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NEW FINDINGS OF PALEOGENE AGGLUTINATED AND PORCELANEOUS FORAMINIFERA FROM THE REPUBLIC OF MACEDONIA

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Abstract

The present article represents the taxonomy of the Palaeogene agglutinated and porcelaneous foraminifera of the Republic of Macedonia. Eight species belonging to 7 genera, 7 families (BATHYSIPHONIDAE Avnimelech, 1952 to HAUERINIDAE Schwager 1876), and 6 superfamilies are described for the first time from this part of the Balkan Peninsula. The studied micropalaeontological material was obtained from 7 outcrop sections belonging to 4 sedimentary basins.

Key words: agglutinated and porcelaneous foraminifera, taxonomy, Palaeogene, Republic of Macedonia

Introduction. The present article deals with the taxonomy of agglutinated and porcelaneous foraminifera from the Palaeogene basins of the Republic of Macedonia. They are located in two tectonic zones – the Vardar Zone and the Serbo–Macedonian Massif [1]. The studied micropalaeontological material was obtained from the upper flysh unit [2] that is developed in 5 of totally 7 sedimentary basins [3]. The investigated agglutinated and porcelaneous specimens were established in 45 samples picked from 7 outcrop sections belonging to 4 of the basins (Fig. 1).

Foraminiferal data. The first data about the presence of agglutinated and porcelaneous foraminifera were given by Maksimovič et al. [2] during the complex investigation of Ovche Pole and Tikvesh basins. At the end of the 20th century Džuranov et al. [4] published taxonomical descriptions of 2 species of

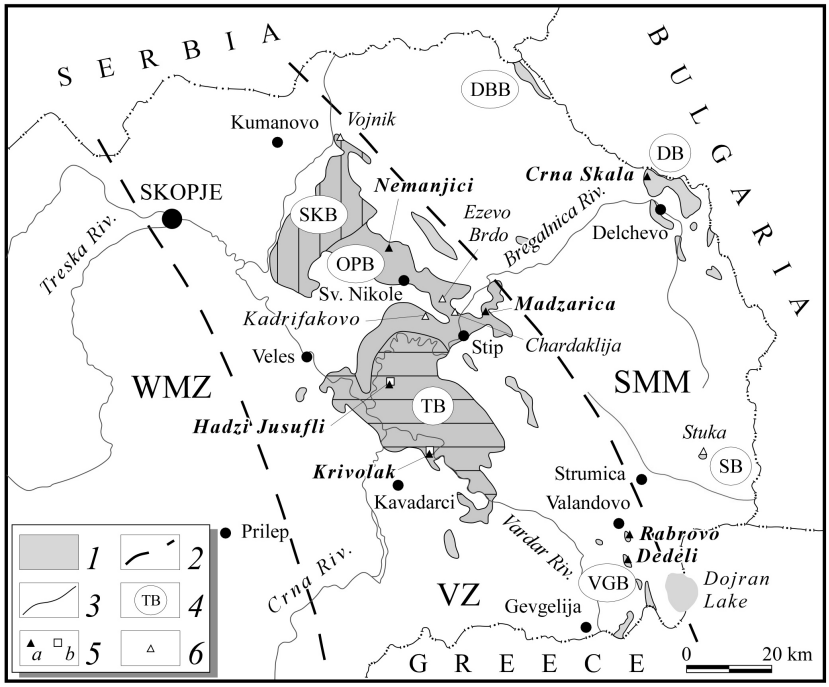

Fig. 1. Sketch of the location of the Palaeogene basins in the Republic of Macedonia and the studied sections: *1* – Distribution of Palaeogene sediments; *2* – Tectonic boundary; WMZ – Western Macedonian Zone, VZ – Vardar Zone, SMM – Serbian–Macedonian Massif; *3* – Basin boundary; *4* – Basins: SKB – Skopje–Kumanovo, OPB – Ovche Pole, TB – Tikvesh, VGB – Valandovo–Gevgelija, DB – Delchevo, SB – Strumica, DBB – Deve Bair; *5a* – section with established agglutinated foraminifera; *5b* – section with established porcelaneous foraminifera; *6* – section without established agglutinated and porcelaneous foraminifera

agglutinated foraminifera (*Textularia bronniana* (d'Orbigny) and *Textularia minuta* Terquem) and 4 taxa of porcelaneous ones (*Spiroloculina communis communis* Cushman & Todd, *Quinqueloculina juleana* d'Orbigny, *Triloculina angularis* d'Orbigny and *Triloculina gibba* d'Orbigny) from Ovche Pole basin (Chardaklija section).

The present investigation allowed us to identify 8 taxa (7 agglutinated and 1 porcelaneous) that have not been described before. With the exception of *Spiroplectinella carinata* (d'Orbigny) they were recorded in 1 or 2 of the sections (Fig. 2) as single or rare specimens. On the other hand, 3 sections (Madzarica, Dedeli, Rabrovo) revealed very poor taxonomic diversity – only one species was found. On the whole, there is no taxon that could be used for age determination – characteristic feature of all the species is their broad stratigraphic range (Upper Cretaceous to Palaeogene or Miocene) and they show almost uniform

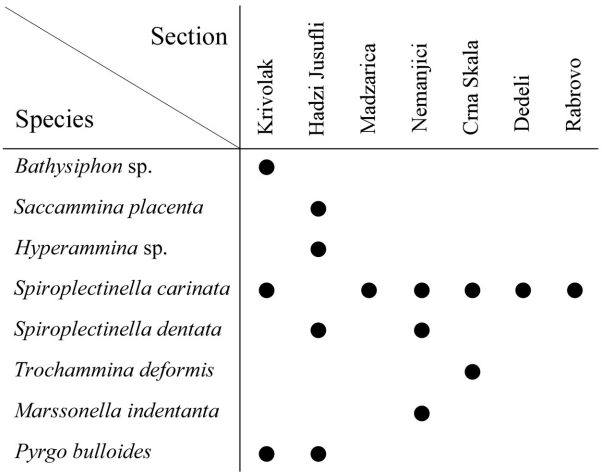

Fig. 2. Distribution of the established agglutinated and porcelaneous taxa in the studied sections

stratigraphic distribution in the studied sections (Fig. 3). That is why the chronostratigraphic framework (Lower Oligocene) of our investigation is based on planktonic foraminiferal data [3].

Taxonomy. The following pages aim to represent taxonomical descriptions of 8 species, belonging to 7 genera, 7 families (BATHYSIPHONIDAE Avnimelech, 1952 to HAUERINIDAE Schwager, 1876) and 6 superfamilies. Taxonomical determination at generic level is based on the classification of Loeblich and Tappan [5].

Suborder TEXTULARIINA Delage and Herouard, 1896

Superfamily ASTRORHIZACEA Brady, 1891

Family BATHYSIPHONIDAE Avnimelech, 1952

Genus ***Bathysiphon*** M. Sars, 1872

Bathysiphon sp.

Plate I, Figure 1

Material. 30 specimens.

Description. The test is tubular, straight, moderately to coarsely agglutinated, thick walled, with rare constrictions.

Remarks. Only short fragments were found during the present investigation.

Occurrence. Tikvesh Basin (Krivolak section – samples 1, 2).

Family SACCAMMINIDAE Brady, 1884

Subfamily SACCAMMININAE Brady, 1884

Genus ***Saccammina*** Carpenter, 1869

Saccammina placenta (Grzybowski, 1898)

Plate I, Figure 2

1981. *Saccammina placenta* (Grzybowski); [6], p. 241, pl. 2, fig. 3.

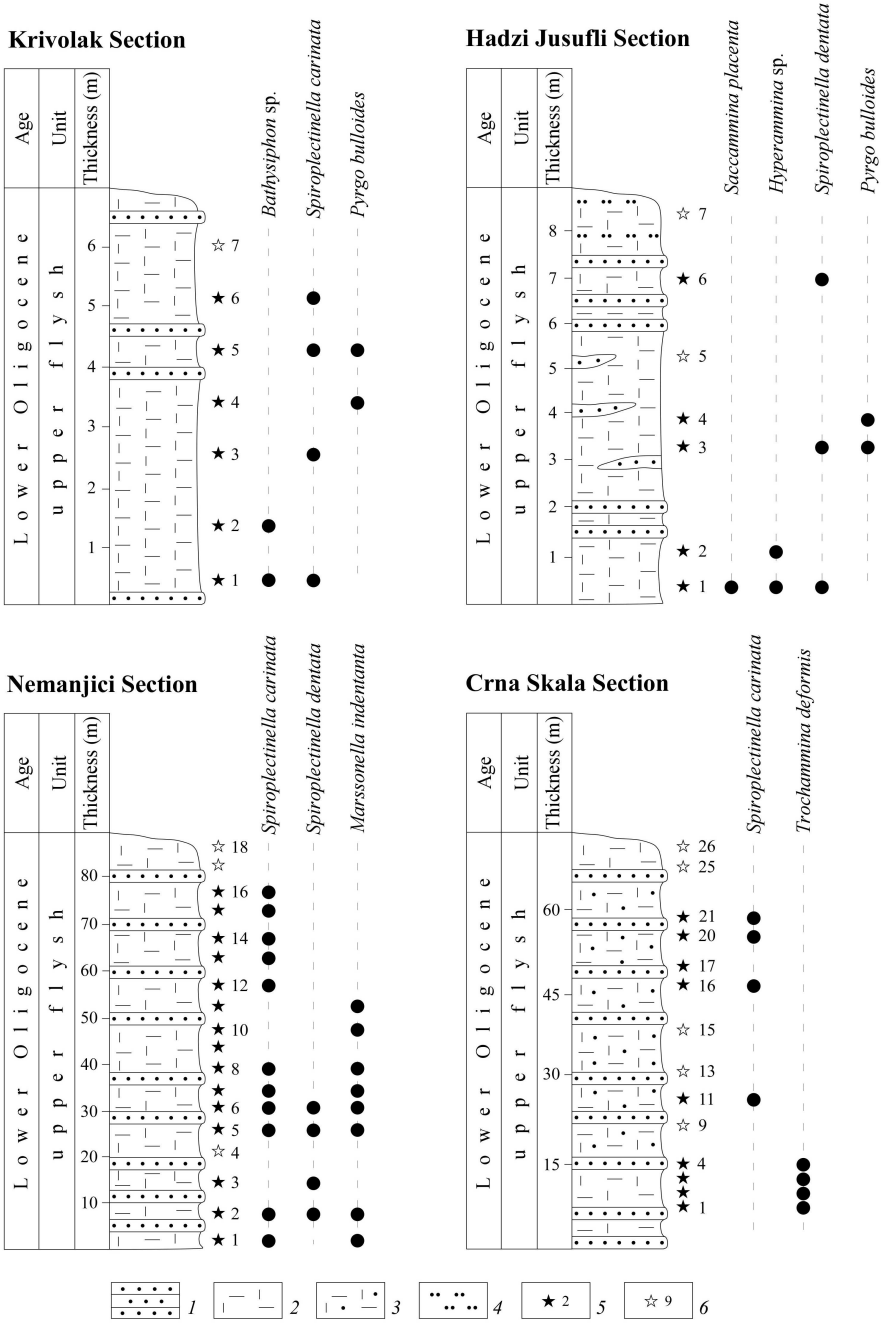

Fig. 3. Stratigraphical distribution of agglutinated and porcelaneous foraminifera taxa in the sections with more than one established species: *1* – thin bedded sandstones; *2* – clayey-carbonate sediments; *3* – clayey-carbonate-sandy sediments; *4* – siltstones; *5* – sample containing agglutinated and porcelaneous specimens; *6* – sample barren of agglutinated and porcelaneous specimens

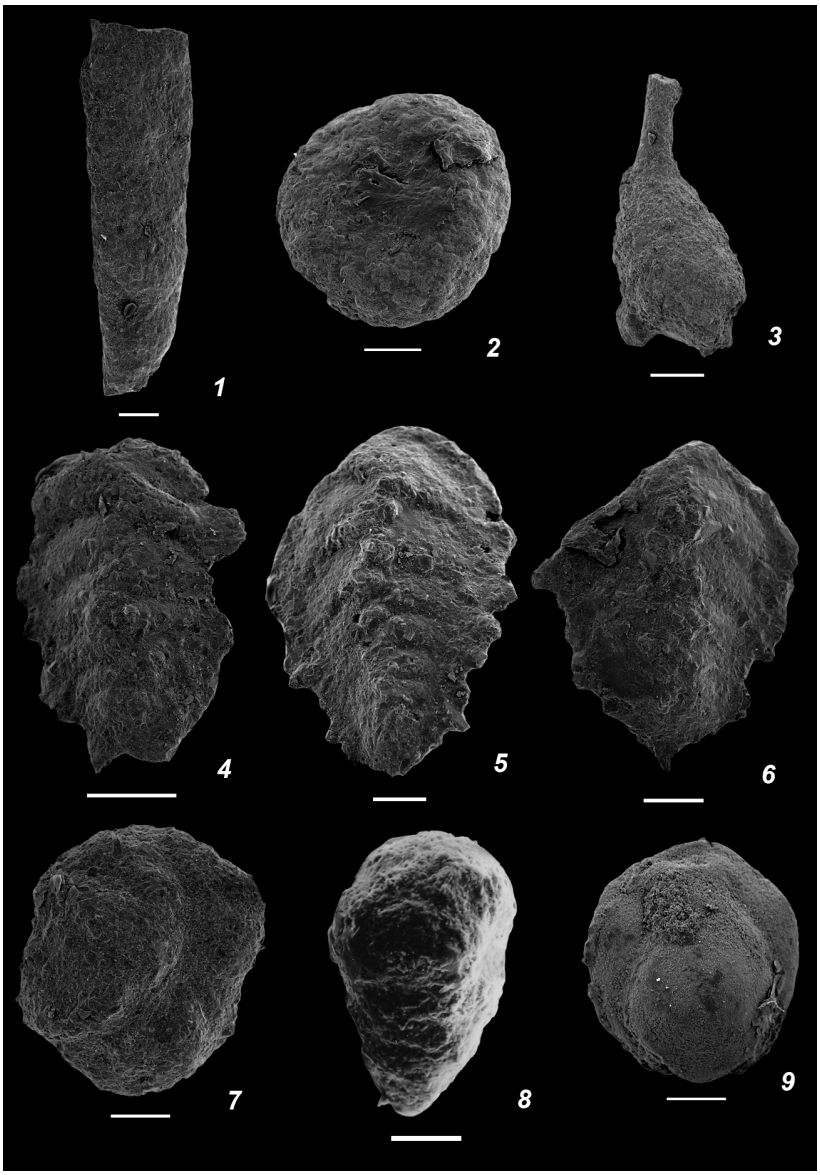

Plate I. *1.* ***Bathysiphon*** sp.; Tikvesh Basin, Krivolak section, sample 1; SEM ×110; *2.* ***Saccammina placenta*** (Grzybowski, 1898); Tikvesh Basin, Hadzi Jusufly section, upper flysh unit, sample 1; SEM ×150; *3.* ***Hyperammina*** **sp.**; Tikvesh Basin, Hadzhi Jusufly section, upper flysh unit, sample 2; SEM ×150; *4, 5.* ***Spiroplectinella carinata*** (d'Orbigny, 1846); *4* – Tikvesh Basin, Krivolak section, upper flysh unit, sample 5; SEM ×95; *5* – Valandovo-Gevgelija Basin, Dedeli section, upper flysh unit, sample 12; SEM ×120; *6.* ***Spiroplectinella dentata*** (Alth, 1850); Tikvesh Basin, Hadzi Jusufly section, upper flysh unit, sample 3; SEM ×130; *7.* ***Trochammina deformis*** Grzybowski, 1898; Delchevo Basin, Crna Skala section, upper flysh unit, sample 2; SEM ×150; *8.* ***Marssonella indentanta*** (Cushman et Jarvis, 1928); Ovche Pole Basin, Nemanjici section, upper flysh unit, sample 3; SEM ×200; *9.* ***Pyrgo bulloides*** (d'Orbigny, 1826); Tikvesh Basin, Hadzi Jusufly section, upper flysh unit, sample 3; SEM ×180. Scale bar – 100 μm

1983. "*Reophax placenta* n. sp."; [7], pl. 10, figs. 9, 10.

1988. *Saccammina placenta* (Grzybowski); [8], p. 183, pl. 2, fig. 9.

2002. *Saccammina placenta* (Grzybowski); [9], p. 71, pl. 1, figs. 9, 10.

Nomenclature. The species was first described from the Eocene of Polish Carpathians (Krosno area). Here it is identified after the refigured original Grzybowski's images[7].

Material. 7 specimens.

Description. The test is round in outline, flattened, and finely agglutinated, with slightly grooved central area. The periphery is rounded. The aperture is with short neck and varying position between the periphery and the central area.

Distribution. Upper Cretaceous of Italy and Spain; Senonian, Palaeocene and Lower Eocene of the Alps and Carpathians; Maastrichtian, Palaeocene and Lower Eocene of Trinidad; Palaeocene of Tunisia, Bulgaria, Eocene–Oligocene of Poland; deep sea holes in Labrador Sea and North Sea (Maastrichtian – Upper Eocene), the Atlantic (Upper Cretaceous).

Occurrence. Tikvesh Basin (Hadzi Jusufly section, sample 1).

Superfamily HIPPOCREPINACEA Rhumbler, 1895

Family HIPPOCREPINIDAE Rhumbler, 1895

Subfamily HYPERAMMINIDAE Eimer and Fickert, 1899

Genus ***Hyperammina*** Brady, 1878

Hyperammina sp.

Plate I, Figure 3

Material. 11 specimens.

Description. The test is finely agglutinated, thin walled, comprised of subspherical slightly elongated proloculous and cylindrical second chamber. The aperture is terminal, oval.

Occurrence. Tikvesh Basin (Hadzi Jusufli section – samples 1, 2).

Superfamily SPIROPLECTAMMINACEA Cushman, 1927

Family SPIROPLECTAMMINIDAE Cushman, 1927

Subfamily SPIROPLECTAMMININAE Cushman, 1927

Genus ***Spiroplectinella*** Kiselman, 1972

Spiroplectinella carinata (d'Orbigny, 1846)

Plate I, Figures 4, 5

1984. *Spiroplectammina carinata carinata* (d'Orbigny); [10], p. 116, pl. 1, fig. 1.

1985. *Spiroplectinella carinata* (d'Orbigny); [11], p. 86, pl. 80, figs. 1–4 (with synonymy).

Nomenclature. The species was first described from the Badenian of the Vienna Basin. Here it is identified after the lectotype figured by Papp, Schmidt (1985, pl. 80, fig. 3) [11].

Material. 40 specimens.

Description. The test is coarsely agglutinated, heteromorphous, with planispiral initial portion and biserial late one. Chambers are low. The periphery is with narrow keel.

Distribution. Eocene of Belgium, Upper Eocene of Poland, Oligocene of the North Sea, Oligocene and Miocene of Spain, the Netherlands, Upper Oligocene and Miocene of the Ukraine, Miocene of the Vienna Basin.

Occurrence. Tikvesh Basin (Krivolak section – samples 1, 3, 5, 6), Ovche Pole Basin (Madzarica section – samples 1–3, 8, 9, 12, 13; Nemanjici section – samples 1, 2, 5–8, 12–16), Delchevo Basin (Crna Skala section – samples 11, 16, 20, 21), Valandovo–Gevgelija Basin (Dedeli section – samples 4, 6, 12; Rabrovo section – samples 8, 13, 15).

Spiroplectinella dentata (Alth, 1850)

Plate I, Figure 6

1962. *Spiroplectammina dentata* (Alth); [12], S. 28, T. 1, Figs. 9-11; Textabb. 1, figs. a-j.

1981. *Spiroplectammina dentata* (Alth); [6], p. 260, pl. 3, fig. 10.

2006. *Spiroplectinella dentata* (Alth); [13], p. 8, pl. 2, figs. 1, 2.

Nomenclature. The species was first described from the Maastrichtian of Western Ukraine (Lvov Marls). Here it is identified after the image of Gradstein, Berggren [6].

Material. 17 specimens.

Description. The test is coarsely agglutinated, heteromorphous, with planispiral initial portion and biserial late one. The sutures are slightly elevated, oblique. The periphery is with broad keel. The aperture is arch-shaped, situated on the internal part of the last chamber surface.

Remarks. Differs from *S. carinata* (d'Orbigny) by the broader keel.

Distribution. Upper Cretaceous of Italy, Spain, Turkmenia, Maastrichtian and Palaeocene of Trinidad, USA, Turronian, Senonian and Palaeocene of Polish Carpathians, Palaeocene of the Alps, Crimea, Spain, Egypt, Tunisia, Bulgaria, deep sea holes in the Atlantic (Campanian – Middle Palaeocene), Labrador Sea and North Sea (Maastrichtian – Middle Eocene).

Occurrence. Tikvesh Basin (Hadzi Jusufli section – samples 1, 3, 6), Ovche Pole Basin (Nemanjici section – samples 2, 3, 5, 6).

Superfamily TROCHAMMINACEA Schwager, 1877

Family TROCHAMMINIDAE Schwager, 1877

Subfamily TROCHAMMININAE Schwager, 1877

Genus ***Trochammina*** Parker and Jones, 1859

Trochammina deformis Grzybowski, 1898

Plate I, Figure 7

1981. *Trochammina deformis* Grzybowski; [6], p. 256, pl. 8, figs. 8–10.

1983. "*Trochammina deformis* sp. n."; [7], pl. 11, fig. 20.

1986. *Trochammina deformis* Grzybowski; [14], p. 53, pl. 4, fig. 5.

2006. *Trochammina deformis* Grzybowski; [13], p. 8, pl. 2, fig. 3.

Nomenclature. The species was first described from the Eocene of Polish Carpathians (Krosno area). Here it is identified after the refigured original Grzybowski's images [7].

Material. 9 specimens.

Description. The test is coarsely agglutinated, trochospiral, flattened, with round outline. Four flattened chambers comprise the last whorl. The aperture is not visible.

Distribution. Upper Cretaceous of Italy, Spain, Upper Senonian, Palaeocene and Eocene of Carpathians, Palaeocene of Bavarian Alps, Bulgaria, deep sea holes in Labrador Sea and North Sea (Maastrichtian – Eocene), Eocene – Oligocene of Poland and North Atlantic.

Occurrence. Delchevo Basin (Crna Skala section, samples 1-4).

Superfamily TEXTULARIACEA Ehrenberg, 1838

Family EGGERELLIDAE Cushman, 1937

Subfamily DOROTHIINAE Plummer, 1931

Genus ***Marssonella*** Cushman, 1933

Marssonella indentanta (Cushman et Jarvis, 1928)

Plate I, Figure 8

1928. *Gaudryina indentata* Cushman and Jarvis, n. sp.; [15], p. 92, pl. 13, fig. 7.

1962. *Marssonella indentata* (Cushman and Jarvis); [12], S. 42, t. 2, figs. 1–2; t. 15, fig. 4-5.

1986. *Dorothia indentata* (Cushman et Jarvis); [14], p. 56, pl. 4, fig. 12.

2007. *Marssonella indentata* (Cushman and Jarvis); [16], p. 38, pl. 1, fig. 38.

Nomenclature. The holotype (Cushman Coll. No. 9733) is from the Palaeocene of Trinidad (Lizard Springs formation).

Material. 17 specimens.

Description. The test is moderately to coarsely agglutinated, thick-walled, conical, with trochospiral early and biserial late stage. The aperture is low basal arch.

Remarks. It differs from *M. oxycona* (Reuss) by its slenderer and more finely agglutinated wall.

Distribution. Upper Cretaceous and Palaeocene of Trinidad, the Maastrichtian, Palaeocene and Eocene of Bulgaria, the Palaeocene of the Alps, Caucasus, Venezuela, the Palaeocene and Lower Eocene of Turkmenia, the Lower Eocene of North Caucasus, the Upper Eocene of the Ukraine, Lower Oligocene of Italy.

Occurrence. Ovche Pole Basin (Nemanjici section – samples 1, 2, 5–8, 10–11).

Suborder MILIOLINA Delage and Herouard, 1896

Superfamily MILIOLACEA Ehrenberg, 1839

Family HAUERINIDAE Schwager, 1876

Subfamily MILIOLINELLINAE Vella, 1957

Genus ***Pyrgo*** Defrance, 1824

Pyrgo bulloides (d'Orbigny, 1826)

Plate I, Figure 9

1882. *Biloculina bulloides* d'Orbigny; [17], p. 153, pl. 15, figs. 37–38.

1962. *Pyrgo bulloides* (d'Orbigny); [18], S. 21, Taf. 2, Fig. 9.

1975. *Pyrgo bulloides* (d'Orbigny); [19], p. 118, pl. 65, fig. 1.

1984. *Pyrgo bulloides* (d'Orbigny); [10], p. 122, pl. 2, figs. 2–3, 7.

Nomenclature. The species was first described from the Eocene of France (Bordeaux vicinities). Here it is identified after the images of Odrzywolska–Bienkowa, Pozaryska [10].

Material. 11 specimens.

Description. The test is ovate in outline, convex on both sides, with two distinct chambers covering one-half coil in length. The periphery is angular, the wall is imperforate. The aperture is ovate, situated at the end of the final chamber.

Distribution. Eocene of France, Upper Eocene of Poland, the Ukraine, Upper Eocene and Lower Oligocene of Slovakia, Oligocene of Belgium, Germany.

Occurrence. Tikvesh Basin (Krivolak section – samples 4, 5; Hadzi Jusufly section, samples 3, 4).

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