ISSN 0031-0301, Paleontological Journal, 2015, Vol. 49, No. 2, pp. 134–144. © Pleiades Publishing, Ltd., 2015.
Original Russian Text © O.P. Mesentseva, 2015, published in Paleontologicheskii Zhurnal, 2015, No. 2, pp. 27–35.

New Data on Devonian Rhabdomesida (Bryozoans) from the Salair Ridge and Gorny and Rudny Altai

O. P. Mesentseva

Siberian State Industrial University, ul. Kirova 42, Novokuznetsk, 654007 Russia
e-mail: MesentsevaOP@yandex.ru

Received February 7, 2014

Abstract—Members of the order Rhabdomesida (Bryozoa) are for the first time recorded in the Emsian Stage (Lower Devonian) and Eifelian Stage (Middle Devonian) of the Altai–Sayan Folded Area. The assemblage of Emsian Rhabdomesida of the Salair Ridge and Gorny Altai comprises three new species of the genera previously only known from the Lower–Middle Devonian deposits of Western Europe and West Africa: *Paracuneatopora egregia* sp. nov., *P. kuvaschensis* sp. nov., and *Lenapora gurievensis* sp. nov. In addition, this assemblage includes *Nematopora rara* sp. nov. and new species of a new genus, *Salairella* gen. nov.—*S. petaloida* sp. nov., *S. variabilis* sp. nov., and *S. maculata* sp. nov. Two new species, *Salairella baskuskanensis* sp. nov. and *S. recta* sp. nov., are described from the Eifelian Stage of the Salair Ridge and the Frasnian Stage of Rudny Altai, respectively.

Keywords: bryozoans, Rhabdomesida, Devonian, Emsian, Eifelian, Frasnian, Altai–Sayan Folded Area

DOI: 10.1134/S0031030115020033

INTRODUCTION

Until recently only 11 bryozoan species (Table 1) belonging to the order Rhabdomesida were know from Devonian deposits of the western part of the Altai–Sayan Folded Area (ASFA) (Morozova, 1961; Volkova, 1974; Tolokonnikova, 2012). Most of these species were described from Frasnian–Famennian sediments in the borderlands of the Kuznetsk Basin. Two of these species were also encountered in sediments of the Frasnian of Gorny Altai. In addition, one species was discovered in Givetian sediments of Gorny Altai, and one more species was encountered in deposits of Rudny Altai that at present are attributed to the Upper Famennian (*Klyuchevye* ..., 2004). In sediments of the Lower Devonian and Eifelian of ASFA Rhabdomesida have not been known.

The examination of the collection of Devonian Rhabdomesida (37 specimens, more than 100 thin sections) that was sampled from nine sections of the Salair Ridge and Gorny and Rudny Altai has shown that the spatiotemporal distribution of these bryozoans was wider and has expanded the species and generic composition of the families Arthroclemidae Simpson and Lenaporidae Ernst, Königshof, Taylor et Bohatý. The colonies of bryozoans were examined in transparent oriented thin sections using the technique proposed by R.V. Gorjunova (1992).

RESULTS OF THE MATERIAL EXAMINATION

In the Salair Ridge the most ancient species of Emsian Rhabdomesida are *Paracuneatopora egregia* sp. nov. and *Nematopora rara* sp. nov. They were revealed in clayey limestones of the Shanda Horizon (*inversus* Zone; Izokh, 1998), alternating with mudstone in the standard section of the Emsian Stage (section B-819, bed 22; *Stratotype* ..., 1986). However these rocks are dominated by members of the order Trepostomida (Mesentseva, 2012, 2013).

The species *Lenapora gurievensis* sp. nov. and *Salairella petaloida* gen. et sp. nov. were revealed in Shanda deposits of the Akarachkino quarry (*serotinus* Zone, Izokh, 1998), uncovered by sections Ya-854 (=E-828) and B-8315 (*Stratotype* ..., 1987). Fragments of colonies of *L. gurievensis* sp. nov. are enclosed in slightly clayey limestones, interstratified with clayey carbonate shales (bed 3, outcrop Ya-854). These rocks also contain infrequent trepostomids and fenestellids (Mesentseva, 2012). The fenestellids are most abundant in clayey carbonate shales. Section B-8315 (bed 3) yielded *S. petaloida* gen. et sp. nov. from clayey limestone alternating with mudstone.

North of the town of Gur'evsk (vicinity of the village of Novo-Pesterevo, section B-8323), limestones of the Shanda Horizon yielded *Salairella variabilis* gen. et sp. nov. as well as numerous trepostomids and sporadic fenestellids (Mesentseva, 2012).

In Gorny Altai specimens of Emsian Rhabdomesida have been discovered in two localities. On the right bank of Kuvash Creek Rhabdomesida are represented by sporadic colonies of *Paracuneatopora kuvaschensis* sp. nov. in clayey to silty limestones attributed to the middle Emsian Stage (section Kuvash 1, bed 19; Udodov and Mesentseva, 2000). Representa-

Table 1. Distribution of Rhabdomesida in Devonian deposits of the borderlands of the Kuznetsk Basin and Gorny and Rudny Altai (according to data from Morozova, 1961; Volkova, 1974; Tolokonnikova, 2012)

Species name	Upper Givetian	Frasnian			Famennian		
		Lower	Middle	Upper	Lower	Middle	Upper
Ipmorella irregularis (Nekh., 1956)							■
Nikiforovella bytchokensis Trizna, 1958							●
Mediapora elegans Tolok., 2010						●	●
Klaucena gracilis Tolok., 2010						●	●
Rhombopora subtilis Nekh., 1977						●	●
Orthopora tomensis Tolok., 2007					●		
Rhombopora maria Moroz., 1961				●	●		
Rhombopora magna Volk., 1974				○			
Saffordotaxis multispinatus (Moroz., 1955)		●		○			
Bigeyella hemiseptata (Moroz., 1961)		●					
Saffordotaxis altaicus Tolok., 2010	○						

● Kuznetsk Basin, ○ Gorny Altai, ■ Rudny Altai.

tives of trepostomids dominate throughout the section, representatives of cryptostomids occur only occasionally (Mesentseva, 2012).

On the right bank of the Anui River (vicinity of the village of Sibiryachikha) separate fragments of colonies of Rhabdomesida occur in arenaceous and thin platy organic limestones (section Sibiryachikha 1, beds 21, 22; Mesentseva and Udodov, 2007). S.A. Rodygin (1986) showed that these limestones belong to the *serotinus* Zone. In these limestones Rhabdomesida are represented by two species of *Salairella* gen. nov., *S. petaloida* sp. nov. and *S. maculata* sp. nov., and trepostomids are represented by abundant remains of colonies of several species (Mesentseva, 2012).

Thus, the assemblage of Rhabdomesida of the Emsian Stage (Lower Devonian) of ASFA contains seven new species. Of them *N. rara* sp. nov., *P. egregia* sp. nov., *L. gurievensis* sp. nov., and *S. variabilis* gen. et sp. nov. were revealed in the Salair Ridge, and *P. kuvaschensis* sp. nov. and *S. maculata* gen. et sp. nov. were discovered in Gorny Altai. The species *S. petaloida* gen. et sp. nov. occur in both regions. The studied specimens of Rhabdomesida occur within a range of two local bryozoan zones of the Emsian Stage of ASFA (Mesentseva, 2012). More specifically the *Eridotrypa beloviensis–Lioclema lucida* Zone contains *P. egregia* sp. nov., *P. kuvaschensis* sp. nov., and *N. rara* sp. nov., and the *Lioclema akarachica–Reteporina ubensis* Zone encloses *L. gurievensis* sp. nov., *S. petaloida* gen. et sp. nov., *S. variabilis* gen. et sp. nov. and *S. maculata* gen. et sp. nov.

The bryozoans of the genus *Salairella* gen. nov., which appeared in the middle Emsian Age (*serotinus* conodont Zone) in the Salair Ridge and Gorny Altai, persisted into the Eifelian Age of the Middle Devonian. In the vicinity of the small town of Baskuskan (section Baskuskan, bed 6; Mesentseva et al., 2007) and the village of Zarechnoe (section Zarechenoe, bed 2), a new species of this genus, *S. baskuskanensis* gen. et sp. nov., was discovered along with numerous trepostomids in Safonovo deposits of the Eifelian Stage (*Middle–Upper* ..., 2011, Fig. 5).

In the Frasnian Age the Late Devonian representatives of the genus *Salairella* gen. nov. invaded Rudny Altai. The species *S. recta* gen. et sp. nov. was discovered in the section of the Kamenevka Formation of the Frasnian Stage located on the right bank of the Gryaznukha River (Razdolnoe Organogenic Massif; bed 2, section BYa-9011; *Klyuchevye* ..., 2004). In addition, redish coral limestones (*falsiovalis* Zone) yielded *S. recta* gen. et sp. nov. and trepostomids, which complemented the bryozoan assemblage of the *Lioclema vassinense* Zone (Tolokonnikova, 2012).

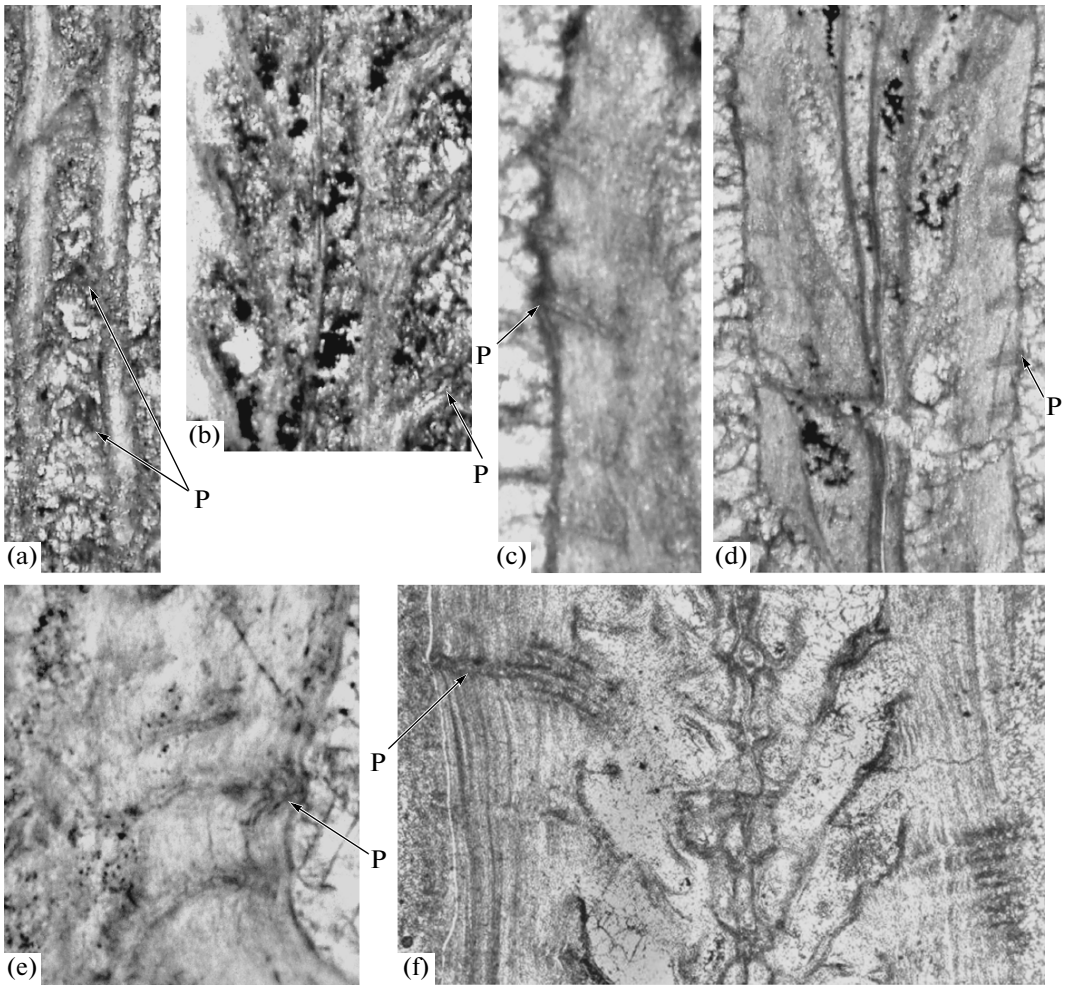


Fig. 1. Pores (paurostyles: Blake, 1983) in walls of Rhabdomesida specimens: (a, b) *Nematopora rara* sp. nov., holotype KuzGPA, no. 12/1, ×8: (a) tangential section; (b) longitudinal section; (c, d) *Paracuneatopora egregia* sp. nov., holotype KuzGPA, no. 12/8: (c) longitudinal section, ×150; (d) the same, ×70; (e) *Salairella petaloida* sp. nov., holotype KuzGPA, no. 12/19, longitudinal section, ×100; (f) *S. baskuskanensis* sp. nov., holotype KuzGPA, no. 12/26, longitudinal section, ×50. Designations: (P) pores.

MATERIAL

The bryozoan collection under consideration is deposited in the Kuzbass State Pedagogical Academy (KuzGPA), no. 12. The following systematic description follows the classification proposed by Gorjunova (1992).

SYSTEMATIC PALEONTOLOGY

Order Rhabdomesida

Suborder Nikiforovellina

Family Arthroclemidae Simpson, 1897

Subfamily Arthrocleminae Simpson, 1897

Genus *Nematopora* Ulrich, 1888

***Nematopora rara* Mesentseva, sp. nov.**

Plate 5, figs. 1, 2

E t y m o l o g y. From the Latin *rarus* (rare).

H o l o t y p e. KuzGPA, no. 12/1; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

D e s c r i p t i o n (Figs. 1a, 1b, 2a). The branches of colonies are 0.41–0.52 mm in diameter and have seven longitudinal rows of the apertures of autozooecia. The endozone is 0.21–0.22 mm in diameter, the exozone is 0.10–0.15 mm wide. The autozooecia are truncated tubular, bud off at an angle of 50°–53° to the median axis. The walls of autozooecia are 0.04–0.07 mm thick in the exozone and ridgelike and 0.02–0.03 mm thick near the surface. Diaphragms are absent. The apertures of autozooecia are ovate and form longitudinal rows. The apertures of autozooecia are 0.15–0.17 mm long and 0.06–0.07 mm wide; there are 7.5–8 apertures per 2 mm along the colony. Above the upper edge of each aperture there is one pore 0.02–0.03 mm in diameter. The ridges separating the rows of apertures of autozooecia have no pores. Capillaries are absent.

Comparison. The new species differs from *N. deresiensis* Gorjunova, 1985 in the smaller dimensions of the apertures of autozooecia (0.15–0.17 × 0.06–0.07 mm instead of 0.17–0.20 × 0.07–0.10 mm in *N. deresiensis*), greater number of apertures per 2 mm (7.5–8 instead of 5 in *N. deresiensis*), and in the presence of pores over apertures and absence of pores and capillaries on the ridges.

Remarks. The species *n. rara* is characterized by the presence of thin-walled tubules in the walls that are 0.02–0.03 mm in diameter and run deep into the exozone (Figs. 1a, 1b). In longitudinal sections the well-preserved areas of colonies clearly show that the tubules project 0.03–0.04 mm above the colony surface. Gorjunova (1985, p. 29) refers to these structures as "pores," and in the papers of foreign bryozoologists (Blake, 1983, p. 561; Ernst and Schroeder, 2007, p. 214) they are referred to as "paurostyles." In this paper these structures are referred to as "pores." These structures are also described below in members of the genera *Paracuneatopora* Ernst, 2008 and *Salairella* gen. nov.

Material. Holotype and six paratypes: KuzGPA, nos. 12/2–12/7; Salair Ridge, vicinity of the town of Gur'evsk, outcrop B-819 (bed 22).

Genus *Paracuneatopora* Ernst, 2008

Paracuneatopora egregia Mesentseva, sp. nov.

Plate 5, figs. 3, 4

Etymology. From the Latin *egregius* (distinguished).

Holotype. KuzGPA, no. 12/8; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

Description (Figs. 1c, 1d). The branches of colonies are 0.40–0.53 mm in diameter and have 7–8 longitudinal rows of autozooecial apertures. The endozone is 0.20–0.27 mm in diameter, the exozone is 0.08–0.13 mm wide. The autozooecia are truncated tubular, expanded at the base, and directed from the median axis to the surface at an angle of 28°–30°. The apertures of autozooecia are ovate, 0.08–0.11 mm long, 0.04–0.06 mm wide; there are 6.5–7 apertures per 2 mm along a branch. The centers of the apertures of autozooecia are spaced 0.29–0.31 mm apart along the branch and 0.18 mm apart across the branch. The walls of autozooecia are 0.06–0.08 mm thick in the exozone. Some autozooecia contain one complete diaphragm. The longitudinal rows of the apertures of autozooecia are separated by 1–3 alternating rows of pores 0.02–0.03 mm in diameter; the centers of pores are spaced 0.06–0.08 mm apart.

Comparison. The new species differs from *P. striata* Ernst, 2008 from the Pragian Stage of Bohemia in the fewer number of the rows of autozooecial apertures on the colony surface (7–8 instead of 8–11 in *P. striata*), larger budding angle of autozooecia from the median axis (28°–30° instead of 25°–28° in *P. striata*), smaller distance between the centers of autozooecial apertures along the branch (0.29–0.31 mm instead of 0.34–0.38 mm in *P. striata*), and in the alternating rows of pores (1–3 rows instead of 1 row in *P. striata*).

Material. Holotype and seven paratypes: KuzGPA, nos. 12/9–12/15, Salair Ridge, vicinity of the town of Gur'evsk, outcrop B-819 (bed 22).

Paracuneatopora kuvaschensis Mesentseva, sp. nov.

Plate 5, fig. 5

Etymology. From Kuvash Creek.

Holotype. KuzGPA, no. 12/16; Gorny Altai, right bank of Kuvash Creek; Lower Devonian, Emsian Stage, Shanda Horizon.

Description. The branches of colonies are 0.49–1.00 mm in diameter and have 9–10 longitudinal rows of apertures. The exozone is 0.11–0.16 mm wide, the endozone is 0.25–0.30 mm in diameter. The autozooecia are truncated tubular and bud off at an angle of 20°–25° to the median axis. The apertures of autozooecia are ovate, the narrow oval apertures form longitudinal rows. The apertures are 0.11–0.14 mm long, 0.04–0.06 mm wide; there are 4.5–5.5 apertures per 2 mm along a branch. In some autozooecia there are one or two diaphragms. The walls are 0.05–0.11 mm thick in the exozone. The pores form a single longitudinal sinuous row between the apertures of autozooecia. There are 8 or 9 pores 0.02–0.03 mm in diameter per 1 mm along a row (centers are 0.06–0.10 mm apart).

Comparison. The new species differs from *P. striata* Ernst, 2008 in the smaller angle at which autozooecia bud off from the median axis (20°–25° instead of 25°–28° in *P. striata*), sinuous rows of pores, and in the greater distance between the centers of pores (0.06–0.10 mm instead of 0.04–0.07 mm in *P. striata*).

Material. Holotype and two paratypes: KuzGPA, nos. 12/17, 12/18, Gorny Altai, right bank of Kuvash Creek, section Kuvash 1 (bed 19).

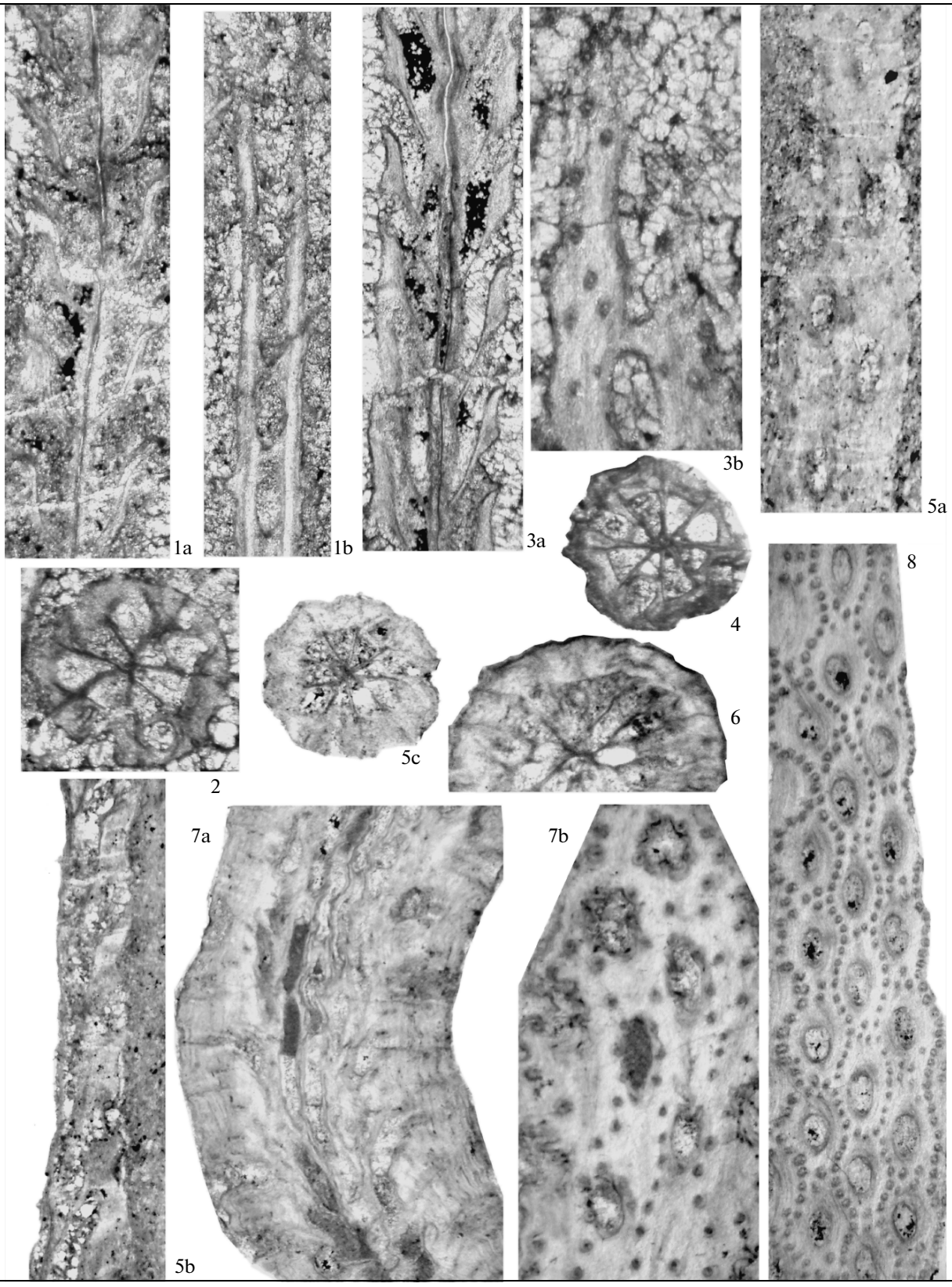
Genus *Salairella* Mesentseva, gen. nov.

Etymology. From the Salair Ridge.

Type species. *Salairella baskuskanensis* sp. nov.

Diagnosis. Colonies dendroid with lateral branches and well-defined exozone. Autozooecia elongated tubular, with spiral budding pattern. In autozooecia hemisepta common, complete diaphragms sporadic. Apertures of autozooecia ovate and circular to oval, arranged in diagonally intersecting or longitudinal rows. In exozone walls of autozooecia pierced by abundant pores, usually forming rows on colony surface or, occasionally, assemblages in interapertural areas or in peristomes of apertures. Heterozooecia, nodes, stellatopores, or capillaries are absent.

Plate 5



Species composition and occurrence. Five species: *S. petaloida* sp. nov.; Salair Ridge, Gorny Altai; Lower Devonian, Emsian Stage, Shanda Horizon; *S. variabilis* sp. nov.; Salair; Lower Devonian, Emsian Stage, Shanda Horizon; *S. maculata* sp. nov.; Gorny Altai; Lower Devonian, Emsian Stage, Shanda Horizon; *S. baskuskanensis* sp. nov.; Salair; Middle Devonian, Eifelian Stage, Mamontovo Horizon; *S. recta* sp. nov.; Rudny Altai; Upper Devonian, lower Frasnian Stage.

Comparison. The new genus differs from the most closely related genus *Isostylus* Ernst, Dorsch et Keller, 2011 in the formation of lateral branches from the main branches (Figs. 2b–2d), longitudinal tubular autozooecia, and in the presence of hemisepta.

Salairella petaloida **Mesentseva, sp. nov.**

Plate 5, figs. 6, 7

Etymology. From the adjective *petaloid*.

Holotype. KuzGPA, no. 12/19; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

Description (Figs. 1e, 2b). The branches of colonies are 0.83–1.3 mm in diameter. The endozone is 0.43–0.50 mm in diameter, the exozone is 0.33–0.45 mm wide. The autozooecia are elongated tubular, at the beginning of the exozone they are abruptly deflected to the surface. The apertures of autozooecia are circular to ovate, more rarely circular, arranged in diagonally intersecting rows. The apertures are 0.14–0.15 mm long, 0.08–0.11 mm wide, and 0.13–0.15 mm in diameter; there are 3.5–4 apertures per 2 mm. The peristomes of apertures contain pores (5–6 pores around one aperture). The diaphragms are flat to concave, widely spaced, occurring throughout the colony. Hemisepta have not been found. The walls of autozooecia are finely plicate, in places sinuous, and 0.03–0.04 mm thick in the endozone and up to 0.08–0.11 mm thick in the exozone. The pores are 0.020–0.035 mm in diameter and form one to three sinuous longitudinal rows in interapertural areas.

Comparison. The new species differs from the species of *Salairella* gen. nov. that are described below in the development of pores in the peristomes of apertures. In addition, it differs from the most closely related species, *S. maculata* sp. nov., in the smaller diameter of branches (0.83–1.3 mm instead of 2.60–3.00 mm in *S. maculata* sp. nov.), presence of complete diaphragms, and in the absence of accumulations of pores.

Occurrence. Lower Devonian, Emsian Stage, Shanda Horizon of the Salair Ridge and Gorny Altai.

Material. Holotype from the outskirts of the town of Gur'evsk, section B-8315 (bed 3); two paratypes: KuzGPA, nos. 12/20, 12/21, Gorny Altai, right bank of the Anui River, Sibiryachikha section 1 (bed 21).

Salairella variabilis **Mesentseva, sp. nov.**

Plate 5, fig. 8; Plate 6, figs. 1, 2

Etymology. From the Latin *variabilis* (variable).

Holotype. KuzGPA, no. 12/22; Salair Ridge, vicinity of the village of Novo-Pesterevo; Lower Devonian, Emsian Stage, Shanda Horizon.

Description (Fig. 2c). The branches of colonies are 0.80–1.26 mm in diameter. The endozone is 0.63–0.70 mm in diameter; the exozone is 0.18–0.28 mm wide. The autozooecia are elongated tubular. The apertures of autozooecia are ovate or circular to oval, occasionally circular, and are arranged in diagonally intersecting rows. The apertures are 0.13–0.15 mm long, 0.07–0.08 mm wide, and 0.10–0.15 mm in diameter; there are 5.5 apertures per 2 mm along a branch. The autozooecia have a thin inferior hemiseptum. Diaphragms are absent. In the exozone the walls of autozooecia are 0.15–0.20 mm thick and are pierced by pores 0.02–0.04 mm in diameter, forming longitudinal sharply curving rows, with the neighboring rows connected around the apertures of autozooecia in a ring (17–23 pores around an aperture); in some areas the pores are arranged in 2–3 rows. In interapertural areas between the rows of autozooecial apertures and pores there is longitudinal striation.

Comparison. The new species differs from *S. baskuskanensis* sp. nov. in the larger diameter of endozone (0.63–0.70 mm instead of 0.50–0.60 mm in *S. baskuskanensis* sp. nov.), absence of diaphragms, smaller dimensions of the apertures of autozooecia

Explanation of Plate 5

Figs. 1 and 2. *Nematopora rara* sp. nov.: (1) holotype KuzGPA, no. 12/1: (1a) longitudinal section, ×60; (1b) tangential section, ×60; (2) paratype KuzGPA, no. 12/2, cross section, ×70; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

Figs. 3 and 4. *Paracuneatopora egregia* sp. nov.: (3) holotype KuzGPA, no. 12/8: (3a) longitudinal section, ×50; (3b) tangential section, ×100; (4) paratype KuzGPA, no. 12/9, cross section, ×70; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

Fig. 5. *Paracuneatopora kuvaschensis* sp. nov., holotype KuzGPA, no. 12/16: (5a) tangential section, ×70; (5b) longitudinal section, ×50, (5c) cross section, ×50; Gorny Altai, right bank of Kuvash Creek; Lower Devonian, Emsian Stage, Shanda Horizon.

Figs. 6 and 7. *Salairella petaloida* sp. nov.: (6) paratype KuzGPA, no. 12/20, cross section, ×50; (7) holotype KuzGPA, no. 12/19: (7a) longitudinal section, ×40; (7b) tangential section, ×50; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

Fig. 8. *Salairella variabilis* sp. nov., holotype KuzGPA, no. 12/22, tangential section, ×45; Salair Ridge, vicinity of the small town of Novo-Pesterevo; Lower Devonian, Emsian Stage, Shanda Horizon.

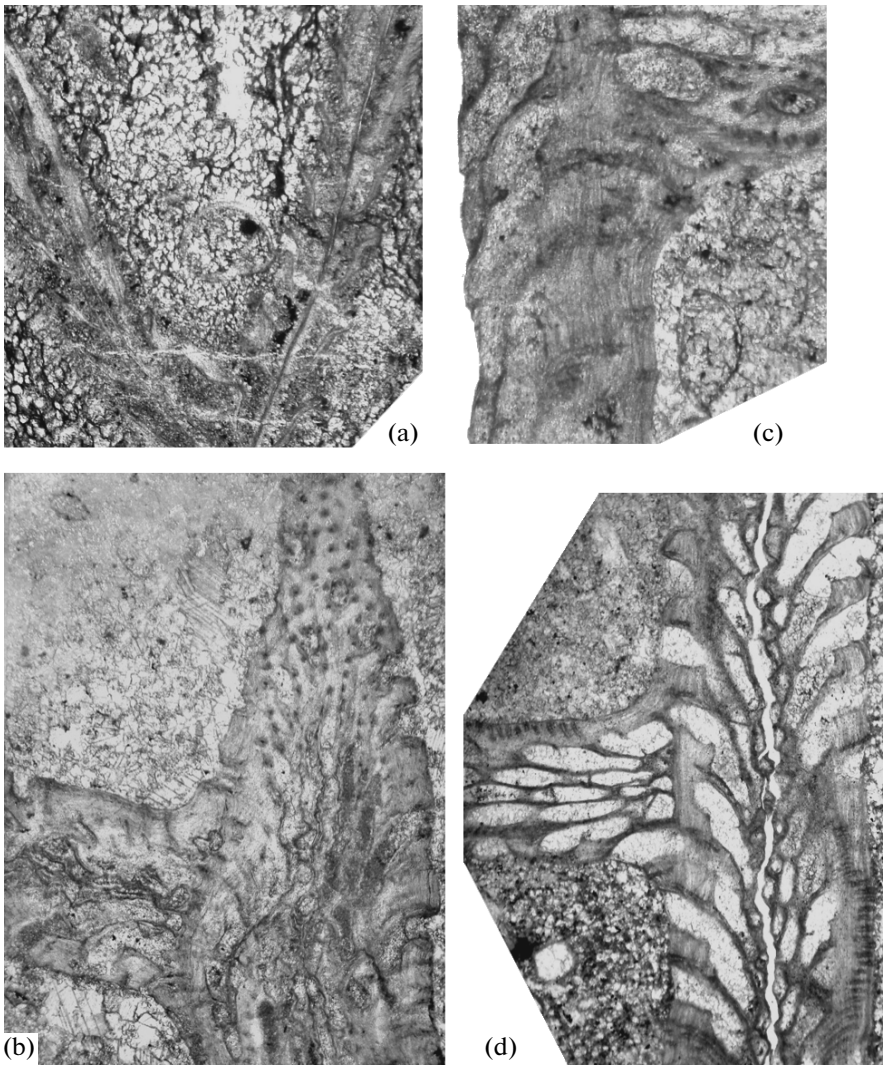


Fig. 2. Types of colony branching in Rhabdomesida: (a) dichotomous branching, *Nematopora rara* sp. nov., holotype KuzGPA, no. 12/1, ×30; (b–d) lateral branching showing lateral branches: (b) *Salairella petaloida* sp. nov., holotype KuzGPA, no. 12/19, ×25; (c) *S. variabilis* sp. nov., holotype KuzGPA, no. 12/22, ×45; (d) *S. baskuskanensis* sp. nov., holotype KuzGPA, no. 12/26, ×25.

(0.13–0.15 × 0.07–0.08 mm instead of 0.14–0.18 × 0.06–0.10 mm in *S. baskuskanensis* sp. nov.), and sharply curving rows of pores, arranged in rings around the apertures of autozooecia (in *S. baskuskanensis* sp. nov. there is a single slightly sinuous row of pores between the rows of autozooecial apertures).

Occurrence. Salair Ridge; Lower Devonian, Emsian Stage, Shanda Horizon.

Material. Holotype and two paratypes KuzGPA, nos. 12/23, 12/24, Salair Ridge, vicinity of the village of Novo-Pesterevo, section B-8323 (bed 3).

***Salairella maculata* Mesentseva, sp. nov.**

Plate 6, fig. 3

Etymology. From the Latin *maculatus* (spotted).

Holotype. KuzGPA, no. 12/25; Gorny Altai, right bank of Anui River; Lower Devonian, Emsian Stage, Shanda Horizon.

Description. The branches of colonies are 2.60–3.0 mm in diameter. The exozone is 0.88–1.20 mm wide, the endozone is 0.73–0.80 mm in diameter. The autozooecia are elongated tubular. The apertures of autozooecia are ovate or circular to oval and form longitudinal rows. The apertures of autozooecia are 0.14–0.17 mm long and 0.08–0.10 mm wide. There are 4.5–5 apertures per 2 mm along a branch. The walls of autozooecia are finely plicate, 0.02–0.03 mm thick in the endozone, and abruptly thicken up to 0.10–0.20 mm in the exozone. In addition, the cavities of autozooecia are frequently narrowed by secondary calcareous deposits on their walls. The autozooecia have a short superior hemiseptum, which is frequently completely covered by secondary

calcareous deposits. Diaphragms are absent. The pores are abundant, 0.02–0.04 mm in diameter, and are arranged at random, in places forming rows (13–14 pores per 1 mm in a row) and numerous accumulations measuring 0.30 × 0.90 mm. Longitudinal striation is mainly visible where the pores are arranged in rows.

Comparison. *S. maculata* sp. nov. differs from the other species of this genus in the larger colonies, arrangement of the apertures of autozooecia in longitudinal rows, and in the random development of pores, forming numerous accumulations.

Material. The holotype comes from the right bank of the Anui River, Sibiryachikha section 1 (bed 22).

***Salairella baskuskanensis* Mesentseva, sp. nov.**

Plate 6, fig. 4

Etymology. From the small town of Baskuskan.

Holotype. KuzGPA, no. 12/26; Salair Ridge, vicinity of the small town of Baskuskan; Middle Devonian, Eifelian Stage, Mamontovo Horizon.

Description (Figs. 1f, 2d). The branches of colonies are 0.70–1.40 mm in diameter. The endozone is 0.50–0.60 mm in diameter; the exozone is 0.21–0.40 mm wide. The autozooecia are elongated tubular, in the exozone they are arranged perpendicular to the surface. The autozooecia have inferior and superior hemisepta; there are sporadic thin concave complete diaphragms at the the endozone–exozone boundary. The walls of autozooecia are 0.02–0.04 mm thick in the endozone and thicken up to 0.13–0.22 mm in the exozone. The apertures of autozooecia are ovate or circular to oval-shaped and form diagonally intersecting rows. The apertures of autozooecia are 0.14–0.18 mm long and 0.06–0.10 mm wide; there are 5.5 apertures per 2 mm along a branch. Between the rows of apertures the autozooecia are arranged in a single slightly sinuous row of pores. Within the interapertural areas the pores are sporadic. The pores are 0.02–0.04 mm in diameter; there are 17–19 pores per 1 mm in a row. The space between the rows of autozooecial apertures and pores is covered by longitudinal striation.

Comparison. The new species differs from *S. recta* sp. nov. in the smaller diameter of the branches of colonies (0.70–1.40 mm instead of 0.77–1.50 mm in *S. recta* sp. nov.), in the dimensions of the apertures of autozooecia (0.14–0.18 × 0.06–0.10 mm instead of 0.17–0.20 × 0.08–0.11 mm in *S. recta* sp. nov.), in the greater number of apertures per 2 mm (5.5 instead of 4.5–5.5 in *S. recta* sp. nov.), in the development of inferior and superior hemisepta, and in the arrangement of pores in a single row (instead of 1–4 in *S. recta* sp. nov.).

Occurrence. Salair Ridge; Middle Devonian, Eifelian Stage, Mamontovo Horizon.

Material. Holotype and one paratype: KuzGPA, no. 12/27; Salair, vicinity of the small town of Baskuskan, Baskuskan section (bed 6); vicinity of the village of Zarechnoe, Zarechnoe section (bed 2).

***Salairella recta* Mesentseva, sp. nov.**

Plate 6, fig. 5

Etymology. From the Latin *rectus* (regular).

Holotype. KuzGPA, no. 12/28; Rudny Altai, right bank of the Gryaznukha River; Upper Devonian, lower part of the Frasnian Stage.

Description. The branches are 0.77–1.50 mm in diameter. The exozone is 0.35–0.58 mm wide; the endozone is 0.40–0.46 mm in diameter. The autozooecia have a poorly defined inferior hemiseptum, and in the exozone some autozooecia contain 1–3 complete diaphragms. The walls of autozooecia are 0.02–0.04 mm thick in the endozone and abruptly thicken up to 0.11–0.21 mm in the exozone. The apertures of autozooecia are ovate or, occasionally, circular- to oval-shaped, and are arranged in diagonally intersecting or, occasionally, in longitudinal rows. The apertures of autozooecia are 0.17–0.20 mm long and 0.08–0.11 mm wide; there are 4.5–5.5 apertures per 2 mm along a branch. The pores form a single slightly sinuous longitudinal row between the rows of autozooecial apertures; in places the number of rows increases up to 2–4. In interapertural areas the pores are sporadic. The pores are 0.01–0.03 mm in diameter; there are 17–20 pores per 1 mm. In some places between the apertures of autozooecia and pores there is longitudinal striation.

Comparison. See the Comparison section for the species *S. baskuskanensis* sp. nov.

Occurrence. Rudny Altai; Upper Devonian, lower Frasnian Stage.

Material. Holotype and three paratypes: KuzGPA, nos. 12/29–12/31; Rudny Altai, right bank of the Gryaznukha River, section BYa-9011 (bed 2).

Family Lenaporidae Ernst, Königshof, Taylor et Bohatý, 2011

Genus *Lenapora* Ernst et Königshof, 2010

***Lenapora gurievensis* Mesentseva, sp. nov.**

Plate 6, fig. 6

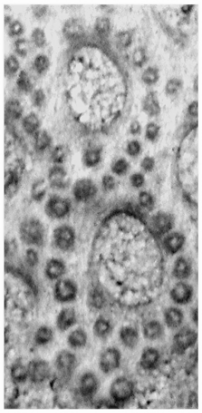
Etymology. From the town of Gur'evsk.

Holotype. KuzGPA, no. 12/32; Salair, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

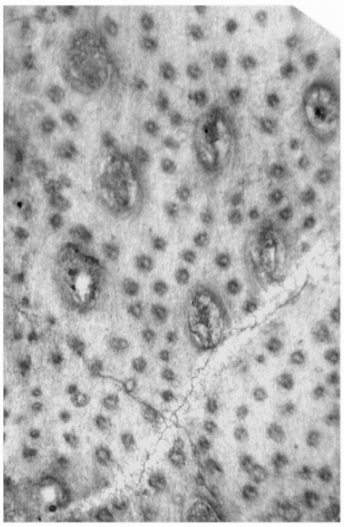
Description. The branches of colonies are 1.5–1.7 mm in diameter. The exozone is 0.53–0.70 mm wide; the endozone is 0.35–0.38 mm in diameter. The autozooecia are elongated tubular and are budding around the median axis in a spiral pattern. In the exozone the autozooecia are perpendicular to the surface. The apertures of autozooecia are circular to ovate or, circular, 0.11–0.14 mm long and 0.10–0.11 mm wide. The walls of autozooecia are 0.01–

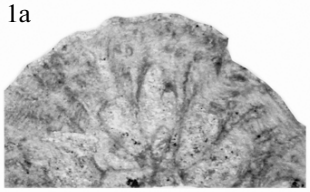
Plate 6

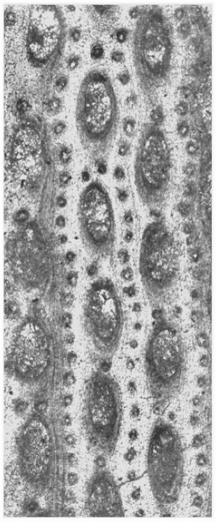

1a

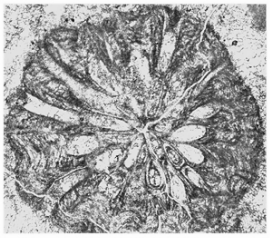

2


3a


3b

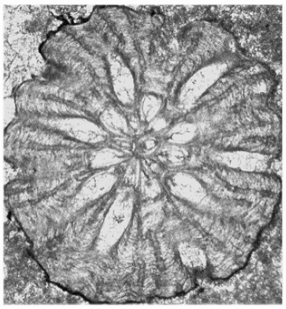

1b

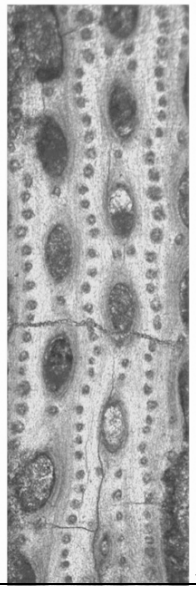

4b

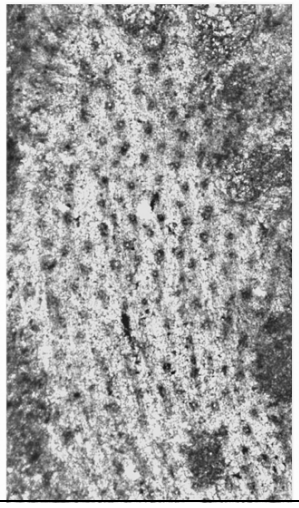

4c

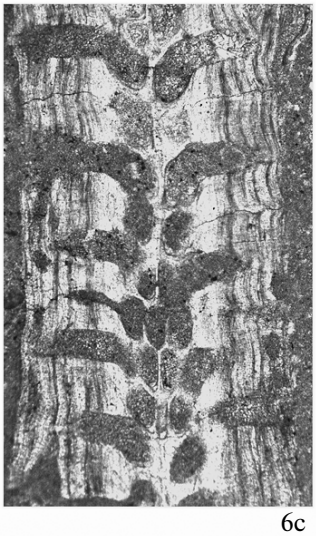

5a


4a


5b


5c


6b


6c


6a

Explanation of Plate 6

Figs. 1 and 2. *Salairella variabilis* sp. nov.: (1) holotype KuzGPA, no. 12/22: (1a) longitudinal section, ×60; (1b) cross section, ×40; (2) paratype KuzGPA, no. 12/23, tangential section, ×70; Salair Ridge, vicinity of the small town of Novo-Pesterevo; Lower Devonian, Emsian Stage, Shanda Horizon.

Fig. 3. *Salairella maculata* sp. nov., holotype KuzGPA, no. 12/25: (3a) longitudinal section, ×35; (3b) tangential section, ×45; Gorny Altai, right bank of the Anui River; Lower Devonian, Emsian Stage, Shanda Horizon.

Fig. 4. *Salairella baskuskanensis* sp. nov., holotype KuzGPA, no. 12/26: (4a) longitudinal section, ×30; (4b) tangential section, ×45; (4c) cross section, ×30; Salair Ridge, vicinity of the small town of Baskuskan; Middle Devonian, Eifelian Stage, Mamontovo Horizon.

Fig. 5. *Salairella recta* sp. nov., holotype KuzGPA, no. 12/28: (5a) longitudinal section, ×30; (5b) cross section, ×30; (5c) tangential section, ×40; Rudny Altai, Gryaznukha River; Upper Devonian, lower Frasnian Stage.

Fig. 6. *Lenapora gurievensis* sp. nov., holotype KuzGPA, no. 12/32: (6a) cross section, ×25; (6b) tangential section, ×50; (6c) longitudinal section, ×25; Salair Ridge, vicinity of the town of Gur'evsk; Lower Devonian, Emsian Stage, Shanda Horizon.

0.03 mm in the endozone and up to 0.14–0.18 mm in the exozone. The interapertural areas are covered by more or less regular rows of capillaries (tubules: Ernst and Königshof, 2010). The capillaries are 0.005–0.010 mm in diameter and are spaced 0.056–0.084 mm apart.

C o m p a r i s o n. The new species differs from *L. pulchra* Ernst et Königshof, 2010 in the larger diameter of the branches of colonies (1.5–1.7 mm instead of 0.36–0.63 mm in *L. pulchra*), larger apertures of autozooecia (0.11–0.14 × 0.10–0.11 mm instead of 0.04–0.10 mm in *L. pulchra*), and in the unbranched capillaries [judging by pl. 13, fig. C in: Ernst and Königshof (2010), in *L. pulchra* the capillaries branch].

M a t e r i a l. The holotype from the outskirts of the town of Gur'evsk, outcrop Ya-854 (bed 3).

CONCLUSIONS

The investigations carried out in the western part of ASFA have yielded nine new species of Rhabdomesida: seven from the Early Devonian (Emsian), one from the Middle Devonian (Eifelian), and one from the Late Devonian (Frasnian). The genus *Salairella* gen. nov. has been established. This genus was widespread in this region from the Emsian to Frasnian ages: it was encountered in six sections of the Salair Ridge and Gorny and Rudny Altai.

The study of the Devonian Rhabdomesida in the Salair Ridge and Gorny and Rudny Altai has resulted in an expanded knowledge about the spatiotemporal distribution of the genera *Paracuneatopora* and *Lenapora*, known in Western Europe and Western Africa. The genus *Paracuneatopora* was first discovered in the Koněprusy Limestone of the Pragian Stage in the Czech Republic and in coeval sediments of Morocco (Ernst, 2008); in the Salair Ridge and in Gorny Altai it is distributed in the Shanda Horizon sediments of the Emsian Stage. The genus *Lenapora* was described from the Junkerberg and Ahbach formations of the Eifelian Stage in Germany and from the upper Givetian of Morocco (Ernst and Königshof, 2010). In the Salair Ridge this genus was encountered in the Emsian Stage (Shanda Horizon, *serotinus* Zone). *Nematopora rara* sp. nov. is the first species of the genus *Nematopora* described from the Emsian Stage.

In the Devonian sections of the western part of ASFA the members of the order Rhabdomesida are considerably less diverse and widespread than those of Trepostomida and Fenestellida, which were used in establishing local biostratigraphic zones. In some instances, however—e.g., in reef facies uncovered by sections in the right bank of the Gryaznukha River—bryozoans are represented predominantly by Rhabdomesida.

ACKNOWLEDGMENTS

The author is grateful to the reviewers.

REFERENCES

Blake, D.B., Introduction to the suborder Rhabdomesina, *Treatise on Invertebrate Paleontology. Part G. Bryozoa*, Lawrence: Geol. Soc. Am., Univ. Kansas Press, 1983, pp. 530–616.

Ernst, A. and Schroeder, S., Stenolaemate bryozoans from the Middle Devonian of the Rhenish Slate Massif (Eifel, Germany), *N. Jb. Geol. Paläontol. Abh.*, 2007, vol. 246, no. 2, pp. 205–233.

Ernst, A., Trepostome and cryptostome bryozoans from the Koněprusy Limestone (Lower Devonian, Pragian) of Zlatý Kůň (Czech Republic), *Riv. Ital. Paleontol. Stratigr.*, 2008, vol. 114, no. 3, pp. 329–348.

Ernst, A. and Königshof, P., Bryozoan fauna and microfacies from a Middle Devonian reef complex (Western Sahara, Morocco), *Abh. Senckenb. Ges. Naturforsch.*, 2010, vol. 568, pp. 1–91.

Gorjunova, R.V., *Morfologiya, sistema i filogeniya mshanok (otryad Rhabdomesida)* (Morphology, Taxonomic System, and Phylogeny of Bryozoans: Order Rhabdomesida), Tr. Paleontol. Inst. Akad. Nauk SSSR, vol. 208, Moscow: Nauka, 1985.

Gorjunova, R.V., *Morfologiya i sistema paleozoiskikh mshanok* (Morphology and System of Paleozoic Bryozoans), Tr. Paleontol. Inst. Akad. Nauk SSSR, vol. 251, Moscow: Nauka, 1992.

Izokh, N.G., Conodonts and zonal subdivision of the Emsian sediments in the Salair Ridge, *Extended Abstract of*

Cand. Sci. (Geol.–Mineral.) Dissertation, Novosibirsk: Joint Inst. Geol. Geophys. Mineral., 1998.

Klyuchevye razrezy devona Rudnogo Altaya, Salaira i Kuzbassa (Key Sections of the Devonian of Rudny Altai, Salair, and Kuznetsk Basin Regions), Bakharev, N.K., Sennikov, N.V., Yolkin, E.A., and Izokh, N.G., Eds., Novosibirsk: Sib. Otd. Ross. Akad. Nauk, 2004.

Mesentseva, O.P. and Udodov, V.P., *Emsskie formatsii i paleotektonicheskoe raionirovanie territorii Gornogo Altaya* (Emsian Formations and Paleotectonic Zoning of the Gorny Altai Region), Tr. Kuzbass. Gos. Ped. Akad., Novokuznetsk: Kuzbass. Gos. Ped. Akad., 2007.

Mesentseva, O.P., Udodov, V.P., and Udodov, Yu.V., *Rasprostranenie trepostomid (mshanki) v nizhnezhivetskikh otlozheniyakh Salaira* (Distribution of Trepostomids (Bryozoa) in the Lower Givetian Sediments of the Salair Ridge), Prir. Ekon. Kuzbassa, no. 11, vol. 1, Novokuznetsk: Novokuznets. Gos. Ped. Inst., 2007, pp. 38–49.

Mesentseva, O.P., *Mshanki (Bryozoa) emsskogo yarusa zapadnoi chasti Altae-Sayanskoi skladchatoi oblasti* (Moss Animals (Bryozoa) of the Emsian Stage in the Western Altai–Sayan Folded Area), Bakharev, N.K., Ed., Novosibirsk: Sib. Otd. Ross. Akad. Nauk, 2012.

Mesentseva, O.P., New data on Cryptostomata (Bryozoa) from the Emsian Stage of the Salair Ridge, *Paleontol. J.*, 2013, vol. 47, no. 4, pp. 400–406.

Middle–Upper Devonian and Lower Carboniferous Biostratigraphy of Kuznetsk Basin: Field Excursion Guidebook. International Conference "Biostratigraphy, Palaeogeography, and Events in Devonian and Lower Carboniferous" (SDS/IGCP 596 Joint Field Meeting), Bakharev, N.K., Izhokh, N.G., Obut, O.T., and Talent, J.A., Eds., Novosibirsk: Sib. Otd. Ross. Akad. Nauk, 2011.

Morozova, I.P., *Devonskie mshanki Minusinskikh i Kuznetskoi kotlovin* (Devonian Bryozoans of the Minusinsk and Kuznetsk Depressions), Tr. Paleontol. Inst. Akad. Nauk SSSR, vol. 86, Moscow: Akad. Nauk SSSR, 1961.

Rodygin, S.A., On the conodont-based age of the Sibiryachikha Horizon in the Devonian of Gorny Altai, *Byull. Mosk. O-va Ispyt. Prir. Otd. Geol.*, 1986, vol. 61, no. 3, pp. 51–53.

Stratotipicheskie razrezy nizhnego i srednego devona Salaira. Telengitskii nadgorizont: terrigenno-karbonatnye fatsii (Stratotype Sections of the Lower and Middle Devonian of Salair: Telengit Superhorizon: Terrigenous-Carbonate Facies), Yolkin, E.A. and Kanygin, A.V., Eds., Novosibirsk: Inst. Geol. Geofiz. Sib. Otd. Akad. Nauk SSSR, 1986.

Stratotipicheskie razrezy nizhnego i srednego devona Salaira. Telengitskii nadgorizont: karbonatnye fatsii (Stratotype Sections of the Lower and Middle Devonian of Salair: Telengit Superhorizon: Carbonate Facies), Yolkin, E.A. and Kanygin, A.V., Eds., Novosibirsk: Inst. Geol. Geofiz. Sib. Otd. Akad. Nauk SSSR, 1987.

Tolokonnikova, Z.A., Biostratigraphy of Upper Devonian sections in the western Altai–Sayan region based on bryozoans, *Stratigr. Geol. Correlation*, 2012, vol. 20, no. 6, pp. 528–540.

Udodov, V.P. and Mesentseva, O.P., *Stratotip baragashskoi svity, kak etalonnyi razrez emskogo yarusa Tsentral'nogo Altaya* (Stratotype of the Baragash Formation As a Standard Section of the Emsian Stage of the Central Altai), Prir. Ekon. Kuzbassa, vol. 8, 2000, Novokuznetsk: Novokuznets. Gos. Ped. Inst., pp. 19–36.

Volkova, K.N., *Devonskie mshanki Yugo-Vostochnogo Altaya* (Devonian Bryozoans of the Southeastern Altai Mountains), Tr. Inst. Geol. Geofiz., Sib. Otd. Akad. Nauk SSSR, vol. 199, Moscow: Nauka, 1974.

Translated by L. Lukyanov