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, Turrilinacea, 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 Caransebeș intermountainous basins), from samples collected both in outcrops (Balta Sărată, Lăpușiu, Pance, Coștiul de Sus-Nemeștești) and in drillings (Zlișgîntâ, Coșava, Coșuștea, Coștei, etc.). Beside the mentioned areas some specimens come from northern and north-western Transylvania (Chiuza, Popești, 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 (Carașeș – Mehedia Basin and Zarand Basin), in the western part of the Getic Depression (Western Oltenia), the subcarpathian units (Subcarpathian Nappe and Târcău Nappe), Transylvanian Basin and Maramureș Basin. To these, samples collected from continuous drilling cores from Caransebeș – 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 Caransebeș – Mehedia 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 facies.
shelf deposits. The most representative samples were collected from the famous fossiliferous locations from Lăpuștiu 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

(1, fig. 1)

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


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. pokornyi* in strongly curved sutures and subtriangular shape in lateral view.

*Bolivina jriensis* TEDESCHI, 1957

(1, figs. 2-4)


*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 sporadical 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 lobs giving apparently a lobate sutural line. Specimens having almost parallel margins (pl. 1, fig. 6), conferred to the same species, remind of *Bolivina pokornyi gracilis* Cicha & Zapletalova (1963, p. 143, text-fig. 18).

*Bolivina cf. pokornyi* CICHA & ZAPLETALOVA, 1963

(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 pokornyi pokornyi* 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

(1, figs. 7-9)

*Bolivina dilatata maxima* CICHA & ZAPLETALOVA, 1963, p. 136, fig. 15; Papp & Cicha, 1978, p. 290 pl. 15, figs. 2, 3; Rögl 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 Sărăță, south of Caransebes. *Bolivina maxima* differs of *B. dilatata* in lanceolate, triangular outline and limbate sutures.

*Bolivina viennensis* (MARKS), 1951

(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

(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; aperture oval-perforated; periphery broadly rounded; sutures biserial throughout; wall calcareous, radial, perforated; aperture oval-elongated with hyaline lip.

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.

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.


Range: The species was described from the Miocene deposits in Carpathian Area. Frequently found in the Lower Badenian deposits from Transylvania and Banat, rare in the marine Lower Miocene deposits from Transylvania (Chechi 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.


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 sarmatica* 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).

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, 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 nisporenica* is regarded here as synonym. Both type material for the two species is coming from the same stratigraphic level ("Cryptomactra strata").

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


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, fig. 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, fig. 48, figs. 5, 6.

Globocassidulina oblonga (Reuss). Belford, 1966, p. 150, pl. 20, figs. 1-4, 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 Coșului (Lăpușul 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 Stainforthidae 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 Coștet, Valea Gemini section (Middle Badenian). The species occurs also in Upper Badenian (Kossovan) deposits (Popescu, 1979, p. 33).

Holotype (pl. 3, fig. 14) comes from Valea Gemini section, Coștet, Timiș 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 (Timiș 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.

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 bononiensis 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.

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. bononiensis Fornasini.

In Paratethys the species was mentioned from the marine Lower Miocene deposits (Chechiș
Formation) (Popescu, 1975, as U. szakalensis).
Rare in the Middle and Upper Badenian from
Romania.

Pappina primiformis (PAPP & TURNOVSKY), 1953
(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 &
Schmidt, 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 biseriately arranged in
the initial part, with parallel margins, later tending
to become uniserial; periphery rounded; sutures
flush, hidden by the ornamentation in the 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 Zig-Zigowkowski &
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.

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,
triseriately 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

Nodosaria (Dentalina) zsigmondyi HANTKEN, 1868

(p. 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 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. 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

(p. 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. Luczkowsa, 1960, p. 318, pl. 29, figs. 4, 5.

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

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).  

Remarks: Papp & Schmid (1985, p. 73, pl. 63, fig. 1-4) described this species as synonymous 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'Orbigny. (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.  

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 *Protaglobobulimina*, 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 *Buliminoidea* and *Buliminella*, from which differs by the presence of the internal toothplate.

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

Test ovate-elongate, with numerous high, narrow chambers, 10-11 to whorl, arranged in 2 – 21/2 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. parallelliformis* (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. parallelliformis*.  
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: *Praeuvgervina, Angulogerina, Eeuvgervina, Alувigerina* (UVigerina), and *Neouvigerina*. 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 *Eeuvgervina* THALMANN, 1952  
*Eeuvgervina 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.  
*Euvigerina 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; eeuvgervinid type toothplate.

The species is close to *U. orbignyana* Czizek, 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 umula_.

**Genus Neouvigerina** THALMANN, 1952

_Neouvigerina_ is regarded by many authors as a junior synonym of _Siphougerina_ 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 _Siphougerina_.

**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 biseri al 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, tr-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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Middle Miocene Foraminifera from Romania: Order Buliminida, Part I


PLATES CAPTIONS

PLATE 1

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


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

Fig. 6. Bolivina cf. B. gracilis CICHA & ZAPLETALOVA. Lateral view. Valea Morilor section, Colibași, Mehedinti 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, Timiş 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, Lăpușu de Sus, Hunedoara district. Moravian (Langhian).

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

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


Fig. 21 Brizalina antiqua (d'ORBIGNY). Lateral views. Valea Coșului section, Lăpușu 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, Lăpușu 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, Lăpușu 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, Timiş district. Wielician (Early Serravallian).
Figs. 6-9 Cassidulina laevigata d'ORBIGNY. Lateral views. Borehole F5 – Coşava, Timiş district. Upper Moravian (Upper Langhian)
Figs. 10, 11 Cassilongina oblonga (REUSS). Lateral-apertural views. Borehole F4 – Făget, Timiş district. Wielician (Lower Serravallian)
Fig. 12 Cassilongina bradyi (NORMAN). Lateral-apertural view. Valea Lupoaiei secton, Archiş, Arad district (Zarand Basin). Upper Moravian (Lower Serravallian)
Fig. 13 Ehrenbergina serrata Reuss. Frontal-apertural view. Valea Coşului section, Lâpu guie de Sus, Hunedoara district. Moravian (Langhian).
Fig. 14 Virgulopsis marksi n.sp. Holotype. Lateral view. Valea Gemini section, Coştei, Timiş district. Wielician (Lower Serravallian).

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

PLATE 5
Figs. 1. 2 Pappina parkeri (KARRER). Frontal views. Fig. 2, detail of fig. 1. Borehole Balta Sărătă, Caransebeş, Timiş district.
Figs. 3, 4 Pappina sp. 2. Frontal views. Borehole Balta Sărătă, Caransebeş, Timiş district.
Figs. 5, 6 Pappina neudorfensis (TOULA). Frontal views. Borehole Balta Sărătă, Caransebeş, Timiş district.
Fig. 9. Pappina primiformis (PAPP & TURNOVSKY). Lateral view. Valea Gemini section, Coştei, Timiş district. Moravian (Langhian).
Figs. 10-13. Lapugyina schmidi POPE SCU. Figs. 10, 11, 13, Lateral views; fig. 12, surface detail of fig 13. Valea Gemini section, Coştei, Timiş district. Moravian (Langhian).
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, Coştei, Timiş district. Wielician (Lower Serravallian).

PLATE 6
Fig. 8. Bulimina striata d'ORBIGNY. Lateral view. Valea Gemini section, Coştei, Timiş district. Wielician (Lower Serravallian).
Fig. 9. Bulimina aculeata d'ORBIGNY. Lateral view. Borehole 15-Faget, Timiş district. Upper Moravian (late Langhian).
Fig. 10. Globobulimina pyrula (d'ORBIGNY). Lateral view. Valea Gemini section, Coştei, Timiş district. Wielician (Lower Serravallian).
Figs. 11, 12. Floresina sp. Lateral views. Valea Gemini section, Coştei, Timis district. Moravian (Langhian).
Fig. 13. Floresina cf. paralleliformis (McCULLOCH). Lateral view. Valea Gemini section, Coştei, Timiş district. Wielician (Lower Serravallian).
Fig. 17 Euuvigerina aculeata (d'ORBIGNY) Lateral view. Cinciş Lake, Teliucul Superior, Hunedoara district. Wielician (Lower Serravallian).