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On some rare trochoidean gastropods from the Miocene of the West Ukraine

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With 7 tables and 32 figures

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Abstract

On the basis of modern documentation of the type material for *Squamisolariella squamosospinosa* (SINZOV, 1875), *S. sinzovi* V. ANISTRATENKO & PRISJAZHNUK, 1996, *S. mediana* V. ANISTRATENKO & PRISJAZHNUK, 1996 (Cyclostrematidae FISCHER, 1815) and *Granulifera pulla* O. ANISTRATENKO, 2000 (Trochidae RAFINESQUE, 1815) extended new descriptions and a taxonomic re-evaluation are provided.

Zusammenfassung

Das Typusmaterial von *Squamisolariella squamosospinosa* (SINZOV, 1875), *S. sinzovi* V. ANISTRATENKO & PRISJAZHNUK, 1996, *S. mediana* V. ANISTRATENKO & PRISJAZHNUK, 1996 (Cyclostrematidae FISCHER, 1815) und *Granulifera pulla* O. ANISTRATENKO, 2000 (Trochidae RAFINESQUE, 1815) wird zeitgemäß dargestellt und mit ausführlichen neuen Beschreibungen versehen. Zudem wird ihre taxonomische Stellung neu evaluiert.

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I . Introduction

A large a number of species belonging to the superfamilies Turbinoidea RAFINESQUE, 1815 and Trochoidea RAFINESQUE, 1815 have lived in the Miocene Basins of the Paratethys in south-eastern Europe. Their documentation up to date is quite insufficient. Recently, four new species and two new genera of trochoidean gastropods were described from Badenian and Sarmatian deposits of the Vohlynian-Podolian region of the Ukraine (V. ANISTRATENKO & PRISJAZHNUK, 1996; O. ANISTRATENKO, 2000). Some additional data of these taxa are reevaluated and confirmed. Besides, as both the original descriptions had been based on one or few individuals of these rare species more specimens have since been collected and are newly documented here. Since the systematic position was published in Russian, their accessibility for the international scientific community is limited. We, therefore, present the data in this renewed version.

II. Material and methods

The present investigation is based on material deposited in the Institute of Geological Sciences NAS Ukraine (Kiev, Ukraine). The material comes from natural outcrops and a borehole exposing Late Badenian and Middle Sarmatian deposits in western Ukraine (tab. 1). A few specimen of *Granulifera pulla* from the Late Badenian of Poland could additionally be studied from material coming from Weglin, Poland and deposited in the collection of the Institute of Paleobiology (PAS) in Warsaw, Poland.

Localities mentioned in this paper (with abbreviations used here) are: 1 – outcrop between Pilyava and Ivankovcy villages, Staraya Sinyava district, Khmelnytsky region (PIL); 2 – outcrop between Kos’kov and Grycev villages, Shepetovka district, Khmelnytsky region



Tab. 1: The mentioned localities in the Ukraine.

(KOS); 3 – borehole 1529 near Litinka village, Litin district, Vinnitsky region (LIT); 4 – outcrop near Antonovka village, Letichev district, Khmelnytsky region (ANT); 5 – outcrop near Letichev, Khmelnytsky region (LET); 6 – outcrop near Satanov town, Khmelnytsky region (SAT); 7 – precipice on the bank of river Goryn, vicinity of Izyaslav town, Khmelnytsky region (IZA). S – SINZOV's (1875) record of *S. squamosospinosa* in Moldova near Kishinev – type locality; A – ANDRUSSOV's (1899) record of *S. squamosospinosa* from Kertsch Peninsula.

Material from localities 1 – 6 were provided by Dr. VALENTIN PRISJAZHNUK and from 7 – by Dr. TATYANA SHEVCHENKO (both Institute of Geological Sciences NAS Ukraine, Kiev). The distribution of species in each locality is given in tab. 2.

Shell characters were studied and photographed by aid of an optical stereomicroscope, and smaller details by a Scanning Electron Microscope housed in the Geologisch-Paläontolo-

Species	Localities						
	PIL	KOS	LIT	ANT	LET	SAT	IZA
<i>Squamatisolariella squamosospinosa</i> (SINZOV, 1875)							
<i>S. mediana</i> V. ANISTRATENKO & PRISJAZHNUK, 1996							
<i>S. sinzovi</i> V. ANISTRATENKO & PRISJAZHNUK, 1996							
<i>Granulifera pulla</i> O. ANISTRATENKO, 2000							
Number of species in each locality	2	1	2	1	1	1	1

Tab. 2: Distribution of species in the different localities.

logisches Institut of the University of Hamburg. Some specimen of *Granulifera pulla* were documented with the SEM at the Institute of Paleobiology in Warsaw. Standard dimensions for shell characters were used. Apical angles proved to be a simple and easy parameter to distinguish the described species, since large differences without overlaps were noted even separating apparently otherwise closely related species.

III. Taxonomy

In previous studies ANISTRATENKO & PRISJAZHNUK (1996) and ANISTRATENKO (2000) described four species and established two genera: *Squamatisolariella* ANISTRATENKO & PRISJAZHNUK, 1996 and *Granulifera* O. ANISTRATENKO, 2000. The first species of *Squamatisolariella* – *S. squamosospinosa* was described by SINZOV (1875) as „*Delphinula squamosospinosa*“ from the Middle Sarmatian of Moldova near Kishinev. Later this species was registered by ANDRUSSOV (1899) in the Sarmatian of Kertsch Peninsula (see tab. 1). The systematic position of this species and others recently described had to be revised. There are at least two different interpretations of the generic and familial relationships of „*Delphinula squamosospinosa*“. The species has been referred to belong to the Angariidae THIELE, 1921 (=Delphinulidae) by SINZOV (1875) and was also placed in that relation by ANDRUSSOV (1899).

We suggest that *Squamatisolariella squamosospinosa* and related species should not to be placed to the *Angaria* RÖCKING, 1798 (= *Delphinula* LAMARCK, 1803) relation and thus into the family Angariidae (=Delphinulidae) since members of this family usually have

characteristically spiral ornament – costae, spines, scales, tubercles, etc., and at the same time lack any axial sculpture with exception of growth lines. Besides all modern angariids have a thick and large shell, usually thicker and larger (THIELE, 1929; KEEN, 1960, HICKMAN & McLEAN, 1990) than that of the species discussed here. Only a few shell characters could be considered as evidence of a relationship of „*Delphinula squamoso-spinosa*“ to actual angariids. The most important of these is the presence of sharp scales in the ornament, which does not represent a unique character of this family but also occurs in other vetigastropods and can be considered to represent a shell character that is convergent in the group.

We placed „*Delphinula squamosospinosa*“ and its relatives into the family Cyclostrematidae FISCHER, 1885 due to the similarity in shell shape with species belonging to *Cyclostrema* MARRYAT, 1818. The family Cyclostrematidae has been discussed controversially by some authors. It was interpreted to be close to the family Liotiidae GRAY, 1850 HICKMAN & McLEAN (1990) and also as quite independent of this family, as we also assume. We follow here THIELE (1929), KOROBOV (1955), and GOLIKOV & STAROBOGATOV (1975) who interpreted the Cyclostrematidae to represent a separate family distinct from the Liotiidae. HICKMAN & McLEAN (1990), in contrast, suggested some correction and changes of THIELE's system and added some genera established after 1935, and they included the subfamily Liotiidae into the family Turbinidae RAFINESQUE, 1815. These Liotiinae according to HICKMAN & McLEAN (1990) together with „traditional“ liotiids (namely *Liotia* GRAY, 1847, *Liotina* FISCHER, 1885) also contain *Otollonia* WOODRING, 1928 formerly placed in the family Colloniidae COSSMANN, 1916. Liotiinae were also interpreted to hold the genus *Cyclostrema*.

Regarding the family Cyclostrematidae we follow ANDO & HABE (1980) who described from the Japan Sea a living species which is amazingly similar to „*Delphinula squamoso-spinosa*“ and placed it within Cyclostrematidae. They suggested for it a place within the genus *Pondorbis* BARTSCH, 1915, which is usually (KOROBOV, 1955 and others) treated as belonging to the family Skeneidae CLARKE, 1851.

Class Gastropoda CUVIER, 1767

Superfamily Turbinoidea RAFINESQUE, 1815

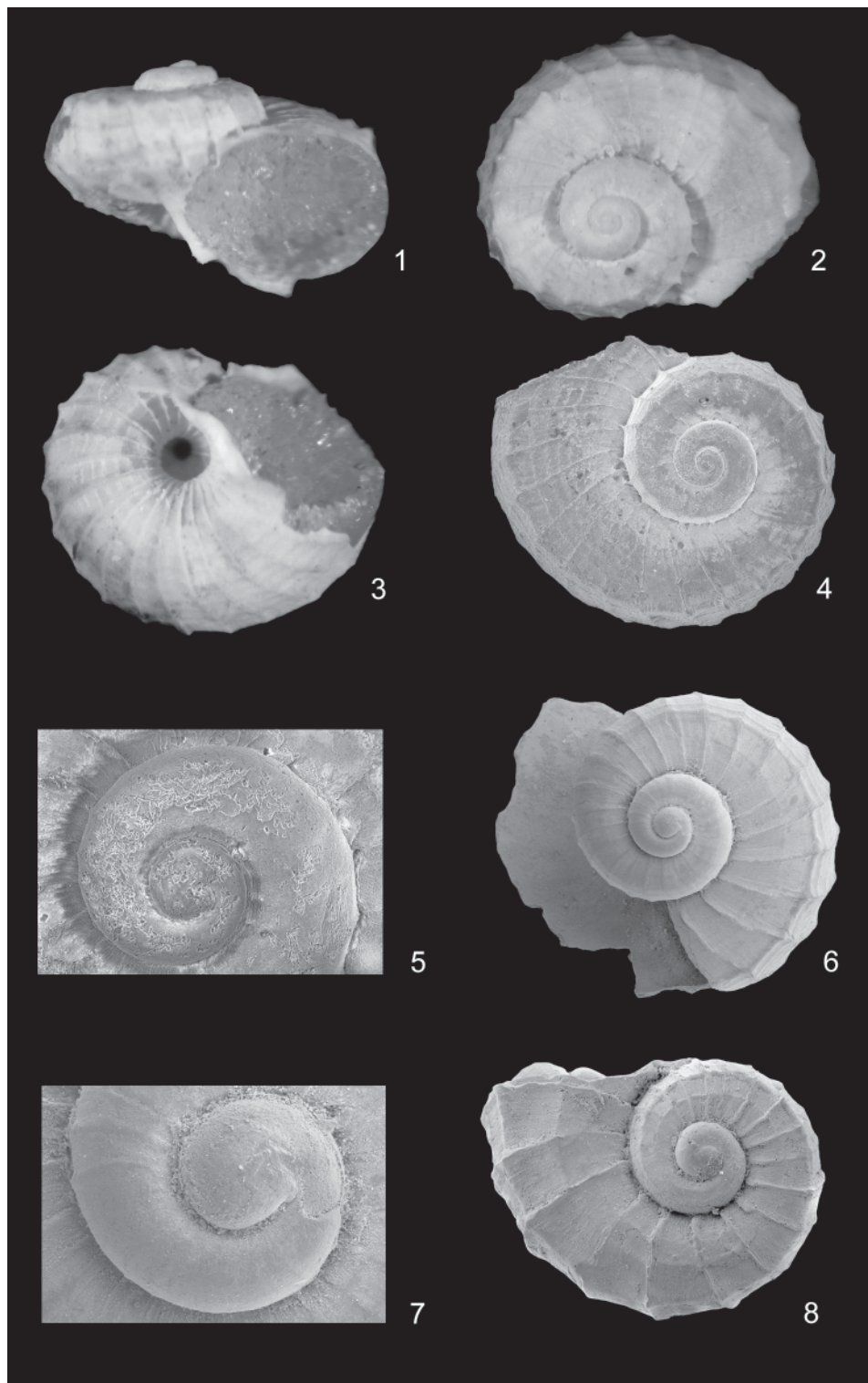
Family Cyclostrematidae FISCHER, 1885

Genus *Squamatisolariella* V. ANISTRATENKO & PRISJAZHNUK, 1996

Type species: *Squamatisolariella mediana* V. ANISTRATENKO & PRISJAZHNUK, 1996 from the Middle Sarmatian of western Ukraine. The name was derived from latin *squamatus* = scaly, squamose, and *Solariella* - representing a nominal generic name.

Diagnosis: Shell medium-sized, thin-walled, low-conical, with short spire consisting of few (4-5) whorls and with very expanded body whorl. Spire always more or less elevated

Figs. 1 - 8 *Squamatisolariella mediana* V. ANISTRATENKO & PRISJAZHNUK, 1996 from the Middle Sarmatian of the Ukraine; **1:** Apertural view of a 4,1 mm wide shell, documenting the wide and thin aperture; **2:** Apical view of the same shell as in fig.1, documenting the ornament of axial and spiral ribs and the scale-like thorns formed where they cross each other; **3:** Umbilical view of the shell as in fig. 1, showing the open umbilicus, penetrated by sharp axial ribs and the spiral ornament of the base; **4:** Similar view as in fig.2, but photographed with the SCAN, documenting more clearly the spiral ornament; **5:** Early whorls of the individual in fig. 1, showing the protoconch with characteristic triangular apex as found commonly in archaeogastropods, and the smooth begin of the teleoconch; **6:** Shell with 3,2 mm in diameter with the first whorls raised and smooth and ornament inserting with spiral lines first; **7:** Protoconch from the individual in fig. 6, with the characteristic triangular apex of the archaeogastropods, measures 0,2 mm in diameter; **8:** Juvenile shell, measuring 2,6 mm across, showing the characteristic ornament of the early teleoconch.



above the body whorl. The sculpture of spiral and axial ribs form low sharp spines where they cross each other. The body whorl is ornamented with up to 17-19 axial ribs. Aperture rounded, inner and outer lips thin. The umbilicus is wide. A thin layer of nacre is present within the shell wall. The protoconch is that of an archaeogastropod with the characteristic deformation fold (BANDEL, 1982).

Species composition: *S. squamosospinosa* (SINZOV, 1875), *S. sinzovi* V. ANISTRATENKO & PRISJAZHNUK, 1996 and *S. mediana* V. ANISTRATENKO & PRISJAZHNUK, 1996.

Differences: *Squamatisolariella* differs from *Cyclostrema* by its smaller shell and the spire raised above the body whorl. From *Pondorbis* it differs by much larger shell (3-4 times) while having an equal number of whorls (ANDO & HABE, 1980). From most other genera of the family Cyclostrematidae namely *Zalipais* IREDALE, 1915, *Brookula* IREDALE, 1912, *Chunula* THIELE, 1925 and *Tasmocrossea* DELL, 1952, *Squamatisolariella* differs in having a lower spire and not only well developed axial sculpture as these but also spiral ribs. The spire in *Squamatisolariella* species resembles that found in species of the genus *Circulus* JEFFREYS, 1865 (fam. Vitrinellidae), but axial sculpture of the former is sharper and the aperture is more rounded. From *Munditia* FINLAY, 1927 (family Liotiidae) *Squamatisolariella* differs in having spines on the surface of the shell and lack of ring-like thickening of the apertural edge.

Distribution: Sarmatian deposits of the eastern Paratethys.

Squamatisolariella mediana V. ANISTRATENKO & PRISJAZHNUK, 1996

(figs. 1 - 8)

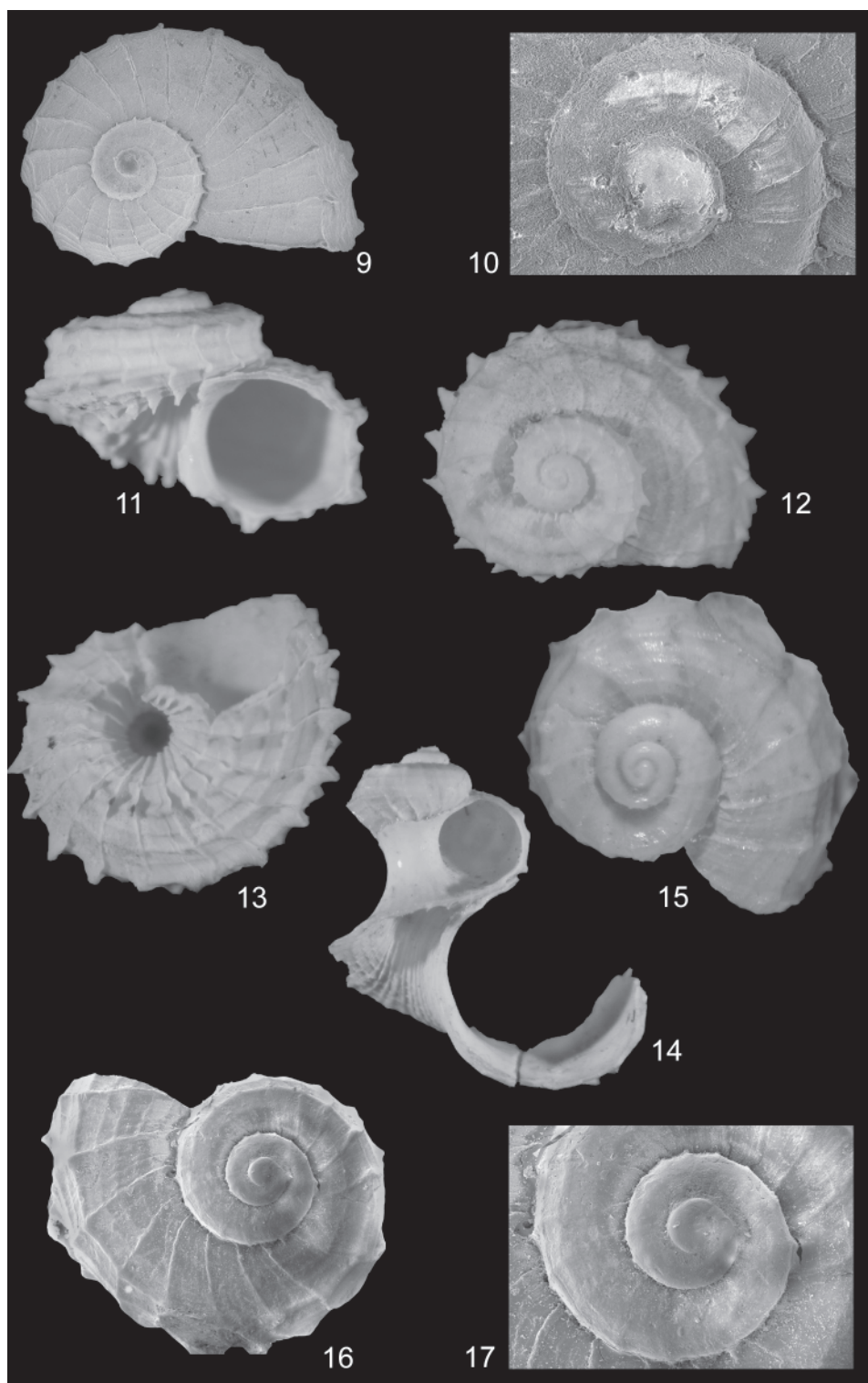
1996 *Squamatisolariella mediana* V. ANISTRATENKO & PRISJAZHNUK, p. 21-22, fig. 1a -b.

Material examined: 2 (PIL); 1 (KOS); 1 (LIT); 3 (LET); 4 (IZA).

Description: The shell is of medium size, has a wide conical shape, and consists of three one half to four rapidly expanding whorls. The initial whorls are raised somewhat above the apical level. The first whorl is smooth, all following ones have spiral and axial ribs which in crossing points form sharp scales with their points oriented toward to the aperture. Sculpture increases with growth. The large body whorl occupies almost 90 % of the shell height. The aperture is rounded, with equal height and width. It occupies about 75% of total shell height. Its edge is thin and the shell is thickened only in position of the spiral ribs. The open umbilicus has a sharp lamellar axial crest. The apical angle measures about 140°, and the spire profile is almost straight. The protoconch occupies almost one

Figs. 9 –13: *Squamatisolariella squamosospinosa* (SINZOV, 1875) from the Sarmatian of West Ukraine; **9:** Apical view of 3,3 mm wide shell, ornamented by axial ribs and a peripheral spiral keel in marginal position; **10:** Detail to fig.9, with the about 0,2 mm wide protoconch, the short initially smooth teleoconch that is rapidly ornamented by axial folds; **11:** Apertural view, documenting the lowly, conical shape of the 4,6 mm high shell. Scale-like spines feature the crossing points of axial and spiral ribs on the body whorl; **12:** Apical view of the same specimen as in fig. 11; **13:** Umbilical view of the specimen in fig.11 that is 6,2 mm wide, showing the deep umbilicus and the oblique aperture.

Figs. 14 –17: *Squamatisolariella sinzovi* V. ANISTRATENKO & PRISJAZHNUK, 1996 from the Sarmatian of West Ukraine; **14:** Apertural view of a damaged but fully grown shell, 5.35 mm high and only a little wider; **15:** Apical view of the same shell as in fig. 14, showing the smooth first teleoconch whorls and the later ornament, dominated by axial ribs; **16:** Apical view, documented by SEM, showing the fine spiral ornament more clearly; where peripheral spiral ribs cross axial ribs spines are developed; **17:** Detail of fig.16, showing the protoconch of about 0,2 mm in diameter with the characteristically pointed apex of the embryonic shell of archaeogastropods, and the smooth first whorl of the teleoconch.



whorl and is about 0.2 mm wide. It has the characteristic lateral fold and, thus, a somewhat triangular apex. First half whorl of the teleoconch is smooth and in the second half of the first whorl axial ribs appear presented by narrow distant lamellae.

Differences: *S. mediana* is distinguished from *S. squamosospinosa* in having slower expansion of whorl diameter and, as a result, the shell has a smaller apical angle and smaller size with equal number of whorls (see tab. 3, 6).

Distribution: This species is known only from the Sarmatian deposits of Khmel'nitsky and Vinnitsa regions in western Ukraine (V. ANISTRATENKO & PRISJAZHNUK, 1996).

HS	WS	HBW	HA	WA	NW
2,2	3,2	2	1,6	1,6	3,5
1,7	2,6	1,55	1,3	1,3	3,1
2,6	4,1	-	-	-	3,5

Tab. 3: Measurements (in mm) *Squamatisolariella mediana*, 1st holotype: height of shell (HS); width of shell (WS); height of last (body) whorl (HBW); height of aperture (HA); width of aperture (WA); number of whorls (NW).

Squamatisolariella squamosospinosa (SINZOV, 1875)

(figs. 9-13)

1875 *Delphinula squamosospinosa* SINZOV: p. 32

1996 *Squamatisolariella squamosospinosa*, – V. ANISTRATENKO & PRISJAZHNUK, p.23-24, fig. 1a-b.

Material examined: 1 (ANT); 1 (LIT).

Description: The shell is of medium size and of low-conical shape. Whorls expand very rapidly during growth and are arranged in step-like manner. In cross section whorls are rounded, forming angulations only in the position of the abapical and adapical spiral keels. The blunt apex is only very little elevated, and the first three initial whorls are almost planispirally coiled. The first whorl forming the protoconch is smooth, further teleoconch whorls are covered by very fine spiral ribs and thin axial lamella-like folds. Where spiral and axial elements cross, sharp scales are present. Ornament on the first three whorls is rather delicate while later two to three spiral ribs increase in size more than the others. The body whorl is relatively large, forming more than 90 % of shell height. The aperture is rounded, occupying 70 % to 85 % of total shell height. The base of the last whorl is weakly convex, and the umbilicus is wide, deep, funnel-shaped. The apical angle amounts to 150-155°, and the profile of the spire is concave. The protoconch is like that of *S. mediana* in shape and size.

Differences: *S. squamosospinosa* differs from all others known species of *Squamatisolariella* by a more rapid expansion of whorl diameter during growth and by having the largest apical angle (see tab. 4, 6).

Figs. 18 – 25: *Granulifera pulla* O. ANISTRATENKO, 2000 from the Late Badenian of the West Ukraine and Poland, **18:** Detail of fig.19 with the 0,2 mm wide protoconch, better preserved in fig.29; **19:** Apical view of an individual from Ukraine, 6,5 mm wide, showing the change from more spiraled ornament on the early teleoconch to the more granular ornament on the later whorls, better seen in fig. 20; **20:** Same individual as in fig.19 with the rounded tubercles of the body whorl well visible; **21:** Same as in fig.19 and 20, apertural view, with the aperture of the juvenile shell without folds and constrictions; **22:** Same as in fig. 18-20 in umbilical view with flattened and spirally ornamented base and narrow umbilicus; **23:** Fully grown individual from Poland that is almost 8 mm high and consists of 6 whorls. The aperture is shown in fig.24; **24:** Well developed aperture of fully grown individual from Poland. The aperture is 4 mm wide and has a columellar fold and five teeth on the inner side of the outer lip; **25:** Same individual as in fig.23 in apical view.



Remarks: *Pondorbis japonicus* from the Japan Sea as described by ANDO & HABE (1980) resembles closely *S. squamosospinosa* but is four times smaller in size. The modern species may be closely related to the fossil one and size difference may be due to heterochronous homeomorphism.

Distribution: This species is known from the Sarmatian of Moldova, West Ukraine and Kertsch Peninsula (SINZOV, 1875; ANDRUSSOV, 1899; V. ANISTRATENKO & PRISJAZHNUK, 1996).

HS	WS	HBW	HA	WA	NW
4,6	6,2	4,2	3,1	3,1	4
1,85	3,35	1,7	1,55	1,7	3,1

Tab. 4: Measurements (in mm) *Squamatisolariella squamosospinosa*.

Squamatisolariella sinzovi V. ANISTRATENKO & PRISJAZHNUK, 1996

(figs. 14 - 17)

1996 *Squamatisolariella sinzovi* V. ANISTRATENKO & PRISJAZHNUK, p. 24, fig. 2.

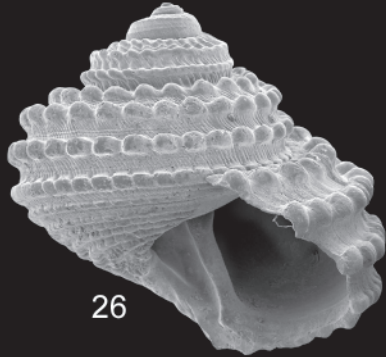
Material examined: This species has been based on the holotype only and was named in honor of the Russian paleontologist IVAN SINZOV, who first described a species of this genus in 1875.

Description: The shell has a wide-conical shape and consists of 4.5-5 evenly expanding whorls. In cross-section the whorls are rounded, appearing angular only where the abapical and adapical spiral keels are present. The inner surface of shell has a thin layer of nacre. The protoconch measures about 0.2 mm across and has the characteristic archaeogastropod shape. The first whorl of the teleoconch is smooth, on the second weak spiral threads and coarser slightly curved axial ribs are present. On following whorls the ornament changes to coarser pattern, with axial ribs still more pronounced and transformed into low thin lamellae which bear small tubercles where spiral ribs cross. Ornament on the early teleoconch is rather delicate and there are about 12-15 spiral ribs with two or three of them expressed more sharply than the others, and 30-32 axial ribs. On the last whorl spiral and axial ribs are developed in such a way that the whorl base is covered by a reticulate ornament. Sharp axial ribs enter the open umbilicus. The body whorl is large, forming 85% of the shell height. The aperture is rounded and occupies about 60% of total shell height. In the last whorl the base is slightly convex, the umbilicus very wide and funnel-like. The apical angle is about 120°, and the profile of the spire is straight.

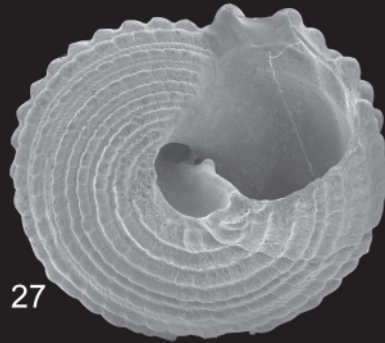
Differences: From all other species of *Squamatisolariella* this species differs by having the most slowly expanding shell tube and the smallest apical angle (see tab. 6).

Distribution: According to V. ANISTRATENKO & PRISJAZHNUK (1996) the species occurs in the Sarmatian of the Khmel'nitsky region, western Ukraine.

Figs. 26 - 32: *Granulifera pulla* O. ANISTRATENKO, 2000, from the Late Badenian of Poland; **26:** Apertural view of an about 5 mm high juvenile shell with details in figs. 27-32; **27:** Umbilical view of the same shell as in fig. 26 with 5,5 mm in width. The base is ornamented by spiral ribs and the umbilicus is narrow and deep; **28:** The apical portion of the shell shown in fig. 26 with the changing ornament on the early teleoconch. The initial ornament consists of a spiral keel, only in the second whorl axial ornament appears; **29:** The detail to fig. 28 with the 0,2 mm wide smooth protoconch documenting well the lateral fold of the embryonic shell and drastic change to the early teleoconch; **30:** Apex of the shell detail of fig. 26 with the subsutural shoulder well seen; **31:** Detail the ornament of fig. 26 on the last teleoconch whorl with spiral rows of tubercles; **32:** Detail of the ornament of fig. 26 on the third whorl with spiral ribs and fine granules



26



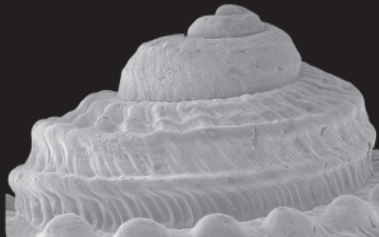
27



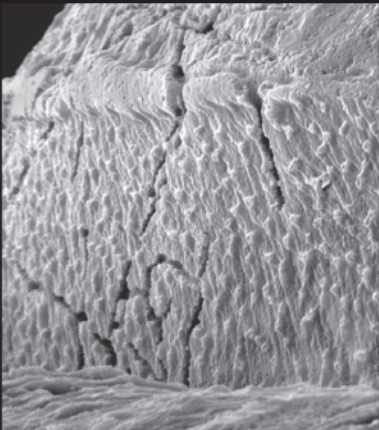
28



29



30



32



31

HS	WS	HBW	HA	WA	NW
5,35	5,7	4,55	3,3	3,5	4,35

Tab. 5: Measurements (in mm) of *Squamatisolariella sinzovi*, holotype.

Species	Apical angle (°)	Height of the shell (in mm)	Height/width of the shell	Shape of the profile
<i>S. squamosospinosa</i>	150-155	3,35	0,55-0,75	concave
<i>S. mediana</i>	140	2,6	0,65	slightly concave
<i>S. sinzovi</i>	120	2,35	0,9	straight

Tab. 6: Comparison of some shell measures characteristic of three species of *Squamatisolariella*.

Superfamily Trochoidea RAFINESQUE, 1815

Family Trochidae RAFINESQUE, 1815

Subfamily Gibbulinae STOLICZKA, 1868

Genus *Granulifera* O. ANISTRATENKO, 2000

Type species: *Granulifera pulla* O. ANISTRATENKO, 2000 from the Late Badenian of the West Ukraine. The species name is derived from latin *granulum* – grain, and *fero* – carry, hold.

Diagnosis: The medium-sized, thin-walled shell has a peg-shaped apex or is lowly conical. The short spire consists of few (up to 5-6) whorls. The body whorl is large and has the spire always elevated above it. The juvenile teleoconch bears 2-3 fine spiral ribs and consists of about two whorls. The ornament of the teleoconch consists of about 10-14 spiral and axial ribs which at their cross points carry rounded tubercles which sometimes grade into scales. The aperture is rounded or oval and of oblique orientation. The umbilicus is narrow, funnel-like. The columella carries an oblique fold in its upper part.

Species composition: ANISTRATENKO (2000) placed here besides the type species also a few other trochids, such as *Trochus cinctus* PHILIPPI, 1836, *Trochus guttadauri* PHILIPPI, 1836, *Trochus otto* PHILIPPI, 1844, *Turbo auingeri* FUCHS, 1873, and *Gibbula sosensis* COSSMANN & PEYROT, 1917. Also *Monodonta tuberculata* EICHWALD, 1799 can be included in this genus.

Differences: *Granulifera* differs from *Trochus* LINNAEUS, 1758, *Tectus* MONTFORT, 1810, *Colliculus* MONTEROSATO, 1888 and *Gibbula* RISSO, 1826 in having a particular sculpture. From *Monodonta Lamarck*, 1799 it differs in having an umbilicus. From *Colliculus* distinguishes a much more expressed columellar fold. In addition, both *Gibbula* and *Colliculus* have a shell that is at least three to five times larger than that of *Granulifera*. *Phorculus* COSSMANN, 1888 from Eocene to Recent differs from *Granulifera* by having a larger and thicker shell that lacks the subsutural shoulder and carries more tubercles on its 8-10 spiral ribs (KEEN, 1960).

Clanculus MONTFORT, 1810 resembles *Granulifera*, but its outer lip is sharp and not coarsely dented on its inner side, while it is thickened and dented in case of *Granulifera*. The latter has a few rather large teeth on the inner side of the outer lip and also a tooth on the base of the columellar lip which is large. *Granulifera* may also be distinguished from *Chlorostoma* SWAINSON, 1840 and *Euchelus* PHILIPPI, 1847 by having a smooth protoconch, while that of the later as illustrated by (SASAKI 1998) is ornamented with a reticulate pattern. But this difference may not be present in all species once studied and known, as could be shown in case of the Scissurellidae by BANDEL (1998). Here ornament of the protoconch

can rarely be used to distinguish a genus. While the aperture in *Granulifera* is round in outline, that of many trochids is quadrangular (HICKMAN & McLEAN, 1990).

Distribution: Miocene of Mediterranean and Paratethys.

Granulifera pulla O. ANISTRATENKO, 2000

(figs. 18 - 32)

2000 *Granulifera pulla* O. ANISTRATENKO: p. 4-5, fig. 1.

Material examined: The name of the species was derived from Latin *pulla* – nestling, and the studied material consists of the holotype and four paratypes (SAT). In addition, 12 shells from the Late Badenian of Poland, (Weglin, Roztocze) were studied.

Description: The small sized shell is rounded top shaped with 5-6 equally and rapidly expanding whorls with corner and separated by deep sutures. All whorls have a sharply expressed subsutural shoulder. Only the surface of the initial whorl of the teleoconch lacks sculpture, the next whorl is ornamented by two low spiral keels. From the third whorl onward a third keel appears in its upper part and all keels further onward dissolve into rows of round, quite large tubercles. From the third whorl onward the sculpture becomes coarser. The surface between spiral rows of tubercles is covered by clear reticulate sculpture consisting of fine spiral and axial threads. The last whorl is large and its height occupies two thirds of total shell height. The basis of the last whorl carries seven spiral rows consisting of flattened tubercles which are arranged like tiles covering each other marginally. The aperture has an oval quadrangular shape with its long axis oriented slightly oblique to the shell axis. The inner side of the outer lip bears about 5 teeth and its margin undulates according to the ornament. The umbilicus is almost completely open, narrow, and deep. The upper part of the columellar lip carries a distinct oblique fold which is continuous into the interior of the shell and found on the columella. The color of the shell is horn-like or light-brownish. The protoconch measures a little more than 0.2 mm in diameter, is not well preserved but carries the characteristic fold of the archaeogastropod embryonic shell.

Distribution: Middle Miocene (Late Badenian) of western Ukraine.

Remarks: The genus *Granulifera* is interpreted to hold a few trochids which had been considered before as belonging to others genera. Among these *Turbo auingeri* FUCHS, 1873 was described from the Sarmatian of Austria (FUCHS, 1873: p.24, pl. 4, figs. 26-29). This species has also been encountered from Sarmatian deposits of others regions of Central and East Europe (SVAGROVSKY, 1971). It differs from *G. pulla* in lacking a columellar fold

HS	WS	HBW	HA	WA	NW
5.8	6.5	4.2	2.8	2.8	5.5

Tab. 7: Measurements (in mm) of *Granulifera pulla* (holotype).

and in having a smoother sculpture. With some doubts also *Trochus guttadauri* PHILIPPI, 1836 may belong here which was described from Sicily. The original description of *T. guttadauri* was quite brief and the figures are of low quality (PHILIPPI, 1836: p.182, pl. XI, fig. 1) and exact identification is thus difficult. Fortunately, this species was under the name *Gibbula (Forskalia) guttadauri* (PHIL.) mentioned and well-illustrated in the compendium of CERULLI-IRELLI (1969: p.467, pl. 57, figs. 17,18) devoted to fossil mollusks of Italy. Here it is evident that these shells are extremely similar to *G. pulla* and the only differences are present in details of the sculpture. *G. guttadauri* has smaller tubercles, and

between spiral rows of tubercles deep pits occur. Also the curving nature of the columellar fold is expressed more sharply than in *G. pulla*.

Trochus cinctus PHILIPPI, 1836 is also placed in *Granulifera*. It differs from *G. pulla* in having a deeper suture, sometimes even disjunct whorls. It also has thinner and more numerous growth lines which when crossing the two spiral ribs form numerous small tubercles with them, and these may be scale-like (PHILIPPI, 1836: p.185, pl. X, fig. 20). Also *Trochus otto* PHILIPPI, 1844 that was described from Late Miocene of Italy (PHILIPPI, 1844: p.227, pl. 28, fig. 9) is placed in this genus. It differs from *Granulifera pulla* in having only two rows of tubercles instead three on its adult whorls.

Gibbula (Colliculus) sosensis COSSMANN & PEYROT, 1917 is also considered as belonging to *Granulifera*, differing from *G. pulla* by a smooth early teleoconch, in having finer ornament, and by lacking sharply expressed tubercles on its spiral keels and also by lacking a columellar fold. This species is known from the Early-Middle Miocene of southern France (COSSMANN & PEYROT, 1917: 127-128, pl. 4., fig. 33-36.)

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