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Heterobranchia (Gastropoda) from the Jurassic Deposits of Russia

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Abstract—Small gastropods from the Jurassic deposits of the European Russia, united into the lower Heterobranchia or Allogastropoda, are described. The families of Ampezzanildidae, Cimidae, Cornirostridae, Ebalidae, and Stuoraxidae are distinguished, and a set of taxa is given without reference to a definite family. The family Ampezzanildidae from the Jurassic deposits is described for the first time on the basis of the mass material, ascribed to the new genus *Zizipupa* gen. nov. with the sole species of *Z. costata* sp. nov. The family Cimidae includes the genera of *Cristalloella, Rotfanella*, *Urlocella,* and *Unzhispira gen. nov.* with species *C. spiralocostata* (Gründel, 1998), *R. gerasimovi* sp. nov., *R. reticulata* sp. nov., *Urlocella undulata* sp. nov., and *Unzhispira minuta* sp. nov. The genus *Heteronatica* gen. nov. is included into the family Cornirostridae. This genus is the first siphonostomatous representative of the given family including the sole long-living species *H. globosa* sp. nov., which is subdivided into subspecies *H. globosa globosa* and *H. globosa promota* subsp. nov. The family Ebalidae is represented by the genus *Ebala*, shells of which are distributed from the Middle Oxfordian to the Middle Volgian. The family Stuoraxidae is described based on two genera *Stuoraxis* and *Aneudaronia* gen. nov., including species of *S. crassa* sp. nov. and *A. elegans* sp. nov. The genus *Doggerostra*, which fits into different families of Heterobranchia in terms of shell morphology is represented by the species *D. riedeli* Gründel, 1998, which was previously known from the Bathonian and Callowian deposits in Poland and Germany, as well as form the Upper Jurassic interval in the Russian Plate. The Middle Volgian subspecies *D. riedeli affinis* subsp. nov. is distinguished in the composition of this species. In addition, the genus *Masaevia* gen. nov. with the sole species of *M. sinistra* sp. nov. is described. Due to so specific shell morphology of this genus, its position in the Heterobranchia system is unclear. It is not improbable that we deal with small planktonic gastropods of protoconchs of unknown group of planktonic or benthic gastropods.

Keywords: Allogastropoda, Oxfordian, Kimmeridgian, Volgian, Russian Plate

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SYSTEMATICS OF THE DESCRIBED GROUPS OF HETEROBRANCHIA

This paper describes some of the Mesozoic smallest representatives of marine macrobenthos, the study history of which has began in the 1990s. Nowadays, they are interpreted as representatives of the subclass Heterobranchia (the so-called lower Heterobranchia or Allogastropoda). Bandel (1995, 1996; the study the Tyrolean Triassic) and Gründel (1998, 1999a, 2007a, 2007b, etc.; the study of the Lower and Middle Jurassic of Europe) made the main contribution to the study of these animals. These authors established that allogastropods were a rather diverse and integral part of benthic assemblages, which has remained unknown due to a small size of shells and laboriousness of their extraction. Shells of this group usually reach 1–2 mm in height or diameter. As follows from the experience of collecting the material, genera with planispiral shells or close to this shape are quite a rare element in the Jurassic assemblages in the Russian Plate, while a number of genera with more or less high-spired shells was markedly higher in some cases. However, adult shells of the latter are less 0.5 mm in diameter. In addition, their shells are thin-walled and very fragile. Due to this, even after 30-year history of studying the Jurassic small gastropods, there are only rare finds of complete shells. As a result, researchers have to work with incomplete specimens. This has resulted in the situation that high-spired shells were not remained in the sieve with smallest size of 0.5 mm, through which the Jurassic samples were sieved. The finer fraction contained abundant foraminifera and protoconchs of larger gastropods, but it was extremely time-consuming to extract allogastropods given the volumes and a number of samples. K. M. Shapovalov, an amateur of paleontology, has carried out such a spider work. Owing to shells extracted it became possible to describe many species. Even the faunistically richest samples, the proportion of allogastropods does not exceed in fact one percent of all shells.

As the variety of allogastropods in the Jurassic deposits of the Russian Plate is significantly lower than that in the Triassic and the Jurassic deposits of Europe, only those families, representatives of which were described, are discussed below. The first group is represented by planispiral shells of the genera of *Stuoraxis* Bandel, 1996 and *Aneudaronia* gen. nov. These genera belong to the family Stuoraxidae Bandel, 1996[1] and are characterized by the presence of a short heterostrophic protoconch. Due to early torsion, the embryonic and the early larval stages are sinistral of the protoconch, while the other whorls are already dextral. This is expressed in submergence of the beginning of the protoconch into the apex. As a result, the embryonic chamber protrudes from the lower side of the shell. The embryonic stage has a polygonal cellular surface, which is soon replaced by a series of strong transverse folds at the larval stage. The protoconch ends with a expanded aperture, forming a ridge-like thickened process bumping into the preceding whorl of the protoconch. The teleoconch is almost planispiral, but the lower umbilicus is usually deeper; whorls are more or less bilaterally asymmetrical, and the shell is holostomatous. The genus *Sturaxis* is known from the Upper Triassic to Upper Jurassic owing to single finds and is represented by the following species: *S. lehmanni* Bandel, 1996 (Upper Triassic, Carnian of the Italian Alps), *S. angulata* Gründel, 2007 (Jurassic, Toarcian and Aalenian of Germany), *S. wareni* Kaim, 2004 (Middle Bathonian of Poland), S. *parvula* Gründel, 1998 (Middle Jurassic, Lower or Middle Callovian of Germany), and *S. crassa* sp. nov. (Upper Kimmeridgian of the Russian Plate), whereas the genus *Aneudaronia*, which is described below, is represented by the only species *A. elegans* sp. nov. from the Lower Kimmeridgian of the Russian Plate. Initially, Stuoraxidae species were attributed to Archiectonicoidea (Bandel, 1996) and, then, to Omalogyroidea (Bouchet at al., 2005) that was accepted in the subsequent articles (Gründel, 2007b, 2014).

The following forms with a low spire and shells close to helicoid or naticoid in shape are as follows: genera of *Doggerostra* Gründel, 1998 and *Heteronatica* gen. nov. *Doggerostra* were ascribed by Gründel to Cornirostridae Ponder, 1990 (Gründel, 1998, 2003), while Kaim (Kaim, 2004; Kaim et al., 2017) consider them as synonyms of *Bandellina* Schröder, 1995. At first, *Bandellina* was attributed to Cornirostridae (Schröder, 1995); later, it was suggested to include this genus into Hyalogyrinidae Warén et Bouchet, 1993 (Kaim et al., 2017). There are great problems in comparison of modern and fossil Valvatoidea (Cornirostridae, Hyalogyrinidae) and Orbitestelloidea (Orbitestellidae, Xylodisculidae), as the representatives of the latter are often indistinguishable based on the shells, and unambiguous identification is possible only on the basis of the anatomy of a soft body. This is a reason of discrepancies in the systematic position of the genera under discussion. Due to this, it seems logical to consider the genera *Bandellina*, *Doggerostra* and *Alexogyra* Bandel, 1996 as taxa of unclear systematic position in the lower Heterobranchia. In our opinion, *Doggerostra* and *Alexogyra* should not be consider as synonyms of *Bandellina*, as they are distinctly different in the features of a shell. In terms of morphological features, the shells *Doggerostra* reminds above all the modern *Cornirostra* Ponder, 1990 or *Xenoskenea* Warén et Gofas, 1993, and *Alexogyra* is very similar to modern *Xylodiscula* B. Marshall, 1988. However, it is not improbable that species *Alexogyra* and *Doggerostra* belong to the same genus, but varying in a spire height. When describing modern Valvatoidea a significant change in a whorl height within a genus was mentioned repeatedly (for *Hyalogyra expansa* B. Marshall, 1988 (Marshall, 1988); *Cornirostra pellucida* (Laseron, 1954) (Ponder, 1990)). The monotypic genus *Bandellina* is different from *Doggerostra* and *Alexogyra* in a thick-walled shell with tightly adjoining whorls. Due to this, they are separated by the surface suture. The very similar shells are included into the modern genus *Tomura* Pilsby et McGinty, 1946 from the family Cornirostridae (for example, *T. depressa* (Granata, 1877) (Warén et al., 1993: p. 3) and *T. apextruncatus* Rubio, Rolán et Fernández-Garcés, 2013 (Rubio et al., 2013: p. 82).

These three genera are characterized by the occurrence of a short planispiral protoconch with a poorly defined hyperstrophy on the initial half a whorl. This is expressed in a slight submergence of an embryonic chamber into the apex of a shell, whereas the torsia occurred at the beginning of the larval stage. An embryonic chamber has polygonal–cellular or sculptured surface, which becomes smooth at the larval stage. The protoconch is ended by more or less defined terminal extension and is separated distinctly from the following planispiral or low-spired holostomatous teleoconch. All genera are monotypical. The genus *Doggerostra* includes long-living species *D. riedeli* Gründel, 1998 (Middle Bathonian–Middle Volgian of Europe). At this, it cannot be excluded that we deal with several species, which are different in anatomy, but not in conchology. In addition, a poorly preserved specimen of *Doggerostra* sp. with similar morphology of a shell was described from the Upper Bajocian of Germany (Gründel, 2003, p. 77). *Alexogyra* includes *A. magna* Gründel, 1998 from the Bathonian of Germany and Poland. Also, we ascribe *Alexogyra* n. sp. from the same stratigraphic interval (Gründel, 2003, p. 76) to *Alexogyra* and *B. laevissima* Schröder, 1995 from the Lower Valanginian of Poland to the genus *Bandellina*

New genus *Heteronatica* differs in rather high-spired naticoid shells with a short planispiral protoconch consisting of two whorls, with poorly defined hyperstrophy. The teleoconch whorls are smooth,

[1] In a number of papers (Kaim, 2004; Bouchet et al., 2005, 2017), 1994 year is mentioned as the date of the family. This is an incorrect reference to Bandel's works (Bandel, 1994a: p. 149; 1994b: p. 89), in which the family Stuoraxidae and its genera of Stuoraxis and Ampezzogyra are only mentioned and/or discussed, although the valid taxonomic description was made only in 1996 (Bandel, 1996: pp. 346–350).

tightly adjoining to each other; with a narrow slit-shaped umbilicus, surrounded by a high ridge. It should be especially noted the remarkable siphonostomy of the aperture, which forms a short triangle projection, from which an umbilical ridge become developing. Shell is thick-walled, solid, with thick lips. In terms of morphology, *Heteronatica* is very similar to Cornirostirdae, being different from other genera, first of all, in the siphonostomy of a shell. This difference is not critical, as there are known cases of the occurrence of siphonostomatous and holostomatous forms within the single family (for example, Rissoidae Gray, 1847 and Mathildidae Dall, 1889). Due to this, *Heteronatica* was attributed to Cornirostridae. The genus was distinguished based on the sole long-lived species *H. globosa* sp. nov. (Middle Oxfordian–Middle Volgian Stage of the Russian Plate); the morphology of an umbilical ridge in this species changes gradually. This made it possible to distinguish two subspecies: *H. globosa* s.s. (Middle Oxfordian–Lower Kimmeridgian) and *H. globosa promota* subsp. nov. (Upper Kimmeridgian–Middle Volgian).

Other allogastropods are represented by slender high-spired forms, of which mollusks are the most diverse attributed to the superfamily Cimoidea. Initially, they were ascribed to the family Tofanellidae Bandel, 1995[2], which included the genera of *Camponaxis* Bandel, 1995, *Cristalloella* Bandel, 1995, and *Tofanella* Bandel, 1995 and was a part of the superfamily Mathildoidea (Bandel, 1995). Later, the composition of this family was extended, and the family was subdivided into two subfamilies: Tofanellinae (*Camponaxis*, *Cristalloella*, *Tofanella*, *Wonwalica* Schröder, 1995) and Usedomellinae Gründel, 1998 (*Rotfanella* Gründel, 1998, *Urlocella* Gründel, 1998, *Usedomella* Gründel, 1998) (Gründel, 1998). Later, the Usedomellinae composition was extended by *Conusella* (Gründel, 1999) and *Graphis* Jeffreys, 1867, in which synonomy *Rotfanella* was included (Gründel, 2007b) and also *Reinbergia* Gründel, 2007 (Gründel, 2007a). In the final review (Gründel and Nützel, 2013) subfamilies were absent (they were rejected for the first time in Gründel et al., 2011) and the composition of the family included *Camponaxis*, *Conusella*, *Cristalloella*, *Graphis*, *Neodonaldina* Bandel, 1996, *Tofanella*, *Urlocella*, and *Usedomella*. However, there were opposite points of view. As an example, *Urlocella* was suggested to consider as a synonym to *Chrysallida* Carpenter, 1856 (Pyramidellidae Gray, 1840, Pyramidelloidea) (Kaim, 2004) and *Conusella* as a representative of Pyramidelloidea (family Piramidellidae or as incertae sedis) (Gründel, 1999b; Gründel and Kaim, 2006). Recently, Tofanellidae were synonymized with Cimidae Warén, 1992, Cimoidea (Bouchet et al., 2017).

The genus *Wonwalica* was proposed for the Valanginian species *W. minuta* Schröder, 1995 in December 1995, whereas the genus *Cristalloella* was proposed for the Late Triassic species *C. cassiana* Bandel, 1995 (type species), *C. sinuata* Bandel, 1995, and *C. delicata* Bandel, 1995 in November 1995. Later, *Wonwalica* was firstly included in *Cristalloella* synonymy (Kaim, 2004). Then, it was proposed to restore it to the rank of a subgenus (Gründel, 2006) based on the following criteria: *Cristalloella* – very slender multispiral shells with a sharp carina and a flat base, separated by a sharp bordering spiral rib; *Wonwalica*—usually low paucispiral shells with a less defined carina, always a convex base and its rounded transition into the lateral side (without a bordering rib). In the final review (Gründel and Nützel, 2013) the species are distributed among the subgenera as follows: *Cristalloella* comprises *C. carinata* Gründel, 2006, *C. cassiana*, *C. parva* Bandel, Gründel et Maxwell, 2000, *C. spiralocostata* (Gründel, 1998); *Wonwalica* comprises *C. bandeli* Gründel, 2007, *C. boczarowskii* Kaim, 2004, *C. delicata*, *C. minuta*, *C. pusilla* Gründel, 2006, and *C. sinuata*. The characteristics of the genera remain the same.

Are the criteria for subdividing *Cristalloella* into subgroups consistent? The slenderness of a shell varies equally greatly in both subgenera. Let us compare, for example, *C. cassiana* and *C. spiralocostata* in *Cristalloella* s.s or *C. pusilla* and *C. sinuata* in *Wonwalica*. In terms of morphology and ontogenesis, more than two groups can be distinguished: the species in which the lower carina remained sharp at the level of the suture (*C. cassiana*, *C. parva*) or rose relative to the suture during the ontogenesis (*C. pusilla*), become smooth at the adult stage (*C . minuta*, *C. spiralocostata*, *C. bandeli*, and *C. boczarowskii*), shifted or not relative to the suture, or seems to have been absent initially (*C. sinuata* and *C. delicata*). Also, both subgenera include species with the carina crowned with a thicker rib or species with spiral ribs developed on the latter as on the rest of the whorl surface. In addition, a degree of development of spiral sculpture in both cases varies from striae to threads. In fact, the only sustained difference is the preservation of the carina/bend at the level of the suture in *Cristalloella* s.s., whereas, in case of *Wonwalica*, it shifts upward from the suture or absent. The subdivision of the genus proposed by Gründel has the right to life. However, given the variety of combinations of features used for the diagnostics of the subgenera, this subdivision is conditional. Due to this, it is omitted in this article.

Now, let us consider the morphology of other genera, which were included in the composition of Tofanellidae. The Triassic *Camponaxis* includes species (Bandel, 1995) that are characterized by shells

[2] Dates of the family (1992 and 1994) are erroneous. The family and constituting genera (*Cristalloella*, *Tofanella*, *Wonwalica*) were first mentioned and discussed in articles issued in 1994 (Bandel, 1994a, 1994b), but the factual description of Tofanellidae and type genus *Tofanella* was published in 1995 (Bandel, 1995).

predominated by collabral elements and are shaped like *Cerithidium* (*C. lateplicata* (Klipstein, 1843) and *C. subcompressa* (Kittl, 1894)) or *Epitonium* (*C. beneckei* (Kittl, 1894)). Moreover, they look like elements of an endosculpture[3] in the first two species and—like elements of an exosculpture in the latter species. Later, the following Jurassic species were ascribed to this genus (Gründel and Nützel, 2013): *C. zardinensis* Bandel, Gründel et Maxwell, 2000 (upper Lower Jurassic—lower Middle Jurassic of New Zealand) and *C.* [*Rotfanella*] *costigera* Gründel, 2003 (? Callovian of Germany). The sculpture of these species are represented by thick well-defined endosculptural folds. *Urlocella undulata* sp. nov. with less pronounced folds, as well as *Urlocella minuera* Gründel, 1998 (type species of *Urlocella*, Bathonian and Callovian of Germany and Poland) with even more reduced folds and the appearance of poorly defined spiral sculpture on the first teleoconch whorl are close to them. Of the species included into the *Rotfanella* composition, only *Graphis* sp. is close to *U. minuera* (Gründel, 2007a; Plinsbachian, Germany), which has a similar spiral sculpture and narrower and denser collabral elements, probably already exosculptural. *Rotfanella gerasimovi* sp. nov. (Oxfordian of the Russian Plate), *R. herrigi* Gründel, 1999 (Bathonian of Germany and Poland), *R. reticulata* sp. nov. (Oxfordian of the Russian Plate), *R. rotundata* Gründel, 1998 (type species of the genus *Rotfanella*), *R. weissi* Gründel, 1999 (Toarcian—Aalenian of Germany), *Rotfanella* sp. nov. (Oxfordian of the Russian Plate) have reticulate exosculpture, whereas *R. sinecosta* (Gründel, 2007) (Aalenian of Germany) has only collabral exosculpture. In our opinion, it seems more reasonable to limit *Camponaxis* only by Triassic species, although the combination of species with different genesis of collabral sculpture in the genus is doubtful. The genus *Urlocella* should be limited to species with developed collabral endosculpture to a varying degree, and the rest of species with collabral and reticulate exosculpture should be preserved in the composition of the genus *Rotfanella*. It is natural that such a subdivision is temporary, requiring clarification and verification as new actual data appear. In addition, two Jurassic species were described, assigned conventionally to the genus *Camponaxis*: *C. ? jaegeri* Gründel et Nützel, 2015 with a poorly preserved high-spiral shell with collabral folds and *C. jurassica* Nützel et Gründel, 2015 with a high-spiral *Bittium*-shaped shell from the Plinsbachian of Germany. Based on the division described here, the first species is most similar to *Urlocella*, while the second species should rather be distinguished as a new genus.

The *Urlocella* protoconchs vary in length from 1.7 to 2.2 whorls, the protoconchs of *Rotfanella* are 1.7–2 whorls long. The embryonic chamber in Rotfanella species is short (Pl. 11, fig. 1c), probably with a polygonal scrobiculate surface (Pl. 10, figs. 6a, 6b). The larval stage of *Urlocella* and *Rotfanella* is either smooth with slight growth lines or with a more or less pronounced and prolonged collabral sculptured section. The first 1–1.5 whorls are planispiral, then the whorl begins to quickly lower down. The protoconch looks homeostrophic, but on closer examination one can see that the whorl axis at first is oriented slightly upwards, then its direction becomes reversed and the whorl begins to lower down. The *Rotfanella* protoconchs are also different in the shape of whorls: (a) protoconchs with rapidly growing whorls in diameter (*Rotfanella* sp., Pl. 11, fig. 1; *R. herrigi*) and (b) protoconchs with slower thickening whorls (other species).

It was already mentioned above that *Rotfanella* was suggested to consider as a synonym for the recent genus *Graphis* (Gründel, 2007b), but the situation with the latter is confusing. Jeffreys (1867: p. 102) distinguished the genus *Graphis* for the species *Turbo unicus* Montagu, 1903. Montagu (1803: p. 299) provided the *T. unicus* synonymy, which refers to the figure of the shell in the Walker's atlas (Walker, 1784: p. 11, pl. 2, fig. 40). The atlas gives a very brief description of the very small form without a species definition: "Fig. 40. Turbo. Turris septem anfactibus strigatis apertura ovali. The taper turbo with seven ridged spires and an oval aperture, the colour opaque white, from Sandwich—rare". Apparently, Montagu knew nothing about the later reprint of the Adams's book made by Kanmacher (Kanmacher, 1798; p. 637, pl. 14, fig. 17), in which a reprint of the figure and text added with the species name: "Turbo albidus. Fig. 17. Turbo. T. turris septem anfactibus strigatis apertura ovali. The taper turbo with seven ridged spires and an oval aperture. The colour opaque white. From Sandwich: rare". Nowadays, *Turbo albidus* Kanmacher, 1798 is considered to be an index species, but not the species distinguished by Jeffreys. The synonymy of *Turbo albidus* Kanmacher, 1798 includes *T. unicus*. However, is there any reason to do so? Neither the picture nor the description of *T. albidus* provides any information apart from the fact that the question is some small, high-spired shell. In fact, there is no reason to con-

[3] When studying the shell material with a scanning electron microscope, it was found that the sculpture of gastropods is formed by the thickening of different layers of the shell. The exosculpture is formed due to a local thickening of the outer shell layer. Elements of the exosculpture (ribs, threads, striae) often have sharply outlined boundaries, which is never the case with elements of the endosculpture (folds, spiral bends), which are formed due to thickening the deeper layers of the shell, while the overlying layer covers these thickening parts with almost no changes. Therefore, elements of the endosculpture always have more or less indistinct outlines and boundaries, and rounded profiles. Some forms of relief have a complex genesis; for example, sculpted carinae, which consist of a spiral bend, formed due to thickening of the lower layers of the shell and crowning an exoelement in the form of a rib. Due to this, the bend looks like a pointed carina.

sider the species from the Kanmacher's book (there are discrepancies in the authorship of the species *T. albidus*[4]) as a conspecific to a Montagu's species. Moreover, there are no data on the type series of *T. albidus* in contrast to the syntypes *T. unicus*, the data, including images, on which were recently published (Oliver et al., 2017: p. 407, fig. 91). In this situation, it is reasonable to consider *T. unicus* Montagu, 1803 as a valid type species by monotypy.

The Cenozoic species of *Graphis* have different types of protoconchs. As far as one can judge on images, the type species, *G. barashi* Aartsen, 2002, *G. infans* (Laseron, 1951)[5], *G. menkhorsti* Jong et Coomans, 1988, G. *perrierae* J. Barros, Lima Silva Mello, F. Barros, S. Lima, Carmo Ferrão Santos, Cabral et Padovan, 2003, *G. peruviana* Chira, Chanamé et Kajihara, 2017, *G. underwoodae* Bartsch, 1947 have conical smooth protoconchs with a planispiral semi-whorl at the beginning (Bartsch, 1947; Fretter and Graham, 1982; Aartsen et al., 1984; Aartsen, 2002; Barros et al., 2003; Chira et al., 2017; Linden and Moolenbeek, 2004). They are more high-spired then in the Jurassic representatives and, probably, somewhat longer in whorls. The rounded protoconch of *G. striata* (Jeffreys, 1884) (Giannuzzi-Savelli et al., 2014) looks similar to protoconchs of Jurassic species of *Rotfanella* sp. (described in this paper) and *R. herrigi*. The third group is represented by species with top-flattened protoconchs with spiral, including carinate, sculpture: *G. eocaenica (Boury, 1887), G. eugenei* (Deshayes, 1861) *G. gracilis* (Monterosato, 1874), *G. minutissima* (Deshayes, 1861), *G. pruinosa* Gofas et Rueda, 2014 (Cossmann and Pissaro, 1907[6]; Scaperrotta et al., 2013; Giannuzzi-Savelli et al., 2014; Gofas et al., 2014). The sole exception is *G. pacifica* Bandel, 2005 (Bandel, 2005) with very low-spired protoconch of 1.5 whorls. Another exception are such species as *G. eikenboomi* Linden et Moolenbeek, 2004 and *G. lightbourni* Linden et Moolenbeek, 2004. The first species has low-spired protoconch, which is different from protoconchs of other *Graphis* and Jurassic *Rotfanella*, and noticeably more stocky shell. In terms of morphology the second species is more similar to small rissoid gastropod, than to the Cimoidea representative. Currently, *Graphis* is a conchological genus, that is based on similarity in the shell morphology of recent species, but not on the data on the anatomical structure of the soft body. A review of the most of recent and fossil, in part, species belonging now to the genus *Graphis* demonstrates a significant diversity in the appearance of the protoconchs and the sculpture of the teleoconch (there are species with a reticulate, only collabral or thin spiral sculpture on the teleoconch). Due to this, it seems as if we deal with the combined taxon. If we compare all the groups with *Rotfanella* in terms of morphology, then only *G. striata* has a great similarity in the protoconch with the aforementioned forms, differing in the absence of the spiral sculpture on the teleoconch. *Graphis* s.s. (i.e., the morphological group with *G. unica*) is different from *Rotfanella* in the protoconch morphology, while demonstrating the greatest degree of similarity in the sculpture and the appearance of the teleoconch. In terms of geometry of the protoconchs the species *Graphis* of the type *G. gracilis* are the most similar to the main part of the *Rotfanella*, being different in the sculpture of the protoconchs and teleoconch. Therefore, in author's opinion it would be more reasonable to consider *Rotfanella* in the status of an separate genus. At the same time, as follows from the material depicted by Bandel (2005: p. 22, text-figs. 64–67), the genus *Rotfanella* lived up to the Pliocene.

The last genera from the *Cimidae* family under discussion are *Conusella* and *Reinbergia*. They include rather slender smooth forms with short hyperstrophic protoconchs. Apart from the type species *C. conica* Gründel, 1999, *Conusella* includes poorly preserved shells resembling the type of genus. All of them have anomphaloid shells with orthocline or slightly opisthocyrt lines on the lateral side (*C. conica* (Gründel, 1999b), *C.* sp. (Gründel and Kaim, 2006)). *Reinbergia* includes the sole species *R. inflata* Gründel, 2007, which is characterized by a more stocky phaneromphalous shell with sigmoid-shaped growth lines on the lateral side (Gründel, 2007a). As far as can be judged, the protoconchs in both genera look similar: short (1.7–2 whorls), low-spired, with visible slight submergence of the early whorl due to a poorly defined hyperstrophy, as in *Rotfanella* and *Urlocella* discussed above. The protoconchs are separated from the teleoconch by a marginal fold or a clear line of growth interruption. Here, the species of *Unzhispira minuta* sp. nov. is described from the Upper Oxfordian of the Russian Plate, which, like *R. inflata*, has sigmoid-shaped growth lines, narrowly gaping, but differs visually in the homeostrophic protoconch, without visible submergence into the apex (Pl. 14, fig. 5c; Pl. 15, fig. 3b). Due to this, *Unzhispira minuta* sp. nov. is similar to some species of recent *Cima* Chaster, 1896.

When distinguishing the genus *Cima*, Chester includes the following species to its composition: *C. minima* (Jeffreys, 1858) and *C. cylindrica* (Jeffreys, 1856) without focusing on any of them (Aartsen, 1981; Chaster, 1896). At the simple counting, *C. minima*, the first species on the list is customary to consider as type species, but not *C. cylindrica* (for example, Warén, 1993; Rolán and Swinnen, 2014) and not by the monotype (Warén, 1993; Lozouet, 2015). Aartsen

[4] Sherborn reports E. Jacob as an author of *T. albidus* (Sherborn, 1902: p. 28). In addition, in Kanmacher, 1798 (p. 630) is mentioned that Jacob took part in processing the material, published by Walker, as well as he determined the species (Kanmacher, 1798, p. 633), which Kanmacher took from his letter and translated into Latin. Thus, Kanmacher can not be considered as an author of diagnoses and definitions/names of the species.

[5] Image of holotype is given in https://seashellsofnsw.org.au.

[6] The original images is given in https://science.mnhn.fr.

(1981) examined in detail the situation with the identification of species in the later works and with the reference material being used. The slender low-spired smooth shells with a short smooth protoconch consisting of two whorls are attributed to *C. minima* (Aartsen, 1981; Fretter and Graham, 1982; Warén, 1993). The protoconch is conical, looks homeostrophic, without apparent submergence of the early whorl into the apex, separated by a line of growth interruption from the teleoconch. The sigmoid-shaped growth lines on the teleoconch are the same as in the Jurassic *Reinbergia* and *Unzhispira*. The living species of *Cima* are characterized by the same morphology of shells, differing in its slenderness, a length of the protoconch and more or less strongly sigmoid-shaped curved growth lines (*C. cuticulata* Warén, 1993, *C. diminuta* Rolán et Rubio, 2018, *C. inconspicua* Warén, 1993, *C. mingorancae* Rolán et Swinnen, 2014). The subcylindrical shells with thin spiral sculpture are attributed to *C. cylindrica*. Other species (*Cima urdunensis* Bandel, 2005, *C. apicisbelli* Rolán, 2003) should be excluded from *Cima*. According to the protoconch geometry, the *Cima* species are subdivided into two groups. The first group has a large embryonic chamber, which is clearly elevated above the apex of the shell as in the type species, *C. cuticulata*, *C. diminuta* and *C. mingorancae*. The beginning of the protoconch of the second group is more similar to the planispiral: species *C. conspicua* and *C. cylindrica*. At present, the data on external features of the body structure and the pattern of the radula are published only for the species of the first group—*C. minima* and *C. inconspicua* (Graham, 1982; Fretter and Graham, 1982; Warén, 1993). For *C. minima*, there is a text description of the radula, which does not contradict the depicted radula of *C. inconspicua*. The question remains about the anatomy of the second group, which is particularly close to the Jurassic *Unzhispira* in the pattern of the protoconch and the morphology of the shell.

Conusella is different from the both groups in the genus *Cima* in the beginning of the protoconch slightly submerged into the apex and the direction of growth lines, *Reinbergia* differs only in the pattern of the protoconch, as in *Conusella*. However, the species *Cima melitensis* Mifsud, 1998, which was recently attributed to the independent genus *Mifsudia* Mietto, Nafroni et Quaggiotto, 2014 (Mifsud, 1998; Mietto et al., 2014) has the protoconch, similar to that in *Reinbergia*, being different only in the absence of the umbilicus. As evidenced from *Unzhispira minuta* (see description), the degree of presence or absence of the umbilicus is variable even within the species in the given systematic group. Therefore, the question is opened about the synonymy of *Reinbergia* to the genus.

In addition, the shells, which are attributed to the composition of the genus *Cima* were described form the Cenozoic deposits (Lozouet, 2015): *C. neglecta* (A. Janssen, 1969), *C. oligocaenica* Lozouet, 2015, *C. planorbiformis* Lozouet, 2015, *C. tenuispina* Lozouet, 2015 and *C. virodunensis* Lozouet, 2015. The first species is known from the Middle Miocene, the others are known from the Upper Oligocene of Europe. They are different from each other in the pattern of the protoconch and the direction of growth lines, being similar only in small turriculate shell consisting of smooth convex whorls. Based on distinctly elevated embryonic chamber and sigmoid-shaped growth lines, *C. neglecta* (Janssen, 1969, 1984) and *C. virodunensis* match to the first group of the genus *Cima*. In turn, *C. tenuisrpira* is especially similar to the recent *C. cylindrica* from the second group of the genus *Cima* according to less elevated beginning of the protoconch, sigmoid-shaped growth lines and the presence of the spiral sculpture. Based on the submergence of the beginning of the protoconch into the apex and weakly sigmoid-shaped growth lines *C. planorbiformis* corresponds to the diagnosis of the genus *Mifsudia*. In turn,*C. oligocaenica*, having orthocline growth lines, but, probably, with the elevated early protoconch whorl, combines the features of *Conusella* (direction of growth lines) and *Cima* (protoconch).

The following group is the family Ampezzanildidae Bandel, 1995, to which we have attributed the species *Zizipupa costata* gen. et sp. nov. The representatives of the given family are characterized by slender spirally coiled shells and hyperstrophic strongly collabral sculptured protoconchs. They are known from the Tirol Triassic, where they are represented by several genera, greatly variable in the morphology of teleoconch (Bandel, 1995). The find of Ampezzanildidae-type protoconchs from the Jurassic (Callovian) of Germany was previously described in Gründel, 1998. Apart from the presence of numerous protoconchs, our form is represented by a few specimens with partly preserved teleoconch. The latter consists of rounded smooth whorls, coiling into a high spiral. All the Triassic genera have complex sculptured shells and are highly different from the Jurassic form in the teleoconch.

The genus *Falsoebala* Gründel, 1998 was proposed for the Jurassic representatives of the family Murchisonellidae. There are different points of view on the status and the volume of the genus. This genus is considered as the synonym of *Ebala* Gray, 1847 (Kaim, 2004) or independent genus (Gründel, 1998; Nützel and Gründel, 2015). At this, other researchers attribute only some Mesozoic species to *Ebala* (Bandel, 2005). First of all, the opposition of points of view is caused by the pattern of growth lines. Kaim states that growth lines in recent *Ebala* vary from straight growth lines to sigmoid-shaped curved ones, whereas opponents state that there are no published images of *Ebala* species, which could demonstrate sigmoid-shaped growth lines. It is true that despite a rather large number of images of *Ebala* shells, there are a few shells with visible growth lines, and authors of articles pay no attention to their pattern. One can't even say what the pattern of the growth lines is in a type species (*E. niti-*

dissima (Montagu, 1803), since under this name the very close, but different forms probably depicted, or the type species is quite variable in a number of the features. For example, *E. nitidissima* with orthocline growth lines on the lateral side, slightly curving forward at the top of a whorl, close to the suture (Warén, 1994). Another situation is described in (Peñas and Rolán, 2001), where several shells of *E. nitidissima* are depicted and some shells have sigmoid-shaped curved growth lines: prosocyrt on the lateral side, forming opisthocline or opisthocyrt bend near the suture, as in *Falsoebala*. At this, the sculpture and profile of whorls are highly variable. Similar sigmoid-shaped lines depicted for *E. pointeli* (Folin, 1868) in the same paper. The same thing goes for *E. bermudensis* (Dall et Bartsch, 1911), which is erroneously attributed to the composition of *Bacteridium* Thiele, 1929 (Pimenta and Absalão, 2001). *Ebala* included not only species with whorls, which are straightly go to the suture (as those described above), but also species, in which more or less defined shoulder is formed at the top of the whorl (for example, *E. eulimoides* (Fekih, 1969), *E. gradata* (Monterosato, 1878). In addition, shouldered shells include genera of *Pseudochileutomia* Friedberg, 1983 and *Bacteridium*. The unshouldered shells in the given group are characterized by the presence of both orthocline and sigmoid-shaped growth lines, and the direction of these lines can be bend forward and backward. It is probable that the bend is formed after the first teleoconch whorl. This is evidenced from the images of the first whorl of *Ebala*, which show the orthocline character of growth lines (Aartsen et al., 1984; Warén, 1994; Peñas and Rolán, 2001, Pimenta and Absalão, 2001). Another pattern is characteristic of the species with shoulders: sigmoid shape of growth lines develops beginning from the first whorl and the more developed shoulder, the more distinct opisthocyrt bend of lines in the zone of development of shoulder (for example, *E. communis* Bandel, 1995, *E.* spp. in Bandel, 1995, and *P. carinata* (Folin, 1870) (Peñas and Rolán, 2001; Oliver et al, 2015); *B. resticulum* (Dall, 1889) (Pimenta and Absalão, 2001). Thus, sigmoid-shaped growth lines are widely distributed among the recent species, which are ascribed to *Ebala* and related species. Due to this, there is ground to synonymize *Falsoebala* with *Ebala*. Moreover, the sigmoid-shaped pattern of growth lines is characteristic not of all the Jurassic species. For example, growth lines in *E. costata* (Gründel, 1998) and *E. procera* (Gründel, 1998) are almost orthocline with a slight bend forward on a weakly developed shoulder (Gründel, 1998). As seen on images, the specimens from the Russian Plate show sigmoid-shaped curved growth lines: prosocyrt on the lateral side with opisthocyrt bend near the upper suture, with the maximum on the outer edge of the shoulder.

The last described representative is the species *Masaevia sinistra* gen. et sp. nov., which has oval sinistral shells. They are different from the known types of protoconchs in morphology and geometry, as well as in an absence of dextral torsia that is known in forms with clearly sinistral protoconch and dextral teleoconch. In fact, this is unclear whether we deal with small planktonic gastropod or with protoconchs of the unknown group of completely sinistral benthic gastropods. There was already a case of description of new genus based on the protoconch during the study of Jurassic gastropods (Nützel and Gündel, 2015: *Costasphaera*). This is accepted by authors of the taxon. In our collection there is the specimen with a similar protoconch and a fragment of the first teleoconch whorl, indicating that the latter consisted of smooth rapidly growing thin-walled whorls. For this reason, apparently, they are not preserved without the bedrock. The morphology of the *Masaevia* material available is so specific that its position in the Heterobranchia composition is unclear.

Original specimens, used in this article are stored in the Borissiak Paleontological Institute of Russian Academy of Sciences (PIN), collection no. 4814.

SYSTEMATIC PALEONTOLOGY

Family Cornirostridae Ponder, 1990

Genus *Heteronatica* Guzhov, gen. nov.

E t y m o l o g y. The name of the genus indicates the naticoid shape of shells. Feminine gender.

T y p e s p e c i e s. *H. globosa* sp. nov.

D e s c r i p t i o n. Tiny naticoid shell with a short smooth hyperstrophic protoconch. The change of direction of coiling occurred after the hatching of a larva. Due to this, only the very beginning of the protoconch is submerged into the apex. The apertural protoconch edge is straight, with marginal ridge or thin. Whorls of a teleoconch are convex, rounded, and smooth. Growth lines on the lateral side are prosocline. The aperture is oval, with short and slightly convex process anteriorly and rounded–angular conjunction of the lips posteriorly. The umbilicus is slit-like, surrounded by umbilical ridge.

C o m p o s i t i o n. Type species.

D i s t r i b u t i o n. Upper Jurassic in the Russian Plate.

Heteronatica globosa Guzhov, sp. nov.

E t y m o l o g y. From Latin *globosus* (rounded).

H o l o t y p e. PIN, no. 4814/289: Jurassic, Lower Kimmeridgian, Amoeboceras bauhini Zone, *Amoeboceras zieteni* biohorizon; Mikhalenino; Pl. 9, fig. 1.

D e s c r i p t i o n. Tiny naticoid narrow anomphalous shell of up to 1.7 mm high, consisting of two smooth whorls of the coaxial protoconch and about two smooth teleoconch whorls. The suture rather deep. Protoconch hypertrophic, with the first whorl slightly submerging into the apex, with wakly the expanded end. A teleoconch angle is 75°–87°, often

78°–81°. Teleoconch whorls are convex, rounded. On the protoconch and the teleoconch one can see only growth lines, which have prosocline direction on the latter. A last very high whorl is about 80% of a shell height, rounded, with a maximum width in the middle. Umbilicus is slit-like, surrounded by a spiral ridge, covered by coarse growth lines, which can be crossed by spiral threads. The aperture is rounded, with weakly defined siphonostomy as a rounded–angular slightly concave process anteriorly. Lips are thick, forming angular joint posteriorly. The inner lip is non-turned towards the whorl base, the flare-shaped outer lip is often turned outwards.

Species composition. Subspecies *H. globosa globosa* and *H. globosa promota*.

Occurrence. Middle Oxfordian–Middle Volgian of the Russian Plate.

***Heteronatica globosa globosa* Guzhov, subsp. nov.**

Plate 8, figs. 1–4; Plate 9, figs. 1–3

Description. Tiny naticoid, narrow gaping shell of up to 1.7 mm high, consisting of two smooth whorls of the coaxial protoconch and about two smooth teleoconch whorls. The protoconch is hyperstrophic with the first whorl slightly submerging into the apex, with the weakly expanded end. A teleoconch angle is 75°–1°. Whorls of the teleoconch are convex, rounded. On the protoconch and the teleoconch one can see only growth lines, which have prosocline direction on the latter. The last very high whorl is about 80% of the shell height, rounded, with maximum width in the middle. Umbilicus is slit-like, surrounded by a spiral ridge, covered by coarse growth lines and spiral threads. The aperture is rounded, with weakly defined siphonostomy as a rounded–angular slightly concave process anteriorly. Lips are thick, forming angular joint posteriorly. The inner lip is non-turned towards the whorl base, the flare-shaped outer lip is turned outwards.

Comparison. This subspecies is different from subspecies *H. globosa promota* in well developed spiral sculpture on an umbilical ridge and usually flare-shaped outer lip turned outwards.

Occurrence. Middle Oxfordian–Lower Kimmeridgian of the Russian Plate.

Material. Middle Oxfordian: Nikitino (97 spec.), village of Novoselki (1 spec.); Cardioceras densiplicatum Zone: Mikhalenino (1 spec.), Beds $BV_{0/4}$ (9 spec.) and $BV_{0/3}$ (2 spec.), dacha village of Novoselki (42 spec.), “Northern Makariev” (3 spec.); Cardioceras tenuiserratum Zone: Konstantinovo (7 spec.), “Northern Makariev” (23 spec.), Shchurovo (1 spec.); Upper Oxfordian, Amoeboceras alternoides Zone, Amoeboceras ilovaiskii Subzone: Mikhalenino, bed BV_2 (1 spec.); A. alternoides Subzone: Mikhalenino, bed BV_3 (9 spec.); Amoeboceras serratum Zone, A. serratum Subzone: EPhM, quarry 7-2bis (8 spec.), Mikhalenino, bed BV_7 (6 spec.); A. serratum–Amoeboceras rosenkrantzi Zone: Moscow, Brateevo dustrict (1 spec.); Lower Kimmeridgian, Amoeboceras bauhini Zone, Amoeboceras zieteni biohorizon: Mikhalenino, beds BV_9 (17 spec.) and BV_{10} (5 spec.); Amoeboceras kitchini Zone, Amoeboceras bayi Subzone: Mikhalenino, in the middle of bed BV_{12} (5 spec.), beds BV_{13} (8 spec.) and BV_{14} (2 spec.).

***Heteronatica globosa promota* Guzhov, subsp. nov.**

Plate 9, figs. 4, 5; Plate 10, figs. 1–3

Etymology. From Latin *promotus* (late).

Holotype. PIN, no. 4814/295: Jurassic, Middle Volgian, Virgatites virgatus Zone, Virgatites rosanovi Subzone; Moscow, Kuntsevo district; Pl. 10, fig. 2.

Description. Tiny naticoid narrow gaping shell up to 1.5 mm, consisting of two smooth whorls of the coaxial protoconch and about two smooth teleoconch whorls. The protoconch is hyperstrophic with the first whorl slightly submerging into the apex, with the slightly expanded end. The teleoconch angle is 79°–81°, sometimes up to 87°. The whorls of the teleoconch are convex and rounded. On the protoconch and teleoconch are only growth lines, which have prosocline direction on the teleoconch. The very high last whorl is about 80% of the total shell height, rounded, with maximum width in the middle. The umbilicus is slit-like, surrounded by a spiral ridge, covered with coarse growth lines. The aperture is rounded, with weakly defined siphonostomy as a rounded–angular slightly concave process anteriorly. Lips are thick, forming angular joint posteriorly. The inner lip is non-turned towards the whorl base.

Comparison. See description of *H. globosa globosa*.

Remarks. The rudiment spiral sculpture as striae is still preserved on the umbilical ridge of the Upper Kimmeridgian shells, while it is completely disappeared in the Middle Volgian specimens.

Occurrence. Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone–Middle Volgian of the Russian Plate.

Material. Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone, S. subborealis biohorizon: Murzitsy, (25 spec.); Middle Volgian, Dorsoplanites panderi Zone, Zaraiskites scythicus Subzone: Ivkino, bed 3[7] (1 spec.); Virgatites virgatus Zone, Virgatites rosanovi Subzone: Moscow, Kuntsevo district (33 spec.).

[7] Bed numbering is given after the description of the section from Gavrilov et al., 2008.

Family Cimidae Warén, 1993

Genus *Rotfanella* Gründel, 1998

Rotfanella reticulata **Guzhov et Shapovalov, sp. nov.**

Plate 10, figs. 4–6

E t y m o l o g y. From Latin *reticulatus* (reticulate).

H o l o t y p e. PIN, no. 4814/297: Jurassic, Middle Oxfordian, Cardioceras densiplicatum Zone; dacha village of Novoselki; Pl. 10, fig. 4.

D e s c r i p t i o n. Tiny, high-spired, slender, anomphalous shell. The preserved shells have up to three teleoconch whorls; height of less 1 mm. Protoconch coaxial, consisting of 1.8 whorls, with the first planispiral whorl and the subsequent rapidly lowering one. The first whorl without visible submergence into the apex, with cellular sculptured embryonic part. The second whorl shows the development of high collabral folds, which are crossed by wide apart rows of microscopic pustules. The sculpture covers half a whorl, disappearing towards the end of the protoconch. The spiral rim appears on the sculptured stage at the top of a whorl and reaches the maximum development after the disappearance of the sculpture. The end of the protoconch shows the development of opisthocyrtally curved marginal fold. The teleoconch consists of rounded–convex reticulate sculptured whorls separated by a rather deep suture. The teleoconch angle is 18°–21°. The sculptureconsists of well developed collabral ribs and narrower and poorly developed spiral threads. Collabral ribs are slightly prosocline–prosocyrtic. On the last whorl of the holotype are about 30 collabral ribs and 8 spiral threads above the suture. The lateral side passes roundly into the low convex base, on which two–three spiral ribs are visible. The aperture is unknown.

C o m p a r i s o n. This species differs from *R. gerasimovi* in the sculptured protoconch, differently curved and more sharply elevated collabral ribs on the teleoconch, poorly developed spiral sculpture, the pattern of the base; it differs from *R. herrigi* Gründel, 1999 in slowly growing whorls and the sculpture on the protoconch, lower teleoconch whorls with a rarer spiral sculpture on them; it differs from *R. rotundata* Gründel, 1998 in the sculptured protoconch, in teleoconch with prosocline oriented and coarser collabral ribs, a rarer spiral sculpture and rounded whorls without angularity; it differs from *R. sinecosta* (Gründel, 2007) in the sculptured protoconch, in teleoconch by the character, frequency, and the orientation of collabral ribs, the presence of spiral sculpture; and it differs from *R. weissi* Gründel, 1999 in symmetrically convex whorls of the teleoconch, prosocline collabral ribs, and a rarer spiral sculpture.

O c c u r r e n c e. Middle Oxfordian, Cardioceras densiplicatum Zone of the Russian Plate.

M a t e r i a l. Collection of K.M. Shapovalov: type locality (6 spec.).

Rotfanella gerasimovi **Guzhov, sp. nov.**

Plate 10, figs. 7, 8

E t y m o l o g y. In honor of geologist and paleontologist P.A. Gerasimov.

H o l o t y p e. PIN, no. 4814/305: Jurassic, Upper Oxfordian, Amoeboceras alternoides Zone, A. alternoides Subzone; Mikhalenino; Pl. 10, fig. 8.

D e s c r i p t i o n. Tiny high-spired slender anomphalous shell. The preserved shells have up to 3.3 teleoconch whorls; height, about 1.2 mm. Protoconch coaxial, consisting of two smooth whorls, with the first planispiral and subsequent rapidly lowering whorls. The first whorl without visible submergence into the apex. At the end the protoconch is expanded, with straight edge. Teleoconch consists of rounded–convex reticulate sculptured whorls, separated by a rather deep suture. The teleoconch angle is 21°–23°. Sculpture is represented by similar well defined collabral and spiral flat-topped ribs. Collabral ribs are sigmoid-shaped, with prosocyrtic bend at the top of a whorl; there are 25–27 on the last whorl. A number of spiral ribs increases with a shell growth through their adding near the upper suture. On the lateral side of the last whorl are 8–10 spiral ribs. The base is low, flattened, smooth, separated from the lateral side by a rib-like spiral bend. The aperture is unknown.

C o m p a r i s o n. This species differs from all species in separated non-sculptured base. It differs from *R. reticulata* in smooth protoconch, the sculpture pattern of the teleoconch; from *R. herrigi* Gründel, 1999 in slowly growing whorls of the protoconch, lower whorls of the teleoconch covered with coarser and rarer sculpture; from *R. rotundata* Gründel, 1998 in flat-topped sculpture consisting of wider collabral ribs

→

E x p l a n a t i o n o f P l a t e 8

Scale bar 100 μm; shell dimensions for other figures.

Figs. 1–4. *Heteronatica globosa globosa* Guzhov, subp. nov. (1) spec. PIN, no. 4814/285 (shell height 1.5 mm), Mikhalenino, bed BV_{12} (middle), Lower Kimmeridgian, Amoeboceras kitchini Zone, Amoeboceras bayi Subzone: (1a) apertural view, (1b) abapertural view; (2) spec. PIN, no. 4814/286 (shell height 1.6 mm), Mikhalenino, bed BV_{13} (top), Lower Kimmeridgian, the same zone and subzone: (2a) apertural view, (2b) abapertural view, (2c) protoconch, (2d) morphology of a protoconch; (3) spec. PIN, no. 4814/287 (shell height 1.7 mm), Nikitino, Middle Oxfordian: (3a) apertural view, (3b) abapertural view, (3c) morphology of umbilical ridge; (4) spec. PIN, no. 4814/288 (shell height 1.6 mm, diameter 1.5 mm), section "Northern Makariev", Middle Oxfordian, Cardioceras tenuiserratum Zone: (4a) apertural view, (4b) apical view, (4c) protoconch, (4d) the morphology of the initial whorl of a protoconch.

Plate 8

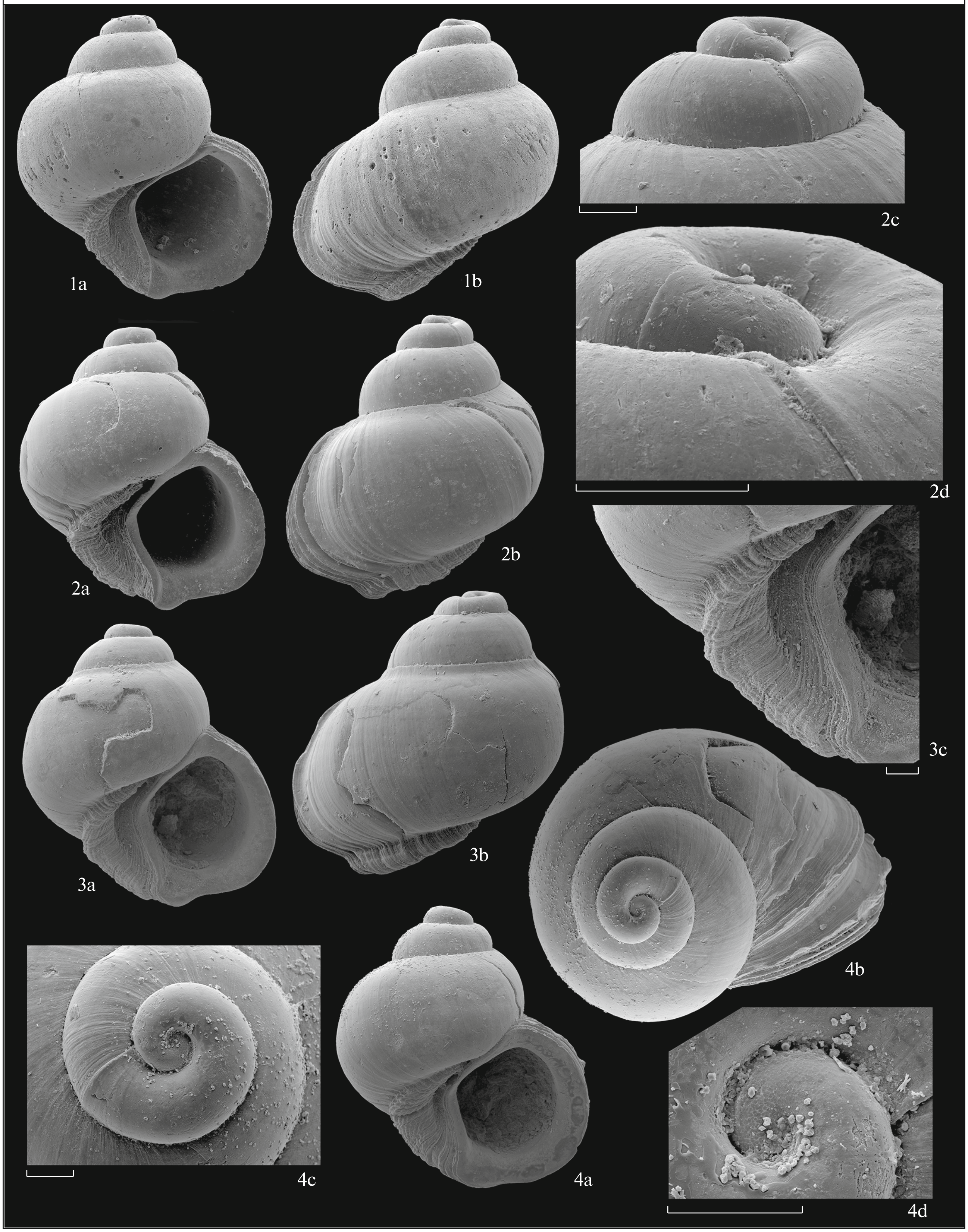
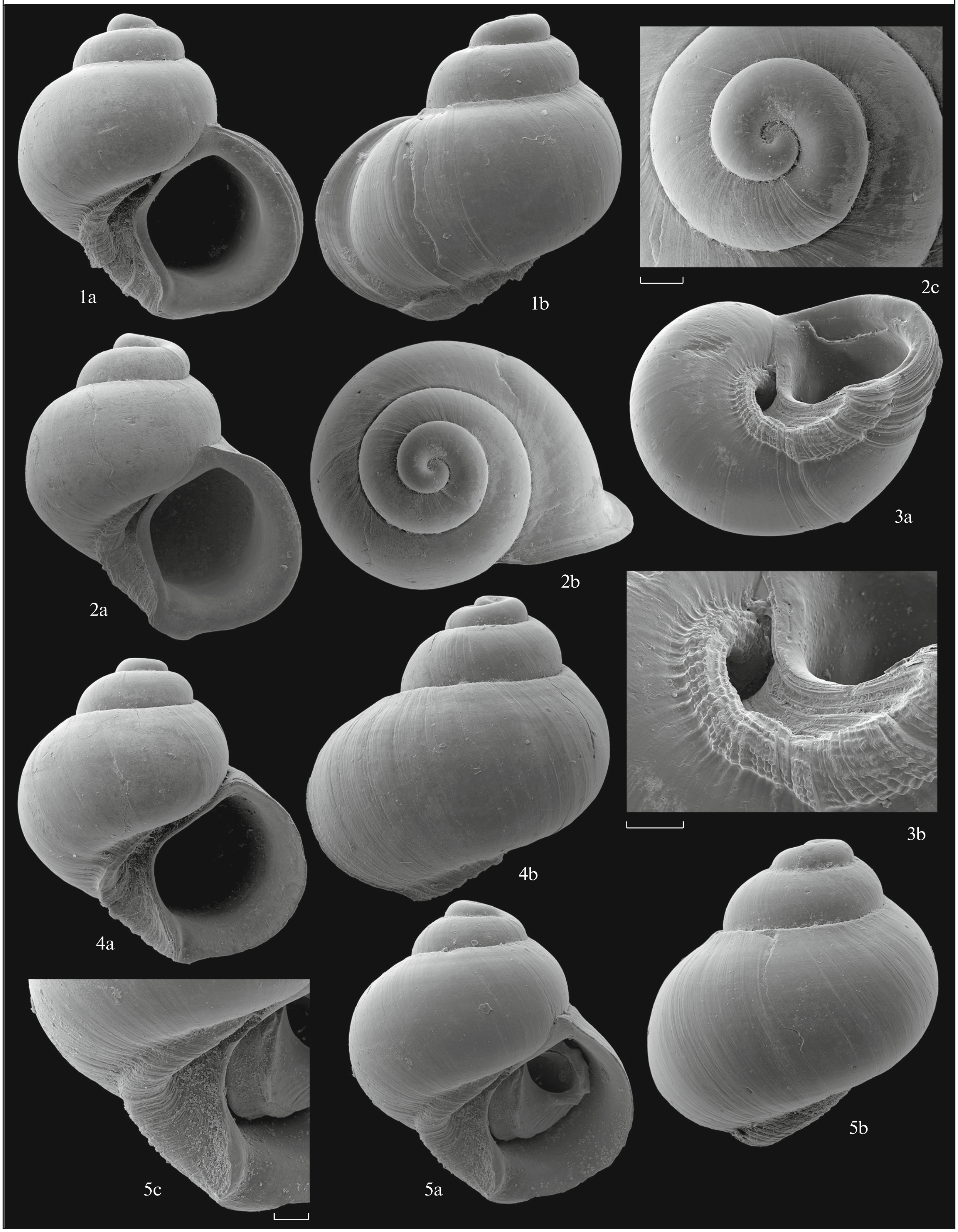


Plate 9



and better developed spiral ribs, rounded whorls without angularity on the lateral side; from *R. sinecosta* (Gründel, 2007) in the wider, flat-topped and rare collabral ribs, the presence of spiral sculpture; and from *R. weissi* Gründel, 1999 in the smooth protoconch, symmetrically convex whorls of the teleoconch, flat-topped sculpture, wider collabral ribs and better developed spiral ribs.

R e m a r k s. *R. gerasimovi* differs from other species of the genus in the presence of separate smooth base, which is similar in morphology to that in species of the genus *Urlocella*. Due to an absence of the spiral sculpture the base od Urlocella is not so morphologically contrast to the lateral side, as in reticulate ribbed *R. gerasimovi*.

O c c u r r e n c e. Upper Oxfordian, Amoeboceras alternoides Zone of the Russian Plate.

M a t e r i a l. Type locality, bed BV_3 (12 spec.).

***Rotfanella* sp.**

Plate 11, fig. 1

D e s c r i p t i o n. Tiny high-spired slender anomphalous shell. The studied specimen has two whorls of a teleoconch and a shell height of 0.6 mm. Protoconch is coaxial, consisting of two smooth whorls rapidly growing in diameter, with the first planispiral and the subsequent rapidly lowering whorls. The first whorl with visible submergence into the apex. The protoconch edge simple, prosoclinally oblique. Teleoconch consists of high convex and reticulate sculptured whorls, separated by a rather deep suture. The sculpture is presented by collabral and spiral ribs, which are similarly developed at the beginning of the first whorl, but, then, collabral ribs become higher in contrast to spiral ones. Within the whorl, the sculpture becomes thinner and more frequent. The last whorl is convex, with the maximum width in the middle, roundly passes into the low weakly convex base with the same sculpture. The aperture is unknown.

R e m a r k s. This shell is very similar to *R. herrigi,* described from the Lower Bathonian of the Baltic Sea Region, being different in rarer and thicker sculpture at the beginning of the teleoconch. At the second whorl the sculpture becomes similar to that of *R. herrigi*. This makes it possible to suggest that our form is connected phylogenetically with *R. herrigi*, but ontogenetic differences of our material (singleness and juvenility) force us to refrain form synonymization or description of new species.

M a t e r i a l. Collection of K.M. Shapovalov: Lower Oxfordian, Cardioceras cordatum Zone: village of Novoselki (1 spec.).

Genus *Urlocella* Gründel, 1998

***Urlocella undulata* Guzhov et Shapovalov, sp. nov.**

Plate 11, figs. 2–7

E t y m o l o g y. From Latin *undulatus* (iridescent).

H o l o t y p e. PIN, no. 4814/307: Jurassic, Upper Oxfordian, Amoeboceras alternoides Zone, A. alternoides Subzone; Mikhalenino; Pl. 11, fig. 6.

D e s c r i p t i o n. Tiny high-spired anomphalous shell. The preserved shells have up to three whorls of the teleoconch and a height of nearly 1 mm. Smooth coaxial protoconch consists of two whorls, with the first planispiral and the subsequent rapidly lowering whorls. The first whorl without visible submergence into the apex. Growth lines are visible only on the protoconch surface. The ending of the protoconch is without marginal fold, prosoclinally oblique. The teleoconch consists of convex rounded whorls, separated by a rather deep suture. The teleoconch angle is 21°–25°. The maximum width of a whorl is in the middle of lateral side. The sculpture is represented by rather relief folds: 20–22 of them on the last whorl in specimens without reduction of folds. They are opisthocline with prosocline bend in the uppermost part of the whorl. With the proper lighting one can see indistinct spiral elements. The lateral side passes roundly into low slightly convex base, which is smooth, sometimes with spiral striation. Sometimes, it is separated from the lateral side by a spiral groove. Aperture is unknown.

C o m p a r i s o n. This species differs from *U. minuera* Gründel, 1998 in more defined folds and absence of the spiral sculpture on the first whorl; from *U. costigera* Gründel, (2003) in less developed collabral sculpture; and from *U. zardinensis* (Bandel,

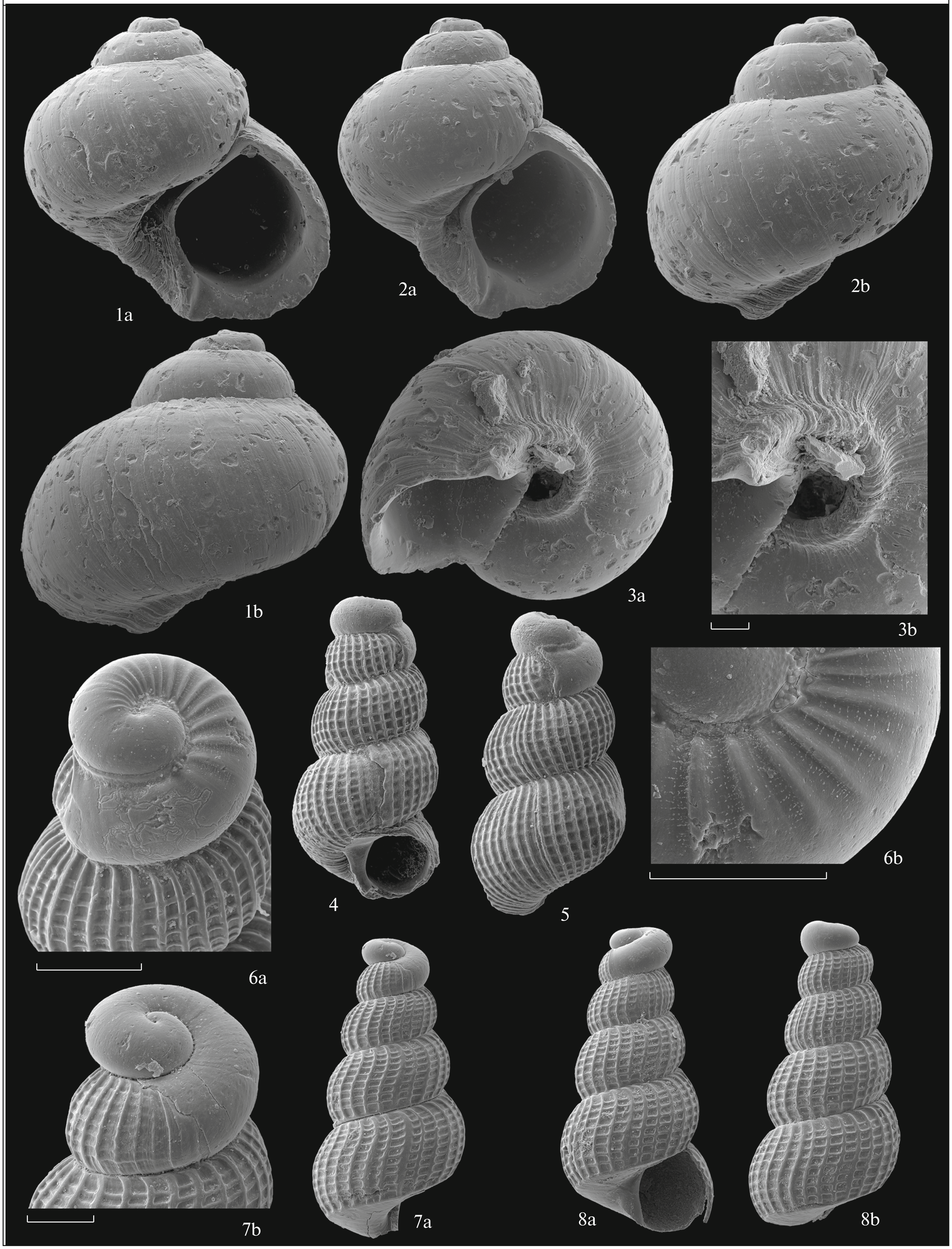
E x p l a n a t i o n o f P l a t e 9

Scale bar 100 μm; shell dimensions for other figures.

Figs. 1–3. *Heteronatica globosa globosa* Guzhov, subp. nov. (1) holotype, spec. PIN, no. 4814/289 (shell height 1.6 mm), Mikhalenino, bed BV_9 (top), Lower Kimmeridgian, Amoeboceras bauhini Zone, Amoeboceras zieteni biohorizon: (1a) apertural view, (1b) abapertural view; (2) spec. PIN, no. 4814/290 (shell height 1.45 mm, diameter 1.3 mm), the same locality and age: (2a) apertural view, (2b) apical view, (2c) protoconch; (3) spec. PIN, no. 4814/291 (shell diameter 1.25 mm), section "Northern Makariev", Middle Oxfordian, Cardioceras tenuiserratum Zone: (3a) abapical view, (3b) umbilicus and umbilical ridge.

Figs. 4 and 5. *Heteronatica globosa promota* Guzhov, subsp. nov., Murzitsy, Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone and biohorizon. (4) spec. PIN, no. 4814/292 (shell height 1.35 mm): (4a) apertural view, (4b) abapertural view; (5) spec. PIN, no. 4814/293 (shell height 1.25 mm): (5a) apertural view, (5b) abapertural view, (5c) morphology of umbilical ridge.

Plate 10



Gründel et Maxwell, 2000) in more slender shell, the profile of whorls, and the pattern of folds.

R e m a r k s. The samplings show variability in a degree of smoothing of the collabral sculpture. The Cardioceras densiplicatum Zone (dacha village of Novoselki) is dominated by specimens without visible rudimentation on the first two–three whorls of the teleoconch, whereas shells with defined smoothing occur in a small amount. The sampling from Amoeboceras alternoides Zone (Mikhalenino) shows the opposite pattern: the predominance of shells with smoothed folds. The rest of localities provide not enough shells of the same completeness to evaluate their variability on the basis of this feature. The differences between the samples from Novoselki and Mikhalenino can be related both to some variations in habitat conditions and to be the result of a gradual evolution, which was reflected in the shift of the morphological norm. Shells from Mikhalenino with reduction of folds were depicted, whereas shells without reduction are shown from other localities.

O c c u r r e n c e. Lower Oxfordian Cardioceras cordatum Zone–Upper Oxfordian Amoeboceras serratum Zone of the Russian Plate.

M a t e r i a l. Middle Oxfordian, Cardioceras densiplicatum Zone: dacha village of Novoselki (1 spec.); Cardioceras tenuiserratum Zone: "Northern Makariev" (2 spec.); Upper Oxfordian, Amoeboceras alternoides Zone, A. alternoides Subzone: Mikhalenino, bed BV_3 (9 spec.).

Collection of K.M. Shapovalov: Lower Oxfordian, Cardioceras cordatum Zone: village of Novoselki (23 spec.); Lower–Middle Oxfordian: Timokhovo (9 spec.); Middle Oxfordian, Cardioceras densiplicatum Zone: dacha village of Novoselki (more 100 spec.); Upper Oxfordian, Amoeboceras alternoides Zone, A. alternoides Subzone: Mikhalenino (45 spec.); Amoeboceras serratum Zone: Mikhalenino (1 spec.).

Genus *Unzhispira* Guzhov, gen. nov.

E t y m o l o g y. From the Unzha River and from Latin *spira* (bend). Feminine gender.

T y p e s p e c i e s. *U. minuta* sp. nov.

D e s c r i p t i o n. The very small turriculate smooth shell with a separate short smooth protoconch. The protoconch is visually homeostrophic, without submergence of its beginning into the apex. Teleoconch whorls are smooth with sigmoidally curved growth lines, forming first an opisthocyrt bend and then, below, a prosocyrt bend. Aperture is rounded, holostomatous, with thin lips.

C o m p a r i s o n. This genus differs from *Reinbergia* Gründel, 2007 in the presence of elevated, not submerged into the apex, first protoconch whorl and from *Cima* Chaster, 1896 in a separate protoconch with smaller embryonic chamber and the first whorl close to the planispiral.

O c c u r r e n c e. Oxfordian of the Russian Plate.

***Unzhispira minuta* Guzhov, sp. nov.**

Plate 13, fig. 1; Plate 15, figs. 1–3

E t y m o l o g y. From Latin *minutus* (small).

H o l o t y p e. PIN, no. 4814/328: Jurassic, Upper Oxfordian, Amoeboceras alternoides Zone, A. alternoides Subzone; Mikhalenino; Pl. 15, fig. 1.

D e s c r i p t i o n. Tiny high-spired shell, reaching 1.4 mm in height. Shells consist of 1.5 protoconch whorls and 4 teleoconch whorls. Protoconch smooth, coaxial, without visible submergence of its beginning into the apex. There are only growth lines on the surface of the last whorl. The anterior edge of the protoconch is thin and orthocline. Teleoconch consists of smooth convex whorls, separated by a rather deep suture. The teleoconch angle is 33°–37°. Growth lines are sigmoid-shaped: transition from opisthocyrt at the top to prosocyrt at the bottom. The last whorl is rounded with the maximum width in the middle. The shell is usually narrow phaneromphalous, sometimes, the umbilicus is more wide. The aperture is rounded with thin lips, roundly connected anteriorly and posteriorly.

O c c u r r e n c e. Middle Oxfordian Cardioceras tenuiserratum Zone–Upper Oxfordian Amoeboceras alternoides Zone of the Russian Plate.

M a t e r i a l. Middle Oxfordian, Cardioceras tenuiserratum Zone: Mikhalenino, bed BV_1 (3 spec.); Upper Oxfordian, Amoeboceras alternoides Zone,

E x p l a n a t i o n o f P l a t e 1 0

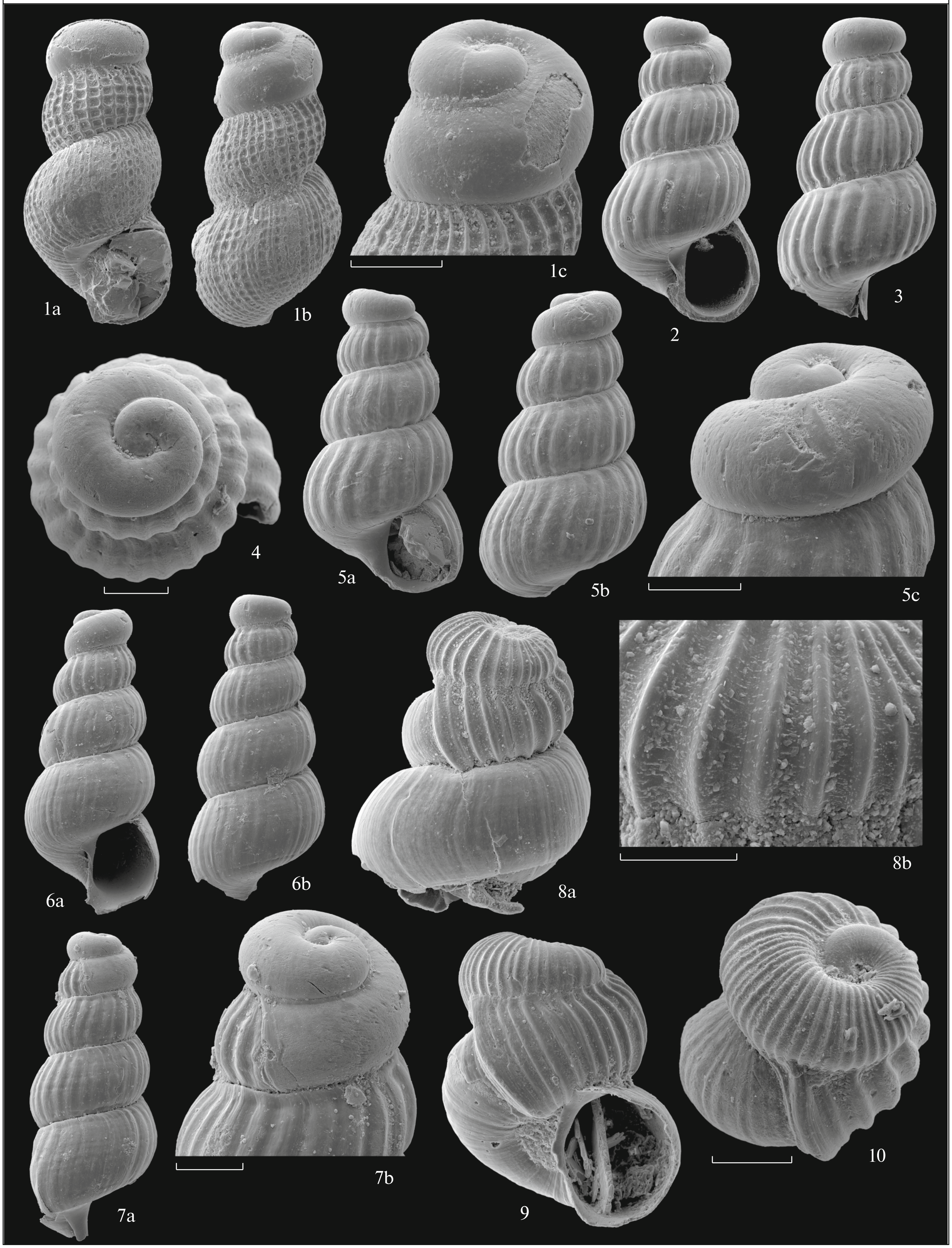
Scale bar 100 μm; shell dimensions for other figures.

Figs. 1–3. *Heteronatica globosa promota* Guzhov, subsp. nov., city of Moscow, Virgatitesvirgatus Zone, Virgatites rosanovi Subzone. (1) spec. PIN, no. 4814/294 (shell height 1.5 mm): (1a) apertural view, (1b) abapertural view; (2) holotype, spec. PIN, no. 4814/295 (shell height 1.5 mm): (2a) apertural view, (2b) abapertural view; (3) spec. PIN, no. 4814/296 (shell diameter 1.25 mm): (3a) abapical view, (3b) umbilicus and umbilical ridge.

Figs. 4–6. *Rotfanella reticulata* Guzhov et Shapovalov, sp. nov., dacha village of Novoselki, Middle Oxfordian, Cardioceras densiplicatum Zone. (4) holotype, spec. PIN, no. 4814/297 (shell height, 0.7 mm), apertural view; (5) spec. PIN, no. 4814/298 (shell height 0.6 mm), abapertural view; (6) spec. PIN, no. 4814/299: (6a) protoconch, (6b) microsculpture on a protoconch.

Figs. 7 and 8. *Rotfanella gerasimovi* Guzhov, sp. nov., Mikhalenino, bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone. (7) spec. PIN, no. 4814/304 (shell height 1.15 mm): (7a) abapertural view, (7b) protoconch; (8) holotype, spec. PIN, no. 4814/305 (shell height, 1.15 mm): (8a) apertural view, (8b) abapertural view.

Plate 11



A. alternoides Subzone: Mikhalenino, bed BV_3 (107 spec.).

Genus *Cristalloella* Bandel, 1995

***Cristalloella spiralocostata* (Gründel, 1998)**

Plate 12, figs. 3–7

Wonwalica spiralocostata: Gründel, 1998, p. 3, pl. 1, figs. 1–3.

Holotype. Paläontologisches Museum der Humboldt-Universität, no. MB.-GA.508: Jurassic, Lower Callovian; Germany, borehole Usedom 1/60; Gründel, 1998, pl. 1, figs. 1–3.

Description. Tiny, high-spired, anomphalous shell, reaching 1.2 mm in height. The shell consists of 1.7 protoconch whorl and four whorls of the teleoconch. The protoconch is smooth, coaxial, without visible submergence of its beginning into the apex. The growth lines are visible on the surface, they can become rough. The protoconch is terminated by sinusigera consisting of the upper opisthocyrtly concave part with a thickened margin and the lower part extending forward. Teleoconch consists of carinate reticulate–ribbed whorls; angle is 24°–26°. The carina runs in the middle of the lateral side. It is well developed, with rounded top and the maximum width of whorls. The sculpture consists of frequent thin spiral and collabral ribs, the latter of which are somewhat higher. At the top of the carina there is no particular sculpture. Collabral ribs are slightly sigmoidally curved, forming a weakly opisthocyrt bend above the carina, turning into a weakly prosocyrt one below. The lateral side passes into the base across a rounded bend, which becomes less sharp and high as a shell grows. The base is low, flattened, covered with the same sculpture (spiral ribs are somewhat defined in relief) as the lateral side. Aperture is not preserved, but it is evident that anteriorly there is a weakly concave outgrowth.

Comparison. It differs from *C. boczarowskii* Kaim, 2004, *C. carinata* Gründel, 2006, *C. minuta* (Schröder, 1995), and *C. parva* (Bandel, Gründel et Maxwell, 2000) in less slender shell, an absence of thicker spiral ribs on the carina and basal–palatal bend. It is also different from *C. minuta* in lower position of the bend; from *C. boczarowskii* in less developed spiral sculpture on the rest of the whorl surface; from *C. boczarowskii* in the absence of thicker spiral rib at the top of the whorl and more developed sculpture on the rest of the whorl surface; and from *C. parva* in the development of the spiral sculpture on the rest of the whorl surface and less coarse collabral sculpture. It differs from *C. bandeli* Gründel, 2007 in the absence of thicker rib on the carina, a different pattern and low position of the basal–palatal bend, which is elevated earlier and faster in *Cristalloella spiralocostata* (Gründel, 1998) above the suture and shifted close to the carina.

Occurrence. Callovian in Germany; Middle–Upper Oxfordian, Amoeboceras alternoides Zone of the Russian Plate.

Material. Middle Oxfordian: Nikitino (18 spec.); Cardioceras densiplicatum Zone: dacha village of Novoselki (8 spec.); Cardioceras tenuiserratum Zone: "Northern Makariev" (6 spec.), Shchurovo (1 spec.); Upper Oxfordian, Amoeboceras alternoides Zone, A. alternoides Subzone: Mikhalenino, bed BV_3 (69 spec.).

Family Murchisonellidae Casey, 1904

Subfamily Ebalinae Warén, 1995

Genus *Ebala* Gray, 1847

***Ebala* sp.**

Plate 15, figs. 4–7

Description. Tiny, subcylindrical, anomphalous shells, up to two mm in height. The protoconch is transaxial, consisting of 1.5 whorls. The latter in the Upper Kimmeridgian specimens are covered with widely spaced spiral rows of microscopic pustules. The boundary with the teleoconch is sharp, with the formation of a small marginal rim. Teleoconch subcylindrical, consisting of weakly convex whorls slowly growing in diameter. At the beginning of the teleoconch, the whorls grow faster in diameter than at later whorls. That is why juvenile shells look less slender than adult ones. The whorls are smooth, usually with

Explanation of Plate 11

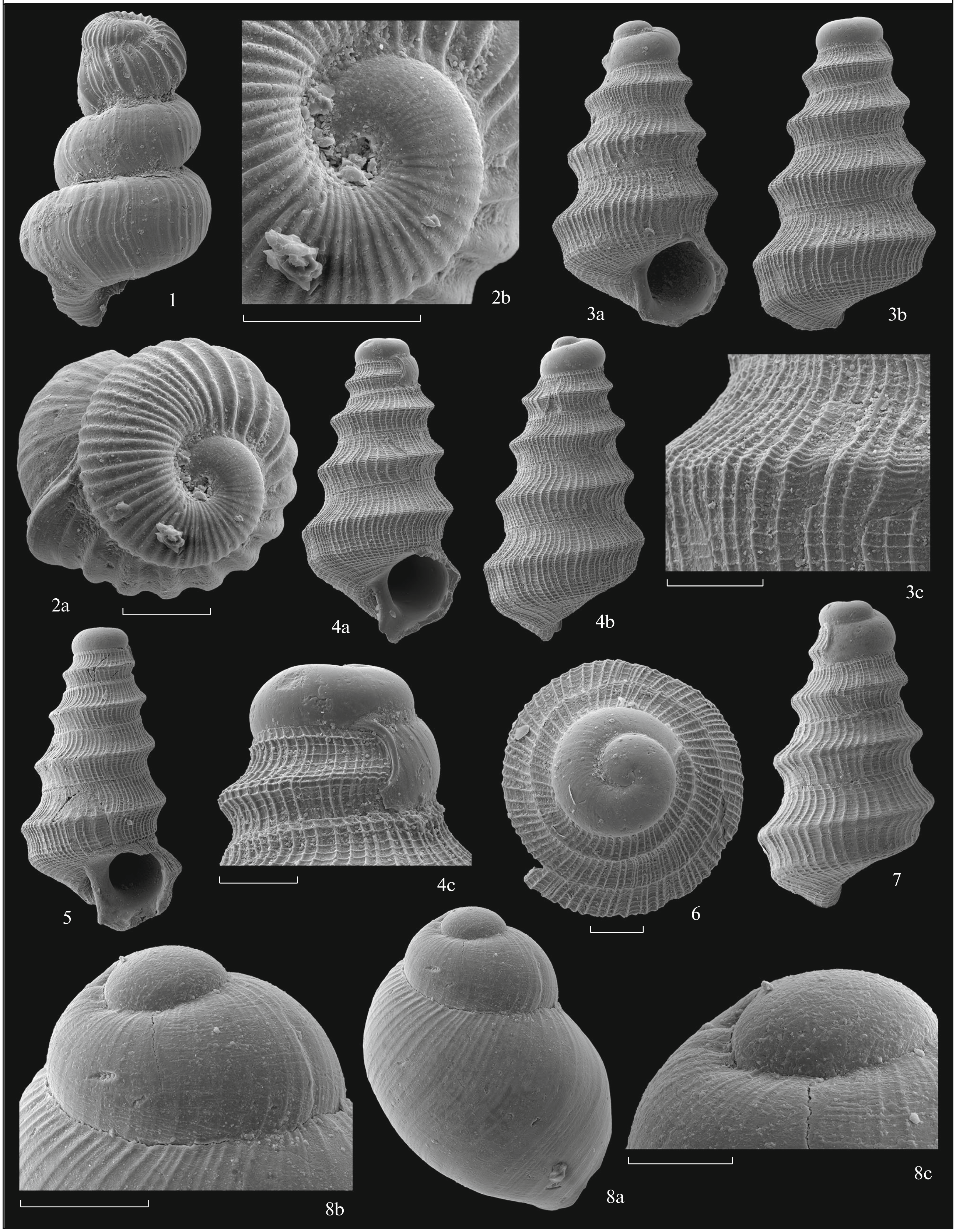
Scale bar 100 μm, except for fig. 8b (50 μm); shell dimensions for other figures.

Fig. 1. *Rotfanella* sp., spec. PIN, no. 4814/306 (shell height 0.6 mm), the village of Novoselki, Lower Oxfordian, Cardioceras cordatum Zone: (1a) apertural view, (1b) abapertural view, (1c) protoconch.

Figs. 2–7. *Urlocella undulata* Guzhov et Shapovalov, sp. nov., (2) spec. PIN, no. 4814/302 (shell height 0.85 mm), dacha village of Novoselki, Middle Oxfordian, Cardioceras densiplicatum Zone, apertural view; (3) spec. PIN, no. 4814/303 (shell height 0.85 mm), the same locality and age, abapertural view; (4) spec. PIN, no. 4814/300, the same locality and age, protoconch; (5) spec. PIN, no. 4814/301 (shell height 0.9 mm), village of Novoselki, Lower Oxfordian, Cardioceras cordatum Zone: (5a) apertural view, (5b) abapertural view, (5c) apex, view at an angle; (6) holotype, spec. PIN, no. 4814/307 (shell height 1.15 mm), Mikhalenino, bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone: (6a) apertural view, (6b) abapertural view; (7) spec. PIN, no. 4814/308 (shell height 1.15 mm), the same locality and age: (7a) lateral view, (7b) protoconch.

Figs. 8–10. *Zizipupa costata* Guzhov et Shapovalov, sp. nov. (8) spec. PIN, no. 4814/309 (shell height 0.55 mm), village of Novoselki, Lower Oxfordian, Cardioceras cordatum Zone: (8a) lateral view, (8b) microsculpture of protoconch; (9) spec. PIN, no. 4814/310 (shell height 0.43 mm), Mikhalenino, Upper Oxfordian, Amoeboceras alternoides Zone, lateral view; (10) spec. PIN, no. 4814/311, dacha village of Novoselki, Middle Oxfordian, Cardioceras densiplicatum Zone, apical view.

Plate 12



a narrow, concave shoulder near the upper suture; whorls reach less often the suture without the formation of a shoulder. Shells without a shoulder prevail only in the Upper Kimmeridgian, whereas more ancient specimens usually have shells with a shoulder. The growth lines are weak, but often strengthen to low folds on the first teleoconch whorls. Growth lines are prosocyrt below the shoulder with the formation of a shallow opisthocyrt curve with a maximum at the bend, bounding the shoulder. Aperture is oval, elevated, angular posteriorly, rounded anteriorly, with thin lips.

Remarks. It is hardly possible to distinguish the species in this genus group based on the available material. Most of the Oxfordian shells have a satisfactory preservation, with a destroyed shoulder and often a worn surface. The protoconchs are characteristic of only the Kimmeridgian samples. In general, the shells differ in the development of a shoulder with a slight variation in the convexity of whorls and cyrtoconoidness of the early part of the teleoconch. The relief of growth lines or its absence can not considered as a reliable feature and may be related to the habitat conditions of the mollusk.

Occurrence. Middle Oxfordian–Kimmeridgian, Middle Volgian of the Russian Plate.

Material. Middle Oxfordian: Nikitino (2 spec.); Cardioceras densiplicatum Zone: Mikhalenino, beds $BV_{0/3}$–$BV_{0/4}$ (16 spec.); Cardioceras tenuiserratum Zone: Konstantinovo (2 spec.); Upper Oxfordian, Amoeboceras alternoides Zone, Amoeboceras ilovaiskii Subzone: “Northern Makariev” (2 spec.); A. alternoides Zone: Mikhalenino, bed BV_3 (4 spec.); Amoeboceras serratum Zone: EPhM, quarry 7-2bis (1 spec.); A. serratum Subzone: Mikhalenino, bed BV_7 (1 spec.); Lower Kimmeridgian, Amoeboceras bauhini Zone, Amoeboceras zieteni biohorizon: Mikhalenino, bed BV_9 (1 spec.); Amoeboceras kitchini Zone, *Amoeboceras bayi* Subzone: Mikhalenino, middle part of Bed BV_{12} (2 spec.), beds BV_{13} (1 spec.) and BV_{14} (4 spec.); Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone, S. subborealis biohorizon: Murzitsy (14 spec.); Middle Volgian, Virgatites virgatus Zone, Virgatites rosanovi Subzone: Moscow, Kuntsevo district (1 spec.).

Family Ampezzanildidae Bandel, 1995

Genus *Zizipupa* Guzhov et Shapovalov, gen. nov.

Etymology. Free combination of letters. Feminine gender.

Type species. *Z. costata* sp. nov.

Description. The tiny high-spired anomphalous shell with the collabrally sculptured hyperstrophic protoconch. Teleoconch whorls are convex, weakly embracing, without sculpture. Growth lines are opisthocyrt in the lateral side.

Comparison. *Zizipupa* differs from other genera in high-spired shell without sculpture.

Occurrence. Oxfordian of the Russian Plate.

Zizipupa costata Guzhov et Shapovalov, sp. nov.

Plate 11, figs. 8–10; Plate 12, figs. 1–2

Etymology. From Latin *costatus* (ribbed).

Holotype. PIN, no. 4814/312: Jurassic, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone; Mikhalenino; Pl. 12, fig. 1.

Description. The tiny high-spired anomphalous shell. The most complete specimen has 2 teleoconch whorls and a height less than 1 mm. Protoconch consists of 2 whorls, coaxial and with the beginning immersed into the apex. Protoconch probably starts with a smooth stage, which goes into sculptured stage of 1.5 whorls. Their sculpture consists of chaotically arranged microscopic strokes and pustules and high folds, which gradually become sparser and thicker as a shell grows. Initially folds are orthocline and then become prosocline. Protoconch ends by thickened fold. Teleoconch consists of weakly embracing rounded convex whorls, separated by a deep suture and covered by more or less rough prosocyrt growth lines. The aperture is unknown.

Occurrence. Lower–Upper Oxfordian, Amoeboceras serratum Zone of the Russian Plate.

Explanation of Plate 12

Scale bar 100 μm, except for fig. 8c (50 μm); shell dimensions for other figures.

Figs. 1 and 2. *Zizipupa costata* Guzhov et Shapovalov, sp. nov. (1) holotype, spec. PIN, no. 4814/312 (shell height 0.83 mm), Mikhalenino, bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone; (2) spec. PIN, no. 4814/311, dacha village of Novoselki, Middle Oxfordian, Cardioceras densiplicatum Zone, protoconch (apical view).

Figs. 3–7. *Cristalloella spiralocostata* (Gründel, 1998). (3) spec. PIN, no. 4814/313 (shell height 1 mm), Mikhalenino, bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone: (3a) apertural view, (3b) abapertural view, (3c) sculpture of teleoconch; (4) spec. PIN, no. 4814/314 (shell height 1.15 mm), the same locality and age: (4a) apertural view, (4b) abapertural view, (4c) protoconch; (5) spec. PIN, no. 4814/316 (shell height 1.2 mm), dacha village of Novoselki, Middle Oxfordian, Cardioceras densiplicatum Zone, apertural view; (6) spec. PIN, no. 4814/315, Mikhalenino, Bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone, apical view; (7) spec. PIN, no. 4814/317 (shell height, 0.95 mm), Nikitino, Middle Oxfordian, abapertural view.

Fig. 8. *Masaevia sinistra* Guzhov et Shapovalov, sp. nov., spec. PIN, no. 4814/318 (shell height 0.46 mm), village of Novoselki, Lower Oxfordian, Cardioceras cordatum Zone: (8a) abapertural view, (8b, 8c) details of an initial whorl.

Plate 13

M a t e r i a l. The material is represented by protoconchs or specimens with an incomplete first teleoconch whorl.

Upper Oxfordian, Amoeboceras alternoides Zone and Subzone: Mikhalenino, bed BV_3 (1 spec.).

Collection of K.M. Shapovalov: Lower Oxfordian, Cardioceras cordatum Zone: village of Novoselki (11 spec.); Lower–Middle Oxfordian: Timokhovo (11 spec.); Middle Oxfordian, Cardioceras densiplicatum Zone: dacha village of Novoselki (52 spec.); Cardioceras tenuiserratum Zone: Mikhalenino (1 spec.); Upper Oxfordian, Amoeboceras alternoides Zone: Mikhalenino (30 spec.); Amoeboceras serratum Zone: Mikhalenino (1 spec.); Amoeboceras serratum Zone and Subzone: Mikhalenino (1 spec.).

Family Stuoraxidae Bandel, 1996

Genus *Stuoraxis* Bandel, 1996

Stuoraxis crassa Guzhov, sp. nov.

Plate 13, fig. 3

E t y m o l o g y. From Latin *crassus* (thick).

H o l o t y p e. PIN, no. 4814/321: Jurassic, Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone and biohorizon; Murzitsy.

D e s c r i p t i o n. Tiny planispiral shell, consisting of 1.3 protoconch whorls and nearly two teleoconch whorls; 1 mm in diameter. Protoconch is coaxial, with the beginning immersed into the apex. Due to this, the embryonic part is located from the lower side of a shell. The rest of the protoconch is covered with collabral folds, developed only in upper and lower sides of a whorl. At the end of the protoconch is well-defined fold looking as a septum, bumping to an embryonic chamber. Teleoconch whorls are rounded, smooth, separated by a deep suture. Growth lines are orthocline. The upper umbilicus is somewhat shallower than the lower one, umbilical sides are steep and gradate. Aperture is unknown.

C o m p a r i s o n. It is different from other species in thick whorls, rapidly growing in diameter.

O c c u r r e n c e. Upper Kimmeridgian of the Russian Plate.

M a t e r i a l. Holotype.

Genus *Aneudaronia* Guzhov, gen. nov.

E t y m o l o g y. From Latin *an* (non) and genus *Eudaronia* Cotton, 1945, the formal resemblance between which and the described genus is noted. Feminine gender.

T y p e s p e c i e s. *A. elegans* sp. nov.

D e s c r i p t i o n. Tiny planispiral shell with collabarlly sculpted hyperstrophic protoconch. The whorls of the teleoconch are convex, carinate at the top and bottom, with thin collabral sculpture. The growth lines are prosocline on the lateral side. Aperture holostomatous, trapezoidal, with thin lips.

D i s t r i b u t i o n. Kimmeridgian of the Russian Plate.

Aneudaronia elegans Guzhov, sp. nov.

Plate 13, fig. 4

E t y m o l o g y. From Latin *elegans* (elegant).

H o l o t y p e. PIN, no. 4814/322: Jurassic, Lower Kimmeridgian, Amoeboceras kitchini Zone, Amoeboceras bayi Subzone; Mikhalenino.

D e s c r i p t i o n. Tiny planispiral shell, consisting of 1.3 protoconch whorl and 2.3 teleoconch whorls; 1.3 mm in diameter. Protoconch is coaxial, with the beginning submerged into the apex. Due to this, the embryonic part is located from the lower side of a shell. The rest of the protoconch is covered with collabral ridges, developed only in upper and lower sides of the whorl. At the end of the protoconch is well developed fold looking as a septum, bumping into the embryonic chamber. The teleoconch whorls are obliquely trapezoidal, sharply bilaterally asymmetric, separated by a slightly indepth suture. From upper side whorls are angular–curved, with carina-like bend approximately in the middle of their width. A less sharp rounded bend, located close to the outer edge of the whorl, is developed lower side. Both bends are crowned by a low spiral rib, at which the collabral sculpture, represented by frequent weakly developed narrow folds and developed from the inner side to these ribs, is interrupted. The lateral side is smooth,

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Explanation of Plate 13

Scale bar 100 μm; shell dimensions for other figures.

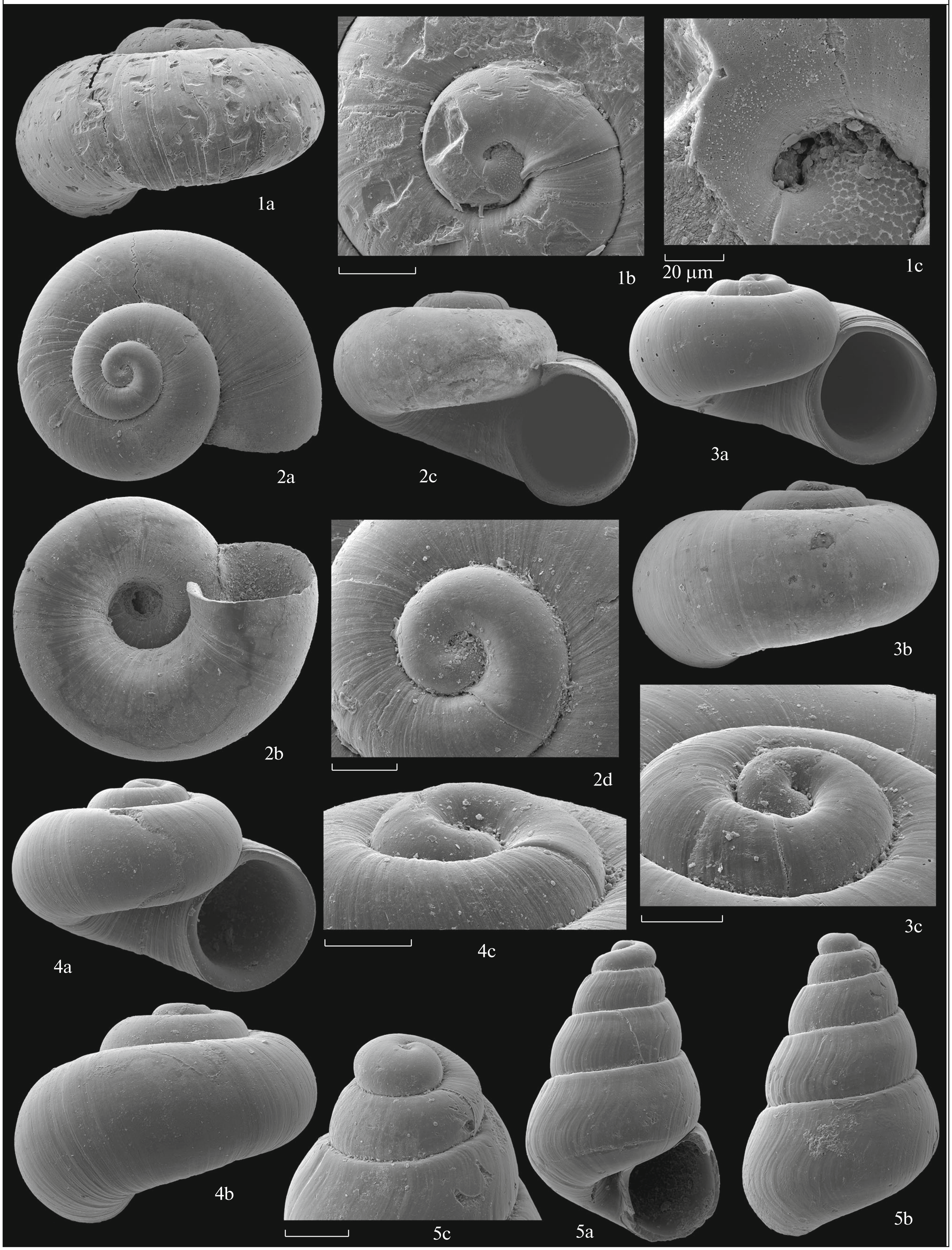
Figs. 1 and 2. *Masaevia sinistra* Guzhov et Shapovalov, sp. nov., village of Novoselki, Lower Oxfordian, Cardioceras cordatum Zone. (1) holotype, spec. PIN, no. 4814/319 (shell height 0.47 mm), apertural view; (2) spec. PIN, no. 4814/320, apical view.

Fig. 3. *Stuoraxis crassa* Guzhov, sp. nov., holotype, spec. PIN, no. 4814/321, Murzitsy, Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone and biohorizon: (3a) apical view, (3b) protoconch (apical view), (3c) abapical view, (3d) protoconch (apical view), (3e) lateral view.

Fig. 4. *Aneudaronia elegans* Guzhov, sp. nov., holotype, spec. PIN, no. 4814/322 (shell diameter 1.27 mm), Mikhalenino, bed BV_{14} (bottom), Lower Kimmeridgian, Amoeboceras kitchini Zone, Amoeboceras bayi Subzone: (4a) abapical view, (4b) apical view, (4c) lateral view, (4d) protoconch (abapical view), (4e) protoconch (apical view).

Fig. 5. *Doggerostra riedeli affinis* Guzhov, subsp. nov., holotype, spec. PIN, no. 4814/323 (shell diameter 1.35 mm), Moscow, Kuntsevo district, Virgatites virgatus Zone, Virgatites rosanovi Subzone: (5a) dorsal view, (5b) ventral view.

Plate 14



with more or less coarse growth lines, which are orthocline on the lateral and lower sides and of the whorl; and slightly sigmoidally curved on the upper side of the whorl. The upper and lower umbilici are nearly of the same depth, with gently sloping walls. The aperture is obliquely trapezoidal, holostomatous, with narrow lips, connecting at an angle posteriorly and roundly posteriorly.

O c c u r r e n c e. Lower Kimmeridgian, Amoeboceras kitchini Zone of the Russian Plate.

M a t e r i a l. Type locality, bed BV_{14} (2 spec.).

Family incertae sedis

Genus *Doggerostra* Gründel, 1998

Doggerostra riedeli Gründel, 1998

H o l o t y p e. Bundesanstalt für Geowissenschaften und Rohstoffe, no. X3802: Jurassic, Upper Bathonian; Poland, borehole Klemmen (Kłęby) 1/37; Gründel, 1998, pl. 5, figs. 56–58.

D e s c r i p t i o n. Tiny low-spired helicoid phaneromphalous shell of up to 1.4 mm in diameter, consisting of 1–1.3 protoconch whorl and 2–2.2 smooth teleoconch whorls. The protoconch is planispiral with slight immersion of the embryonic chamber into the apex. The embryonic chamber is covered with cellular sculpture. The rest of the protoconch is smooth, slightly widened at the ending; the anterior edge is orthocline, simple or thickened. The teleoconch consists of strongly embracing rounded, convex whorls, separated by a rather deep suture. The teleoconch angle is 120°–143°. The lateral side passes gradually into the convex base. The growth lines are slightly prosocline. The umbilicus is rather wide with umbilical wall, passing gently into the base. Aperture is rounded, with thin lips.

C o m p o s i t i o n. Subspecies of *D. riedeli riedeli* and *D. riedeli affinis* subsp. nov.

O c c u r r e n c e. Upper Bathonian of Poland, Kimmeridgian and Volgian of the Russian Plate.

Doggerostra riedeli riedeli Gründel, 1998

Plate 14, figs. 2–4

Doggerostra riedeli: Gründel, 1998, p. 14, pl. 5, figs. 56–59.
Bandellina riedeli: Kaim, 2004, p. 145, text-fig. 124A,B.

D e s c r i p t i o n. Tiny low-spired helicoid phaneromphalous shall of up to 1.3 mm high, consisting of 1.3 protoconch whorl and two smooth teleoconch whorls. The protoconch is planispiral with slight immersion of the embryonic chamber into the apex. The embryonic chamber is covered with cellular sculpture. The rest of the protoconch is smooth, slightly widened at the ending; the anterior part is orthocline and thin. The teleoconch consists of strongly embracing rounded convex whorls, separated by a rather deep suture. The lateral side passes gradually to the convex base. Growth lines are slightly prosocline. The umbilicus is rather wide, with umbilical wall, passing gradually into the base. Aperture is rounded, with thin lips.

C o m p a r i s o n. See description of *D. riedeli affinis*.

O c c u r r e n c e. Upper Bathonian of Poland, Middle Oxfordian–Kimmeridgian of the Russian Plate.

M a t e r i a l. Middle Oxfordian: Nikitino (3 spec.); Cardioceras densiplicatum Zone: Mikhalenino, bed $BV_{0/3}$ (2 spec.), dacha village of Novoselki (8 spec.); Cardioceras tenuiserratum Zone: Konstantinovo (1 spec.); Lower Kimmeridgian, Amoeboceras kitchini Zone, Amoeboceras bayi Sub-Zone: Mikhalenino, beds BV_{13} (2 spec.); Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Sub-Zone, S. subborealis biohorizon: Murzitsy (27 spec.).

Doggerostra riedeli affinis Guzhov, subsp. nov.

Plate 13, fig. 5; Plate 14, fig. 1

H o l o t y p e. PIN, no. 4814/295: Jurassic, Middle Volgian, Virgatites virgatus Zone, Virgatites rosanovi Subzone; Moscow, Kuntsevo district; Pl. 10, fig. 2.

D e s c r i p t i o n. Tiny low-spired helicoid phaneromphalous shell of up to 1.4 mm high, consisting of a protoconch whorl and 2.2 teleoconch whorls. Protoconch is planispiral with slight submergence of an

Explanation of Plate 14

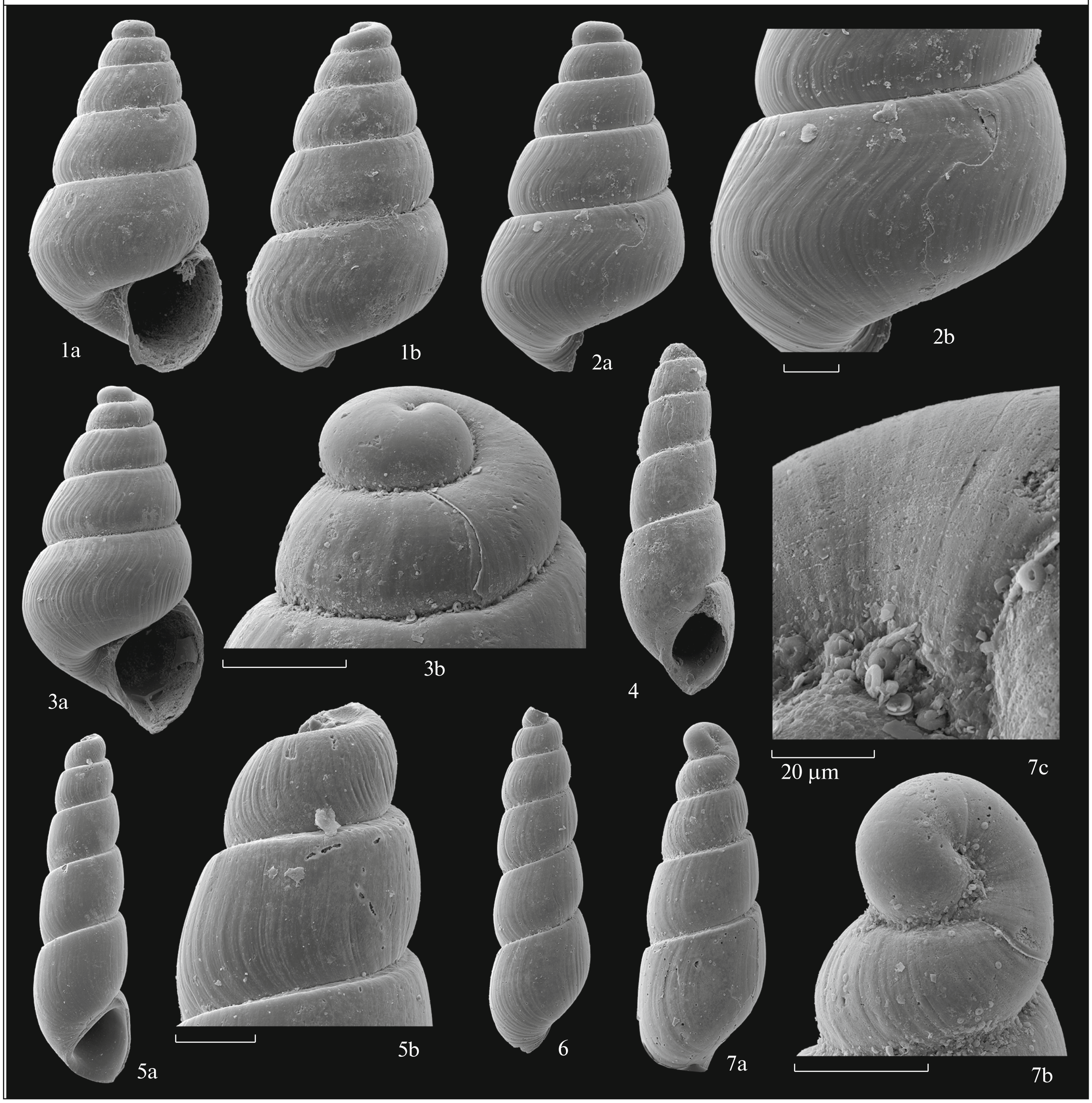
Scale bar100 µm, except for fig. 1c (20 µm); shell dimensions for other figures.

Fig. 1. *Doggerostra riedeli affinis* subsp. nov., holotype, spec. PIN, no. 4814/323 (shell diameter1.35 mm), Moscow, Kuntsevo district, Virgatites virgatus Zone, Virgatites rosanovi Subzone: (1a) abapertural view, (1b) protoconch, (1c) sculpture of a protoconch.

Figs. 2–4. *Doggerostra riedeli riedeli* Gründel, 1998. (2) spec. PIN, no. 4814/324 (shell diameter 1.3 mm), Murzitsy, Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone and biohorizon: (2a) apical view, (2b) abapical view, (2c) apertural view, (2d) protoconch (apical view); (3) spec. PIN, no. 4814/325 (shell diameter1.2 mm), Mikhalenino, bed BV_{13} (top), Lower Kimmeridgian, Amoeboceras kitchini Zone, Amoeboceras bayi Subzone: (3a) apertural view, (3b) abapertural view, (3c) protoconch (apical lateral view); (4) spec. PIN, no. 4814/326 (shell diameter 1.2 mm), Murzitsy, Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone and biohorizon: (4a) apertural view, (4b) abapertural view, (4c) protoconch (apical lateral view).

Fig. 5. *Unzhispira minuta* Guzhov, sp. nov., spec. PIN, no. 4814/373 (shell height 1 mm), Mikhalenino, bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone: (5a) apertural view, (5b) abapertural view, (5c) protoconch.

Plate 15



Explanation of Plate 15

Scale bar 100 μm, except for fig. 7c (20 μm); shell dimensions for other figures.

Figs. 1–3. *Unzhispira minuta* Guzhov, sp. nov., Mikhalenino, bed BV_3, Upper Oxfordian, Amoeboceras alternoides Zone and Subzone: (1) holotype, spec. PIN, no. 4814/328 (shell height 1.35 mm): (1a) apertural view, (1b) abapertural view; (2) spec. PIN, no. 4814/329 (shell height 1.1 mm): (2a) abapertural view, (2b) growth lines; (3) spec. PIN, no. 4814/330 (shell height 1.2 mm): (3a) apertural view, (3b) protoconch.

Figs. 4–7. *Ebala sp*. (4) spec. PIN, no. 4814/331 (shell height1.6 mm), Konstantinovo, Middle Oxfordian, Cardioceras tenuiserratum Zone; (5) spec. PIN, no. 4814/332 (shell height 1.75 mm), Mikhalenino, Lower Kimmeridgian, Amoeboceras kitchini Zone, Amoeboceras bayi Subzone: (5a) shell, (5b) early whorls; (6) spec. PIN, no. 4814/333 (shell height 1.55 mm), Murzitsy, Upper Kimmeridgian, Aulacostephanus autissiodorensis Zone, Sarmatisphinctes subborealis Subzone and biohorizon; (7) spec. PIN, no. 4814/334 (shell height 0.95 mm), the same locality and age: (7a) juvenile shell, (7b) protoconch, (7c) microsculpture on a protoconch.

embryonic chamber covered by cellular sculpture into the apical part. The rest of the protoconch is smooth, widened at the ending with the formation of a septum, bumping into embryonic chamber. The teleoconch consists of strongly embracing rounded convex whorls, separated by a rather deep suture. The lateral side gently passes into the base. Growth lines are weakly prosocline. The umbilicus is rather wide, with umbilical wall, gently passing into the base. Aperture is rounded, with thin lips.

Comparison. It differs from *D. riedeli riedeli* only in a shorter protoconch with the thickening at the ending, bumping into the previous whorl.

Occurrence. Middle Volgian of the Russian Plate.

Material. Type locality (7 spec.).

Genus *Masaevia* Guzhov et Shapovalov, gen. nov.

Etymology. In honor of A.V. Mazaev, a researcher of Paleozoic gastropods. Feminine gender.

Type species. *M. sinistra* sp. nov.

Description. Tiny sinistral, oval, anomphalous shell consisting of convex, rapidly growing high oval whorls. The surface of whorls is covered by coarse prosocline growth lines, as well as spiral microsculpture close to the beginning of the shell.

Occurrence. Lower Oxfordian of the Russian Plate.

Masaevia sinistra Guzhov et Shapovalov, sp. nov.

Plate 12, fig. 8; Plate 13, figs. 1, 2

Etymology. From Latin *sinistra* (left side).

Holotype. PIN, no. 4814/319: Jurassic, Lower Oxfordian, Cardioceras cordatum Zone; village of Novoselki; Pl. 13, fig. 1.

Description. Tiny sinistral, oval, anomphalous shell consisting of 2.5 whorls, 0.5 mm in height. Whorls are convex, rapidly growing in size, high oval in the section. Due to this, the shell develops more in height, than in a diameter. The embryonic part is covered by chaotically arranged elements of sculpture, which are replaced soon by frequent spiral rows of striae, disappearing, in turn, towards the second whorl. Beginning from the embryonic part, there appear prosocline strengthen growth lines, which are the sole element of sculpture on the last whorl.

Occurrence. Lower Oxfordian, Cardioceras cordatum Zone of the Russian Plate.

Material. Collection of K.M. Shapovalov: type locality, about 100 specimens.

LIST OF LOCALITIES

EPhM: quarry 7-2bis, Yegoryevsk Phosphorite Mine, quarry 7-2bis eastward from the Berendino village, Voskresensk district, Moscow Region. 55°23′32″ N, 38°50′40″ E.

Ivkino: a ravine on the Unzha River right bank, near the village of Ivkino, Manturovo district, Kostroma Region. 58°14′36″ N, 44°39′29″ E.

Konstantinovo: the Oka River right bank (near the upper outskirts of the Konstantinovo village, Rybnoe district, Ryazan Region. 54°52′08″ N, 39°34′24″ E.

Mikhalenino: the Unzha River right bank (above the Mikhalenino village), Makariev district, Kostroma Region. 57°59′40″ N, 44°00′12″ E. This section is described in Guzhov, 2019; the cited material is referred to beds of this section.

Moscow, Brateevo district: Brateevo district, the city of Moscow, from excavation pits.

Moscow, Kuntsevo district: a ravine on the Moscow River right bank in the Suvorovsky park, Kuntsevo district, the city of Moscow. 55°44′34″ N, 37°26′29″ E.

Murzitsy: a quarry near the Murzitsy village, Sechenovo district, Nizhny Novgorod Region. 55°18′15″ N, 49°11′50″ E.

Nikitino: the Oka River right bank below the village of Nikitino, Spassky district, Ryazan Region. 54°21′20″ N, 40°24′35″ E.

The dacha village of Novoselki: a ravine on the Oka River right bank near the dacha village of Novoselki, Ryazan district, Ryazan Region. 54°36′31″ N, 39°55′11″ E.

Village of Novoselki: the Oka River right bank near the village of Novoselki, Rybnoe district, Ryazan Region.

“Northern Makariev” section: The Unzha River right bank within the town of Makariev, Makariev district, Kostroma Region. 57°53′40″ N, 43°49′02″ E.

Timokhovo: quarries near the village of Timokhovo, Ramenskoe district, Moscow Region. 55°45′20″ N, 38°18′50″ E.

Shchurovo: a quarry of the cement plant, Zarechie district, town of Shchurovo, Kolomna district, Moscow Region. 55°01′35″ N, 38°47′07″ E.

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