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Taxonomic revision and new species/subspecies of Middle-Late Miocene (Bessarabian) miliolids of the Family Hauerinidae Schwager from Georgia — Eastern Paratethys

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Abstract: Three new miliolid taxa from Bessarabian sediments from Georgia (Eastern Paratethys) are described following the classification of Łuczkowska (1972), which has never been used before by ex-Soviet micropaleontologists. They are: *Varidentella luczkowskae*; *Varidentella reussi* (Bogdanowicz) subsp. *costulata*; and *Affinetrina voloshinovae* (Bogdanowicz) subsp. *eldarica.* This classification takes into account the morphology of the aperture and the shape and size of teeth as criteria to distinguish the species. This study contributes important criteria which will help to unify the taxonomical inconsistencies between the Eastern, Central and Western Paratethyan miliolids.

Key words: Bessarabian, Georgia, Paratethys, Foraminifera, miliolid.

Introduction

The Mediterranean Sea and the Paratethys were formed as new marine realms during the Late Eocene (Popov et al. 1993; Rögl 1999). These basins underwent complex paleogeographical changes especially in the Miocene, such as the opening and closing of marine connections with the Indian Ocean to the East and the Mediterranean Sea and the Atlantic Ocean to the West (Rögl 1999, 2001).

Strong geographical separation also took place within the Paratethys. Basin formation led to semi-independent evolution of the Western (from the Rhone Basin to Western Bavaria), Central (from Bavaria to the eastern foredeep of the Carpathian) and Eastern (from the Euxinian basin complex to Lake Aral) Paratethyan realms (Rögl 1999; Steininger & Wessely 2000; Piller & Harzhauser 2005).

In particular, in the Middle Miocene a regressive phase took place at the end of the Badenian (Central Paratethys) corresponding to the Konkian (Eastern Paratethys) leading to a dramatic change in marine biota (Harzhauser & Piller 2007). A restriction of the connections between the Paratethys and the open ocean occurred at the beginning of the latest Middle Miocene and the connections with the Indo-Pacific disappeared (Rögl 1999; Harzhauser & Piller 2007). In the Middle–Late Miocene the Paratethys was composed of different semi-enclosed sub-basins including the Pannonian in the Central Paratethys and Euxinic–Caspian Basins in the Eastern Paratethys (Kolesnikov 1935). Thus, the complex evolution of the Paratethys is reflected in the distribution and evolution of the fauna and flora with the proliferation of foraminifera, differing in abundance and composition from those of open oceans (e.g. Iaccarino 1985; Rögl 1985; Cicha et al. 1998).

This setting makes correlation of sediments between these realms both interesting and problematic. In the past, different chrono/geochronological time scales were applied in studies of these two basins (e.g. Steininger & Wessely 2000). The lack of dialogue between western and eastern countries, has led to two independent sets of geological and stratigraphical correlations. In particular, the Sarmatian regional stage is defined differently in the Western and Central with respect to the Eastern Paratethys (e.g. Steininger & Wessely 2000; Piller & Harzhauser 2005). Figure 1 shows the stratigraphic correlation between Middle-Late Miocene Mediterranean, Central and Eastern Paratethys regions.

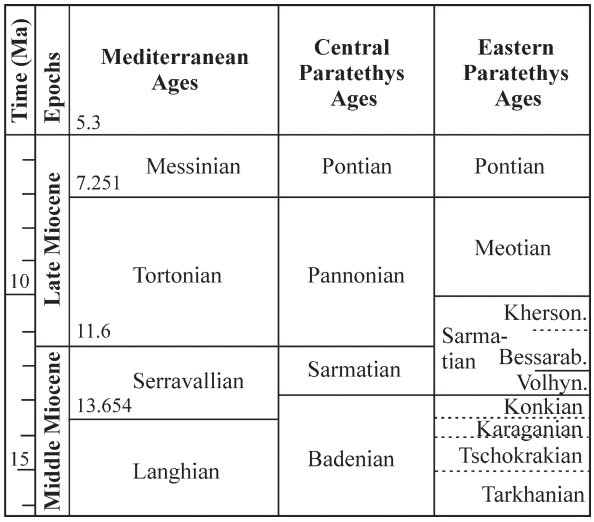

Fig. 1. Stratigraphic correlation between Mediterranean and Paratethyan stages. The Sarmatian regional stage spans a longer time in the eastern basin. Modified after Piller & Harzhauser (2005) and Harzhauser & Piller (2007). The regional stages Volhynian = N_1S_1; Bessarabian = N_1S_2; Khersonian = N_1S_3 after Koiava (2006).

Previous studies on the Family Hauerinidae

Miliolids belonging to the Family Hauerinidae are very abundant in Miocene deposits from the Paratethys and are useful for dating and characterizing these sediments. In particular, their consistent regional development and their distribution, seem to be related to the local/regional paleoenvironmental conditions of the different sub-basins of the Paratethyan realms (Maisuradze 1971).

The classification of the Family Hauerinidae Schwager (1876) is very complex and is still being debated. D'Orbigny (1826) separated this group of miliolids into five genera *Biloculina*, *Triloculina*, *Quinqueloculina*, *Spiroloculina* and *Adelosina* based on the number and shape of the chambers in the last whorl. Williamson (1858) grouped the genera *Quinqueloculina* d'Orbigny and *Triloculina* d'Orbigny into one single genus *Miliolina.* Brady (1884) also included *Adelosina* d'Orbigny into the genus *Miliolina* Williamson. Schlumberger (1887, 1893) described the two genera *Sigmoilina* and *Massilina.* Wiesner (1931) included them in the genus *Miliolina* Williamson. However, he separated the genus *Miliolinella* characterized by a flat, plate-like tooth. Bogdanowicz (1947, 1952) followed Brady's (1884) classification, but also included *Massilina* Schlumberger in the genus *Miliolina* Williamson. In addition Bogdanowicz (1960) proposed, that the amplitude of the angle between the successive chambers should be the main criteria for diving miliolids and restored the genera *Quinqueloculina* d'Orbigny and *Triloculina* d'Orbigny, characterized by an angle of 72°, and 120° between successive chambers, respectively. Vella (1957) divided the genus *Quinqueloculina* d'Orbigny into three subgenera: *Quinqueloculina (Quinqueloculina)* d'Orbigny, *Quinqueloculina (Lachlanella)* Vella, *Quinqueloculina* sensu lato which groups the remaining forms based on the wall texture, tooth size and shape of aperture.

Since those pioneering studies the taxonomy of miliolids has been revised many times (e.g. Loeblich & Tappan 1964), and the currently accepted taxonomy was proposed by Loeblich & Tappan (1988). However, Ex-USSR micropaleontologists have always used the "old" criteria suggested by Bogdanowicz (1959, 1981) for taxonomic division, since western literature is not available in their region.

Łuczkowska (1972, 1974) extensively studied the miliolid fauna from Miocene deposits of Poland, and, at the beginning of her studies, applied the classification of Loeblich & Tappan (1964). However, in the course of her research, she became aware of some inconsistencies concerning the main diagnostic criteria. For example, the main feature to separate the various genera in the Subfamilies Quinqueloculininae Cushman, Miliolinae Ehrenberg and Miliolinellininae Vella is the outline of the aperture, but in the Subfamilies Fabulariinae Reuss and Tubinellinae Rhumbler it is the internal construction of the tests. As a result, species that were characterized by similar morphological features but had different shaped teeth were included in the Subfamilies Quinqueloculininae Cushman, Miliolinae Ehrenberg and Miliolinellininae Vella and were considered to be phylogenetically related. Furthermore, genera with a non-quinqueloculiniform coiling mode such as *Flintina* Cushman, *Sigmoilina* Schlumberger, *Ptychomiliolla* Eimer & Fickert, *Welmanella* Finlay were included in the Subfamily Quinqueloculininae Cushman. In the Subfamilies Miliolinellinae Vella and Miliolinae Ehrenberg forms were included, which were coiled like typical quinqueloculinids.

Therefore, Łuczkowska (1972, 1974) proposed a new classification of miliolids based on the inner structure of the shell, the general morphology, the shape and size of the aperture and the tooth. She identified four types of aperture typical for Miocene miliolids. (1) Wide, oval-elongated, with a simple-shaped long tooth, sometimes bifid at the end; (2) high, narrow, with parallel edges and an elongated tooth; (3) Closed, at the base of the last chamber, with a short V-like tooth; (4) Open semicircular, placed at the base of the last chamber and characterized by a quadrangular tooth, which sometimes may be reduced.

She also identified two subfamilies that include genera still living today, based on the inner structure of the test, the outline of the aperture and the shape of the tooth. (1) Subfamily Quinqueloculininae Cushman emended Łuczkowska (1972), this group includes quinqueloculiniform species with all the typical characters of the genus *Quinqueloculina*. These forms possess, a 2-layer wall texture, an oval and elongate aperture, a long simple or bifid tooth, and an angle of 140° between the successive chambers. Five and three chambers can be observed on the two sides of the test respectively. Beside the genus *Quinqueloculina* sensu stricto this subfamily, included the two genera *Lachlanella* proposed by Vella (1957) characterized by a narrow, elongated and fissure-like aperture with parallel lips and a simple elongated tooth; and *Cycloforina* Łuczkowska characterized by a circular aperture and a short tooth. (2) Subfamily Miliolinellinae Vella (1957) emended Łuczkowska (1972). This second group comprises forms with a crypto-quinqueloculinid coiling mode. In these forms only three chambers are visible in the external whorl, however two smaller and concealed chambers are present which complete the quinqueloculinid coiling mode. Adult forms of this group display a triloculinid coiling mode, in which the chambers of the last whorl are placed at 120° from each other. In this group, forms are also included which have rounded chambers coiled in planes at 130° (or more than 130°) and the last chamber coiled at 90° with respect to the previous chambers.

These forms were grouped into four new genera: (1) *Varidentella* Łuczkowska with a semicircular oblique aperture characterized by a low and flat tooth; (2) *Affinetrina* Łuczkowska with a longitudinal slit-like aperture and a long tooth similar to that of *Lachlanella* Vella; (3) *Sinuloculina* Łuczkowska with a circular aperture, a short bifurcate tooth, similar to that in *Triloculina* d'Orbigny and *Cycloforina* Łuczkowska, and the chambers of the last whorl coiled at 180°. (4) *Crenatella* Łuczkowska, has a narrow slit-like aperture with serrate edges, a crescent-like, oblique tooth in the aperture and additionally the inner structure of the test is similar to the structure observed in the Family Miliolina Ehrenberg.

The classification of Łuczkowska (1972, 1974) presents some limitations. In particular, for its correct application it is often necessary to study thin sections that show the inner structure of the test, otherwise identification of high taxo-

nomic units like subfamilies and families is not possible. Thin sections are not always available. Additional problems arise because, in genera such as *Varidentella* Łuczkowska, *Hauerina* d'Orbigny and *Miliola* Lamarck, changes of both size and shape of the aperture as well as the tooth can occur at different stages of the ontogeny. Ontogenetic changes imply that transitional forms must be classified according to their external morphology (e.g. shape of aperture, teeth and number of chambers). Apart from these limitations the classification of Łuczkowska (1972, 1974) remains the most complete and reliable framework to describe and classify Paratethyan miliolids.

Loeblich & Tappan (1988) accepted most of the genera described by Łuczkowska (1972, 1974). However, in their

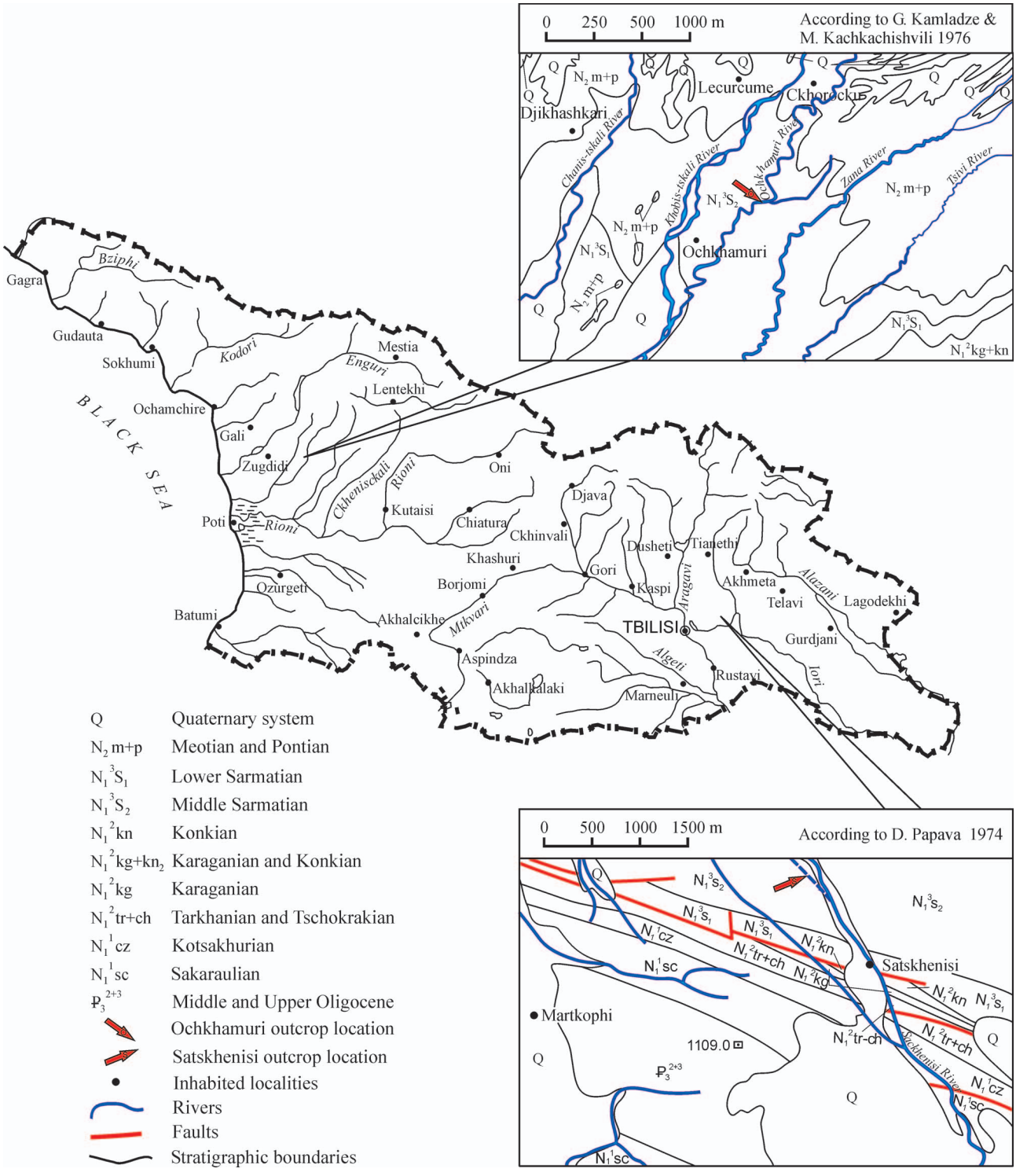

Fig. 2. Geological map of the areas of Ckhorocku and Martkophi, where the Ochkhamuri and Satskhenisi sections outcrop.

classification they placed many of them into the Family Hauerinidae Schwager. According to Loeblich & Tappan (1988) this family includes forms with a proloculus followed by two chambers, rarely with intervening flexostyle. Chambers are added in one to five or more planes of coiling. Rarely the adult test may have more than two chambers per whorl or may be uncoiled and rectilinear. The aperture placed at the end of the last chamber may have a simple or a complex tooth. This family differs from the Family Miliolidae Ehrenberg because the genera included in this latter present numerous perforations or pseudopores in the wall.

Presented here are the descriptions of one new species and two sub-species according to the classification of Łuczkowska (1972, 1974) modified by Loeblich & Tappan (1988). The application of this classification, allows a better comparison between Western, Central and Eastern Paratethyan species and contributes to unifying the taxonomy between the two regions.

Materials and methods

The benthic foraminiferal assemblages analysed in this study come from two sections in Western and Eastern Georgia, respectively (Koiava 2006). The Ochkhamuri section is located in the gorge of river Ochkhamuri in Western Georgia, at a distance of 1 km from the village of Lesichino, in the gorge of the river Ochkhamuri. Sediments span the regional stage N_1S_2 (Koiava 2006) = Bessarabian. The Satskhenisi section is located in the gorge of the river Satskhenisi about 1–1.5 km north-west from the village of Satskhenisi (Eastern Georgia). Sediments span the regional stage N_1S_1 = Volhynian, and N_1S_2 (Koiava 2006) = Bessarabian (Fig. 2).

Samples were washed using standard techniques for foraminiferal preparation (e.g. Spezzaferri & Ćorić 2001). The entire collection is presently stored at the Georgian National Museum, L. Davitashvili Institute of Paleobiology or at the A. Djanelidze Institute of Geology, in Tbilisi. Scanning Electron Microscope (SEM) images were obtained with the FEI XL30 Sirion FEG microscope at the University of Fribourg, Department of Geosciences.

Sedimentology

The lithology and the studied samples together with the thickness of the five distinct layers that can be observed in the Ochkhamuri and Satskhenisi sections are reported in Figs. 3 and 4.

The Ochkhamuri section consists of 5 layers: Layer 1 is 9 m thick and consists of bluish-grey clays with sandy clay layers; Layer 2 is 3 m thick and consists of bluish-grey clays with intercalation of sandstone layers; Layer 3 is 5 m thick and is characterized by alternating clay and sandstone layers; Layer 4 is 5 m thick and consists of bluish-grey sandy clays; Layer 5 is 6 m thick and consists of grey marls.

The Satskhenisi sections consist of 6 layers: Layer 1 is 80 m thick and consists of bluish-grey clays with intercalations of yellowish-grey sandstones and greyish sandy clays; Layer 2 is 57 m thick and consists of bluish-grey clays with interlayered yellowish-grey sandstones and greyish sandy clays at the lower parts of it; Layer 3 is 7 m thick and consists of bluish-grey clays; Layer 4 is 20 m thick and consists of bluish-grey clays; Layer 5 is 3 m thick and consists of yellowish-grey sandstones; Layer 6 is 95 m, it consists of bluish-grey clays with interbedded yellowish-grey sandstones.

Taxonomy

Maisuradze (1971) informally described a few species of Bessarabian miliolids from Georgia but left them in the open nomenclature. These species are now officially described according to Łuczkowska (1972, 1974) with modification by Loeblich & Tappan (1988) and presented for the first time in western literature. Their distribution and accompanying assemblages are documented in Figs. 3 and 4.

Suborder: **Miliolina** Delage & Hérouad, 1896
Superfamily: **Miliolacea** Ehrenberg, 1839
Family: **Hauerinidae** Schwager, 1876
Subfamily: **Haauerininae** Schwager, 1876

Genus: *Varidentella* Łuczkowska, 1972

Varidentella reussi costulata subsp. nov.
Fig. 5.1a–c,2a–c,3a–c

1971 *Quinqueloculina* sp. Maisuradze, pl. IV, figs. 3a–c; 4a–c
no 1974 *Varidentella georgiana* Łuczkowska, p. 138, pl. XXVII, figs. 3–4
no 1998 *Varidentella reussi* Cicha et al., p. 136, pl. 17, figs. 13–14

Motivation: Maisuradze (1971) described this form as belonging to the *Q. reussi* group. However, the main difference between typical *V. reussi* and the taxon described here is the presence of numerous striae as ornamentation of the wall texture.

In particular, Maisuradze (1971) identified this subspecies and termed it *Quinqueloculina* sp. and Łuczkowska (1974) described it as *Varidentella georgiana.* However, *V. georgiana* differs from the forms described in Maisuradze (1971) by the general outline of the test. *Varidentella georgiana* is rounded, the chambers are strongly arched forming semicircles and the proximal part near the aperture is strongly convex. Additionally, the tooth is slightly oval. The outline of *Quinqueloculina* sp. as described by Maisuradze (1971) is wide-oval, the tooth is wide and sub-quadrangular more similar to the *V. reussi* group. Therefore, *V. georgiana* and *Quinqueloculina* sp. of Maisuradze (1971) should be considered as two distinct taxa and *Quinqueloculina* sp. should be regarded as related to *V. reussi* because of its strong resemblance to this species. Additionally, *V. georgiana* Łuczkowska is a typical form from the Lower Sarmatian (Volhynian) deposits of the Western and Central Paratethys. According to our data, *V. reussi costulata* first occurs only in Bessarabian deposits of Georgia, Crimea, Moldova and Pre-Caucasus.

Holotype: It is presented in Fig. 5.1a–c, and it is stored at the Georgian National Museum, L. Davitashvili Institute of Paleobiology with the reference number 14/M.

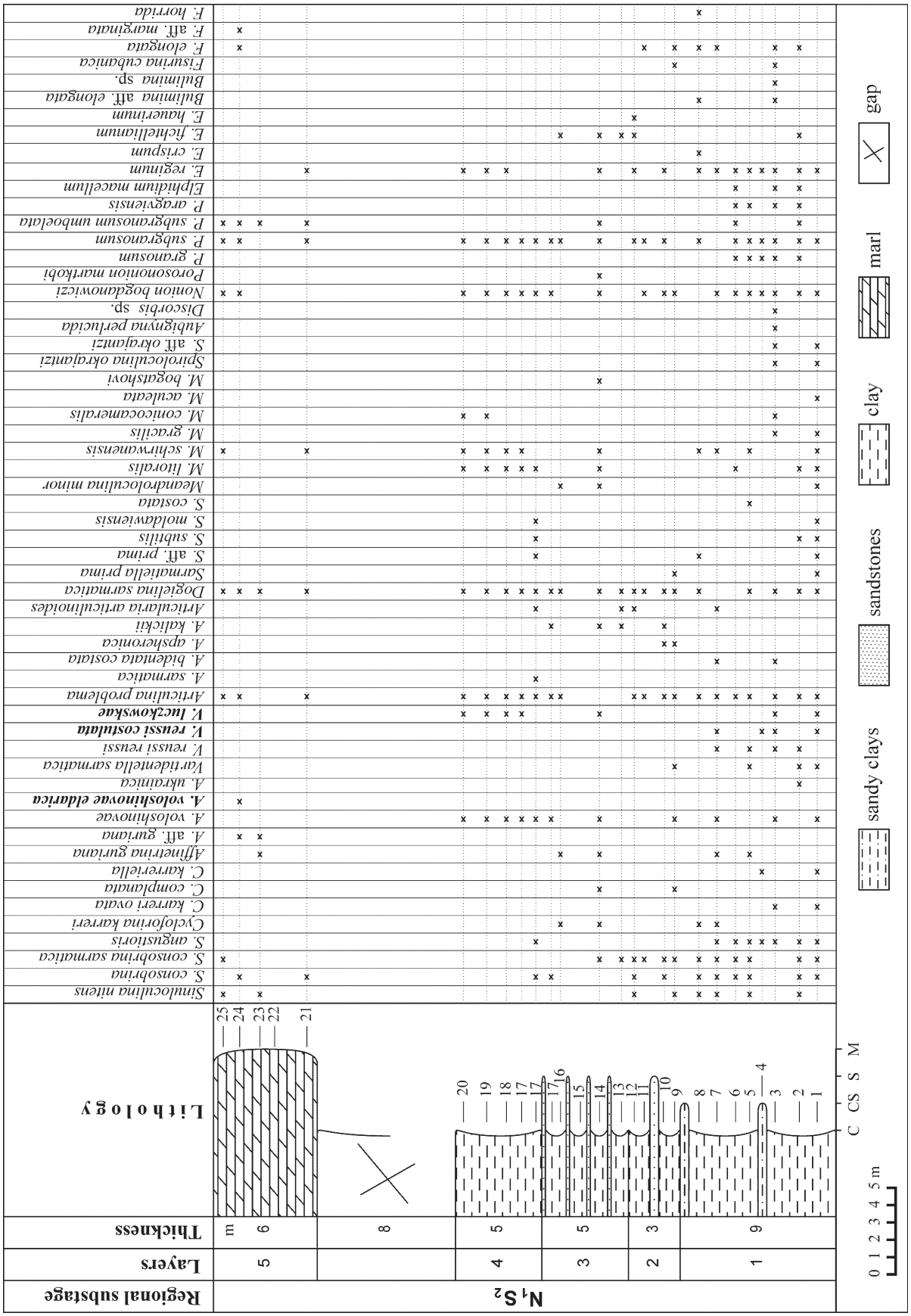

Fig. 3. Lithological log and distribution of benthic foraminifers in the Ochkhamuri section. N_1S_2 = Bessarabian.

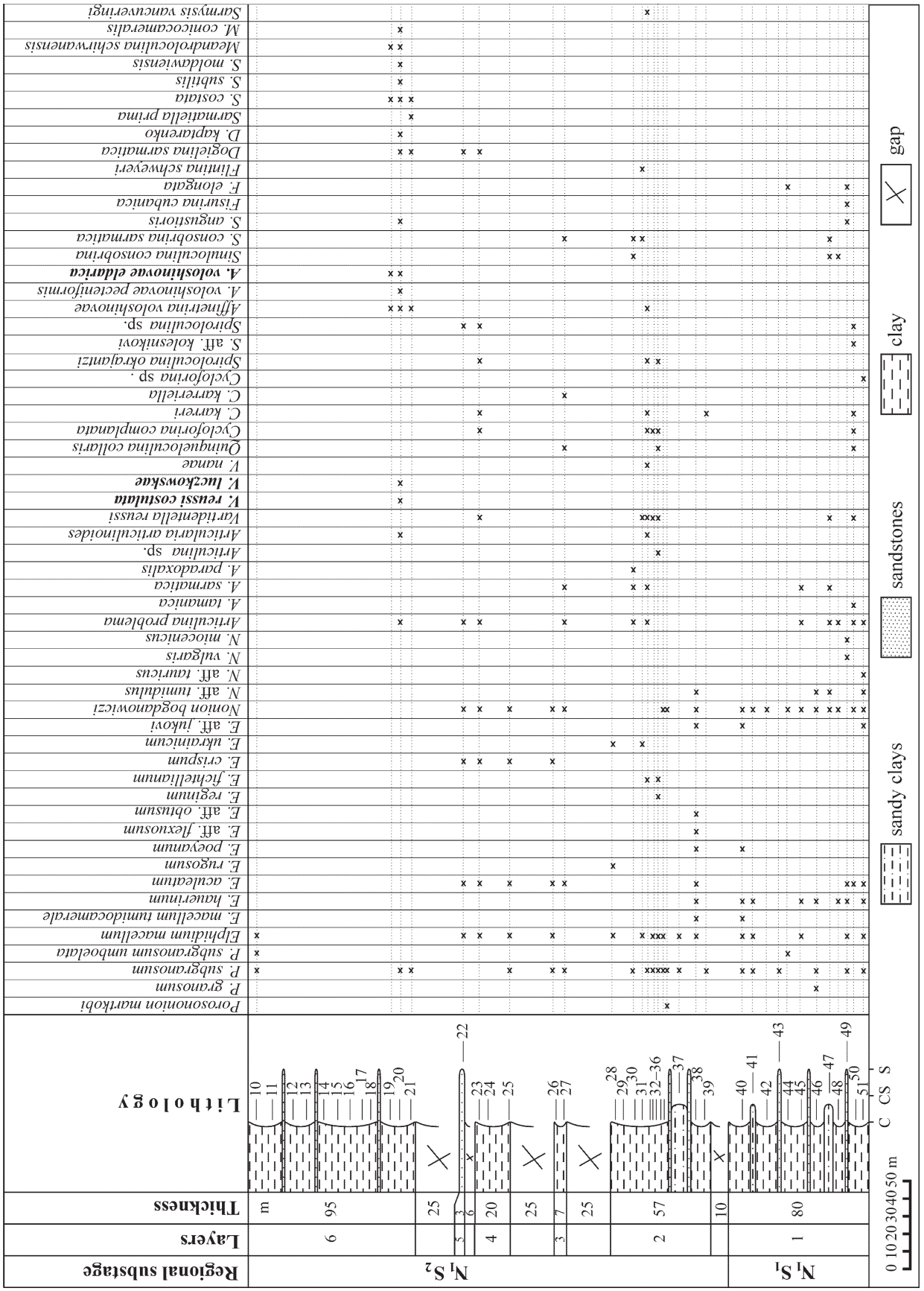

Fig. 4. Lithological log and distribution of benthic foraminifers in the Satskhenisi section. N_1S_1 = Volhynian; N_1S_2 = Bessarabian.

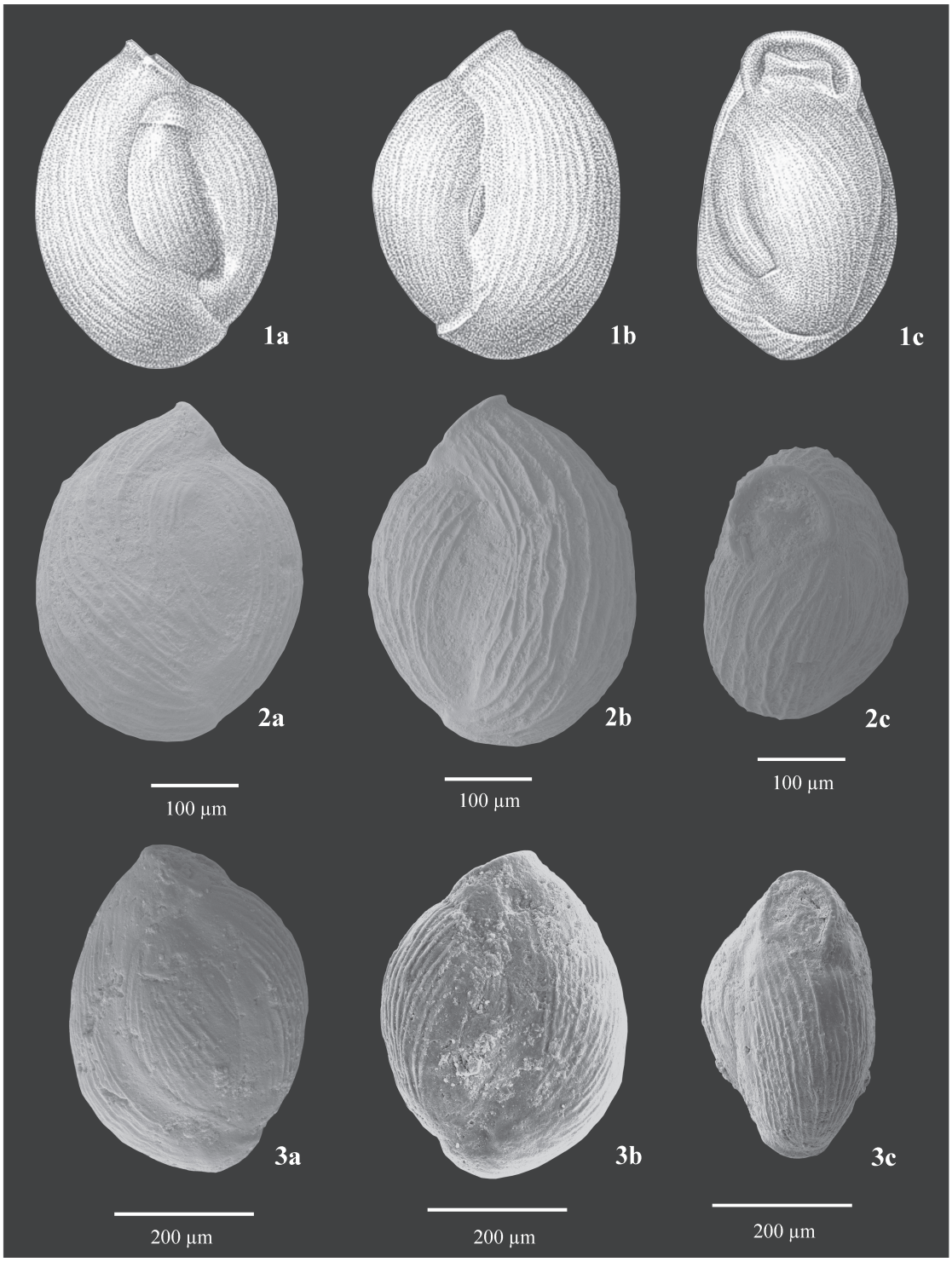

Fig. 5. *Varidentella reussi costulata*. **1a–c** — Holotype N, 14/M; 1a–b = side view; 1c = apertural view; drawing after Maisuradze (1971). **2a–c** — Paratype N, 14a/M; 2a–b = side view; 2c = apertural view. **3a–c** — Specimen N, K/040/127; 3a–b = side view; 3c = apertural view.

Type locality: In the gorge of river Ochkhamuri (Western Georgia).

Type level: Bessarabian.

Paratypes and other material: Number 14a/M (Fig. 5.2a–c) is stored at the Georgian National Museum, L. Davitashvili Institute of Paleobiology (collection of Maisuradze), it was found in sediments from the gorge of the river Ochkhamuri (Western Georgia). The specimen K/040/127 (Fig. 5.3a–c) is stored at the A. Djanelidze Institute of Geology (collection of Koiava, Spezzaferri), it was found in sediments from the gorge of the river Satskhenisi (Eastern Georgia).

Derivation of the name: Because of the presence of striae and costae as ornamentation of the wall texture.

Description: The test is rounded, rarely broadly-oval, inflated, with a rounded basis and an oblique aperture. The arrangement of the chambers is crypto-quinqueloculiniform. The peripheral margin is rounded. Length and width are approximately equal. The side where 4 to 3 chambers in the last whorl are observed is always convex. The side with 3 chambers in the last whorl is flat, concave or convex; the sutures are depressed and distinct. The aperture is oblique, elongate and oval, encompassing the whole width of the last chamber and is bordered by a lip-like structure. The tooth in the aperture is low and wide, slightly bifid. The wall is thin, appearing almost translucent and the surface is covered with dense and fine longitudinal striae.

Dimensions: Width — 0.45–0.65 mm; length — 0.32–0.49 mm; thickness — 0.23–0.35 mm.

Variability: The morphological features that characterize this subspecies are generally consistent. However, the size of the tooth, the thickness of the lip-like structure around the aperture, the rounded to wide oval outline of the test and the visible number of chambers may vary slightly from specimen to specimen.

Remarks: The generic attribution of this species to *Varidentella* is based on the shape of the tooth. It differs from *Varidentella pseudocostata* (Venglinski) described by Popescu (1995) in Volhynian sediments from Romania, because *V. reussi costulata* possesses a more inflated test, and the striae ornamenting the test are denser, thinner and less marked. The specimen described in Cicha et al. (1998) from Sarmatian sediments from Poland, is more similar to the typical *V. reussi*, with an overall smooth wall texture with very weak and rare striae only along the peripheral margins. This form is characteristic for silty sediments (Figs. 3 and 4) that were probably deposited in low energy environments. Hansen & Dalberg (1979), showed that the presence of pits and costae in symbiont bearing miliolids such as *Amphisorus hemprichii* (Ehrenberg) and *Triloculina rupertiana* (Brady) indicate that these features favour the uptake of CO_2. However, a clear relationship between ecological conditions and test ornamentations is difficult to prove for the described species.

Distribution: The analysis of our material from several locations suggests that *V. reussi costulata* is characteristic for the Bessarabian and it is present in Georgia, but also in other Paratethyan regions such as Crimea, Moldova and Bulgaria (collection Maisuradze).

Material: 20 well preserved specimens.

Suborder: **Miliolina** Delage & Hérouad 1896
Superfamily: **Miliolacea** Ehrenberg, 1839
Family: **Hauerinidae** Schwager, 1876
Subfamily: **Hauerininae** Schwager, 1876

Genus: *Varidentella* Łuczkowska, 1972

Varidentella luczkowskae sp. nov.
Fig. 6.1a–c,2a–c,3a–c

1971 *Quinqueloculina* aff. *sartaganica* Maisuradze, p. 50, pl. III, fig. 5a,b,v

Motivation: Karrer (1877) described *Quinqueloculina sarmatica* and its variations — var. *typica*, var. *elongata*, var. *virgata* from Lower Sarmatian deposits of Austria. Łuczkowska (1972) subsequently attributed *Quinqueloculina sarmatica* and related forms to the genus *Varidentella.* In particular, she also documented *Varidentella* aff. *sartaganica* as a species related to *V. sartaganica* (Krashenninikov). This latter species is probably the ancestor of many Volhynian and Bessarabian species of *Varidentella*, e.g. *V. reussi*, *V. nanae*, *V. nanae megrelic* (Maisuradze 1971).

Varidentella aff. *sartaganica* was also described by Maisuradze (1971) as possessing a broadly-oval or oval test (length 1.5 times- or twice its width); a proximal edge, rounded and elongated towards the aperture and bordered by a collar-like structure. According to Maisuradze (1971) this species differs from *Varidentella reussi* by the more convex proximal part, the more rounded periphery and the lower neck and therefore it is now described as *Varidentella luczkowskae*.

Holotype: It is presented in Fig. 6.1a–c, and it is stored at the Georgian National Museum, L. Davitashvili Institute of Palebiology with the reference number 42/M.

Type locality: In the gorge of the river Ochkhamuri (Western Georgia).

Type level: Bessarabian.

Paratypes and other material: Number 42a/M (Fig. 6.2a–c), is stored at the Georgian National Museum, L. Davitashvili Institute of Paleobiology (collection of Maisuradze) and was found in the gorge of the river Ochkhamuri. The specimen K/039/127 (Fig. 6.3a–c) is stored at the A. Djanelidze Institute of Geology (collection of Koiava, Spezzaferri), it was found in sediments from the gorge of the river Satskhenisi (Eastern Georgia).

Derivation of the name: After Eva Łuczkowska because of her valuable work on miliolids.

Description: The test is oval, slightly convex. The length is twice the width. Chambers are arranged in quinqueloculinid-coiling mode. The peripheral margin is rounded. On one side, 3 to 4 chambers are visible, on the other side, which is flatter, only 2 to 3 chambers are visible. The chambers are tubular, inflated, arched, larger at the proximal edge and narrower towards the aperture. The sutures are broad and distinct. The aperture is semicircular, oblique and elongated and follows the outline of the chambers. A semicircular, concave and lamellar tooth is present in the aperture. The wall texture is smooth.

Dimensions: Width — 0.37–0.28 mm; length — 0.67–0.58 mm; thickness — 0.26–0.20 mm.

Variability: The characteristic morphology of this species is generally consistent, no strong variability has been observed. However, test outline may be oval to wide oval; the tooth may display changes in size; visible chambers may vary in number.

Remarks: This species differs from the related species, such as *Varidentella sartaganica* (Krashenninikov) in having a broader oval test; a more rounded proximal edge at one side, with tall neck elongated towards the aperture and a large test.

Distribution: Bessarabian deposits of Georgia.

Material: Thirty well preserved specimens and twenty damaged specimens.

Fig. 6. *Varidentella luczkowskae*. **1a–c** — Holotype N, 42/M; 1a–b = side view; 1c = apertural view; drawing after Maisuradze (1971). **2a–c** — Paratype N, 42a/M; 2a–b = side view; 2c = apertural view. **3a–c** — Specimen N, K/039/127; 3a–b = side view; 3c = apertural view.

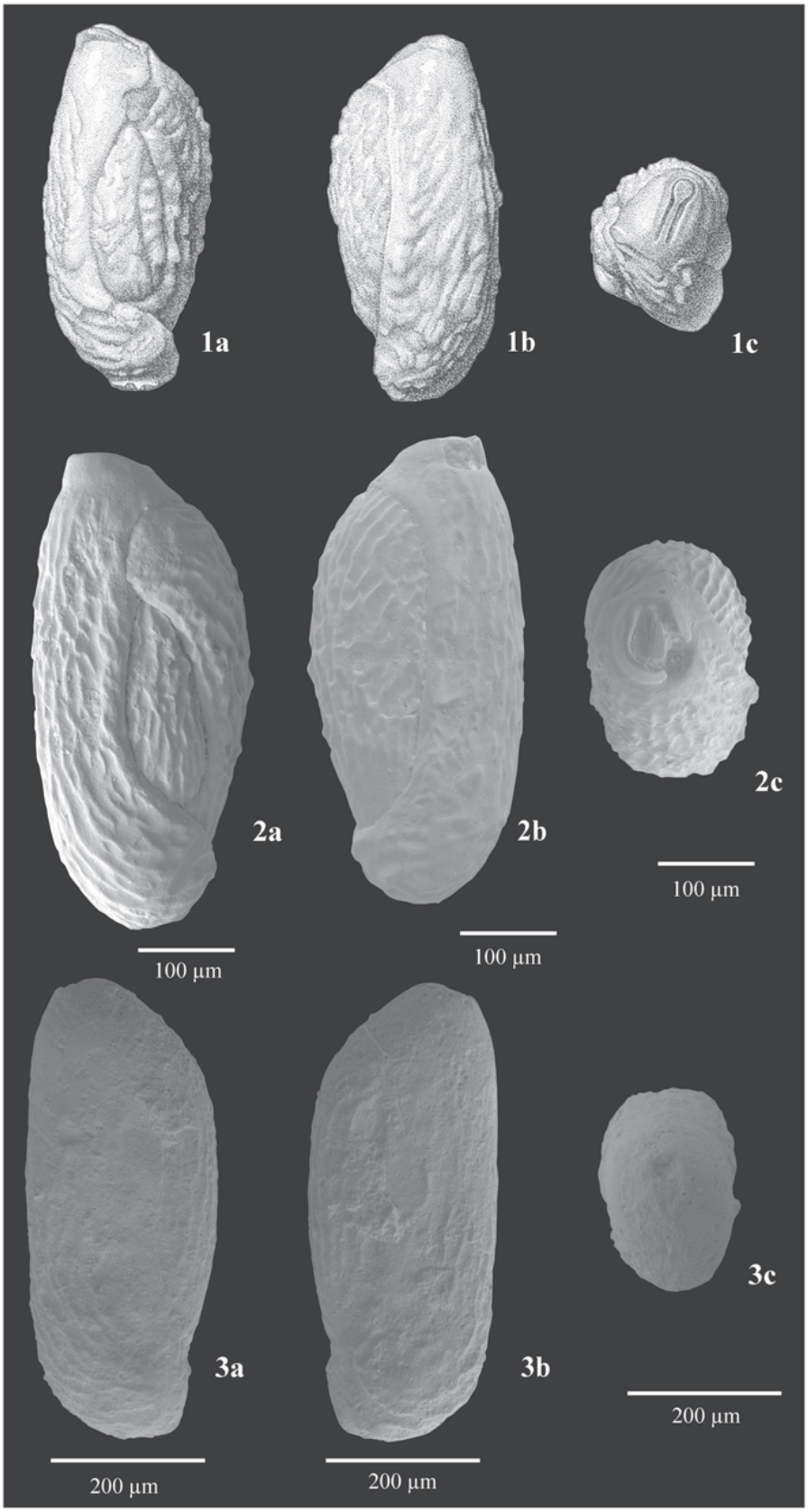

Fig. 7. *Affinetrina voloshinovae eldarica*. **1a–c** — Holotype N, 41/M; 1a–b = side view; 1c = apertural view; drawing after Maisuradze (1971). **2a–c** — Paratype N, 41a/M; 1a–b = side view; 1c = apertural view. **3a–c** — Paratype N, K/035/127; 3a–b = side view; 3c = apertural view.

Suborder: **Miliolina** Delage & Hérouad, 1896
Superfamily: **Miliolacea** Ehrenberg, 1839
Family: **Hauerinidae** Schwager, 1876
Subfamily: **Hauerininae** Schwager, 1876

Genus: *Affinetrina* Łuczkowska, 1972

Affinetrina voloshinovae eldarica subsp. nov.
Fig. 7.1a–c, 2a–c, 3a–c

1956 *Miliolina pseudovoloshinovae* Pobedina — Pobedina et al., p. 112, pl. XII, fig. 3a,b,v. emended
1971 *Quinqueloculina* aff. *voloshinovae* (Bogdanowicz), Maisuradze, p. 47, pl. VII, figs. 2a,b,v; 3a,b,v
no 1995 *Affinetrina* ex group *voloshinovae* (Bogdanowicz), Popescu, p. 90, pl. 1, figs. 12–14

Motivation: *Affinetrina voloshinovae eldarica,* originally termed *Quinqueloculina* aff. *voloshinovae* Bogdanowicz was described by Maisuradze (1971) from Bessarabian deposits of Western Georgia. Similar forms are also present in coeval deposits of Eastern Georgia. In particular, they occur in the bore-hole Eldari-1 and in the outcrops Eldari and Satskhenisi (Koiava 2006). These forms were originally described by Pobedina et al. (1956) as *Miliolina pseudovoloshinovae.* However, after a careful revision of the type material we propose to emend the species *Miliolina pseudovoloshinovae* and include these forms characterized by knob-like ornamentation instead of ribs and a chink-like aperture with elongate tooth in the *Q. voloshinovae* (Bogdanowicz) group.

Holotype: It is presented in Fig. 7.1a–c, and it is stored at the Georgian National Museum. L. Davitashvili Institute of Paleobiology with the reference number 41/M.

Type locality: The gorge of the river Ochkhamuri (Western Georgia).

Type level: Bessarabian.

Paratypes: Number 41a/M (Fig. 7.2a–b) is stored at the Georgian National Museum, L. Davitashvili Institute of Paleobiology (collection of Maisuradze). Number K/035/127 (Fig. 7.3a–c) is stored at the A. Djanelidze Institute of Geology (collection of Koiava, Spezzaferri). All paratypes were found in sediments of the gorge of the river Ochkhamuri (Western Georgia).

Derivation of the name: According to the geographic location.

Description: The test is irregularly elongated and oval, more or less convex and angular-rounded at the basis. The aperture is straight or oblique-truncated. The test is longer than wide (2 or 2.5 times). The arrangement of chambers is quinqueloculiniform. The apertural side is rounded to subtriangular. The peripheral margin is round. The side displaying three to four chambers is generally convex. The opposite side showing two chambers is flat. Chambers are tubular, oblique at the base, especially in the last one. The middle part of chambers is less wide than at the bottom, and aperture. The sutures are depressed but not always clearly visible.

The aperture is narrow, straight or oblique, elongated or elongated-oval, generally wider at one side, with parallel edges and bordered by a lip. It has a single elongate narrow and club-shaped tooth. Sometimes the tooth is extended outside the aperture.

The wall texture is thick, massive and is covered by numerous irregular longitudinal pustule-like striae, which are more developed at the bottom of the test where quite often they are presented by sharp-tipped knobs. Near the end of the aperture the wall texture becomes smoother.

Dimensions: Length — 0.8–0.95 mm; width — 0.36–0.4 mm; thickness — 0.25–0.35 mm.

Variability: The morphological features characterizing this subspecies are generally consistent. However, the outline of the test varies from elongated to slightly oval, the size of the tooth and the wall ornamentations can also be more or less pronounced.

Remarks: This subspecies is very similar to *Affinetrina voloshinovae* (Bogdanowicz), but it differs in ornamentation: more pustule-like in *A. voloshinovae eldarica* and real striae in *A. voloshinovae* (Bogdanowicz). Additionally, *A. voloshinovae pecteniformis* (Bogdanowicz) differs from this subspecies in having a hook-like thick low end of the last chamber, which is sharply projected over the edges of the test; a wider round base; and a very coarse ornamentation, a different outline of the aperture and tooth.

Distribution: Bessarabian of Georgia and Azerbaijan (Vangengeim et al. 1989).

Material: Ten well preserved specimens.

Conclusion

Three new Bessarabian miliolid taxa occurring in Georgia (Eastern Paratethys) are described. They are: *Varidentella luczkowskae*, *Varidentella reussi* (Bogdanowicz) subsp. *costulata*, and *Affinetrina voloshinovae* (Bogdanowicz) subsp. *eldarica*. For the first time the classification of Łuczkowska (1972), based on the morphology of the aperture and the shape and size of the tooth, is applied to Eastern Paratethyan miliolids, providing the framework for possible taxonomic comparison between eastern, central and western taxa.

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