

A New Late Paleozoic Gastropod Genus *Alanstukella* gen. nov. (Trochonematidae)

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Abstract—A new gastropod genus *Alanstukella* gen. nov., from the family Trochonematidae is described. The type species *A. rossica* (Stuckenberg, 1905), belongs to a small group of the largest Late Paleozoic representatives of the class Gastropoda. *A. rossica* has been shown to have pedomorphic features. Despite the extreme rarity of finds, the species has a wide geographical and stratigraphic distribution: the East European Craton, the South Urals and the Fergana Valley; Upper Pennsylvanian—Lower Permian (from the basal Kasimovian to the basal Sakmarian).

Keywords: Gastropoda, Trochonematidae, *Alanstukella*, morphology, systematics, Paleozoic, Pennsylvanian, Permian

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INTRODUCTION

The study of the material described in this paper was initiated by the finding of imprints of very large trochiform shells in the reef limestones of Shakhtau. The taxonomic identification of these specimens was difficult because of their poor preservation; therefore, their description was not included in the monograph on the gastropods of Shakhtau (Mazaev, 2019).

After studying such imprints from the carbonates of the Upper Pennsylvanian and Lower Permian of the East European Craton in the collections of the Paleontological Institute of the Russian Academy of Sciences (PIN RAS), it was found that all this fossil material belongs to one species, described as *Mourlonia rossica* Stuckenberg, 1905. In addition, a specimen from the Lower Permian deposits of the southern margin of the Fergana Valley (Asselian; Karachaty Range), which was described by Popova (1972) as the subspecies *Amaurotoma komishani karachatyrica*, should be assigned to this species.

The species *M. rossica* was established by Stuckenberg (1905) based on a single print from the upper Pennsylvanian of Samarskaya Luka. Unfortunately, the original gastropod material for Stuckenberg, which were housed in Kazan University, was lost. Judging from a pencil image of the cast, the original was represented by an imprint of a coil fragment. Due to the incompleteness of the original, the subsutural ramp at the last whorl appeared strongly inclined, and the details of the morphology of the initial whorls, the basal part of the shell and the aperture are unknown

(Stuckenberg, 1905, pl. 12, fig. 19). On the other hand, the identification of this species is simplified due to the distinct appearance of the shell and the characteristic ornamentation, consisting of numerous spiral lirae and large nodes marking the periphery of the subsutural ramp.

The studied specimens are mainly represented by incomplete imprints. The only exception is the smallest. Due to its good preservation, it shows morphological changes in the first whorls. Thus, the diagnosis of this species can be successfully assembled like a puzzle from comparison of the features observed on different imprints, which complement one another.

DISCUSSION

It is not clear why Popova did not compare her described specimen with Stuckenberg's species (Popova, 1972, p. 91). However, its generic placement, considering the state of preservation of the studied specimen, seems very plausible. The similarity of characters of *M. rossica* with some diagnostic characters of the genus *Amaurotoma* is apparent. A more detailed study of the material described here showed that the morphology of the growth lines and ornamentation of *M. rossica* do not fit into the diagnosis of the genus *Amaurotoma*; therefore, a new genus, *Alanstukella* gen. nov., is proposed for its placement.

In all *Amaurotoma* species, the growth lines on the subsutural ramp and lateral surface of adult whorls are to some extent sinusoidally curved, while in *Alanstu-*



Fig. 1. Localities of *Alanstukella rossica* (Stuckenberg, 1905).

kella rossica (Stuckenberg, 1905), the growth lines are almost straight and lie on different parts of the whorl almost in the same plane. Such a morphology of growth lines is characteristic of the juvenile stages of the teleoconch of *Amaurotoma*; therefore, the preservation of this character in *A. rossica* at adult stages may indicate a pedomorphic origin for this species.

Despite its relatively wide geographical distribution (Fig. 1), *A. rossica* is a very rare species. In all collections assembled by the present author, as well as in collections collected in Samarskaya Luka (Stuckenberg, 1905) and in South Fergana (Licharev, 1967, 1968; Popova, 1972), this species is represented by occasional specimens. Moreover, material has been collected from the locations of South Fergana and the East European Craton for decades. The rarity of this species is especially emphasized by its large size (it is difficult not to notice during sampling).

Interestingly, in the description of the specimen, which was “4 cm in length”, Stuckenberg indicated its relatively large size. This once again emphasizes the fact that gastropods, in general, are small animals. Shells of the Late Paleozoic gastropods that exceed 3.5 cm are usually classified as “large”. Therefore,

finds of specimens up to 15 cm are perceived as something unusual (Kues and Duchene, 1990).

As for *A. rossica*, it is one of the largest species of Late Paleozoic gastropods. The diameter of the largest imprint found in the Late Asselian–Early Sakmarian limestones of Shakhtau was about 25 cm. At present, the only known species larger than *A. rossica* is *Murchisonia yabei* Hayasaka 1943 from the Late Permian of Japan (Capitanian), reaching 40 cm long (Hayasaka 1943; Hayasaka and Hayasaka, 1953). The generic assignment of this species requires revision.

At the same time, other large gastropods and bivalves were described from this location, including *Pleurotomaria yokoyamai* Hayasaka. The latter reaches a size of 18×16 cm (Hayasaka, 1943). More recently, *P. yokoyamai* was proposed as the type species for the genus *Nipponomaria* Asato and Kase, 2016.

Due to the similarities in the shape of the shell, the whorl section, and the ornamentation, *Nipponomaria yokoyamai* (Hayasaka, 1943) and *Alanstukella rossica* are twin species. However, they differ in one important morphological character, that *Nipponomaria* has a narrow and deep selenizone (Asato and Kase, 2016).

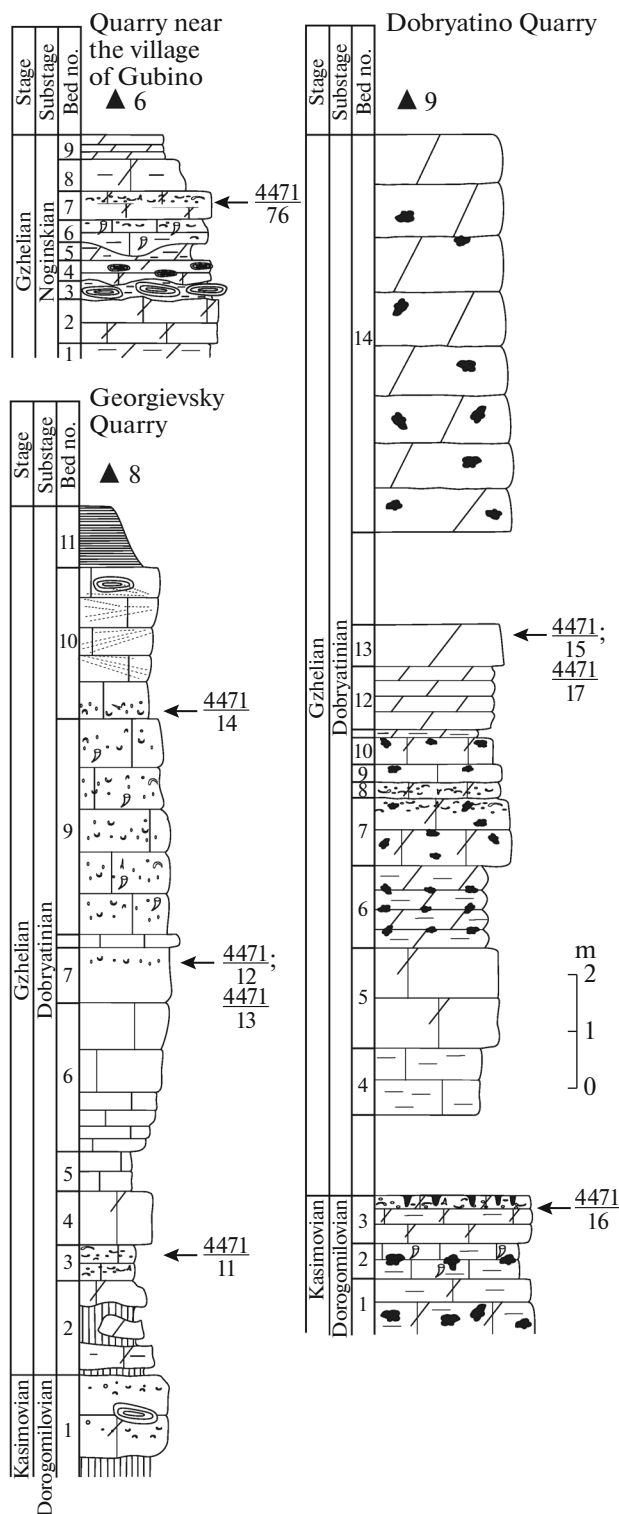


Fig. 2. Stratigraphic position of mollusks in the section of the Georgievsky and Dobryatino quarries and a quarry near the village of Gubino.

MATERIAL

The described species is represented by 11 specimens in the collection of the Paleontological Institute. The most important material comes from the

Dobryatino Quarry. The numbers of localities in the quarries of Dobryatino, Georgievskoye (Vladimir Region), and Gubino (Moscow Region) were published previously (Mazaev, 2011, Fig. 7). Unfortunately, at the editing stage in the publishing house, the locality numbers were changed and printed out with errors. Therefore, all three sections with original locality numbers are re-illustrated in this paper (Fig. 2).

The largest specimen of the species described here was found in the reef limestones of Shakhtau (location no. 5538/1, expedition 2015). It was represented by a print of a coil in a huge slab of limestone, more than 10 m long. Unfortunately, this block was destroyed by mining equipment the day after it was discovered. Only two similar specimens, but of smaller size, were found a year later during the third expedition. Both specimens were discovered by A.S. Byakov (Northeast Complex Research and Engineering Institute of the Far Eastern Branch of the Russian Academy of Sciences, Magadan). One of them is represented by a mold, the second by the external imprint of the initial whorls with the details of ornamentation (specimen no. 5538/11-44, 5538/11-45). The third, largest of the available specimens, was discovered by the author during the fifth expedition, in the autumn of 2017. Its maximum diameter reaches 18 cm (Fig. 3). Limestones of all three localities are confined to the Asselian and Sakmarian boundary beds. These findings determine the uppermost distribution boundary of the species.

The earliest representative of this species was discovered by A.A. Shkolin in the dumps of the development of the Timiryazevskaya Line of the Moscow Metro in 1988. This specimen comes from the Suvorovo Formation of the Krevykinskian Regional Substage of the Kasimovian. The specimen is quite large. The inner mold bears imprints of ornamentation on the outer surface of the shell (Fig. 4g). This preservation is explained by the dissolution of the shell, almost synchronous with the process of compaction of the sediment and is characteristic of all clayey limestones of the Moscow Basin. The specimen is distorted but has all the attributes necessary to identify it to species.

Details of the structure of the sculpture, as well as features of ontogenetic changes are observed on specimens collected by the author in 1991 in the Dobryatino Quarry. Two large specimens are represented by imprints of coils and come from the basal part of the Gzhelian (Dobryatinian Regional Substage, locality no. 4471/17). The elements of the sculpture are well preserved on the prints, however, the initial revolutions are very worn, the aperture is absent (Figs. 4c–4e). The smallest specimens are represented by two more complete imprints. Both specimens come from the terminal part of the Kasimovian (Dorogomilovian Regional Substage, locality no. 4471/16). At present, these are the only specimens showing the morphology of poorly



Fig. 3. *Alanstukella rossica* (Stuckenberg, 1905), specimen PIN, no. 5538/15-1, full imprint and mold, covered with crusts of calcite crystals and ozokerite; Republic of Bashkortostan, Shakhtau; Asselian-Sakmarian boundary beds, Lower Permian.

preserved protoconchs and well-preserved initial whorls (Figs. 5a–5c).

The morphology of the initial and adult whorls of this species varies significantly in ontogeny. Therefore, an important addition was the impression of a medium-sized coil from the Shchelkovo Quarry in the Moscow Region (Gzhelian, Fig. 5d).

Another specimen is represented by a large core (Fig. 4f), which was found by K. Lebedev (Geological School of the Lomonosov Moscow State University) in the Rusavkino Quarry, Moscow Region, locality no. 4471/3. The shape and size class of this mold are identical to that from Shakhtau (specimen no. 5538/11-44).

The eleventh of the studied specimens was discovered by the present author in the Asselian dolomitic limestone of the Soksky Quarry (Samarskaya Luka) in 2013. The specimen (no. 4919/36-1) is represented by an imprint of a large shell fragment with well-preserved ornamentation.

The material is housed in the Orlov Paleontological Museum, Borissiak Paleontological Institute of the Russian Academy of Sciences (PIN RAS), coll. nos. 4471, 4919 and 5538.

SYSTEMATIC PALEONTOLOGY

Family Trochonematidae Zittel, 1895

Genus *Alanstukella* Mazaev, gen. nov.

Etymology. The name is formed from the first letters of the name, patronymic and surname of Alexander Antonovich Stuckenberg, one of the founders of Russian geology.

Type species. *Mourlonia rossica* Stuckenberg, 1905; Russia, Samarskaya Luka; *Bellerophon* horizon; upper Carboniferous, Gzhelian.

Diagnosis. Protoconch almost planispiral. First teleoconch whorls rounded in cross section. Lateral surface of adult whorls above and below bounded by distinct carinae. Subsutural ramp wide. Umbilical and basal surfaces separated by distinct carinate shoulder. Shell surface ornamented with numerous spiral cordlike lirae; the first adult whorl with very thin collabral ribs following course of growth lines. Upper carina in adult whorls can be marked by several large tubercles. Growth lines on subsutural ramp, lateral and basal surfaces almost straight, lying in the same plane, distinctly prosocline. Aperture holostomous; on inner surface of shell. Distinct, well-developed canal present under distal part of upper carina.

Species composition. Type species.

Comparison. The new genus differs from *Amaurotoma* Knight, 1942 in the straight growth lines on the subsutural ramp and lateral surface, the development of thin collabral ribs on the initial whorls, as well as a clear separation of the basal and umbilical surfaces with a distinct shoulder.

Alanstukella rossica (Stuckenberg, 1905)

Mourlonia rossica: Stuckenberg, 1905, p. 96, pl. 12, fig. 19.

Amaurotoma komishani karaschatyrica: Popova, 1972, p. 91, pl. 41, fig. 4 (non *Amaurotoma komishani* Licharew, 1967).

Holotype. The holotype is lost.

Description (Figs. 3–5). One very large turbiniform shell. The protoconch is large, about

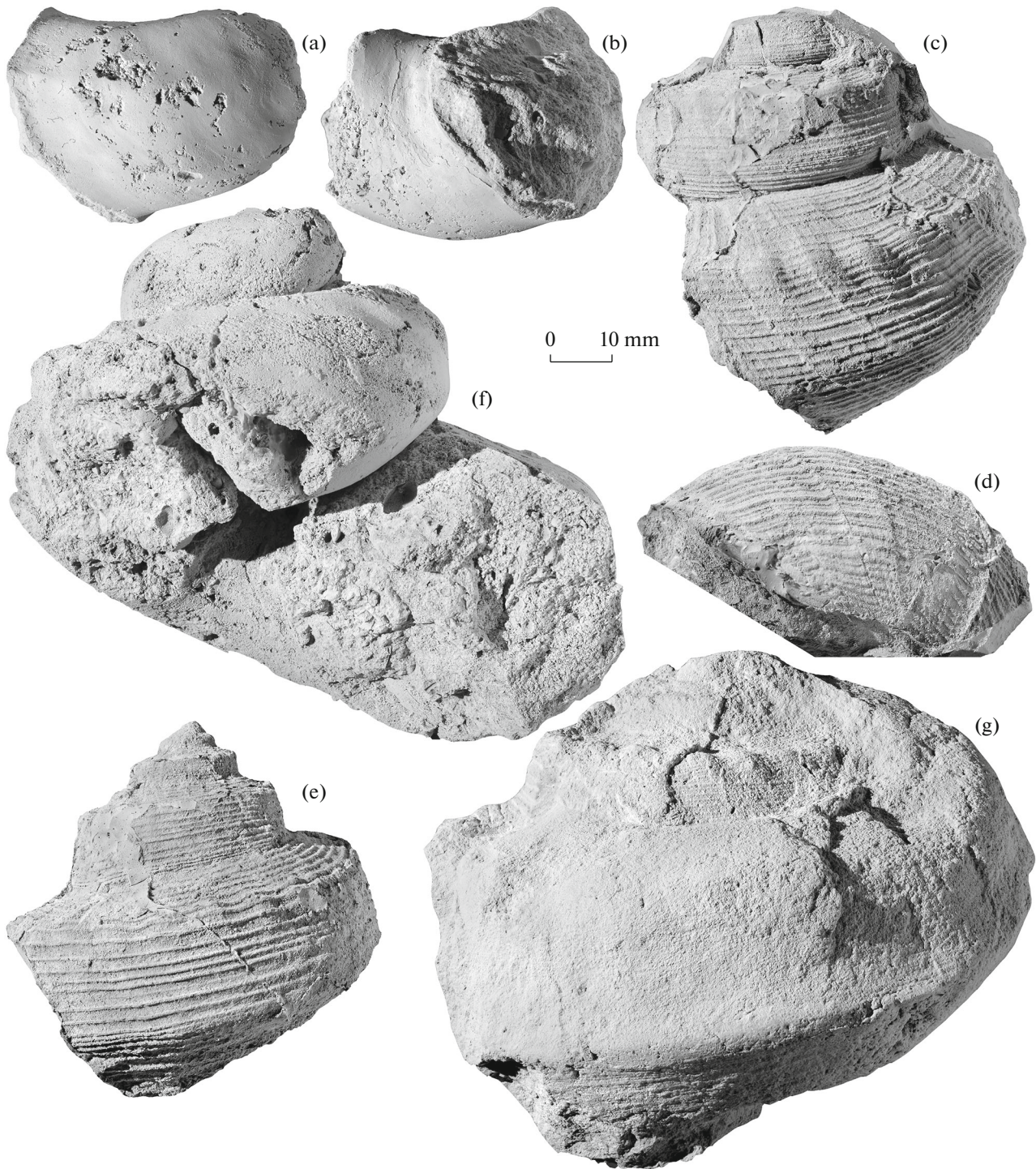


Fig. 4. *Alanstukella rossica* (Stuckenberg, 1905), $\times 1$: (a–d) specimen PIN, no. 4471/17–38: (a, b) mold, inner cast of the beginning of a whorl: (a) lateral view and (b) apertural view; (c, d) latex cast: (c) lateral view, (d) bottom view; (e) specimen PIN, no. 4471/17–39, lateral view; Vladimir Region, Dobryatino Quarry, Gzhelian, Dobryatinian Regional Substage; (f) specimen PIN, no. 4471/3–57, mold; Moscow Region, Rusavkino Quarry; Gzhelian, Dobryatinian Regional Substage; (g) specimen PIN, no. 4471/20–120, mold with an imprint of the external ornamentation; Moscow, dumps of the Timiryazevskaya Line of the Moscow Metro; Kasimovian, Kreviakinian Regional Substage.

0.5 mm, almost planispiral. Three initial whorls are rounded in cross-section; on the third whorl the lateral surface is flattened. The surface of the whorls is

covered with approximately nine thin cordlike spiral lirae, the intercostal spaces are flattened, 1.5–2 times wider than the thickness of the ribs. The sutures are

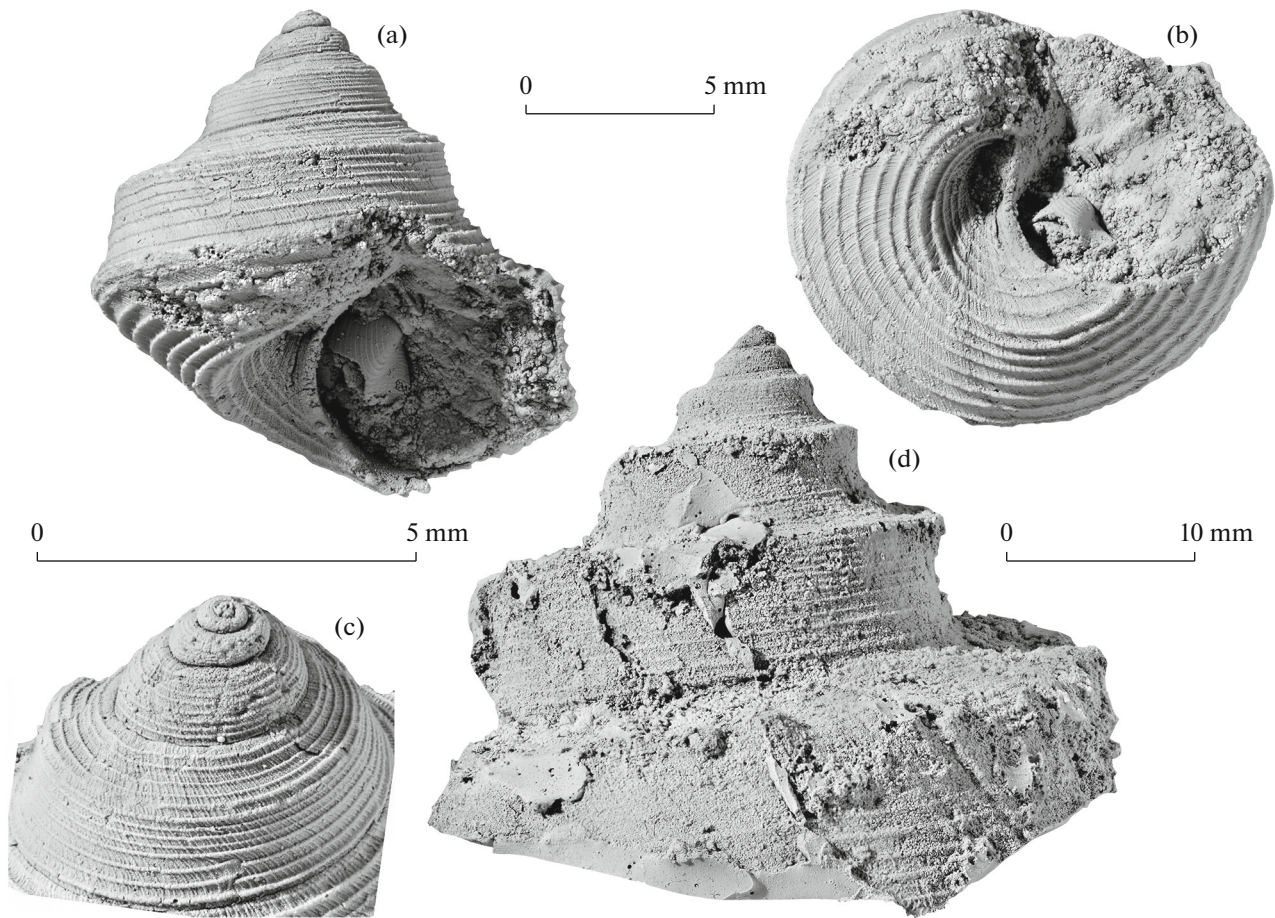


Fig. 5. *Alanstukella rossica* (Stuckenberg, 1905): (a–c) specimen PIN, no. 4471/16-42, latex cast: (a, b) apertural view and bottom view, $\times 5$; (c) poorly preserved protoconch and initial whorls, $\times 10$; Vladimir Region, Dobryatino Quarry; Kasimovian, Dorogomilovian; (d) specimen PIN, no. 4471/4-36, latex cast; Moscow Region, Shchelkovo Quarry; Gzhelian, Dobryatinian Regional Substage, $\times 2.5$.

deep and impressed. On the third whorl, there are clear growth lines: almost straight or very weakly prosocytic, prosoclinally inclines to the axis at about 27° . At the fourth whorl, a wide subsutural ramp is formed, separated from the lateral surface by a sharp carina. The suture is thin and clear, shallow. The surface of the subsutural ramp is slightly concave, convex near the suture, ornamented with five or six cordlike spiral lirae. Their thickness is about the same as on the previous revolution; the width of the intercostal spaces increases significantly; some intercostal spaces can carry a very thin additional lirae of the second order. Clear cordlike collabral ribs appear. Their thickness is less than spiral. The shape of the ribs coincides with the shape of the growth lines: straight, prosocline, adjacent to the suture at an angle of about 60° , directly near the seam sharply curved. The lateral surface of the revolution is straight or slightly concave, inclined to the axis of the shell at about 17° , ornamented in approximately the same way as the subsutural platform, the number of spiral lirae varies from eight to nine. The width of the intercostal spaces gradually

increases downward. The collabral ribs on the lateral surface are straight, inclined at about 30° . The basal surface in the profile is almost straight, distinctly inclined, separated from the lateral and umbilical surface by sharp carinae, ornamented with seven or eight massive cordlike lirae. The intercostal spaces are sharply concave, their width is approximately comparable to the thickness of the ribs, slightly decreases closer to the umbilical region. The umbilical region is slightly convex, ornamented with six or seven cordlike spiral lirae; closer to the umbilicus, their thickness decreases markedly. The intercostal spaces wide, flattened, closer to the umbilicus become narrow. The collabral ribs on the basal and umbilical surfaces are distinct, but thinner than on the subsutural area and whorl lateral surface. On the subsequent whorls, the number of main spiral lirae remains almost unchanged, while the width of the intercostal spaces significantly increases. Additional lirae of the second and third order appear in different variations on the subsutural site, as well as on the lateral and basal surfaces, but disappear at the gerontic stage. The thick-

ness of the collabral ribs gradually decreases to thin, hairlike. Starting from the fifth whorl, very sharp, almost impressed lines of growth are formed in their place. From about the sixth or seventh whorl, large nodes slightly elongated collabrally begin to form on the upper carina. On subsequent whorls, they increase in size, in terms of rounded or slightly elongated along the collabral ribs. The profiles of the upper and lower carinae become less prominent; a distinct shoulder between the basal and umbilical surfaces disappears. On the last whorl of the largest specimens, nodes can be developed to varying degrees, while the intercostal spaces become very wide and flattened. The aperture is holostomous, with a short channel, which is located under the upper carina. The apertural margins are thin, lie almost in one, sharply oblique plane. The columellar lip is slightly arched, curved, smoothly passes into the basal lip. The umbilicus is perforated and narrow. The shape of the growth lines on adult whorls coincides with that of the growth lines on the first whorls.

Dimensions in mm:

Specimen no.	Shell height	Maximum diameter
4471/3-57	≥873.0	100.0
4471/4-36	≥27.0	>32.0
4471/16-35	>12.5	>13.7
4471/16-42	12.9	12.9
4471/17-38	61.4	>61.2

Occurrence. Kasimovian and Gzhelian of the Moscow Basin and on the Oka-Tsna Swell; Kasimovian, Gzhelian, and Asselian in Samarskaya Luka; Asselian and basal part of the Sakmarian in Bashkortostan Shikhans; Asselian of the southern margins of the Fergana Valley.

Material. Altogether 11 specimens: locality no. 4471/3—1 specimen; locality no. 4471/4—1 specimen; locality no. 4471/16—2 specimens; locality no. 4471/17—2 specimens; locality no. 4471/20—1 specimen; locality no. 4919/36—1 specimen; locality no. 5538/11—2 specimens; locality no. 5538/15—1 specimen.

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