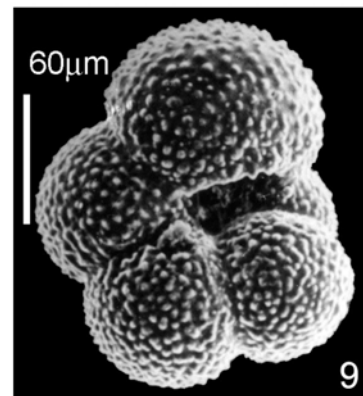
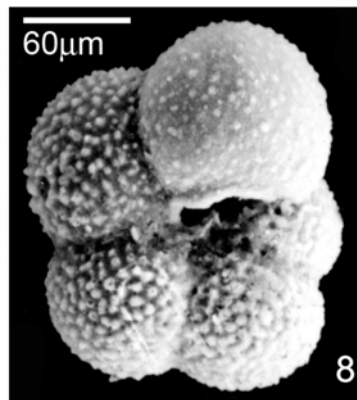
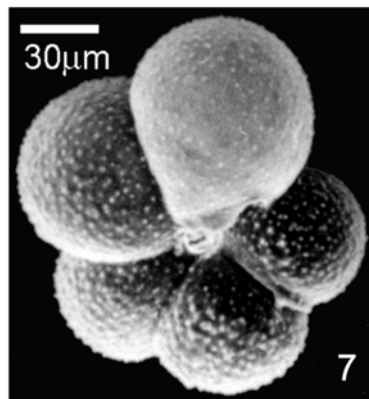
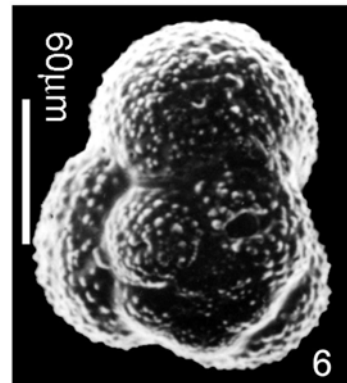
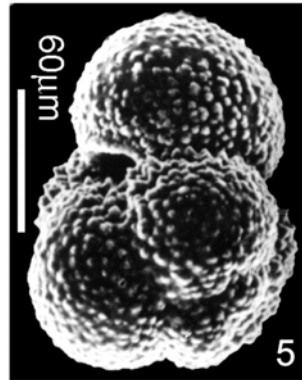
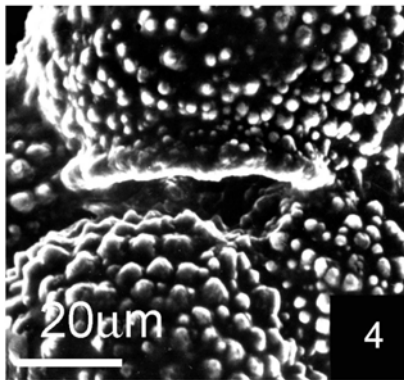
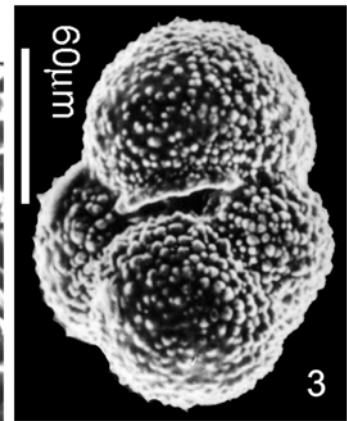
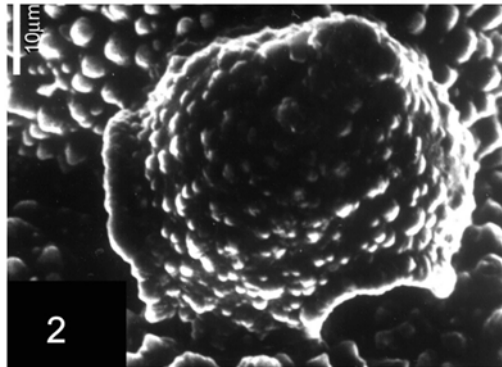
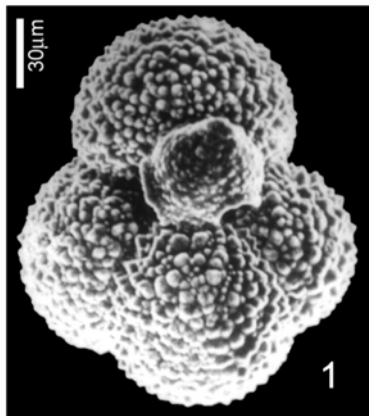
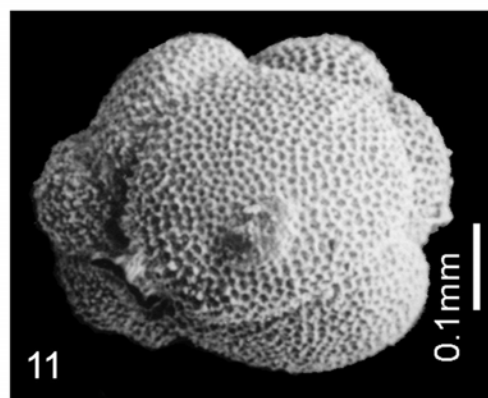
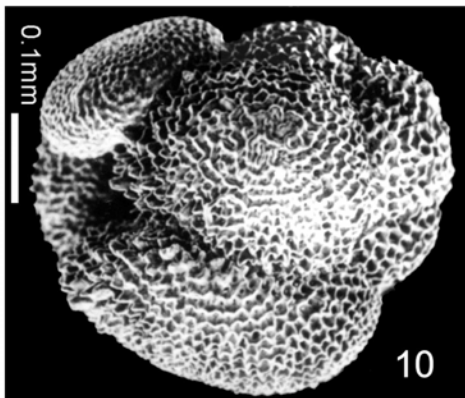
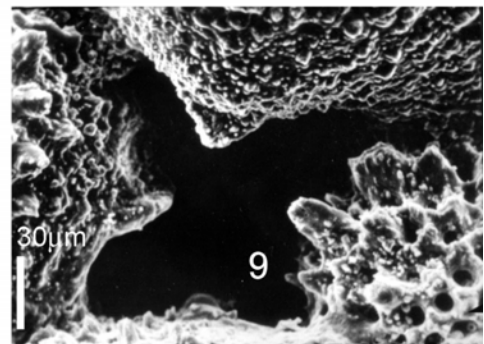
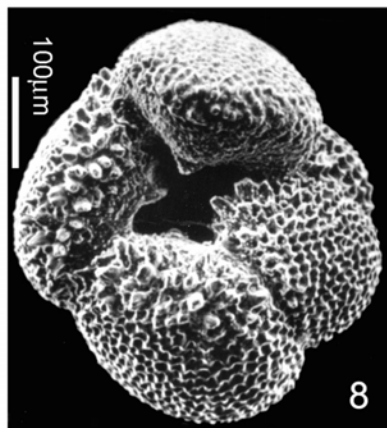
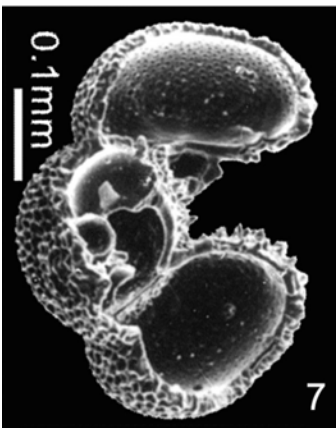
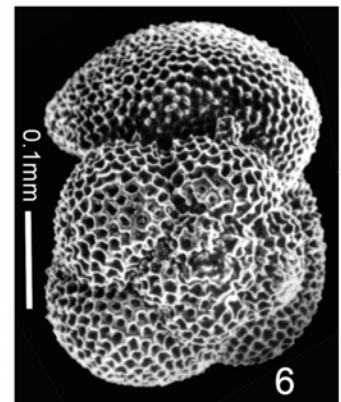
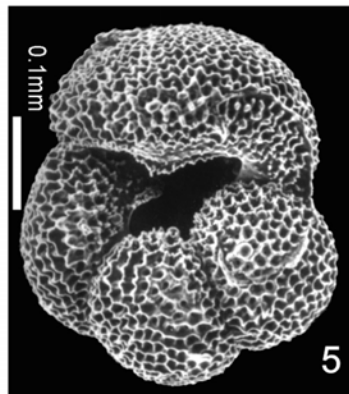
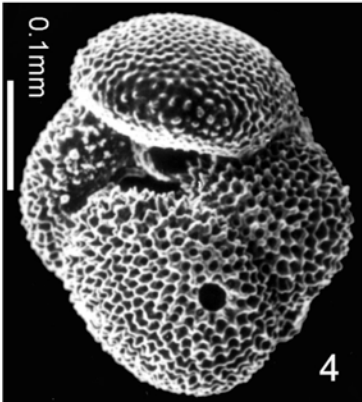
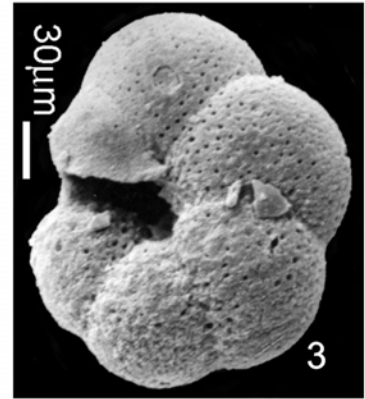
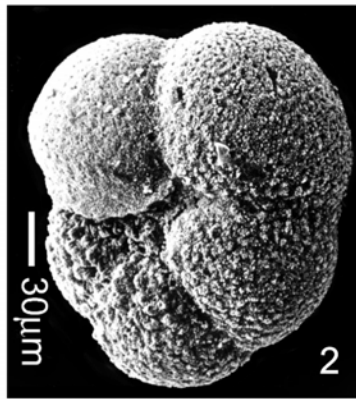
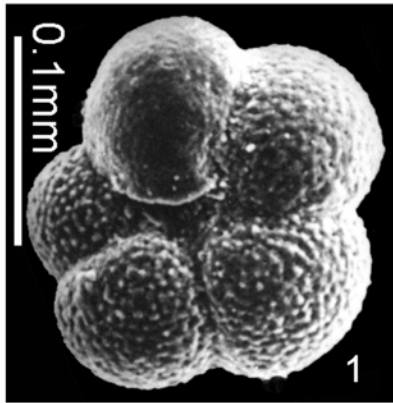


PLATE 5



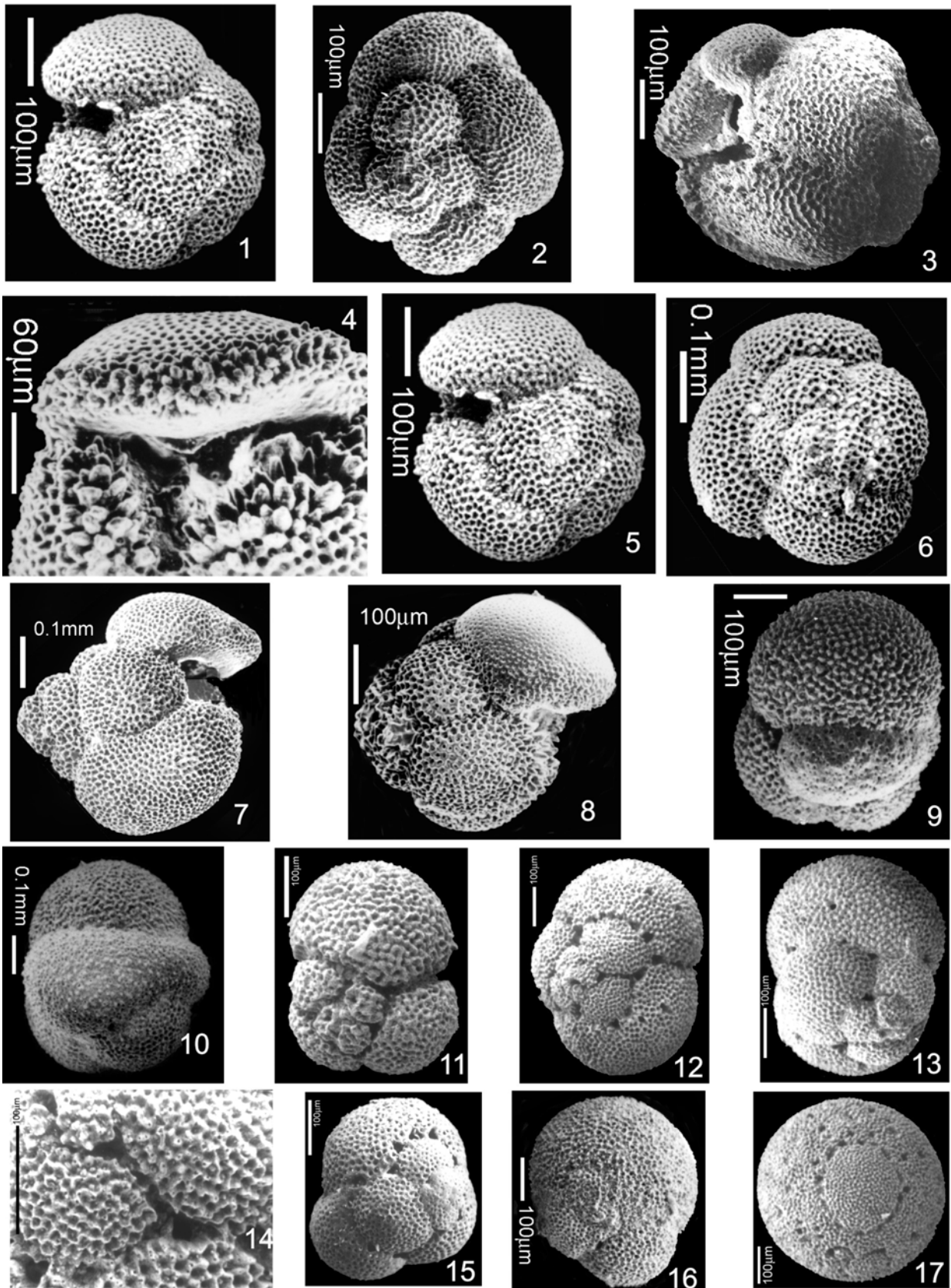
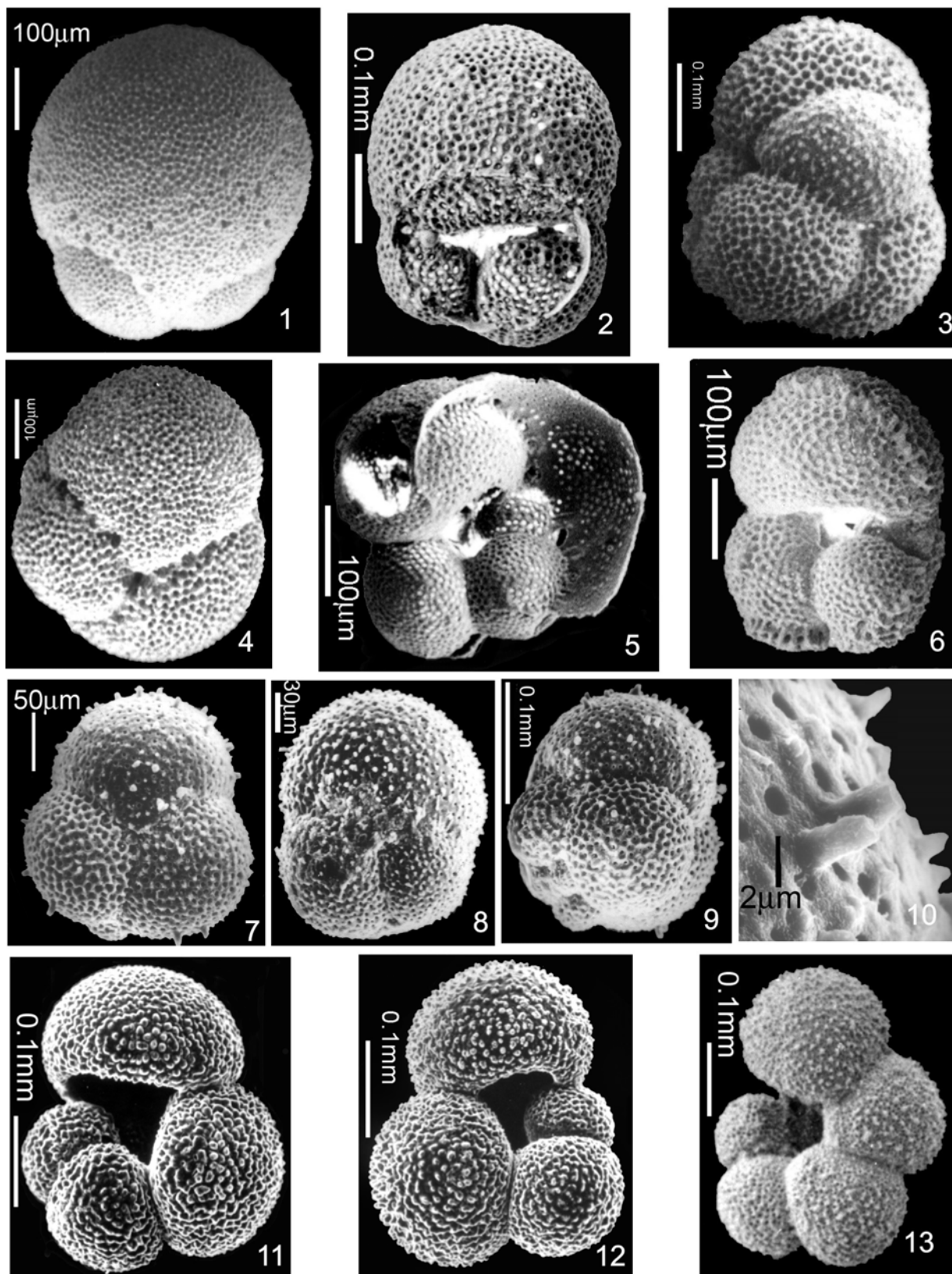


PLATE 7



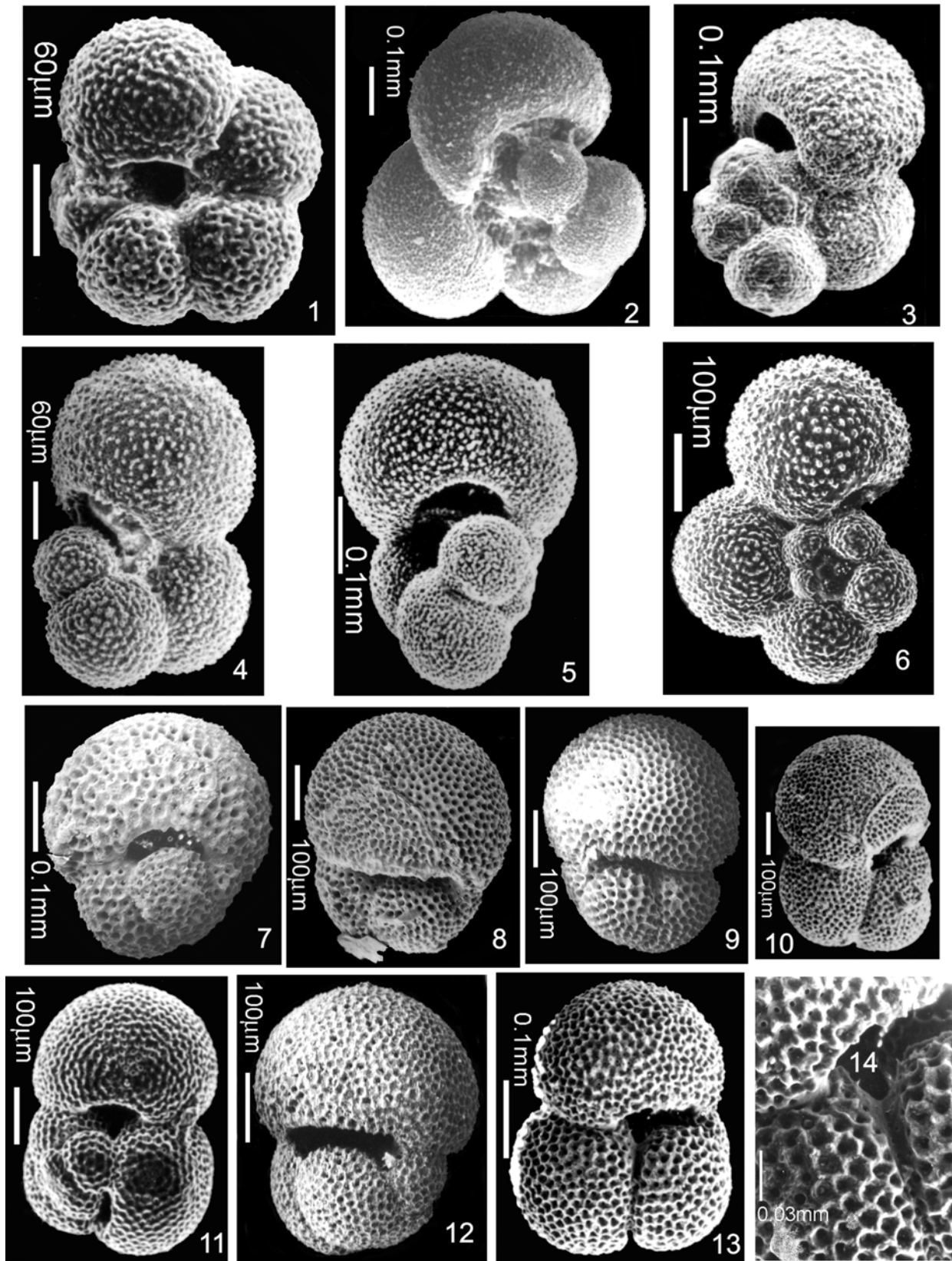
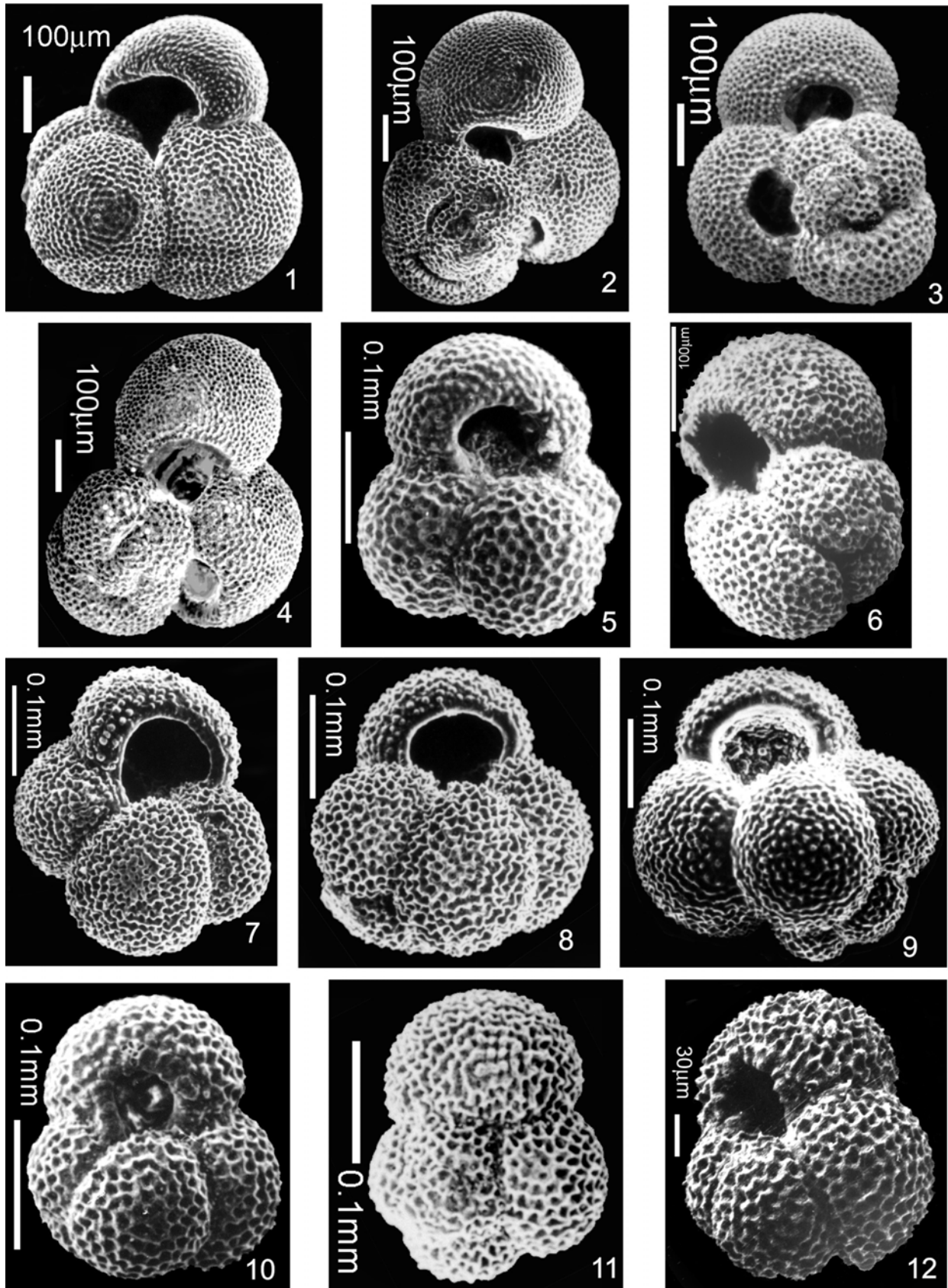


PLATE 9



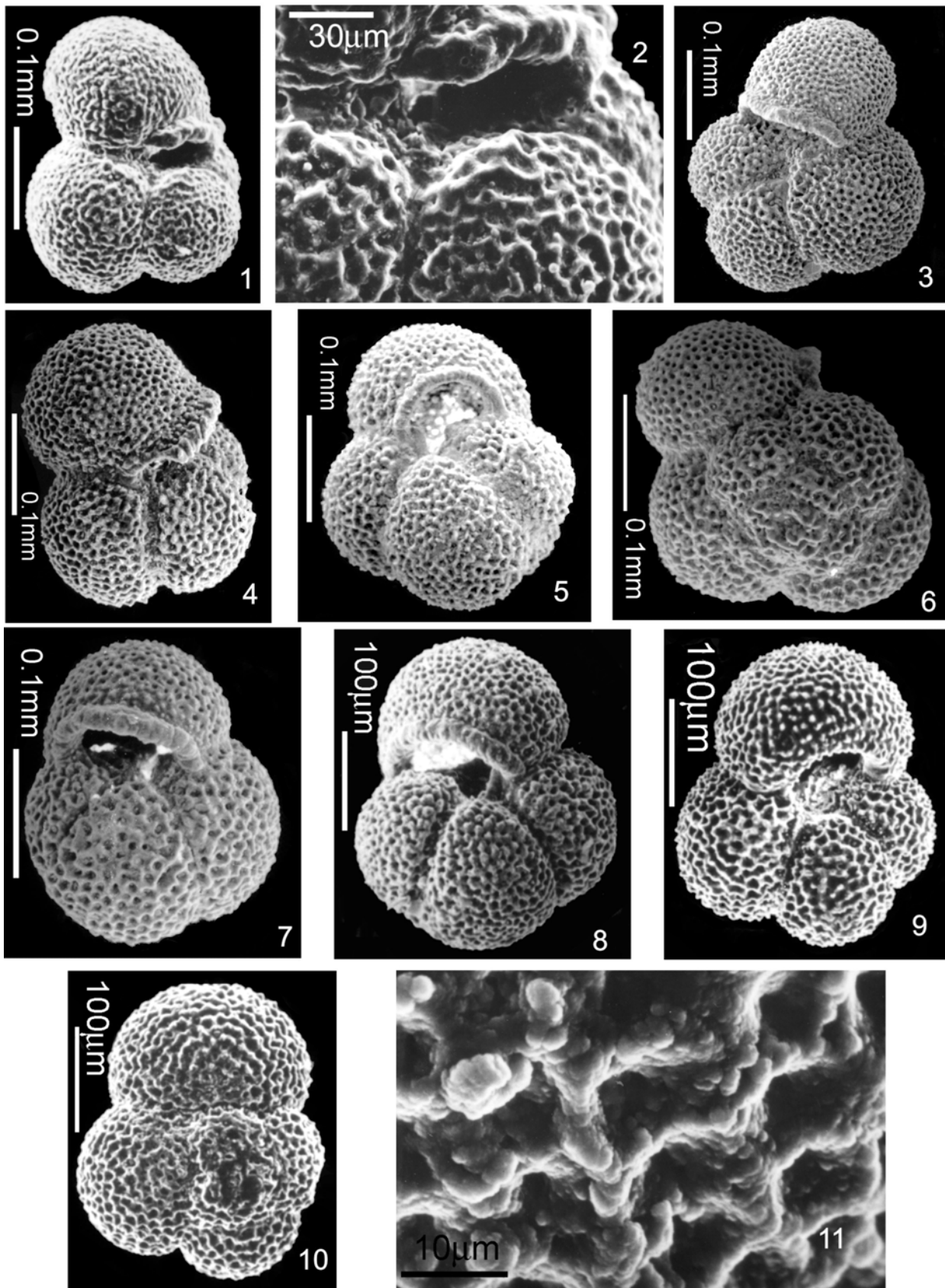
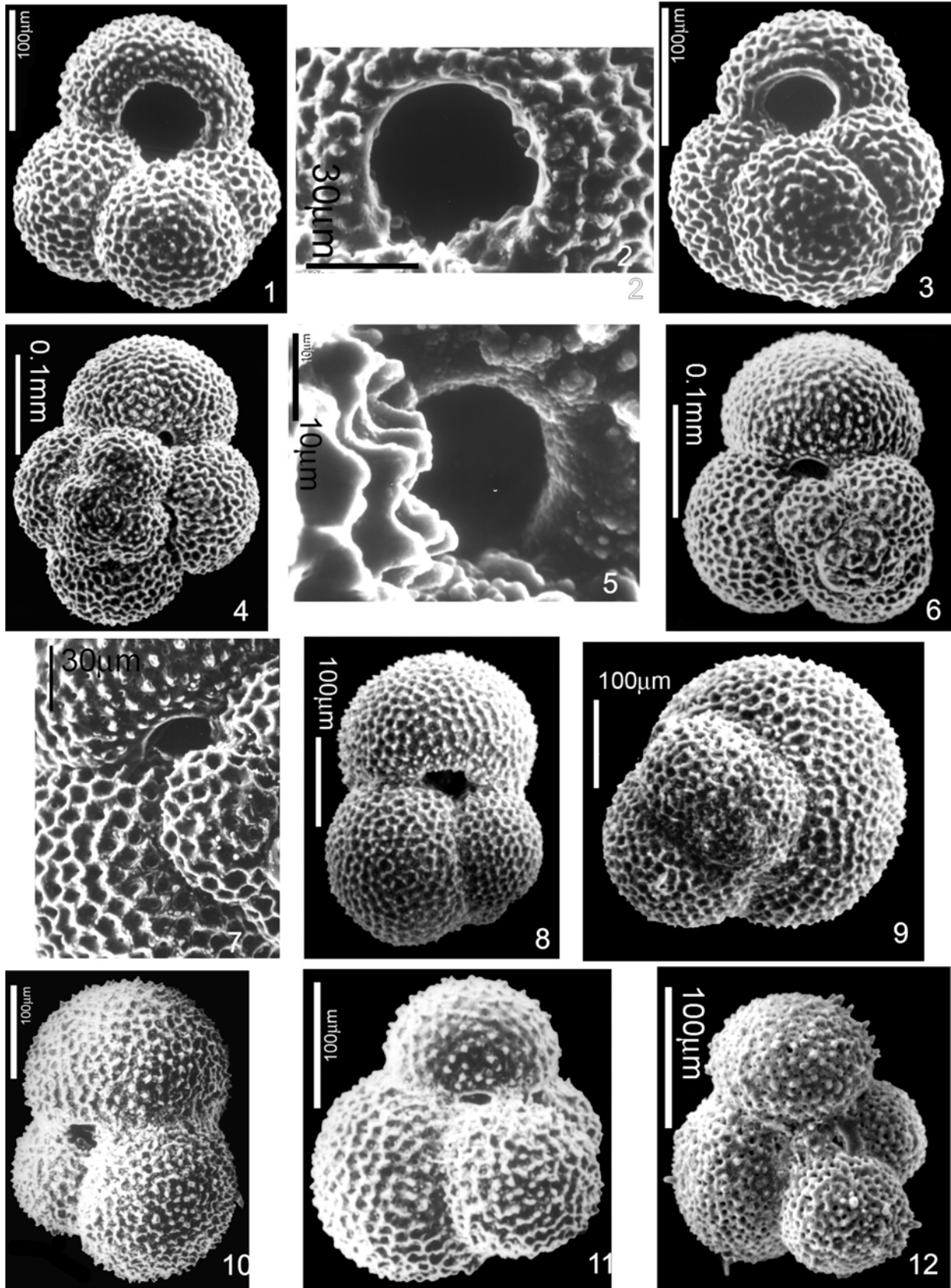


PLATE 11



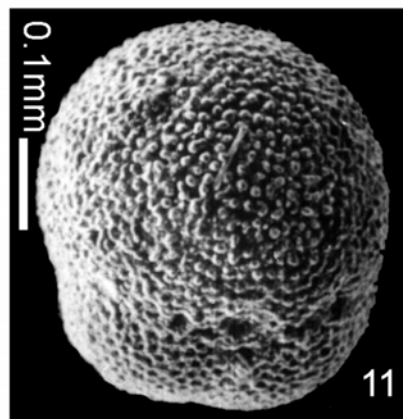
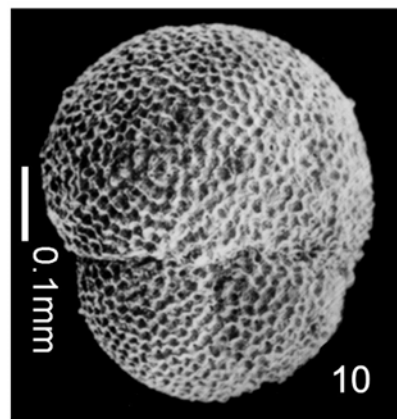
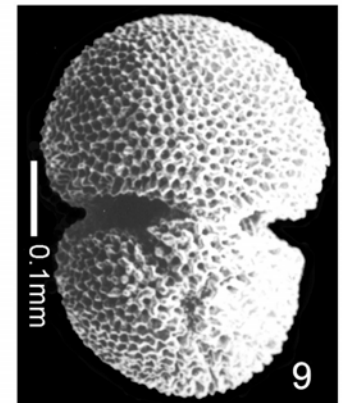
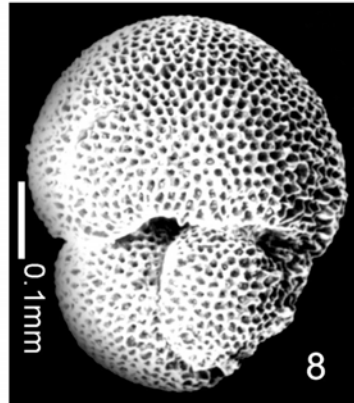
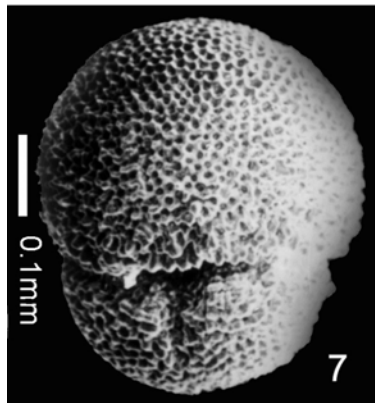
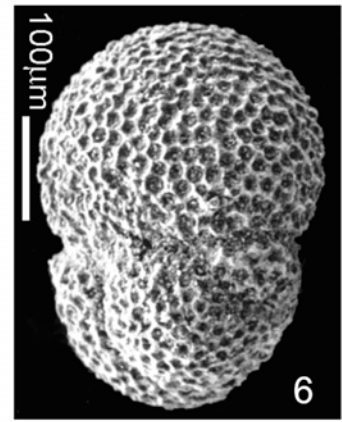
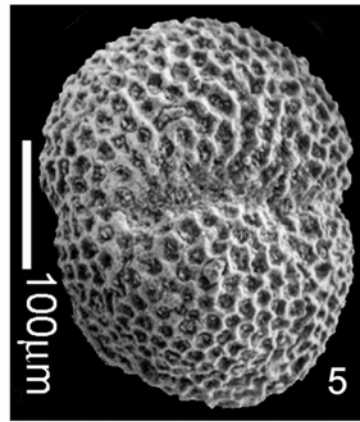
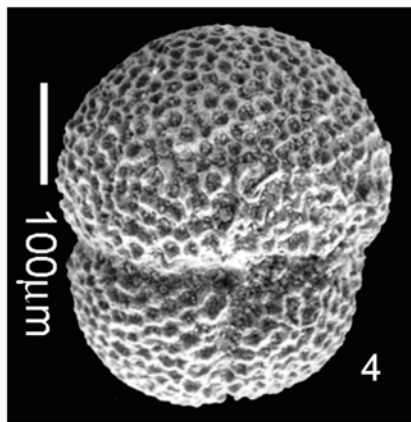
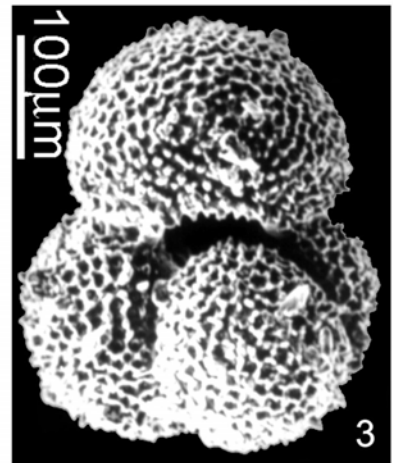
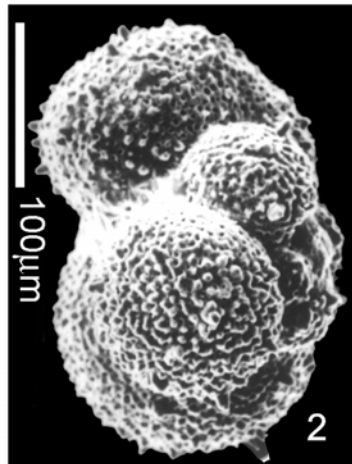
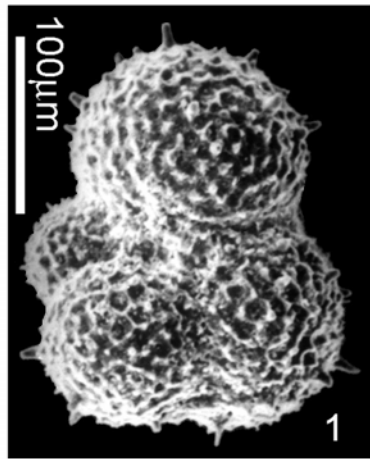


PLATE 13

