

MIDDLE MIOCENE FORAMINIFERA FROM ROMANIA: ORDER BULIMINIDA, PART I

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Abstract: From the very rich and diverse order Buliminida, the authors tried to describe and figure in this paper some species from the superfamilies Bolivinacea, Loxostomacea, Bolivinitacea, Cassidulinacea, Turritinacea, and Buliminacea found in the Middle Miocene deposits from Romania.

The described specimens come from the south-western border of the Pannonian Basin (Bega and Caransebeş intermountainous basins), from samples collected both in outcrops (Balta Sărată, Lăpuşiu, Panc, Coştiul de Sus-Nemeşeşti) and in drillings (Zlăgăniţa, Coşava, Coşuştea, Coştei, etc.). Beside the mentioned areas some specimens come from northern and north-western Transylvania (Chiuză, Popeşti, Notelec).

Key words: Buliminida, Middle Miocene, Romania

INTRODUCTION

The exhaustive knowledge of the foraminiferal microfaunas from the marine Middle Miocene from Romania is one of the goals proposed by these authors. There have already been published some papers regarding the agglutinated foraminifera (Popescu, 1999), the miliolids (Popescu & Crihan, 2002), the nodosariids (Popescu & Crihan, 2004a) and the unicameral calcareous foraminifera (Popescu & Crihan, 2004b), and in an older paper the Sarmatian foraminifera (Popescu, 1995).

Here, we intend the presentation of the foraminifera from the order Buliminida, which for make-up reasons will be divided into two parts.

Most of the worked material comes from samples collected during different activities performed for the Geological Institute of Romania.

Excepting the Cenozoic cover of the Moldavian Platform, the authors have collected samples from all major tectonic units of Romania. From the point

of view of the foraminiferal content the most significant investigated geological sections are situated in the southern part of the eastern border of the Pannonian Basin (Caransebeş – Mehadia Basin and Zarand Basin), in the western part of the Getic Depression (Western Oltenia), the subcarpathian units (Subcarpathian Nappe and Tarcău Nappe), Transylvanian Basin and Maramureş Basin. To these, samples collected from continuous drilling cores from Caransebeş – Lugoj area (Banat) and Romanian Plain are added. As for the foraminifera from the order Buliminida, most of the samples were collected (from drillings or outcrops) from Caransebeş – Mehadia Basin, and especially from its eastern prolongation - Bega Basin, from Zarand Basin, Western Getic Depression, Subcarpathians, and north-western Transylvania (Fig. 1).

The foraminifera from the order Buliminida were commonly recorded from pelitic deposits, in distal shelf or bathyal facies and, quite rarely, in proximal

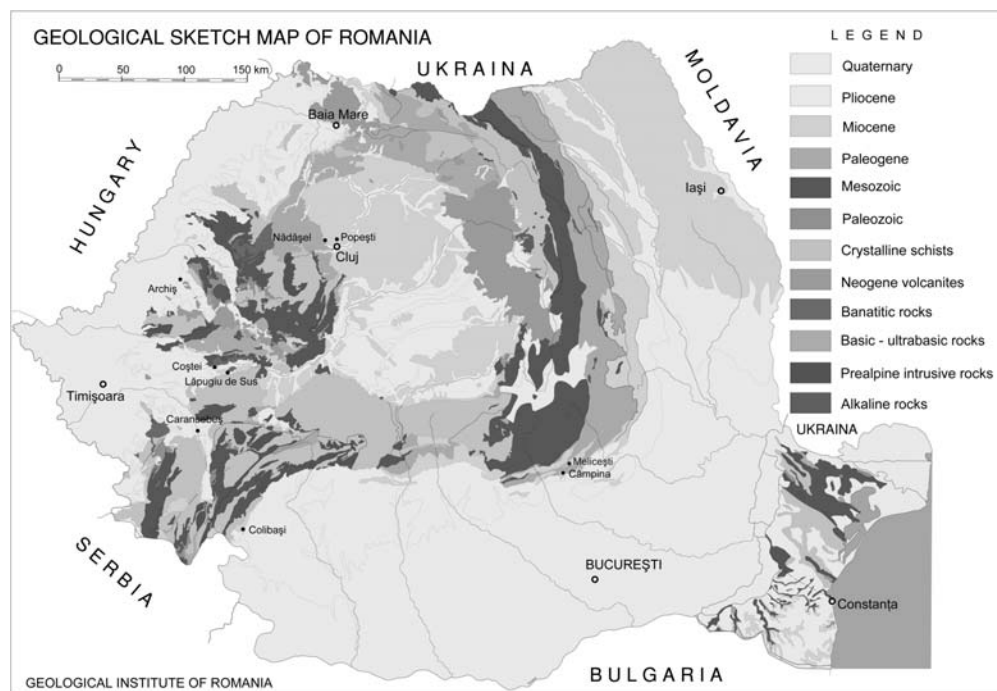


Fig. 1. Geological sketch of Romania with locations of sampled sections

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shelf deposits. The most representative samples were collected from the famous fossiliferous locations from Lăpugiu de Sus and Coștei, as well as from the drillings from the Bega basin (F3, F4, F5) – between Coștei and Făget.

In the Badenian (Langhian and Lower Serravallian) the faunas occur in the upper part of the Moravian, in the Wielician and Kossovian (Buliminidae, Baggatellidae, Uvigerinidae). In the Lower Moravian occur many uvigerinas from the group *macrocarinata* and Bolivinidae, together with numerous Lenticulinidae. In the systematic descriptions of the species the ages and sometimes the planktonic foraminifera biozone where they were recorded from are usually indicated. The regional biozonation proposed by Popescu & Crihan (2004) was used in this paper.

SYSTEMATIC DESCRIPTIONS

Order **BULIMINIDA** FURSENKO, 1958

Superfamily **Bolivinacea** GLAESSNER, 1937

Fam. **Bolivinidae** GLAESSNER, 1937

Genus *Bolivina* d'ORBIGNY, 1839

Bolivina dilatata REUSS, 1850

(pl. 1, fig. 1)

Bolivina dilatata REUSS, 1850, p. 381, pl. 48, fig. 15; Cushman, 1937, p. 78, pl. 9, figs. 17-20.

Bolivina dilatata dilatata Reuss. Cicha & Zapletalova, 1963, p. 131, text-figs. 11a-f.

Test ovate, elongate, slightly lanceolate, compressed, biserial throughout, gently tapering towards both ends; peripheral margin lobate, subacute; chambers distinct, slightly inflated, inner basal part of chambers extending over earlier one; sutures distinct, slightly depressed, slightly sinusoidal, at 30-40 degrees to the horizontal; wall smooth, densely perforate; aperture narrow, an ovate-elongate opening surrounded by slightly elevated border, at the base of the inner margin of the last formed chamber, with distinct tooth plate.

Occurrence: common in Middle Miocene deposits from Transylvania and eastern border of the Pannonian Depression.

Remarks. *Bolivina dilatata* differs of *B. pokorny* in strongly curved sutures and subtriangular shape in lateral view.

Bolivina jriensis TEDESCHI, 1957

(pl. 1, figs. 2-4)

Bolivina jriensis TEDESCHI, 1957, (in Tedeschi, D. and Zanmatti, C., Diagnosi di forme nuove). *Riv. Ital. Paleont. Stratigrafia*, **63**/4, p. 251 text-figs 5a, b (fide Ellis & Messina).

Bolivina aff. jriensis Tedeschi. Cicha & Zapletalova, 1963, p. 145, text-fig. 20; Rögl, in Cicha *et al.*, 1998, p. 84, pl. 43, fig. 3.

Test biserial throughout, ovate, elongate in outline, 2 to 2 ½ times as long as broad, compressed, tapering gently toward both ends; peripheral margin subacute, with spinose projections of the base chambers; chambers distinct, slightly inflated; sutures deep, distinct,

straight in central portion, curved at the periphery; wall densely perforate, except for initial part (2, 3 chambers pairs) and periapertural area; aperture an oval, elongate opening above the base of the last formed chamber, with exposed tooth plate, bordered by a distinct lip.

Occurrence: Middle Miocene (Kossovian and sporadic in Moravian). A similar species was described as *Bolivina pungoensis* (Gibson 1983, p. 382, pl. 8, figs. 1-11) from the Middle Miocene Pungo River Formation (North Carolina). *B. pungoensis* differs in having clear lobes giving apparently a lobate sutural line. Specimens having almost parallel margins (pl. 1, fig. 6), conferred to the same species, remind of *Bolivina pokorny gracilis* Cicha & Zapletalova (1963, p. 143, text-fig. 18).

Bolivina cf. pokorny CICHA & ZAPLETALOVA, 1963

(pl. 1, fig. 5)

Remarks. This species was described from deposits of the same age as *B. dilatata* (Kossovian, auct. Upper Tortonian). Our specimens differ from the type (*Bolivina pokorny pokorny* Cicha & Zapletalova, 1963, p. 140, text-figs. 17a-c) in their straight sutures at 35-45 degrees to the horizontal and more dense chambers.

Bolivina maxima CICHA & ZAPLETALOVA, 1963

(pl. 1, figs. 7-9)

Bolivina dilatata maxima CICHA & ZAPLETALOVA, 1963, p. 136, fig. 15; Papp & Cicha, 1978, p. 290 pl. 15, figs. 2, 3; Rogl in Cicha *et al.*, 1998, p. 82, pl. 43, figs. 21, 22.

Remarks. This species is abundant in the Kossovian deposits from the eastern border of the Pannonian Depression. The figured specimens come from Balta Sărată, south of Caransebes. *Bolivina maxima* differs of *B. dilatata* in lanceolate, triangular outline and limbate sutures.

Bolivina viennensis (MARKS), 1951

(pl. 1, figs. 14-16)

Bolivina viennensis MARKS, 1951, p. 60, pl. 7, fig. 1; Cicha & Zapletalova, 1963, p. 129, text-fig. 5; Verhoeve, 1970, p. 31, pl. 2, fig. 3;

Bolivina papulata Rögl, in Cicha *et al.*, 1998, p. 85, pl. 42, fig. 15 (non Cushman, 1936, p. 52, pl. 7, fig. 21 or Cushman, 1937, p. 83, pl. 10, fig. 1).

Remarks. The test is elongate, compressed, with subacute peripheral margins, characterized by longitudinal, dense, anomostosed ribs which obscured the surface of the test.

Range: Rare in Langhian (Lower Badenian).

Bolivina retiformis CUSHMAN, 1936

(pl. 1, figs. 11-13)

Bolivina scalprata Schwager var. *retiformis* CUSHMAN 1936, p. 53, pl. 7, fig. 19; Cushman, 1937, p. 84, pl. 9, figs. 35-37; Papp & Cicha, 1978, p. 291, pl. 15, figs. 4, 5

Range: Upper Langhian.

Remarks. Close species are *Bolivina reticulata* HANTKEN and *B. anastomosa* FINLAY (1939, p. 320, pl. 27, figs. 75-77, 103, 111; see also Hornibrook, 1961, p. 72, pl. 10, fig. 188.).

Bolivina silvestrina CUSHMAN, 1936

(pl. 2, fig. 10)

Bolivina silvestrina CUSHMAN, 1936, p. 56, pl. 8, fig. 5; Cushman, 1937, p. 109, pl. 13, figs. 14-16.

Test elongated, about 2 ½ times as long as broad, slightly compressed; periphery broadly rounded; chambers, about 5-6 pairs, inflated, about as high as broad, increasing in size as added; peripheral margins distinctly lobate; suture depressed, slightly curved, forming an angle of about 25-30° with the horizontal; wall coarsely perforated and pores surrounded by a slightly elevated border near sutures; aperture large, elliptical at the base of last formed chamber.

Remarks. The specimens assigned to this species differ from the type in the smaller number of chambers, larger pores, more lobate peripheral margins and no initial spine.

Bolivina hebes MACFADYEN, 1930

(pl. 2, figs. 3, 5)

Bolivina hebes MACFADYEN, 1930, Egypt Geol. Surv., p. 59, pl. 2, fig. 5 (fide Ellis & Messina); Cushman, 1937, p. 82, pl. 9, figs. 27-29; Cicha & Zapletalova, 1963, p. 157, text-fig. 30; Rögl, 1969, p. 79, pl. 3, fig. 2; Zweig-Strykowski & Reiss, 1976, p. 157, pl. 1, figs. 1-7; Papp & Cicha, 1978, pl. 15, figs. 12, 13; Rögl, in Cicha et al., 1998, p. 84, pl. 43, fig. 14.

Bolivina trajectina Marks, 1951, p. 60, pl. 7, fig. 3.

Test ovate, subtriangular, slightly compressed, biserial throughout; wall calcareous, radial, perforated; periphery broadly rounded; sutures crenellate, indistinct because of the ornamentation with raised irregular ridges; aperture oval-elongated with hyaline lip.

Remarks: Cushman (1937, p. 83) suspected *Bolivina hirsuta* BIEDA, 1936 (An.Soc.Geol.Pol., 12, 1936, p. 264, pl. 8, figs. 1, 2), later renamed *B. polonica* Bieda (1950, in Thalmann – Cushman Found. Foram. Res., 1, p. 41) to be a junior synonym of *B. hebes*.

Range: The species was described from the Miocene of Egypt and recorded from the Middle Miocene from Austria, Hungary, former Czechoslovakia (in Central Paratethys). Frequently found in the Lower Badenian deposits from Transylvania and Banat, rare in the marine Lower Miocene deposits from Transylvania (Chechis Formation, see Popescu, 1975).

Bolivina polonica BIEDA, 1950

(pl. 2, figs. 1, 2)

Bolivina hirsuta BIEDA, 1936, p. 264, pl. 8, figs. 1, 2; Cushman, 1937, p. 83, pl. 9, fig. 31.

Bolivina polonica Bieda. nom. nov., in: Thalmann, 1950, Cushman Found. Foram. Res., Contr. 1/3-4, p. 41 for *Bolivina hirsuta* Bieda, 1936, non *Bolivina hirsuta* Rhumbler, 1911 (fide Ellis & Messina, Supplement for 1951, nr. 2); Luczkowska, 1955, p. 113, pl. 8, fig. 1.

Remarks. *B. polonica* is similar with *B. hebes* from which differs by elongate, more compressed and smaller test and parallel peripheral margins.

Range: This species is restricted, in Carpathian Area, to the Upper Badenian (Kossovian).

Bolivina crenulata CUSHMAN, 1936

(pl. 2, figs. 4, 6-8)

Bolivina crenulata CUSHMAN, 1936, p. 50, pl. 7, fig. 13;

Rögl (in Cicha et al., 1998), p. 83, pl. 43, figs. 11-12.

Range: Rare in the Upper Lagenids Zone (Lower Badenian).

Bolivina moldavica DIDKOWSKI, 1958

(pl. 2, fig. 13)

Bolivina moldavica DIDKOWSKI. Didkowski & Satanovskaya, 1970, p. 143, pl. 82, fig. 7.

Remarks. This species is similar to *B. sarmatica*, differing in its triangular, lanceolate shape and smaller number of chambers (14-15 instead of 18-22)

Bolivina sarmatica DIDKOWSKI, 1958

(pl. 2, figs. 11, 12, 15)

Bolivina sarmatica DIDKOWSKI. Didkowski & Satanovskaya, 1970, p. 144, pl. 82, fig. 9.

Bolivina nisporonica Didkowski. Didkowski & Satanovskaya, 1970, p. 144, pl. 82, fig. 8.

Test elongate, rectilinear or irregularly curved; chambers inflated, 1 ½ times as long as broad; periphery rounded; suture depressed, obscured by lobes of the next chamber; wall perforated, covered by reticular pattern; aperture oval elongate, at the base of the last formed chamber.

Remarks. *Bolivina nisporonica* is regarded here as synonym. Both type material for the two species is coming from the same stratigraphic level ("Cryptomacra strata").

Genus *Brizalina* O.G. COSTA, 1856

Brizalina antiqua (D'ORBIGNY), 1846

(pl. 1, fig. 21)

Bolivina antiqua d'ORBIGNY, 1846, p. 240, pl. 14, figs. 11-13; Cushman, 1937, p. 77, pl. 9, figs. 15, 16; Papp & Cicha, 1978, p. 292, pl. 15, fig. 9; Rögl, in Cicha et al., 1998, p. 83, pl. 44, figs. 10, 11.

Test elongate, lanceolate, compressed; chambers distinct, slightly inflated, much longer than high, increasing moderately in size as added; periphery acute, carinate; sutures distinct, limbate, slightly depressed, straight, curved near periphery; wall smooth, finely perforated, with elongated pores, parallel to the axis; aperture ovate.

Range. Species common in marine Middle Miocene deposits in Carpathian Area.

Brizalina cf. *B. striatula* (CUSHMAN), 1922

(pl. 1, figs. 19, 20)

Test slender, elongate, compressed, with parallel sides; periphery rounded; chambers slightly inflated increasing rapidly in size in the younger stage, then constantly; sutures distinct, depressed, slightly curved near margins; wall finely perforate, ornamented with numerous filamentous,

fine, longitudinal costae; aperture elongate, at the base of the last formed chamber.

Remarks. Our specimens are close to *Bolivina striatula* Cushman (1937, p. 154, pl. 18, figs. 30, 31) from which differ in less compressed test, deep, distinct sutures instead of limbate, and fine longitudinal costae all over the test surface. Closer to our specimens is *Brizalina striatula* described and illustrated by Hottinger *et al.*, (1993, p. 92, pl. 112, figs.3-8) from which differ in having almost parallel margins in the adult and less compressed test.

Species rare in the Lower Badenian from Costei, valea Gemini section.

Brizalina alata (SEGUENZA), 1862

(pl. 1, figs. 17, 18)

Vulvulina alata SEGUENZA, 1862, Atti Accad. Gioenia Sci. Nat., ser. 2, 18, p. 115, pl. 2, fig.5 (fide Ellis & Messina, 1940 et seq.).

Bolivina alata (Seguenza). Cushman, 1937, p. 106, pl. 13, figs. 3-11.

Test subtriangular elongated in shape, strongly compressed; periphery acute, serrate; chambers distinct, much longer than high, increasing rapidly and constant in size; sutures distinct, depressed, curved toward the periphery; wall smooth, finely perforated except for peri-apertural area; aperture oval elongate, with clear apertural lip.

Occurrence: Lower-Middle Miocene in Carpathian Area.

Superfamily **LOXOSTOMATACEA** LOEBLICH
AND TAPPAN, 1962

Family **BOLIVINELLIDAE** HAYWARD in Hayward
& Brazier, 1980

Genus *Rhombobolivinella* HAYWARD, 1990

Rhombobolivinella haywardi n. sp.

(pl. 3, figs. 1-5)

Test small, lanceolate, compressed, slightly inflated medially; proloculus spherical in gamonts, bearing a weak caudal spine; chambers curved; zigzag medial row of raised rounded or slightly elongate beads; sutures slightly depressed, ornamented with raised, rounded ribs in peripheral area and rounded beads near medial area in the adult, completely covered with rounded raised beads in early part; peripheral profile acute; peripheral edge serrate, spinose on end of each suture; wall surface ornamented with small, rounded beads; aperture cribrate.

Sizes: length, 0.200 – 0.260 mm;

breadth, 0.110 – 0.152 mm;

thickness, 0.025 – 0.027 mm;

chambers average: height, 0.025 – 0.027 mm and width, 0.051 – 0.070 mm.

Holotype comes from Balta Sarata, Caransebeș, Timiș district, from Upper Badenian (=Lower Serravallian) deposits. Deposited in Paleontological Laboratory Coll. LPB.IV, 11692 of the Bucharest University. Paratypes: Coll. LPB.IV. 11693

Etymology: in honor of Prof. Bruce W. Hayward for his important contributions to the study of the Bolivinellids.

Remarks: this species is very rare. In our investigated material were found 4 specimens.

Superfamily **CASSIDULINACEA** d'ORBIGNY,
1839

Family **Cassidulinidae** d'ORBIGNY, 1839

Subfamily **Cassidulininae** d'ORBIGNY, 1839

Genus *Cassidulina* d'ORBIGNY, 1826

Cassidulina laevigata D'ORBIGNY, 1826

(pl. 3, figs. 6-9)

Cassidulina laevigata d'ORBIGNY, 1826, p. 282, pl. 15, fig. 4, 5 (fide Ellis & Messina); Rogl (in Cicha *et al.*, 1998), p. 88, pl. 45, figs. 2-4.

Test small, lenticular, occurring in the Lower and Middle Badenian. Common in the upper part of the Valea Gemini section and Borehole 17 Faget (200-230 m) in the upper Lagenids Zone and Sandschaler Zone.

Genus *Cassilongina* VOLOSHINOVA, 1960

Remarks. These authors consider genus *Evolvocassidulina* EADE, 1967 (type species: *Cassidulina orientalis* CUSHMAN) as synonym with *Cassilongina* VOLOSHINOVA (type species: *Cassidulina oblonga* REUSS).

Cassilongina oblonga REUSS, 1850

(pl. 3, figs. 10, 11)

Cassidulina oblonga REUSS, 1850, p. 376, pl. 48, figs. 5, 6.

Globocassidulina oblonga (Reuss). Belford, 1966, p. 150, pl. 20, figs. 1-4, text-fig. 7, 8; Popescu, 1979, p. 44, pl. 20, fig. 10.

Evolvocassidulina belfordi Nomura 1983a, p.79, pl. 2, fig. 6; pl. 20, figs. 8-10, 12; Hottinger *et al.*, 1993, p. 94, pl. 114, figs. 5-13.

Remarks. Similar specimens are mentioned and illustrated as *Cassidulinoides orientalis* (Cushman) by Hornibrook, 1961, p. 86, pl. 10, fig. 201 (non Cushman).

Our specimens have subglobular test in initial portion, than slightly compressed, oval to pyriform in shape, with bluntly rounded apertural end; periphery rounded; sutures flush with surface; surface smooth, very finely perforate; oval elongate aperture, having a cristate tooth (sensu Nomura, 1983a).

Illustrated specimens come from Middle Badenian deposits from the eastern border of the Pannonian Depression (e.g. Borehole 17- Margina, m 204, Banat, Timiș district).

Range in Paratethys: Badenian

Cassilongina bradyi (NORMAN), 1922

(pl. 3, fig. 12)

Cassidulina bradyi NORMAN. Brady, 1884, p. 431, pl. 54, fig. 6-9 (non fig. 10);

Cassidulinoides bradyi (Norman). Barker, 1960, p.112, pl. 54, fig. 6-9; Jones, 1994, p. 60, pl. 54, figs. 6-9.

Evolvocassidulina bradyi (Norman). Nomura, 1983b, p. 48, pl.4, fig. 3.

Test small, elongate, compressed; initial stage closely coiled, later uncoiling, rectilinear; periphery rounded; chambers as large as high; wall smooth, polished, thin, translucent; sutures slightly curved; aperture oval elongate, loop-shaped, obliquely extending upward from the basal suture of the last formed chamber with a well developed apertural plate.

Remarks. Brady (1884), assigned to *Cassidulina bradyi* NORMAN the illustrated specimens from figs. 6-10. Later, specimen from fig. 10 was transferred to *Evolvocassidulina orientalis* (CUSHMAN): see Loeblich & Tappan, 1985.

Subfamily **Ehrenbergininae** CUSHMAN, 1927

Genus *Ehrenbergina* REUSS, 1850

Ehrenbergina serrata REUSS, 1850

(pl. 3, fig. 13)

Ehrenbergina serrata REUSS, 1850, p. 377, pl. 48, fig. 7; Rögl (in Cicha *et al.*, 1998), p. 94, pl. 45, fig. 17, 18.

Rare specimens recorded from the Lower Badenian deposits from Valea Coşului (Lăpuşiu de Sus) and Valea Gemini (Costei) sections. Sporadically, occur also in western and north-western borders of the Transylvanian Depression.

Remarks: Specimens illustrated here differ from the typical and topotypic specimens (see Reuss, 1850; Loeblich & Tappan, 1964, p. 738, fig. 604/5a-c) in the presence of some irregular longitudinal costae in the initial part of the test.

Superfamily **TURRILINACEA** CUSHMAN, 1927

Family **Stainforthiidae** REISS, 1963

Genus *Virgulopsis* FINLAY, 1939

Virgulopsis marksii n. sp.

(pl. 3, fig. 14; pl. 4, fig. 1)

Virgulopsis sp. Popescu, 1979, p. 33, pl. 21, fig. 7

Test elongate, circular in transverse section; chambers inflated, triserial arrangement in the early stage, biserial in the adult; sutures distinct, deep; wall calcareous, coarsely perforated; surface reticulate, pustulated; aperture large, a curved loop; bolivinide toothplate.

Range. The illustrated specimens were recorded from Coştei, Valea Gemini section (Middle Badenian). The species occurs also in Upper Badenian (Kossovian) deposits (Popescu, 1979, p. 33).

Holotype (pl. 3, fig. 14) comes from Valea Gemini section, Coştei, Timiş district, deposited in Coll. LPB. IV, 11689 and paratypes LPB. IV, 11690.

Etymology. The species name is dedicated to P. Marks in recognizing his contribution to the knowledge of the Miocene foraminifera from Vienna Basin.

Remarks. *Virgulopsis marksii* differs of *V. tuberculata* (Egger) in more elongated test and reticulate ornamentation instead of conical test and heavy tuberculate ornamentation. Described species is possible to be a synonym of *Bulimina*

laxitexa Liventhal (1953, p. 180, pl. 6, figs. 6-8), described from marine Middle Miocene deposits from Ukrainian Precarpathians. Some species described from New Zealand have some similitude with our specimens: see *V. reticulata* Hornibrook (Hornibrook, 1961, p.79, pl. 28, figs. 542, 543) from which differs by some features: longer initial triserial stage, shape of the aperture (narrow in our species) and the presence of a large unornamented area surrounding the aperture.

Virgulopsis tuberculata (EGGER), 1857

(pl. 4, figs. 5-7)

Bulimina tuberculata EGGER, 1857, p. 284, pl. 12, figs. 4-7;

Virgulopsis tuberculatus (Egger). Rögl, in Cicha *et al.*, 1998, p. 136, pl. 46, figs. 1, 2.

Remarks. This species was mentioned and illustrated by Poignant & Pujol (1978) in samples coming from the stratotype Bordelais of the Burdigalian stage. In Carpathian area occurs in Lower Badenian deposits from eastern border of the Pannonian Depression (Timiş and Bega basins).

Superfamily **BULIMINACEA** JONES, 1875

Family **Pappinidae** HAUNOLD, 1990

Genus *Pappina* HAUNOLD,

Pappina neudorfensis (TOULA), 1900

(pl. 4, figs. 14-16; pl. 5, figs. 5, 6)

Uvigerina neudorfensis TOULA, 1900, p. 12, fig. 3.

Pappina neudorfensis (Toula). Haunold, 1990, p. 62, pl. 1, figs. 1, 3, 11; Haunold, 1995, p. 78, pl. 2, figs. 6-11.

Remarks: Haunold (1990) selected from the type locality a neotype for this species, fully corresponding with Toula's description and illustration. The species was mentioned by Papp & Turnovsky (1953) as *U. compressa liesingensis*. For a larger discussion see Haunold (1990, p. 62).

Pappina parkeri (KARRER), 1877

(pl. 4, figs. 10-13; pl. 5, figs. 1,2)

Uvigerina parkeri KARRER, 1877, p. 385, pl. 16b, fig. 50

Uvigerina compressa Cushman, 1925, p. 10, pl. 4, fig. 2.

Uvigerina szakalensis Majzon, 1936, p. 124, figs. 5, 6 (fide Ellis & Massina, 1940).

Uvigerina bonnoniensis compressa Cushman. Papp &

Turnovsky, 1953, p. 120, pl. 5/A, fig. 8; Cicha *et al.*, 1986, p. 176, pl. 20, figs. 9-11.

Uvigerina parkeri parkeri Karrer. Papp & Turnovsky, 1953, p. 121, pl. 5/A, fig. 9.

Pappina parkeri (Karrer). Haunold, 1990, p. 81, pl. 2, fig.

14; Rögl, in Cicha *et al.*, 1998, p. 115, pl. 49, figs. 1, 2, 8, 9; Haunold, 1995, p. 81, pl. 2, fig. 14.

Remarks: *Uvigerina compressa* was described by Cushman from the Vienna Basin. The species was compared with *U. parkeri*, from which differs in its rich ornamentation and smaller size, features considered by others as included in the species variability. Marks (1951) mentioned the species *U. compressa* as a junior synonym of the species *U. bonnoniensis* Fornasini.

In Paratethys the species was mentioned from the marine Lower Miocene deposits (Chechiş

Formation) (Popescu, 1975, as *U. szakalensis*). Rare in the Middle and Upper Badenian from Romania.

Pappina primiformis (PAPP & TURNOVSKY), 1953
(pl. 5, fig. 9)

Uvigerina bononiensis primiformis PAPP & TURNOVSKY, 1953, p. 121, Tab. 5/A, figs. 1, 2.

Pappina primiformis (Papp & Turnovsky). Haunold, 1990, p. 87, pl. 3, figs. 11-14; Haunold, 1995, p. 79, pl. 2, figs. 12, 13; Rogl (in Cicha *et al.*, 1998), p. 115, pl. 49, figs. 3, 4.

The species was recorded from the upper part of the Moravian, Upper Lagenids Zone (Papp & Schmid, 1985) in Valea Gemini section.

Family **Siphogenerinoididae** SAIDOVA, 1981

Subfamily **Siphogenerinoidinae** SAIDOVA, 1981

Genus *Lapugyina* POPESCU, in Cicha *et al.*, 1998

Test elongate, slightly compressed, elliptical in transverse section; chambers biserially arranged in the initial part, with parallel margins, later tending to become uniserial; periphery rounded; sutures flush, hidden by the ornamentation in the early part, become slightly depressed in the adult; surface ornamented with polygonal patterns, bordering the pores; aperture oval, terminal, with hyaline borders; inner flat toothplate.

Type species: *Lapugyina schmidi* Popescu, Coll. LPB. IV, 11691.

Lapugyina schmidi POPESCU, in Cicha *et al.*, 1998.

(pl. 5, figs. 10-13)

Coryphostoma sinuosa Papp & Schmid, 1985 (non *Loxostoma sinuosum* Cushman, 1936), p. 291, pl. 15, figs. 10, 11.

Lapugyina schmidti POPESCU, (in Cicha *et al.*, 1998), p.74, pl.54, figs.20-22.

Test elongate, slightly compressed, elliptical in cross section; early portion biserial, with parallel margins, later tending to become uniserial; sutures indistinct in early portion, hidden by ornamentation, slightly depressed in later portion; surface ornamented with polygonal patterns, surrounding distinct pores; aperture oval, terminal, with hyaline border; inner toothplate.

Age: Langhian (Upper Lagenids Zone).

Genus *Loxostomina* SELLIER DE CIVRIEUX, 1969

Loxostomina digitalis (d'ORBIGNY), 1846

(pl. 5, figs. 14, 15)

Polymorphina digitalis d'ORBIGNY, 1846, p. 235, pl. 14, figs. 1-4; Karrer, 1868, p. 174.

Loxostoma digitale (d'Orb.). Cushman, 1937, p. 180, pl. 21, figs. 10-12.

Loxostomum digitale (d'Orb.). Marks, 1951, p. 60.

Coryphostoma digitalis (d'Orb.). Papp & Cicha, 1978, p. 291.

Bolivina digitalis (d'Orb.). Papp & Schmid, 1985, p. 83, pl. 76, fig. 1-6.

Test elongated, slender, finger-like, elliptical in cross section, biserial in the young portion, tending to become uniserial; sutures indistinct in early

portion, then slightly depressed; wall perforated especially in the adult portion, surface ornamented with fine, irregular, longitudinal costae, more developed in the initial stage, flush, but more numerous on the last chambers; aperture oval-elongated, with toothplate.

Remarks: Similar specimens from the Gulf of Elat (Aqaba) were described by Zwig-Strykowski & Reiss (1975, p. 100, pl. 3, figs. 1-8) and assigned to *Brizalina (Parabrizalina) africana*.

Genus *Sagrinella* SAIDOVA, 1975

Sagrinella convallaria (MILLETT), 1900

(pl. 5, figs. 16, 17)

Bolivina convallaria MILLETT, 1900, p. 97, pl. 4, fig. 6 (fide Ellis & Messina, 1940).

Sagrinella convallaria (Millett). Hottinger *et al.*, 1993, p.98, pl. 122, figs. 8-11.

Test small, strongly elongate, slightly compressed, lenticular in cross section, biserial in early stage, later with cuneate chambers progressively higher as added, with truncated posterior margins, slightly fimbriate; peripheral margins serrate; sutures deep, oblique (50°- 60°); wall calcareous, perforated by large pores; chambers surface ornamented with fine longitudinal ribs; aperture terminal, elliptical, bordered by a distinct lip, with subcylindrical toothplate connecting with the previous opening, changing the orientation with 180°.

Remarks: Differs from *S. bradyi* (Asano) by its truncated and fimbriate aspect of the basal part of the chambers, deep sutures, and by its longitudinal costae.

Genus *Spiroloxostoma* CONATO, 1964

Spiroloxostoma czechoviczi (KANTOROVA), 1975

(pl. 5, figs. 18-21)

Vsevolodia czechoviczi KANTOROVA, 1975, p. 89, pl. 50, figs. 1-4; pl. 51, figs. 1, 2; pl. 52, figs. 1, 2; pl. 53, fig. 1, 2.

Spiroloxostoma czechoviczi (Kantorova). Rögl, in Cicha *et al.*, 1998, p. 128, pl. 46, figs. 5, 6.

Remarks: Species *S. croarae* Conato (1964, p. 284) is suspected to be a senior synonym. R. Wright (1978, p. 715, pl. 6, fig. 1) mentioned and illustrated the same species as *Loxostomum normale* (non Galloway & Heminway, 1941, p. 421, pl. 31, fig. 4), but underlines that his specimens differ from the type species by lacking the uniserial stage.

Subfam. **Tubulogenerininae** SAIDOVA, 1981

Genus *Zsigmondiella* n.g.

Test elongate, arcuate, subcylindrical, circular in cross section; chambers as long as broad, triserially arranged in early stage, later biserial and finally uniserial; sutures flush to depressed, straight in the adult; lower chamber margin sinusoidal, resulting in appearance of lobulated sutures; wall calcareous, perforate; surface smooth or ornamented with fine, longitudinal striae; aperture terminal, elliptical to reniform, slightly elongate,

surrounded by an imperforate area, provided, internally, with a spout like columellar process.

Differs from the genus *Dabulenia* D.-P. POPESCU³ in limbate, flush sutures and smaller pores and shorter triserial stage.

Type species: *Nodosaria (Dentalina) zsigmondyi* HANTKEN, 1868

Range: Upper Paleogene-Neogene.

Etymology: inspired by the specific name given by Hantken to his new species.

Illustrated specimen deposited in Coll. LPB.IV, 11694

Zsigmondiella zsigmondyi (HANTKEN), 1868
(pl. 4, figs. 2, 3)

Nodosaria (Dentalina) zsigmondyi HANTKEN, 1868, p. 87, pl. 1, fig. 12.

Dentalina zsigmondyi Hantken, 1875, p. 32, pl. 12, fig. 17.

Rectobolivina marentinensis Ruscilli, 1952, Ruscilli, M. A., 1952, I foraminiferi del deposito tortoniano di Marentino (Torino), Riv. Ital. Pal. Strat., **58/2**, p. 46, pl. 2, fig. 8 (fide Ellis & Messina).

Rectobolivina zsigmondyi (Hantken). Popescu & Iva, 1971, p. 44, pl. 5, fig. 6, pl. 6, fig. 2; Popescu, 1975, p. 74, pl. 49, fig. 9, text-fig. 24.

Loxostomoides zsigmondyi (Hantken). Rögl, in Cicha *et al.*, 1998, p. 111, pl. 44, fig. 13 (non fig. 12).

Test slender, elongate, gradually enlarging from base, circular in cross-section; early stage biserial, more reduced in megalospheric generation, then uniserial; wall calcareous, finely perforated; surface with longitudinal striae separating longitudinal rows of rounded pores, very clear in ultrastructure; sutures as sinusoidal transversal lines; aperture rounded, terminal, bordered by a hyaline area, with internal twisted (180°) toothplate.

Remarks: The species was recorded from the upper part of the Paleogene deposits. Similar specimens were subsequently mentioned from the Lower and Middle Miocene from Transylvania and the eastern border of the Pannonian Depression, as well as from the Langhian-Tortonian deposits from Italy. This is a rare species in the Middle Miocene. As for the generic affiliation there are some doubts. In the type species of the genus, the chambers are biserial with a tendency to become uniserial, and the aperture is basal. The Oligocene specimens, and especially those Miocene, have the biserial stage very short, and the aperture is circular, areal.

Range: In Carpathian area, this species was recorded from the Oligocene (Rupelian) and the Lower and marine Middle Miocene from Transylvania.

Genus *Sagrina* d'ORBIGNY, 1839

Remarks: Between the genera *Sagrina* and *Bitubulogenerina*, considered here as synonyms,

the differences are in the shape of the inner tube (siphon shaped in *Bitubulogenerina*, and hemicylindrical in *Sagrina*), features also noticed by Strykowski & Reiss (1976).

Sagrina reticulata (CUSHMAN), 1936
(pl. 6, fig. 1-4)

Bitubulogenerina reticulata CUSHMAN, 1936, p. 62, pl. 8, fig. 21; Cushman, 1937, p. 214, pl. 24, fig. 12; Rögl, in Cicha *et al.*, 1998, p. 83, pl. 46, figs. 7-10.

Remarks: The species was described from the Miocene deposits from Coștei (Bega Basin, Banat). It is common in the pelitic facies of the Upper Langhian from Transylvania and the eastern border of the Pannonian Basin.

The species was assigned to the genus *Sagrina* considering the biserial arrangement of the chambers. The lack of the true triserial arrangement of the chamber seems to be related to the dimorphism of the species. The torsion of the chambers in the adult stage recorded in our specimens seems to suggest a possible short triserial stage, probably more developed at the microspheric specimens (as in fig. 3, 4, pl. 6).

Typical for the species is the globular chambers and the ornamentation represented by circular ridges with pseudo-spinose margins with distinct, large pores in the center. A similar species was described as *Sagrinella lobata* (Brady) subsp. *A* by Hottinger *et al.* (1993, p.99, pl. 123, figs. 8-14; pl. 124, figs. 1, 2). Our specimens differ from the latter in less compressed test, globular chambers and more developed moon-craters (polygonal) pattern ornamentation.

Megalospheric specimens differing by their globular chambers increasing rapidly in sizes and having divergent margins (in lateral view) were conferred here to the same species (pl. 6, figs. 5-7).

Family **Buliminidae** JONES, 1875

Genus *Bulimina* d'ORBIGNY, 1826

Bulimina aculeata d'ORBIGNY, 1826
(pl. 6, fig. 9)

Bulimina aculeata d'ORBIGNY, 1826, p. 269, nr. 7 (fide Ellis & Messina); Reuss, 1850, p. 374, pl. 47, fig. 13; Serova, 1955, p.364, pl. 24, figs. 5, 6.

Test drop-shaped, triserial throughout with globular chambers increasing rapidly in size; the test is ornamented with stout, long, rare spines.

Bulimina konkensis LIVENTHAL, 1953

Bulimina pinheiformis konkensis LIVENTHAL, 1953, p.179, pl. 1, fig. 13; pl. 2 figs. 1, 3, 5; pl. 3, figs. 1-3, 5-9.

Bulimina pineiformis subkonkensis Liventhal, 1953, p. 178, pl. 1, fig. 8; pl. 2, fig. 2; pl. 3, fig. 4.

Bulimina aculeata var. *porrecta* Luczkowska, 1955, p. 109, pl. 7, figs. 9-11.

Bulimina insignis nom.corr. Luczkowska, 1960, p. 318, pl. 29, figs. 4, 5.

Baggatella konkensis (Liventhal). Popescu, 1979, p. 32, pl. 19, fig. 7.

³ Popescu, Dan-Petre (2002) Foraminiferele eocene din Aria Carpatică (Faciesul de Șotrile) și Platforma Moesică: studiu comparativ. Ph.D. thesis, Univ. București, Facultatea de Geologie și Geofizică.

Remarks: In the Carpathian area, this species occurs only in Kossovian (Upper Badenian) in medium to distal shelf facies. The test is drop-shaped, with acuminate apex, sometimes ornamented, at its basal part, with one or 2-4 stout, high spines.

Bulimina striata d'ORBIGNY, 1846
(pl. 6, fig. 8)

Bulimina striata d'ORBIGNY, 1837 (in Cuvier), p. 18, pl. 3, fig. 16 (fide Ellis & Messina).

Bulimina striata striata d'Orbigny. Rögl, 1998 (in Cicha *et al.*), p. 87, pl. 48, figs. 1-3.

Remarks: Papp & Schmid (1985, p. 73, pl. 63, fig. 1-4) described this species as synonym with *B. buchiana* and *B. costata*, the last one is considered as a valid name; Cicha & Ctyroka (1988, p. 503) and Rögl (1969) described the same material as *B. striata* d'Orb. (in its synonymy was added *B. inflata* Seguenza).

Genus *Globobulimina* CUSHMAN, 1927
Globobulimina pyrula (d'ORBIGNY), 1846
(pl. 6, fig. 10)

Bulimina pyrula d'ORBIGNY, 1846, p. 184, pl. 11, figs. 9, 10. Papp & Schmid, 1985, p. 69, pl. 62, figs. 2-10.

Praeglobobulimina pyrula (d'Orb.). Rögl (in Cicha *et al.*), 1998, p. 119, pl. 48, figs. 11-13.

Remarks: The species *B. pupoides*, *B. ovata* and *B. pyrula* are considered as synonyms by Papp & Schmid (1985). *B. pupoides* was designated by Hofker (1951) as type species of the genus *Protoglobobulimina*, and *B. pyrula* was designated as type species of the genus *Globobulimina* Cushman, 1927.

Family **Buliminellidae** HOFKER, 1951
Genus *Floresina* REVETS, 1990

Remarks: In his new genus, Revets included species previously considered as belonging to the genera *Buliminoides* and *Buliminella*, from which differs by the presence of the internal toothplate.

Floresina sp.
(pl. 6, fig. 11, 12)

Floresina? multicamerata (Cushman & Parker). Rögl (in Cicha *et al.*, 1998), p. 97, pl. 48, fig. 18.

Test ovate-elongate, with numerous high, narrow chambers, 10-11 to whorl, arranged in 2 – 2½ whorls; wall finely perforate; surface smooth; sutures distinct, deep, u-shaped, curved to sigmoid; apertural face inclined towards the coiling axis, 6-7 grooves radiating from umbilical area.

Remarks: the illustrated specimen (fig. 6, pl. 6) is mentioned by Rögl (in Cicha *et al.*, 1998, p. 97, pl. 48, fig. 18) as *Floresina? multicamerata*.

Type: Coll. LPB.IV, 11695.

Floresina cf. *F. paralleliformis* (McCULLOCH),
1977
(pl. 6, fig. 13)

Test elongated, subcylindrical, rounded in cross section; chambers low and broad, trochospiral,

arranged in 3 ½ whorls; surface smooth, finely perforated; periphery slightly lobate; spiral suture depressed, flush intercameral suture; surface pustulate in its initial part; apertural face inclined toward the coiling axis (35-40°); aperture covered by foreign material, 6-7 grooves radiating from it.

Our specimen is close to the specimens illustrated by Revets (1990, p. 160, pl. 1, fig. 7) as *F. paralleliformis*.

Deposited in Coll. LPB.IV, 11696.

Family **UVIGERINIDAE** HAECKEL, 1894

Test triserial in the early portion; aperture terminal, circular, at the end of a neck, bordered by a hyaline lip, with inner toothplate.

Remarks: Hofker (1951) recognizes five groups of uvigerinas with generic value, differentiated by the inner toothplate characteristics: *Praeuuigerina*, *Angulogerina*, *Euuuigerina*, *Aluuigerina* (*Uvigerina*), and *Neuuuigerina*. The family *Uvigerinidae* was divided in two subfamilies: *Uvigerininae*, with inflated chambers, and *Angulogerininae* with triangular test. Jung (1988) considers that the toothplate characteristics and the type of coiling have generic value. Loeblich & Tappan (1988) restricted the family *Uvigerinidae* to the forms with the tri- and biserial early stage. In the eastern part of the Atlantic, the Northern Sea Basin, the Mediterranean Basin and the Paratethys were separated five groups of uvigerinas which would have represented "a rather natural classification" (Van der Zwaan *et al.*, 1986), in which the main features are the chambers disposal, test morphology and pores shape. In this regard, Haunold (1990) separated the Family Pappinidae, characterized by the polymorphinid arrangement of the chambers in the early stage.

Subfamily **Uvigerininae** HAECKEL, 1894
Genus *Euuuigerina* THALMANN, 1952
Euuuigerina aculeata (d'ORBIGNY), 1846
(pl. 6, fig. 17; pl. 12, figs. 8-11)

Uvigerina aculeata d'ORBIGNY, 1846, p. 191, pl. 11, fig. 27, 28; Cushman & Edwards, 1939, p. 35, pl. 8, figs. 1-5;

Euuuigerina aculeata (d'Orbigny). Jung, 1988, p. 149, pl. 33, fig. 8; pl. 36, fig. 8; pl. 44, figs. 6-10.

Remarks: In the initial illustration, the test is covered with well developed spines irregularly disposed on the test surface. Such specimens usually occur in the upper part of the Moravian and Wielician (early Serravallian, Zone N 9-10) deposits from the Carpathian area. We assigned to this species specimens with the following features: test small to medium sized, fusiform; surface covered with elongated, conical, irregularly distributed spines; long, slender, terminal apertural neck, placed in a slightly depressed area; chambers triserially arranged, with a tendency to reduce to biserial in the adult; euuigerinid type toothplate.

The species is close to *U. orbignyana* Czjzek, differing in smaller test, globular chambers;

distinct, deep sutures; less costate test, large, conical, irregularly distributed spines.

E. aculeata is regarded by Haunold (1995, p. 72) as a part of the variability of the species *Uvigerina urnula*.

Genus *Neouvigerina* THALMANN, 1952

Neouvigerina is regarded by many authors as junior synonym of *Siphouvigerina* Parr, 1950 (e.g. R.W. Jones, 1994, p. 47). Hottinger *et al.*, (1993) differentiated the two genera by longitudinally folded toothplate, "its sides attached to the neck forming an internal tube", circular in transverse section, in *Siphouvigerina*.

Neouvigerina proboscidea (SCHWAGER), 1866
(Pl. 6, figs. 14-16)

Uvigerina proboscidea SCHWAGER, 1866, p. 250, pl. 7, fig. 96; Cushman & Todd, 1941b, p. 73, pl. 17, fig. 9, pl. 19, figs. 3-9.

Neouvigerina proboscidea (Schwager). Jung, 1988, p. 167, pl. 32, figs. 4, 5, 7; pl. 34, figs. 9, 10; pl. 38, figs. 1-7.

Test elongate, triserial in early stage, later biserial with tendency to become uniserial; subglobular chambers, separated by deep sutures; wall covered by fine, conical spines irregularly distributed on surface and apertural neck, and a small caudal spine; aperture rounded, at the end of long, tron-conical neck, provided with folded toothplate.

Remarks. In our material occur micro and megalosphaeric specimens. Rare in Upper Moravian and lower Wielician (=Late Langhian-Early Serravallian).

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PLATES CAPTIONS

PLATE 1

Fig. 1. *Bolivina dilatata* REUSS. Lateral view. Valea Morilor section, Colibași, Mehedinți district. Kossovian (Lower Serravallian)

Figs. 2-4. *Bolivina jriensis* TEDESCHI. Lateral views. Valea Morilor section, Colibași, Mehedinți district. Kossovian (Lower Serravallian).

Fig. 5. *Bolivina* cf. *B. pokornyi* CICHA & ZAPLETALOVA. Lateral view. Valea Morilor section, Colibași, Mehedinți district. Kossovian (Lower Serravallian)

Fig. 6. *Bolivina* cf. *B. gracilis* CICHA & ZAPLETALOVA. Lateral view. Valea Morilor section, Colibași, Mehedinți district. Kossovian (Lower Serravallian)

Figs. 7-9 *Bolivina maxima* CICHA & ZAPLETALOVA. Figs. 7, 8, lateral views; fig. 9, apertural view of a broken specimen. Borehole Zlagna, east of Caransebeș, Timiș district. Kossovian (Lower Serravallian).

Fig. 10 *Bolivina* cf. *B. maxima* CICHA & ZAPLETALOVA. Lateral view. Valea Gemini section, Coștei. Late Moravian (Early Serravallian).

Figs. 11-13 *Bolivina retiformis* CUSHMAN. Lateral views. Valea Coșului section, Lăpugiu de Sus, Hunedoara district. Moravian (Langhian).

Figs. 14-16 *B. viennensis* MARKS. Lateral views. Valea Gemini section, Coștei, Timiș district.

Figs. 17, 18 *Brizalina alata* SEGUENZA. Lateral views. Valea Coșului section, Lăpugiu de Sus, Hunedoara district. Moravian (Langhian).

Figs. 19, 20 *Brizalina* cf. *B. striatula* (CUSHMAN). Lateral views. Valea Coșului section, Lăpugiu de Sus, Hunedoara district. Moravian (Langhian).

Fig. 21 *Brizalina antiqua* (d'ORBIGNY). Lateral views. Valea Coșului section, Lăpugiu de Sus, Hunedoara district. Moravian (Langhian).

PLATE 2

Figs. 1, 2 *Bolivina polonica* BIEDA. Fig. 1, lateral view; fig. 2 apertural view. Valea Romoșului section, Hunedoara district. Kossovian (Lower Serravallian).

Figs. 3, 5 *Bolivina hebes* MACFADYEN. Lateral views. Fig. 5, surface detail. Valea Coșului section, Lăpugiu de Sus, Hunedoara district. Moravian (Langhian).

Figs. 4, 6-8 *Bolivina crenulata* CUSHMAN. Fig. 4, edge view, fig. 7, detail of the apertural face; fig. 6, lateral view; fig. 8, lateral-edge view. Valea Coșului section, Lăpugiu de Sus, Hunedoara district. Moravian (Langhian).

Fig. 9 *Bolivina* sp. Lateral view. Valea Cosmina, Prahova district. Kossovian (Lower Serravallian).

Fig. 10 *Bolivina silvestrina* CUSHMAN. Lateral view. Borehole F-32, Făget, m376, Bega Basin. Sarmatian (Serravallian).

Figs. 11, 12, 15 *Bolivina sarmatica* DIDKOWSKI. Lateral view. Borehole F-32, Făget, m376, Bega Basin. Sarmatian (Serravallian).

Fig. 13 *Bolivina moldavica* DIDKOWSKI. Lateral view. Borehole F-32, Făget, m376, Bega Basin. Sarmatian (Serravallian).

Fig. 14 *Bolivina* sp. 1 Axial section. Borehole F-32, Făget, m376, Bega Basin. Sarmatian (Serravallian).

Figs. 16, 17 *Bolivina* sp. 2 Lateral and apertural views. Borehole F-32, Făget, m376, Bega Basin. Sarmatian (Serravallian).

PLATE 3

Figs. 1-5 *Rhombobolivinella haywardi* n. sp. Fig. 1-3, holotype, lateral views of the same specimen; fig. 2, apertural detail; figs. 4, 5, paratypes, lateral views. Valea Gemini section, Coștei, Timiș district. Wielician (Early Serravallian).

- Figs. 6-9 *Cassidulina laevigata* d'ORBIGNY. Lateral views. Borehole F5 – Coșava, Timiș district. Upper Moravian (Upper Langhian)
- Figs. 10, 11 *Cassilongina oblonga* (REUSS). Lateral-apertural views. Borehole F4 – Făget, Timiș district. Wielician (Lower Serravallian)
- Fig. 12 *Cassilongina bradyi* (NORMAN). Lateral-apertural view. Valea Lupoei section, Archiș, Arad district (Zarand Basin). Upper Moravian (Lower Serravallian)
- Fig. 13 *Ehrenbergina serrata* Reuss. Frontal-apertural view. Valea Coșului section, Lăpuș de Sus, Hunedoara district. Moravian (Langhian).
- Fig. 14 *Virgulopsis marksi* n.sp. Holotype. Lateral view. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).

PLATE 4

- Fig. 1 *Virgulopsis marksi* n. sp. Paratype. Lateral view. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 2, 3 *Zsigmondiella szigmondi* (HANTKEN). Lateral views. Fig. 3, surface detail of fig. 2. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 4, 8, 9 *Ehrenbergina serrata* REUSS. Figs. 4, 8, front views; fig. 9, dorsal view. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 5-7 *Virgulopsis tuberculata* (EGGER). Lateral views. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 10-13 *Pappina parkeri* (KARRER). Frontal views. Borehole Balta Sărată, Caransebeș, Timiș district.
- Figs. 14-16 *Pappina neudorfensis* (TOULA). Lateral views. Borehole Balta Sărată, Caransebeș, Timiș district.
- Figs. 17-20 *Pappina* sp. 1. Lateral views. Fig. 20, young specimen. Borehole Balta Sărată, Caransebeș, Timiș district.

PLATE 5

- Figs. 1, 2 *Pappina parkeri* (KARRER). Frontal views. Fig. 2, detail of fig. 1. Borehole Balta Sărată, Caransebeș, Timiș district.
- Figs. 3, 4 *Pappina* sp. 2. Frontal views. Borehole Balta Sărată, Caransebeș, Timiș district.
- Figs. 5, 6 *Pappina neudorfensis* (TOULA). Frontal views. Borehole Balta Sărată, Caransebeș, Timiș district.
- Figs. 7, 8 *Pappina* sp. cf. *P. neudorfensis* (TOULA). Frontal views. Borehole Balta Sărată, Caransebeș, Timiș district.
- Fig. 9. *Pappina primiformis* (PAPP & TURNOVSKY). Lateral view. Valea Gemini section, Coștei, Timiș district. Moravian (Langhian).
- Figs. 10-13. *Lapugyina schmidi* POPESCU. Figs 10, 11, 13, Lateral views; fig. 12, surface detail of fig 13. Valea Gemini section, Coștei, Timiș district. Moravian (Langhian).
- Figs. 14, 15. *Loxostomina digitalis* (d'ORBIGNY). Frontal views. Valea Coșului section, Lăpuș de Sus, Hunedoara district. Moravian (Langhian).
- Figs. 16, 17. *Sagrinella convallaria* (MILLETT). Frontal views. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 18-21. *Spiroloxostoma czechoviczi* (KANTOROVA). Figs. 18, 19, frontal views; fig. 20, apertural detail; fig. 21, frontal view, in transmitted light. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).

PLATE 6

- Figs. 1-4. *Sagrina reticulata* (CUSHMAN). Lateral views; fig. 2, apertural detail of fig. 1. Valea Gemini section, Coștei, Timiș district. Moravian (Langhian).
- Figs. 5-7. *Sagrina* cf. *S. reticulata* (CUSHMAN). Valea Gemini section, Coștei, Timis district. Moravian (Langhian).
- Fig. 8. *Bulimina striata* d'ORBIGNY. Lateral view. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Fig. 9. *Bulimina aculeata* d'ORBIGNY. Lateral view. Borehole 15-Faget, Timiș district. Upper Moravian (late Langhian).
- Fig. 10. *Globobulimina pyrula* (d'ORBIGNY). Lateral view. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 11, 12. *Floresina* sp. Lateral views. Valea Gemini section, Coștei, Timis district. Moravian (Langhian).
- Fig. 13. *Floresina* cf. *paralleliformis* (McCULLOCH). Lateral view. Valea Gemini section, Coștei, Timiș district. Wielician (Lower Serravallian).
- Figs. 14-16 *Neouvigerina proboscidea* (SCHWAGER). Lateral views; fig. 15, detail of fig. 14. Valea Lupoei section, Archiș, Arad district. Wielician (Lower Serravallian).
- Fig. 17 *Euuvigerina aculeata* (d'ORBIGNY) Lateral view. Cinciș Lake, Teliucul Superior, Hunedoara district. Wielician (Lower Serravallian).

PLATE 1

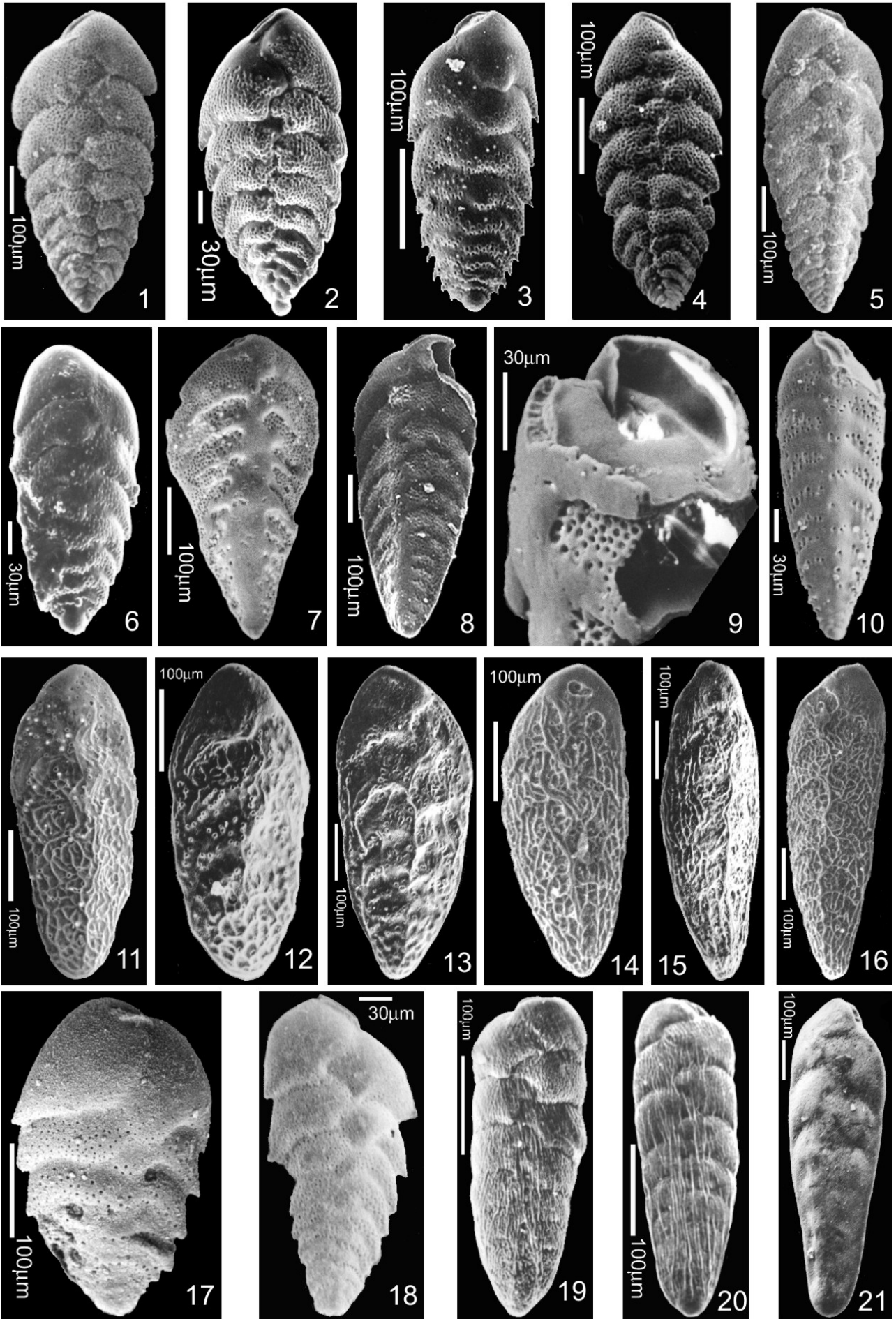


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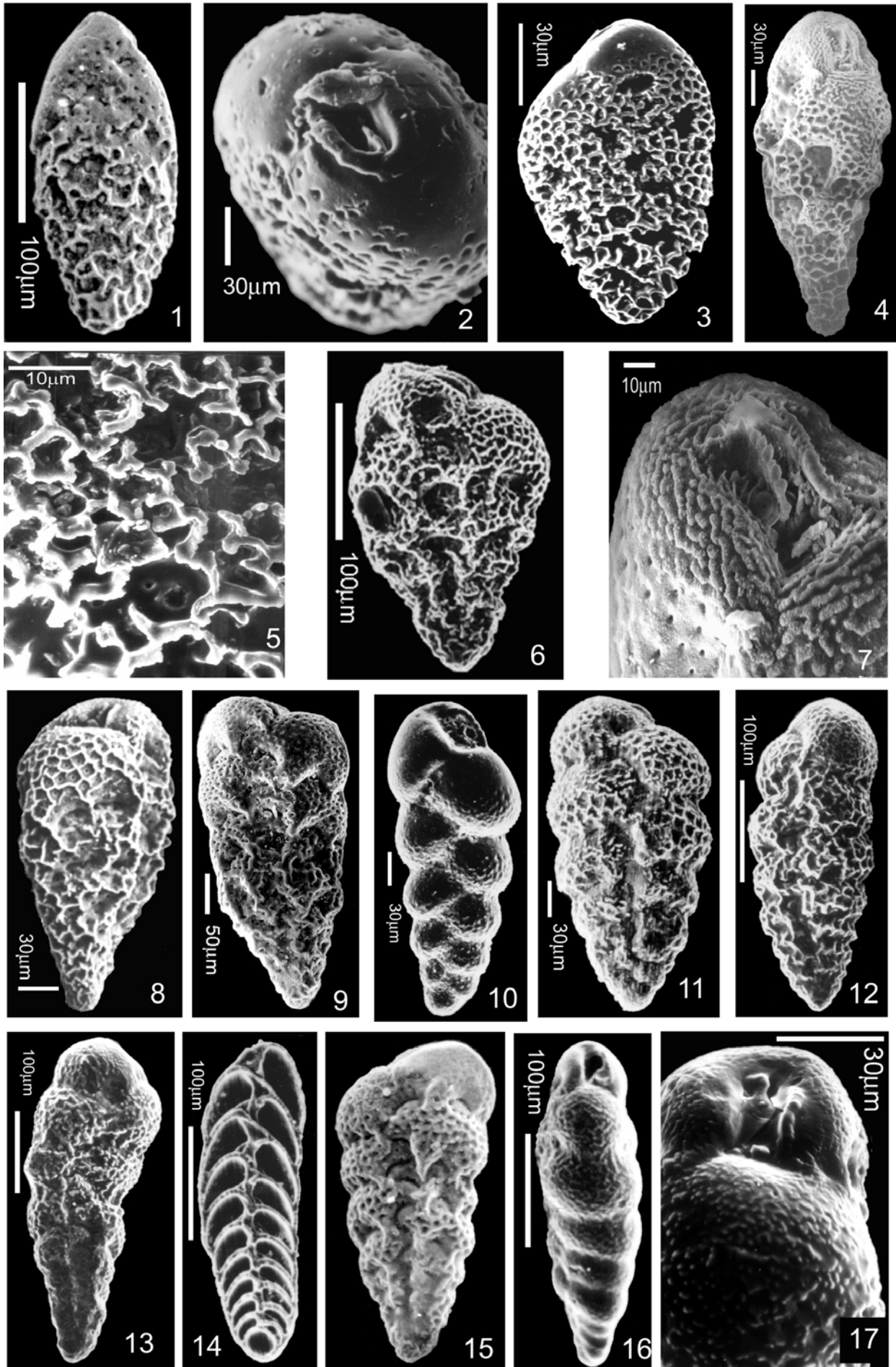


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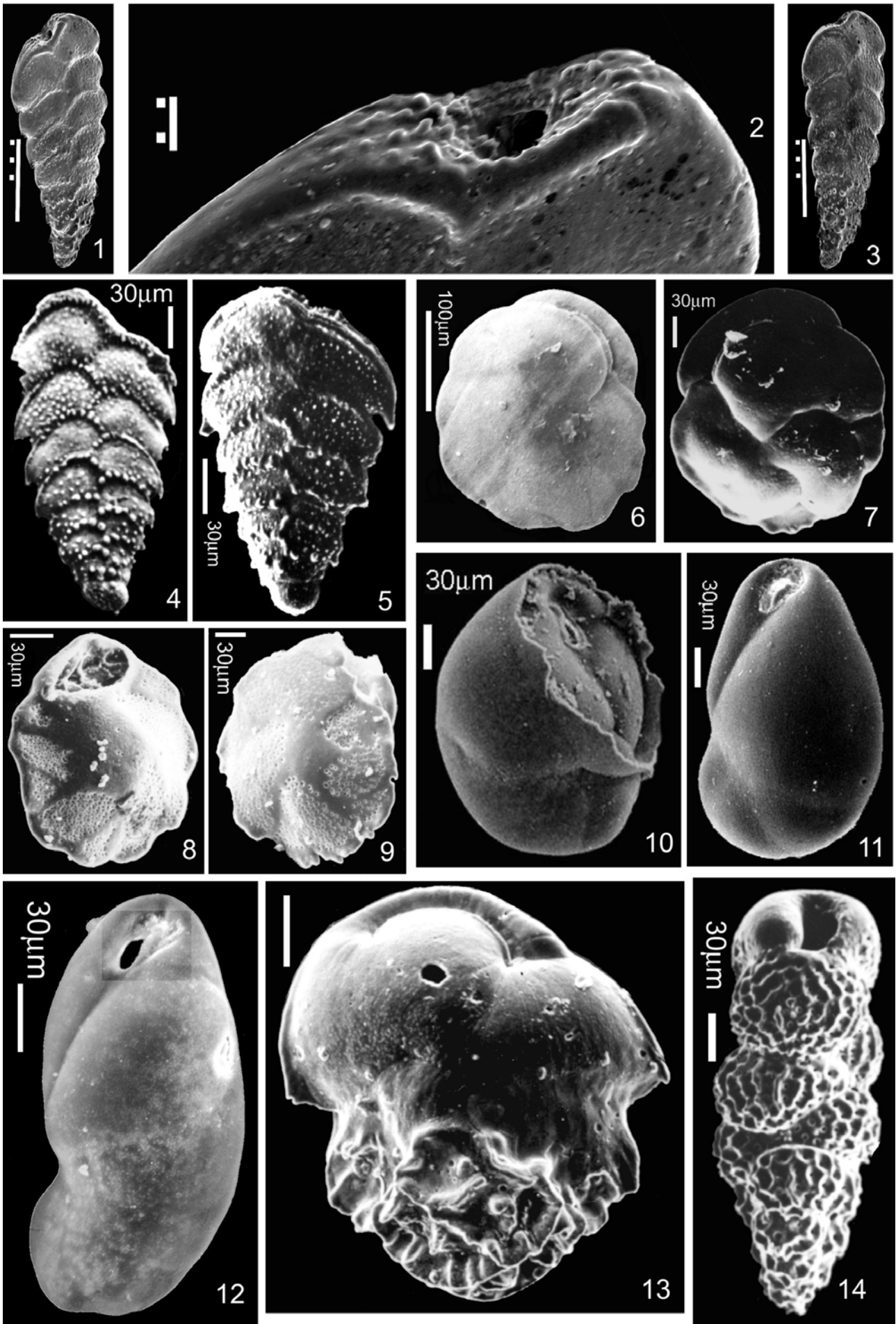


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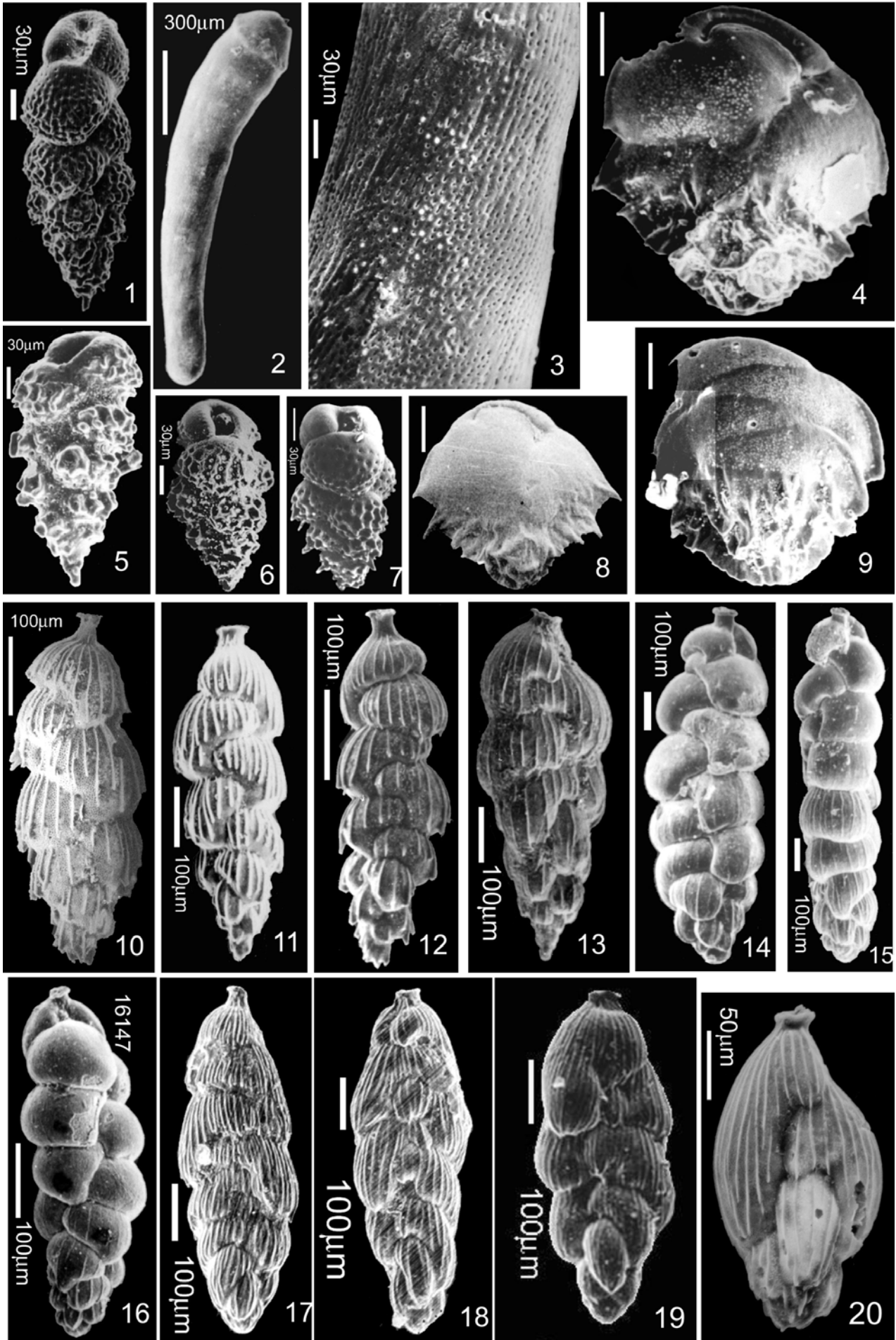


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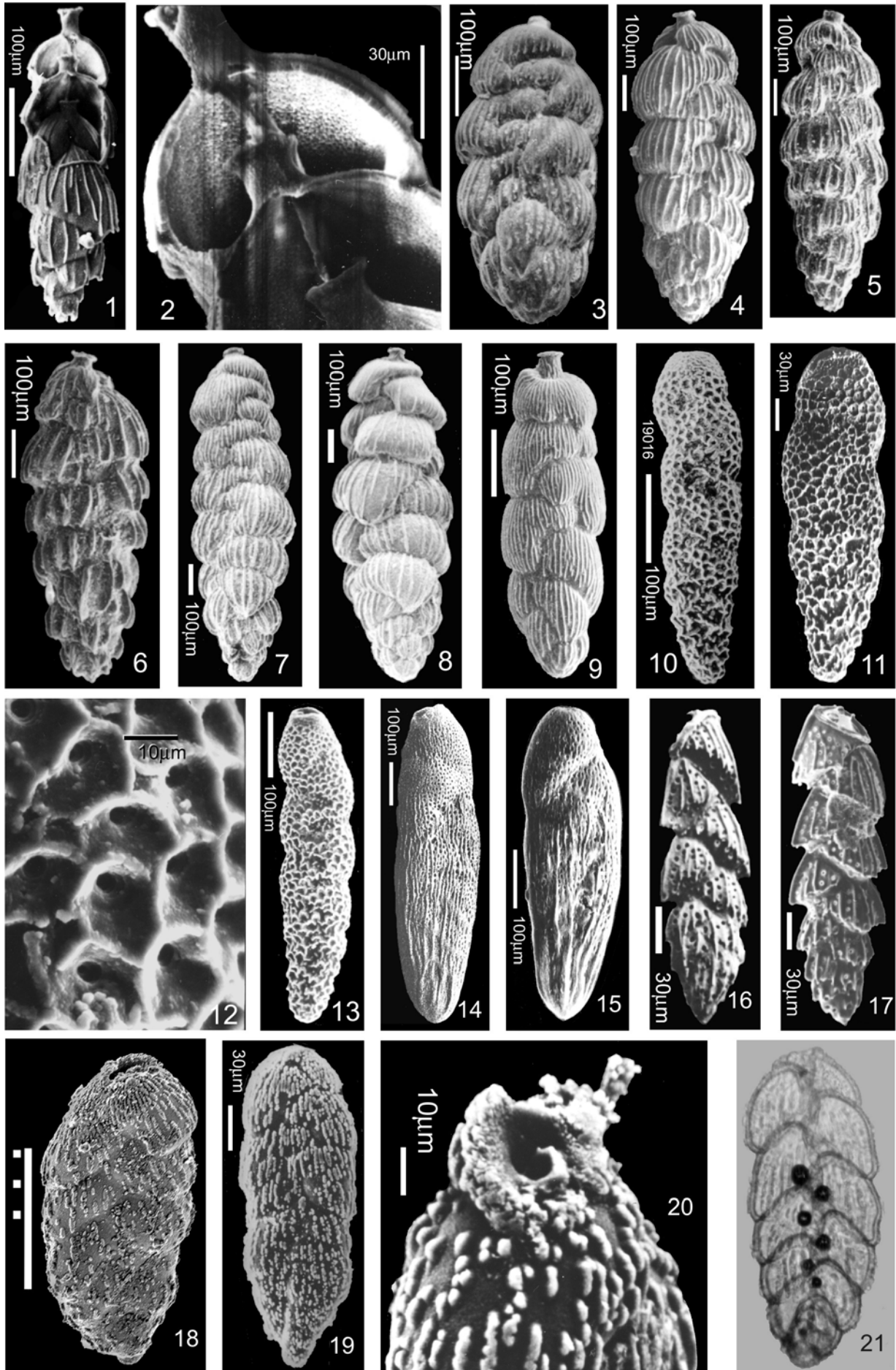


PLATE 6

