



## Representatives of Family AMMOSPHAEROIDINIDAE Cushman, 1927 to Family GLOBOTEXTULARIIDAE Cushman, 1927 from the Paleocene of the coastal part of East Stara Planina

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Б. Вълчев. 2006. Представители на Семейство AMMOSPHAEROIDINIDAE Cushman, 1927 до семейство GLOBOTEXTULARIIDAE Cushman, 1927 от палеоценската серия в приморската част на Източна Стара планина. — *Сп. Бълг. геол. д-во*, 67, 1–3, 5–11.

**Резюме.** Настоящата статия е четвърта от поредицата посветена на таксономията на „флишкия тип“ аглу-тинираны фораминифери от палеоценската серия в приморската част на Източна Стара планина. Представени са таксономични описания на 15 вида, принадлежащи на 9 рода (*Ammosphaeroidina* — 1 вид, *Budashevaella* — 1 вид, *Recurvoides* — 2 вида, *Cyclammina* — 2 вида, *Spiroplectammina* — 2 вида, *Spiroplectinella* — 1 вид, *Trochammina* — 4 вида, *Arenobulimina* — 1 вид, *Remesella* — 1 вид), 6 семейства и 5 надсемейства. 14 вида се описват за първи път в България.

Използвана е класификацията на Loeblich и Tappan (1988).

**Ключови думи:** „флишки тип“ аглутинираны фораминифери, таксономия, Палеоценска серия, Източна Стара планина.

**Abstract.** The present article is the fourth of a series concerning taxonomy of the “flysh-type” agglutinated foraminifera from the Paleocene of the coastal part of East Stara Planina. Taxonomical descriptions of 15 species, belonging to 9 genera (*Ammosphaeroidina* — 1 species, *Budashevaella* — 1 species, *Recurvoides* — 2 species, *Cyclammina* — 2 species, *Spiroplectammina* — 2 species, *Spiroplectinella* — 1 species, *Trochammina* — 4 species, *Arenobulimina* — 1 species, *Remesella* — 1 species), 6 families and 5 superfamilies are given. 14 species are first described in Bulgaria.

The Loeblich and Tappan’s (1988) classification is applied in the article.

**Key words:** “flysh-type” agglutinated foraminifera, taxonomy, Paleocene, East Stara Planina.

### Introduction

The present article is the fourth one from the series concerning the taxonomy of the Paleocene “flysh-type” agglutinated foraminifera from the coastal part of East Stara Planina. The following pages present taxonomical descriptions of 15 species belonging to 9 genera 6 families and 5 superfamilies. 14 species are first described in Bulgaria. The Loeblich and Tappan’s (1988) classification is used in the article.

The map with the location of the studied borehole and outcrop sections was published by Valchev (2002). The biostratigraphical framework was discussed in the same article.

Superfamily HAPLOPHRAGMIACEA Eimer and Fickert, 1899

Family AMMOSPHAEROIDINIDAE Cushman, 1927

Subfamily AMMOSPHAEROIDININAE Cushman, 1927

### Genus *Ammosphaeroidina* Cushman, 1910

**Type species.** *Haplophragmium sphaeroidiniformes* Brady, 1884 (original designation).

**Distribution.** Late Cretaceous — Late Eocene: Ukraine, Carpathians; Oligocene: Australia; Holocene: North Pacific (542–2270 m), Mediterranean (140–240 m), North Atlantic, Gulf of Mexico, Caribbean Sea (392–3562 m).

**Remarks.** The numerous finds of representatives of the genus in several parts of the Tethys region emended geographical distribution given by Loeblich, Tappan (1988).

*Ammosphaeroidina pseudopauciloculata* (Mjatluk, 1966)

Plate I, Figures 1, 2

1966. *Cystamminella pseudopauciloculata* Mjatluk sp. nov.; Mjatluk, p. 264, pl. 1, figs. 5–8, pl. 2, fig. 6, pl. 3, fig. 3.

1970. *Cystamminella pseudopauciloculata* Mjatluk; Mjatluk, p. 104, pl. 15, fig. 6, pl. 30, fig. 10-12, 14.

1988. *Ammosphaeroidina pseudopauciloculata* (Mjatluk); Kaminski et al., p. 193, pl. 8, figs. 3-5.

1988. *Ammosphaeroidina pseudopauciloculata* (Mjatluk); Loeblich, Tappan, pl. 67, figs. 8-10.

*Nomenclature.* Holotype (VNIGRI Coll. No. 430/140) is from the Upper Paleocene of East Carpathians (Chemosh River, Kutu Village, Manyavska Formation, gay horizon). It was figured by Mjatluk (1966, pl. 1, fig. 5-8).

*Material.* Byala Formation (5 specimens), Emine Formation (13 specimens).

*Description.* The test is finely agglutinated, streptospirally coiled, oval to round in outline, strongly flattened. Four chambers with sharply increasing size are visible from the one side, while the other side shows three almost equidimensional chambers. The surface is smooth. The periphery is narrowly rounded. The sutures are straight, radial, depressed. The aperture is arch-shaped, interiormarginal.

*Distribution.* The species is known from the Upper Cretaceous of Italy, Spain, the Senonian, Paleocene and Lower Eocene of Carpathians, the Upper Maastrichtian, Paleocene and Lower Eocene of Trinidad.

*Occurrence.* Byala Formation: C-25 (22.50 m — P1b Zone), C-29 (364.10 m — P3 Zone); Emine Formation: Sections Kochan (P3, NP8 Zones), Emona (NP1 Zone) and Banya-North (P1c Zone).

Subfamily RECURVOIDINAE Alekseychic-Mitskevich, 1973

Genus *Budashevaella* Loeblich and Tappan, 1964

*Type species.* *Circus multicameratus* Voloshina and Budasheva, 1961 (original designation).

*Distribution.* Eocene - Miocene; Ukraine, Sakhalin, Kamchatka.

*Remarks.* According to Loeblich, Tappan (1988) the genus is restricted in the Eocene-Miocene, but the numerous finds of its representatives in the Upper Cretaceous and Paleocene flysh sediments of the Tethys region emended the stratigraphical range.

*Budashevaella trinitatensis* (Cushman and Renz, 1946)

Plate I, Figure 3

1988. *Budashevaella trinitatensis* (Cushman and Renz); Kaminski et al., p. 188, pl. 5, fig. 2, pl. 10, figs. 2, 3.

*Nomenclature.* I have no data about the holotype.

*Material.* Emine Formation (1 specimen).

*Description.* The test is finely agglutinated, with streptospiral initial portion and planispiral late part. The last whorl comprises 8 1/2 chambers with triangular shape and almost equal in size. The sutures are radial, slightly depressed, slightly curved back-

wards. The periphery is broadly rounded. The aperture is slit-like, basal.

*Distribution.* The species is known from the Paleocene of Trinidad, Newfoundland, the holes on Labrador Sea shelf, the Central North Sea.

*Occurrence.* Section Emona (NP1 Zone).

Genus *Recurvoides* Earland, 1934

*Type species.* *Recurvoides contortus* Earland, 1934 (originally designated).

*Distribution.* Middle Jurassic (Russia, Ukraine, Caucasus), Oligocene - Holocene; cosmopolitan.

*Remarks.* The numerous finds of representatives of the genus in the Upper Cretaceous and Paleocene in Caribbean, Trinidad emended the stratigraphical and geographical distribution given by Loeblich, Tappan (1988).

*Recurvoides imperfectus* (Hanzlikova, 1966)

Plate I, Figures 5, 6

1977. *Recurvoides imperfectus* (Hanzlikova); Samuel, p. 42, text-fig. 1c.

1981. *Recurvoides imperfectus* (Hanzlikova); Morgiel, Olzsewska, p. 10, pl. 3, figs. 7, 8.

1983. *Recurvoides imperfectus* (Hanzlikova); Geroch, Novak, pl. 2, fig. 19, pl. 6, fig. 1.

*Nomenclature.* I have no data about the holotype.

*Material.* Emine Formation (57 specimens).

*Description.* The test is subspherical, finely agglutinated, with streptospiral initial and trochospiral late portion. The last whorl consists of 10-12 chambers with small sizes. The sutures are straight, radial, slightly depressed. The surface is smooth. The periphery is broadly rounded. The aperture is basal.

*Distribution.* The species is known from the Upper Cretaceous and Paleocene of the Flysh Carpathians. It was also established in the deep sea holes in the Atlantic (Lower Cretaceous).

*Occurrence.* Sections Kochan (P1c-P3, NP8-9 Zones), Emona (NP1 Zone) and Banya-North (P1c Zone); samples from the geological mapping (Paleocene).

*Recurvoides* sp.

Plate I, Figure 4

*Material.* Byala Formation (90 specimens).

*Description.* The test is finely to moderately agglutinated and moderately finished, with streptospiral initial and trochospiral late portion. The chambers are indistinct.

*Occurrence.* Byala Formation: C-12 (219.20 m — P1b Zone, 264.50 m — Lower Paleocene), C-21 (38.50 m — P1b Zone), C-24 (40.00 m — P2 Zone), C-25 (22.50 m — P1b Zone), C-29 (364.50-365.00 m — P3 Zone, 383.20 m — P4 Zone), C-30 (83.90-91.90 m — P4 Zone, 99.50-107.90 m — P5 Zone), Sections Byala 1 (NP3 Zone), Byala 2b NP1-3 Zones, and Byala 2c (NP1-2 Zones), Byala River Valley (Paleocene).

Superfamily CYCLOLINACEA Loeblich and Tap-  
pan, 1964  
Family CYCLAMMINIDAE Marie, 1941  
Subfamily CYCLAMMININAE Marie, 1941  
Genus *Cyclammina* Brady, 1879

*Type species. Cyclammina cancellata* Brady, 1879  
(original designation).

*Distribution.* Paleocene - Holocene; cosmopolitan.

*Cyclammina* sp. 1  
Plate I, Figures 7, 8

*Material.* Emine Formation (12 specimens).

*Description.* The test is finely agglutinated, planispi-  
ral, involute. The last whorl comprises 6-7 gradually  
increasing in size chambers. The sutures are straight,  
radial, slightly depressed. The periphery is rounded.  
The aperture is slit-like, interiomarginal.

*Remarks.* The chambers found during the present  
study are strongly deformed.

*Occurrence.* Section Kochan (P1c-P3 Zones).

? *Cyclammina* sp. 2  
Plate I, Figure 9

*Material.* Byala Formation (23 specimens).

*Description.* The test is large, compact, coarsely  
agglutinated, moderately finished, involute, slightly  
laterally flattened. The chambers are indistinct. The  
periphery is broadly rounded. The aperture is slit-  
like, equatorial.

*Occurrence.* Byala Formation: C-12 (203.00-204.00  
m — P1c Zone), C-25 (454.60 m — P2 Zone), C-29  
(476.30 m — P5 Zone), Section Byala 2b (NP2-3  
Zones).

Superfamily SPIROPLECTAMMINACEA Cush-  
man, 1927  
Family SPIROPLECTAMMINIDAE Cushman, 1927  
Subfamily SPIROPLECTAMMININAE Cushman,  
1927  
Genus *Spiroplectammina* Cushman, 1927

*Type species. Textularia agglutinans* d'Orbigny, var.  
*biformis* Parker and Jones, 1865 (original designa-  
tion).

*Distribution.* Carboniferous — Holocene; cosmo-  
politan.

*Spiroplectammina excolata* (Cushman, 1926)  
Plate I, Figure 10

1926. *Textularia excolata* Cushman, n. sp.; Cush-  
man, p. 585, pl. 15, fig. 9.

1962. *Spiroplectammina excolata* (Cushman); Hill-  
ebrandt, S. 29, Taf. 1, Fig. 12, 13.

1974. *Spiroplectammina subsphaeringensis* (Grzy-  
bowski); Szczechura, Pozaryska, p. 31, pl. 3,  
fig. 17.

1988. *Spiroplectammina excolata* (Cushman); Ka-  
minski et al., p. 192, pl. 8, fig. 12.

*Nomenclature.* The holotype (Cushman Coll. No.  
5138) is from the Paleocene of Mexico (Velasco  
Shale).

*Material.* Byala Formation (65 specimens), Em-  
ine Formation (4 specimens).

*Description.* The test is heteromorphous, low and  
broad. The initial portion is planispiral, flattened,  
the later one is biserial, sharply broadening. The  
chambers are low, broad and slightly curved back-  
wards. The sutures are thick, slightly elevated, ob-  
lique, slightly curved backwards. The periphery is  
sharpened. The surface is smooth. The aperture is  
arch-shaped, basal.

*Distribution.* The species is known from the Up-  
per Cretaceous to Eocene of Tethys Region: Mexico,  
Trinidad, Morocco, Alps, Carpathians, Crimea, Cau-  
casus. It was also established in the deep sea holes in  
the Atlantic.

*Occurrence.* Byala Formation: C-11 (191.60 m —  
P1c Zone), C-12 (219.20 m — P1b Zone), C-24 (40.00  
m — P2 Zone), C-25 (26.40-40.40 m — P1b Zone,  
355.00 m — P2 Zone), C-29 (420.60 m — P4 Zone,  
433.50 m — P5 Zone), Sections Byala 1 (NP3-4 Zones),  
Byala 2b (NP3 Zone), Byala 2c (NP2 Zone), Byala  
River and Koundilaki Cheshme Valleys (Paleocene);  
Emine Formation: a sample from the geological map-  
ping (Paleocene).

*Spiroplectammina spectabilis* (Grzybowski, 1898)  
Plate I, Figures 11, 12

1962. *Spiroplectammina spectabilis* (Grzybowski);  
Hillebrandt, S. 32, Taf. 2, Fig. 26, 27.

1983. "*Spiroplecta spectabilis* n. sp."; Geroch, Ver-  
denius, pl. 12, fig. 12.

1984. *Spiroplectammina spectabilis* (Grzybowski);  
Kaminski, pls. 12, 13 (with synonymy).

1988. *Spiroplectammina spectabilis* (Grzybowski);  
Kaminski et al., p. 193, pl. 7, figs. 16-18.

*Nomenclature.* Geroch, Verdenius (1983) refigured  
the Grzybowski's original images. I compare to them.  
The species was first described from the Eocene of  
Polish Carpathians (Krosno area).

*Material.* Byala Formation (79 specimens), Emine  
Formation (4 specimens).

*Description.* The test is narrow, elongated, hetero-  
morphous, with planispiral initial portion and biser-  
ial late one. The chambers from the biserial part are  
numerous, low and broad, slightly increasing in size.  
The test sides are often parallel. The sutures are flush  
or slightly depressed, straight or slightly curved in  
the peripheral area, oblique. The periphery is sharp-  
ened. The surface is smooth. The aperture is slit-like,  
basal.

*Remarks.* The species was established in the Low-  
er and Middle Paleocene of North Bulgaria (Darak-  
chieva, 1999).

*Distribution.* It is known from the Upper Creta-  
ceous of Italy, Spain, the Maastrichtian and Pale-  
ocene of Pakistan, the Maastrichtian, Paleocene and  
Eocene of Alps, Carpathians, Caucasus, Trinidad,  
the Paleocene of the Netherlands, Mexico, Tunisia,

deep sea holes in the Atlantic (Upper Cretaceous – Oligocene), Labrador and North seas (Maastrichtian – Paleocene), Norwegian Sea (Lower Eocene).

**Occurrence.** Byala Formation: C-12 (204.00, 268.50 m – P1c Zone), C-23 (139.50 m – P1b Zone), C-25 (26.40-40.40 m – P1b Zone), C-28 (15.00-16.00 m – P2 Zone), C-29 (433.50 m – P5 Zone), C-30 (83.90 m – P4 Zone), Sections Byala 1 (NP3-4 Zones), Byala 2b (NP3 Zone), Byala 2c (NP2 Zone), Byala River Valley (Paleocene); Emine Formation: samples from the geological mapping (Paleocene).

Genus **Spiroplectinella** Kiselman, 1972

*Type species.* *Spiroplecta wrightii* Silvestri, 1903 (original designation by monotypy).

*Distribution.* Paleocene - Holocene; cosmopolitan.

***Spiroplectinella dentata*** (Alth, 1850)

Plate II, Figures 1, 2

1962. *Spiroplectammina dentata* (Alth); Hillebrandt, S. 28, Taf. 1, Fig. 9-11, Texttab. 1.

1970. *Textularia dentata* (Alth); Mjatluk, p. 99, pl. 30, figs. 1, 2.

1975. *Spiroplectammina dentata* (Alth); Braga et al., p. 91, T. 1, fig. 5.

1976. *Spiroplectammina dentata* (Alth); Aubert, Berggren, p. 408, pl. 1, fig. 5.

1988. *Spiroplectammina* aff. *S. dentata* (Alth); Kaminski et al., p. 192, pl. 7, figs. 10, 11.

1990. *Spiroplectammina dentata* (Alth); I. De Klasz, S. de Klasz, p. 411, pl. 5, figs. 9-11.

**Nomenclature.** I have no data about the holotype.

**Material.** Byala Formation (315 specimens), Emine Formation (39 specimens).

**Description.** The test is coarsely agglutinated, moderately finished, heteromorphous, planispirally coiled in the initial portion and biserial in the late one. The chambers from the biserial part are low and broad. The sutures are slightly elevated, oblique. The periphery is with broad and transparent keel. The aperture is arch-shaped, situated on the internal part of the last chamber surface.

**Remarks.** Some variations in the test outline and keel width were established. The species has been referred to genus *Spiroplectammina*, but the presence of keel, as well as the coarsely agglutinated and moderately finished wall made me to refer it to genus *Spiroplectinella*.

**Distribution.** The species is known from the Upper Cretaceous of Italy, Spain, Turkmenia, the Maastrichtian and Paleocene of Trinidad, USA, the Turronian, Senonian and Paleocene of Polish Carpathians, the Paleocene of the Alps, Crimea, Spain, Egypt, Tunisia, deep sea holes in the Atlantic (Campanian – Middle Paleocene), Labrador and North Seas (Maastrichtian – Middle Eocene).

**Occurrence.** Byala Formation: C-11 (192.40 m – P1c Zone), C-12 (167.00 m – Lower Paleocene, 289.20 m – P1c Zone, 296.20 m – P1b Zone), C-21 (29.50-38.50 m – P1b Zone), C-23 (139.50, 271.20 m – P1b

Zone), C-28 (512.00-513.00 m – P3 Zone), C-29 (361.20-364.20 m – P3 Zone, 383.20-420.60 m – P4 Zone, 433.50-476.30 m – P5 Zone), C-30 (83.90 m – P4 Zone, 99.50-107.90 m – P5 Zone), Sections Byala 1 (NP3 Zone), Byala 2b (NP1-3 Zones), Byala 2c (NP1-2 Zones), Byala River and Koundilaki Cheshme Valleys (Paleocene); Emine Formation: Sections Emona (NP1 Zone) and Banya-North (P1c Zone); a sample from the geological mapping (Paleocene).

Superfamily TROCHAMMINACEA Schwager, 1877

Family TROCHAMMINIDAE Schwager, 1877

Subfamily TROCHAMMININAE Schwager, 1877

Genus **Trochammina** Parker and Jones, 1859

*Type species.* *Nautilus inflatus* Montagu, 1808 (original designation by monotypy).

*Distribution.* Carboniferous - Holocene; cosmopolitan.

***Trochammina deformis*** Grzybowski, 1898

Plate II, Figure 3

1977. *Trochammina deformis* Grzybowski; Samuel, p. 50, pl. 26, fig. 4.

1981. *Trochammina deformis* Grzybowski; Gradstein, Berggren, p. 256, pl. 8, figs. 8-10.

1983. "*Trochammina deformis* n. sp."; Geroch, Verdenius, pl. 11, fig. 20.

1990. *Trochammina deformis* Grzybowski; I. De Klasz, S. de Klasz, p. 412, pl. 5, fig. 7.

**Nomenclature.** Geroch and Verdenius (1983) refigured the original Grzybowski's images. I compare to them. The species was first described from the Eocene of Polish Carpathians (Krosno area).

**Material.** Byala Formation (245 specimens), Emine Formation (113 specimens).

**Description.** The test is coarsely agglutinated, trochospiral, flattened, with round outline. The chambers are subspherical, flattened along the axis of coiling. Four chambers comprise the last whorl. The aperture is not visible.

**Distribution.** The species is known from the Upper Cretaceous of Italy, Spain, the Upper Senonian, Paleocene and Eocene of the Carpathians, the Paleocene of Bavarian Alps, deep sea holes in Labrador and North Seas (Maastrichtian – Eocene).

**Occurrence.** Byala Formation: C-11 (191.60-247.50 m – P1c Zone), C-12 (167.00 m – Lower Paleocene, 214.90 m – P1c Zone, 219.20 m – P1b Zone, 264.50 m – Lower Paleocene, 268.50-289.20 m – P1c Zone, 296.10-303.40 m – P1b Zone), C-21 (7.50 m – P1c Zone, 22.00-38.50 m – P1b Zone), C-23 (271.20 m – P1b Zone), C-25 (22.50-40.40 m – P1b Zone), C-29 (361.50 m – P3 Zone, 383.20-399.20 m – P4 Zone, 433.50-440.30 m – P5 Zone), C-30 (83.90-91.60 m – P4 Zone, 99.50-107.90 m – P5 Zone), Sections Byala 1 (NP3-5 Zones), Byala 2b (NP1-3 Zones), Byala 2c (NP1-2 Zones), Byala River Valley (Paleocene); Emine Formation: Sections Kochan (P1c-P3, NP8-9 Zones), Emona (NP1 Zone), Banya-North (P1c Zone) and Banya-Southwest (Lower Paleocene); samples from the geological mapping (Paleocene).

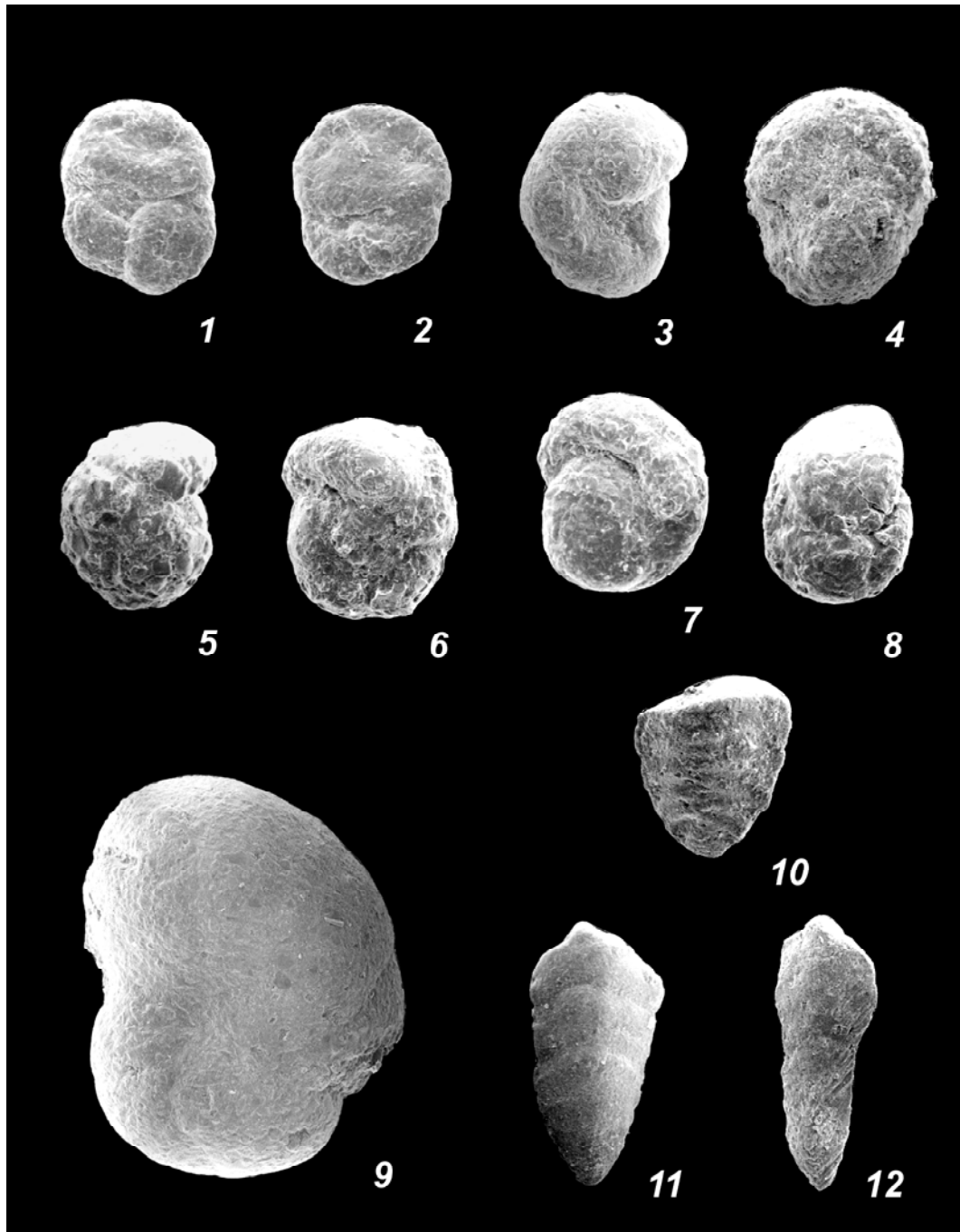


PLATE I

- 1, 2. *Ammosphaeroidina pseudopauciloculata* (Mjatliuk, 1966).  
Emine Formation, Section Banya-North, Lower Paleocene, P1c Zone, Sample E-Бс-1; SEMx55.
3. *Budashewaella trinitatensis* (Cushman and Renz, 1946).  
Emine Formation, Section Emona, Lower Paleocene, NP1 Zone, Sample E-ИЕ-8; SEMx55.
4. *Recurvoides* sp.  
Byala Formation, Apertural view, Koundilaki Cheshme Valley, Paleocene, Sample КЧ-1; SEMx50.5.
- 5, 6. *Recurvoides imperfectus* (Hanzlikova, 1966).  
Emine Formation, Section Kochan, Middle Paleocene, P3 Zone, Sample E-K-9; SEMx48.6.
- 7, 8. *Cyclammina* sp. 1.  
Emine Formation, Section Kochan, Middle Paleocene, P3 Zone, Sample E-K-7; SEMx48.6.
9. ?*Cyclammina* sp. 2.  
Byala Formation, C-29, 476.30 m, Upper Paleocene, P5 Zone, Sample C-29-15; SEMx48.6.
10. *Spiroplectammina excolata* (Cushman, 1926).  
Byala Formation, Section Byala 1, Lower Paleocene, NP3 Zone, Sample Б1-7; SEMx46.4.
- 11, 12. *Spiroplectammina spectabilis* (Grzybowski, 1898).  
Byala Formation, Section Byala 1, Lower Paleocene, 11 — Sample Б1-11; SEMx46.4; 12 — SEMx46.4.

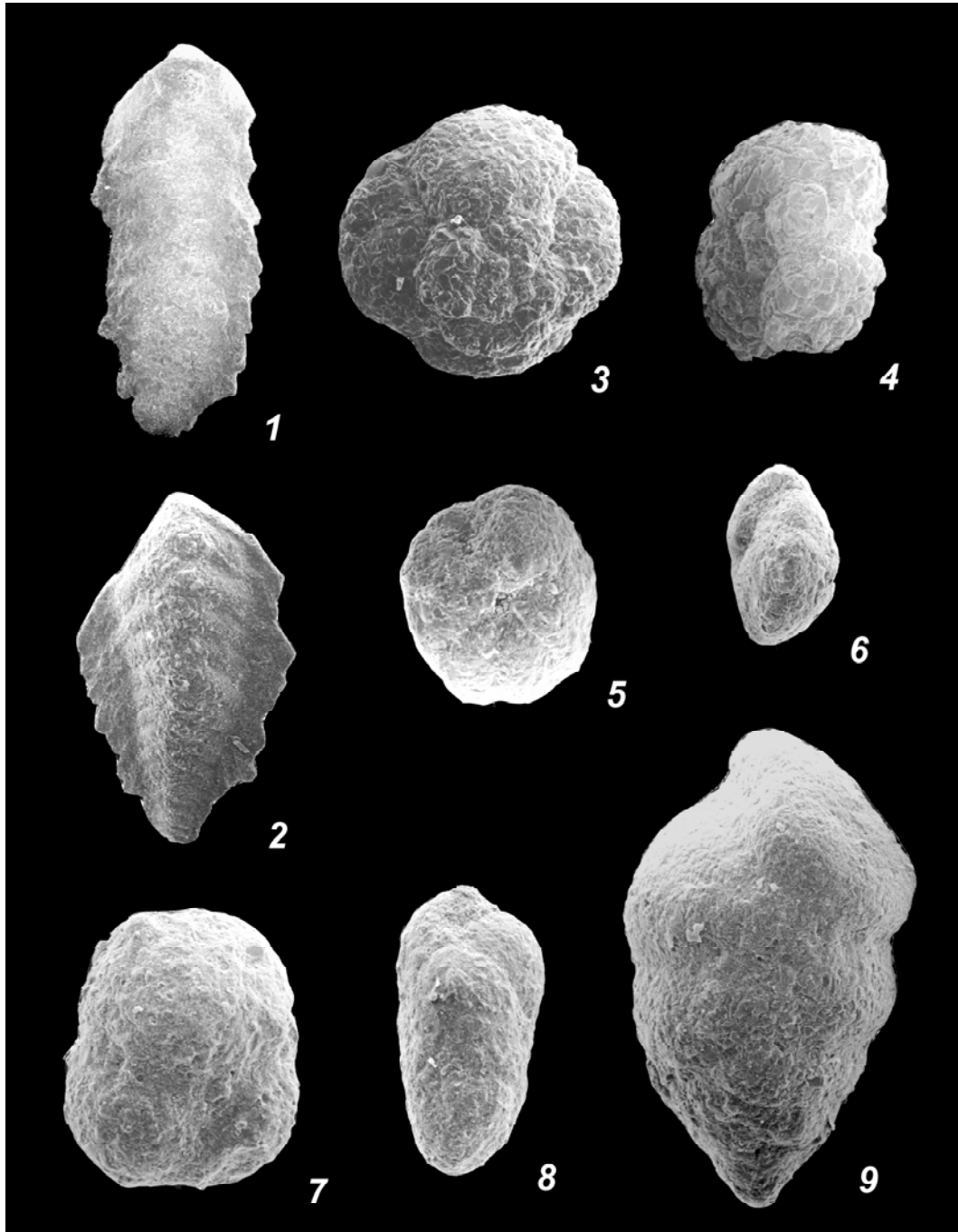


PLATE II

1, 2. *Spiroplectinella dentata* (Alth, 1850).

Byala Formation, C-30, 99.50 m, Upper Paleocene, P5 Zone, Sample C-30-14; SEMx40.8.

3. *Trochammina deformis* Grzybowski, 1898.

Emine Formation, Spiral view; Section Kochan, Middle Paleocene, P3 Zone, Sample E-K-9; SEMx44.4.

4. *Trochammina globigeriniformis* (Parker and Jones, 1865).

Emine Formation, Spiral view; Section Kochan, Middle Paleocene, P3 Zone, Sample E-K-9; SEMx40.8.

5, 6. *Trochammina ruthven-murrayi* Cushman and Renz, 1946.

Byala Formation, 5 — Umbilical view, C-30, 91.90 m, Upper Paleocene, P4 Zone, Sample C-30-12; SEMx55; 6

— Peripheral view, C-29, 433.50 m, Upper Paleocene, P5 Zone, Sample C-29-10; SEMx55.

7. *Trochammina quadriloba* (Grzybowski, 1896).

Byala Formation, Umbilical view; Byala River Valley, Paleocene, Sample БР-2; SEMx55.

8. *Arenobulimina dorbignyi* (Reuss, 1845).

Byala Formation, C-12, 296.10 m, Lower Paleocene, P1b Zone, Sample C-12-107; SEMx42.6.

9. *Remesella varians* (Glaessner, 1937).

Byala Formation, Section Byala 2b, Lower Paleocene, NP1 Zone, Sample B2b-8; SEMx60.

***Trochammina globigeriniformis*** (Parker and Jones, 1865)

Plate II, Figure 4

1962. *Trochammina globigeriniformis altiformis* Cushman and Renz; Hillebrandt, S. 46, Taf. 2, Fig. 25.

1976. *Trochammina globigeriniformis* (Parker and Jones); Aubert, Berggren, p. 411, pl. 1, fig. 17.

1981. *Trochammina globigeriniformis* (Parker and Jones); Gradstein, Berggren, p. 256, pl. 8, fig. 13.

1990. *Trochammina globigeriniformis* (Parker and Jones); I. de Klasz, S. de Klasz, p. 412, pl. 5, figs. 10-12.

**Nomenclature.** I have no data about the holotype.

**Material.** Byala Formation (107 specimens), Emine Formation (91 specimens).

**Description.** The test is coarsely agglutinated, trochospiral. The last whorl consists of 3 1/2 subspherical chambers. The periphery is rounded. The sutures are depressed, radial, slightly curved backwards. The umbo is broad. The aperture is extraumbilical.

**Remarks.** The species was identified in the Middle-Upper Eocene and Oligocene of Bourgas District (Darakchieva, 1999).

**Distribution.** Cretaceous — recent. The species was found in the flysh deposits of the orogenic belts, deep sea holes in the Atlantic (Lower Cretaceous), Labrador and North seas (Maastrichtian - Eocene).

**Occurrence.** Byala Formation: C-11 (247.50 m — P1c Zone), C-12 (214.90 m — P1c Zone, 219.20 m — P1b Zone, 264.50 m — Lower Paleocene, 268.50-289.20 m — P1c Zone, 296.10 m — P1b Zone), C-21 (37.00 m — P1b Zone), C-25 (40.40 m — P1b Zone, 454.60 m — P2 Zone), Sections Byala 1 (NP3-4 Zones), Byala 2b (NP1-3 Zones), Byala 2c (NP1-2 Zones), Byala River Valley (Paleocene); Emine Formation: Section Kochan (P1c-P3, NP8-9 Zones); samples from the geological mapping (Paleocene).

***Trochammina quadriloba*** (Grzybowski, 1896)

Plate II, Figure 7

1960. *Trochammina quadriloba* (Grzybowski); Geroch, p. 64, Tabl. 7, fig. 1.

1977. *Trochammina quadriloba* (Grzybowski); Samuel, p. 51, pl. 27, fig. 1.

1981. *Trochammina quadriloba* (Grzybowski); Gradstein, Berggren, p. 258, pl. 8, fig. 11.

1981. ?*Trochammina bulloidiformis* (Grzybowski); Liszka, Liszkowa, p. 169, pl. 1, fig. 17.

1983. "*Haplophragmium (Reussina) quadrilobum* n. sp."; Geroch, Verdenius, pl. 8, fig. 31.

1996. *Trochammina* cf. *deformis* (Grzybowski); Ujetz, p. 106, pl. 2, figs. 26, 27.

**Nomenclature.** Geroch, Verdenius (1983) refigured the original Grzybowski's images. I compare to them. The species was first described from the Campanian of Polish Carpathians (red clays near Wadowice Village).

**Material.** Byala Formation (140 specimens), Emine Formation (1 specimen).

**Description.** The test is coarsely agglutinated, trochospiral. It is composed of subspherical to oval chambers. The last whorl comprises 4 chambers. The periphery is broadly rounded. The umbo is broad, shallow. The sutures are depressed. The aperture is extraumbilical.

**Distribution.** The species is known from the Paleocene of the Carpathians, deep sea holes in Labrador Sea (Paleocene). Nowadays it lives near the Newfoundland coast.

**Occurrence.** Byala Formation: C-21 (22.00, 38.50 m — P1b Zone), C-23 (139.50 m — P1b Zone), C-25 (22.50-40.40 m — P1b Zone), C-28 (15.00 m — P2 Zone), C-29 (364.40 m — P3 Zone, 383.20-420.60 m — P4 Zone, 433.50-464.70 m — P5 Zone), C-30 (83.90 m — P4 Zone, 99.50-107.90 m — P5 Zone), Sections Byala 1 (NP3-4 Zones), Byala 2b (NP2-3 Zones), Byala 2c (NP2 Zone), Byala River Valley (Paleocene); Emine Formation: Section Kochan (P1c Zone).

***Trochammina ruthvenmurrayi*** Cushman and Renz, 1946

Plate II, Figures 5, 6

1988. *Trochammina ruthven-murrayi* Cushman and Renz; Kaminski et al., p. 193, pl. 8, fig. 6.

**Nomenclature.** I have no data about the holotype.

**Material.** Byala Formation (11 specimens).

**Description.** The test is conical in shape, highly trochospiral. The chambers in the last whorl are 6-7 in number, triangular in shape. The sutures on the umbilical side are depressed, radial, slightly curved backwards. The umbo is narrow, shallow. The periphery is slightly rounded. The aperture is extraumbilical.

**Distribution.** The species is known from the Paleocene of Trinidad.

**Occurrence.** Byala Formation: C-28 (15.00-16.00 m — P2 Zone), C-29 (P5 Zone), C-30 (91.90 m — P4 Zone), Section Byala 2c (NP1 Zone), Byala River and Koundilaki Cheshme Valleys (Paleocene).

Superfamily ATAXOPHRAGMIACEA Schwager, 1877

Family ATAXOPHRAGMIINAE Schwager, 1877

Subfamily ATAXOPHRAGMIINAE Schwager, 1877

Genus ***Arenobulimina*** Cushman, 1927

**Type species.** *Bulimina preslii* Reuss, 1845 (original designation).

**Distribution.** Aptian — Paleocene; Europe, Arkansas, Texas.

***Arenobulimina dorbignyi*** (Reuss, 1845)

Plate II, Figure 8

1845. *B. (Bulimina) d'Orbignyi* Reuss; Reuss, S. 38, Taf. 13, Fig. 74.

1937. *Arenobulimina d'orbignyi* (Reuss); Cushman, p. 39, pl. 4, figs. 9-12.

1957. *Arenobulimina d'Orbigny* Reuss; Yovcheva, p. 105, pl. 1, figs. 9-12.  
 1981. *Arenobulimina dorbignyi* (Reuss); Gradstein, Berggren, p. 261, pl. 5, figs. 5-7.  
 1988. *Arenobulimina dorbignyi* (Reuss); Kaminski et al., p. 194, pl. 8, fig. 9.  
 1988. *Arenobulimina d'orbignyi* (Reuss); Loeblich, Tappan, pl. 145, figs. 19, 20.

**Nomenclature.** Holotype is the specimen figured by Reuss (1845, Taf. 13, Fig. 74). The species was first described from the Cretaceous of Bohemia.

**Material.** Byala Formation (12 specimens), Emine Formation (3 specimens).

**Remarks.** The species was described from the Maastrichtian of Northeast Bulgaria (Yovcheva, 1957).

**Distribution.** It is known from the Cretaceous of Bohemia, the Maastrichtian of deep sea holes in Labrador and North Seas, the Paleocene of Trinidad.

**Occurrence.** Byala Formation: C-11 (191.60 m — P1c Zone), C-12 (204.00 m — P1c Zone, 219.20, 296.10 m — P1b Zone), Sections Byala 1 (NP4 Zone), Byala 2b (NP3 Zone); Emine Formation: samples from the geological mapping (Paleocene).

Family GLOBOTEXTULARIIDAE Cushman, 1927  
 Subfamily LIEBUSSELLINAE Saidova, 1981  
 Genus *Remesella* Vasicek, 1947

**Type species.** *Remesella mariae* Vasicek, 1947 = *Textulariella ? varians* Glaessner, 1937 (original designation).

**Distribution.** Campanian — Paleocene; Carpathians, Crimea, Ukraine, New Zealand.

**Remarks.** The numerous finds of representatives of the genus in several parts of the Tethys region emended geographical distribution given by Loeblich and Tappan (1988).

*Remesella varians* (Glaessner, 1937)  
 Plate II, Figure 9

1937. *Textulariella (?) varians* nov. sp.; Glaessner, S. 366, Taf. 2, Fig. 15.

1962. *Textulariella varians* Glaessner; Hillebrandt, S. 45, Taf. 1, Fig. 27, 28, texttab. 4.

1988. *Matanzia varians* (Glaessner); Kaminski et al., p. 196, pl. 9, fig. 14, pl. 10, fig. 14.

1988. *Remesella varians* (Glaessner); Loeblich, Tappan, pl. 153, figs. 1-3.

1990. *Remesella varians* (Glaessner); I. De Klasz, S. de Klasz, p. 414, pl. 6, figs. 13, 14.

**Nomenclature.** Holotype is the specimen figured by Glaessner (1937, Taf. 2, Fig. 15). The species was first described from the Paleocene of Northwest Caucasus.

**Material.** Byala Formation (49 specimens), Emine Formation (4 specimens).

**Description.** The test is moderately finished, subconical, slightly elongated, with trochospiral initial part and biserial late one. The sutures are straight, horizontal, depressed. The aperture is arch-shaped, interiomarginal.

**Distribution.** The species is known from the Upper Cretaceous of Italy, Spain, the Maastrichtian and Paleocene of Polish Carpathians, Northwest Caucasus, Trinidad, Alps, Algeria, the Paleocene of the Netherlands, deep sea holes in the Atlantic (Paleocene).

**Occurrence.** Byala Formation: C-12 (194.00-204.00 m — P1c Zone), C-28 (513.00 m — P3 Zone), C-29 (365.00 m — P3 Zone, 420.60 m — P4 Zone, 476.30 m — P5 Zone), C-30 (83.90 m — P4 Zone, 99.50-103.50 m — P5 Zone), Sections Byala 1 (NP4 Zone), Byala 2b (NP3 Zone), Byala 2c (NP1-2 Zones), Byala River Valley (Paleocene); Emine Formation: samples from the geological mapping (Paleocene).

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(Постъпила на 07.01.2005 г., приета за печат на 17.05.2005 г.)