

New Species of Syringoporids from Eifelian Deposits of the Subpolar Ural Mountains

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Received January 10, 2005

Abstract—A high diversity of tabulate corals in Eifelian deposits of the Syv’yu River basin (Subpolar Urals) is reported for the first time. Most of the corals are represented by colonies of syringoporids. Five new species *Syringopora parva* sp. nov., *S. insueta* sp. nov., *S. indecora* sp. nov., *Tetraporinus syvjuensis* sp. nov., and *Armalites serotinus* sp. nov. are described.

DOI: 10.1134/S0031030106040022

Key words: corals, Tabulata, Syringoporida, Middle Devonian, Komi Republic, Ural Mountains, Russia.

INTRODUCTION

The Eifelian Age in the northeastern Europe was characterized by a stabilization of the sea basin after the Late Emsian transgression, which led to a strong differentiation of sedimentary environments. The taxonomic diversity of tabulate corals in the region in this time was caused by qualitative changes in the genus-level composition. Representatives of *Favosites* and *Squameofavosites* virtually disappeared, whereas *Alveolites*, *Crasialveolites*, and *Syringopora* became widespread. The communities of tabulate corals became richer in polyprovincial species. However, the facies differentiation of the sedimentary basin resulted in a partial isolation of some biotopes with a subsequent emergence of endemic forms there. One of these fossil biotopes has been discovered in the Syv’yu River basin, a left-bank tributary of the Kozhym River (Subpolar Urals) (Fig. 1).

For the first time the Middle Devonian of the Syv’yu River was described during the geological survey at a scale of 1 : 200000 performed in 1959–1961 in the basins of the Lemva and Kozhym rivers headed by A.D. Miklukho-Maclay. In 1961, A.I. Pershina visited the section and for the first time collected paleontological samples; however, these did not contain tabulate corals. The first detailed level-by-level sampling of faunal remains from the section of the Middle Devonian on the Syv’yu River was conducted by V.S. Tsyganko in 1998. Tabulate corals from his collection are considered below, including the description of several new species.

Deposits of the Eifelian Stage in the middle reaches of the Syv’yu River are represented by the upper Sibiryakovskaya Formation and most of the Malyi Patok Formation. The Sibiryakovskaya Formation comprises a sequence of interbedding clay limestones,

fine-grained quartzitic sandstones, marls, and argillites. The lower part of the Malyi Patok Formation is formed by organogenic detrital limestones, the upper part is composed by gray hummocky-bedded clay limestones alternating with organogenic detrital and clay limestones, and with thin interlayers of calcareous argillites. The limestones contain a rich fauna of stromatoporoids, tabulate and rugose corals, brachiopods, and bivalves. The most representative in this biota is the fauna of tabulate corals, which, together with stromatoporoids and rugose corals, compose small bioherms. The massive

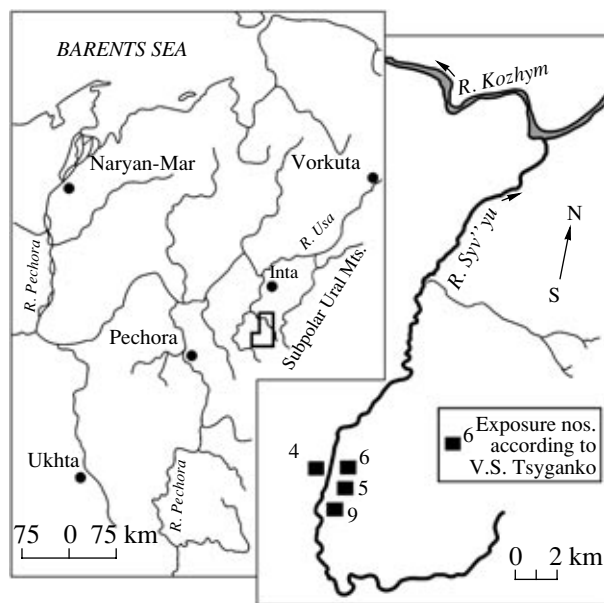


Fig. 1. Schematic map of the sections of the Eifelian Stage on the Syv’yu River (Subpolar Urals).

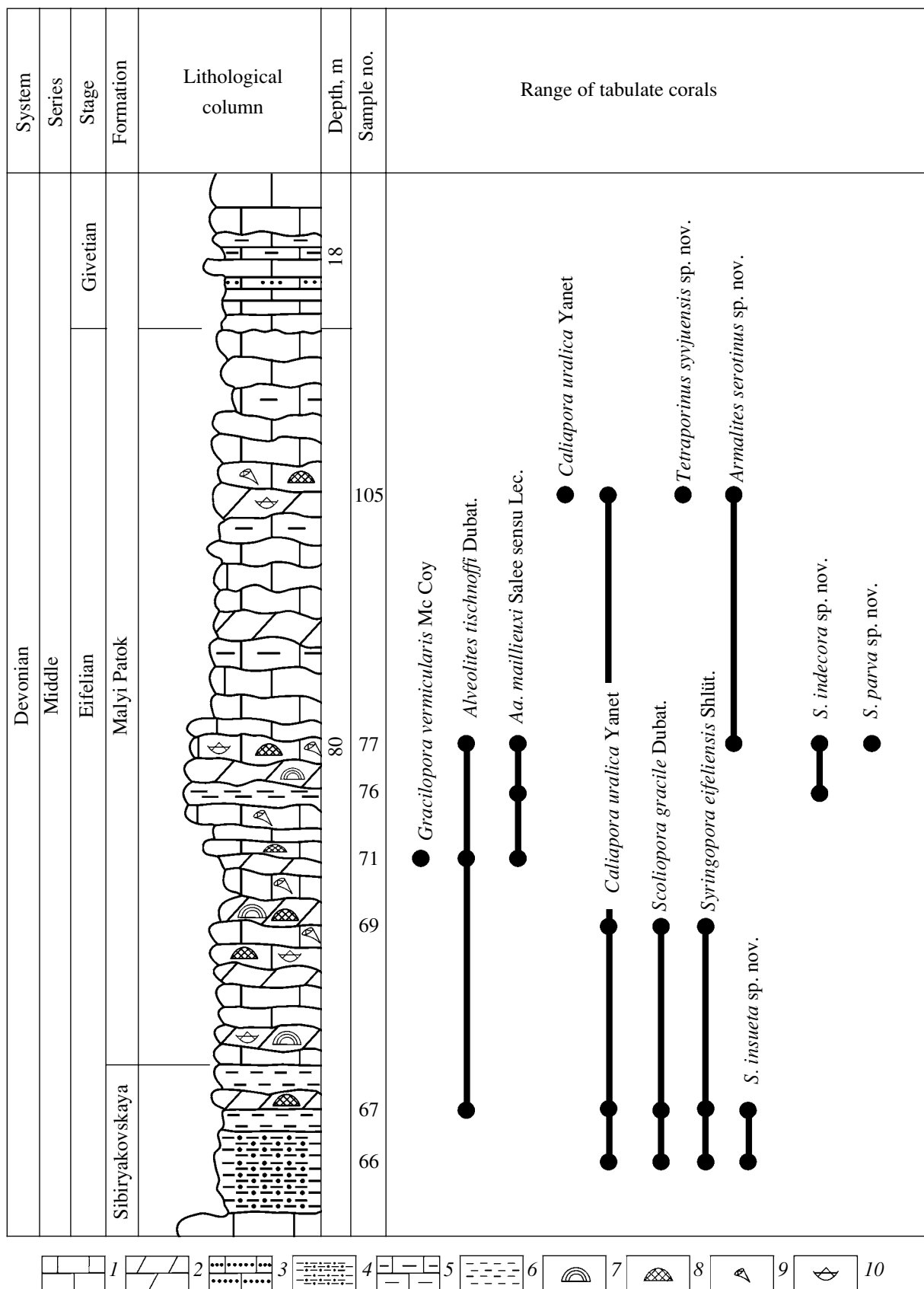


Fig. 2. Distribution of tabulate corals in the section of the Eifelian deposits in the middle reaches of the Syv'yu River. Designations: (1) limestones; (2) marls; (3) sandy limestones; (4) siltstones; (5) clay limestones; (6) clay; (7) stromatoporoids; (8) tabulate corals; (9) rugose corals; and (10) brachiopods.

colonies of these tabulate corals typically have a spherical or discoid shape; they normally occur in their lifetime positions, but some coralla are overturned. It can be assumed that this community occupied the littoral zone of the sea.

The tabulate coral assemblage in the section on the Syv'yu River contains 12 species of the genera *Gracilopora*, *Alveolites*, *Crassialveolites*, *Caliopora*, *Scoliopora*, *Syringopora*, *Armalites*, and *Tetraporinus* (Fig. 2). Most corals are represented by colonies of syringoporids. An important feature of the Syv'yu assemblage is the co-occurrence of the globally distributed genus *Syringopora* Goldfuss, 1826 with the genera *Tetraporinus* Sokolov, 1947 and *Armalites* Tchudinova, 1964. The *Tetraporinus* species are not numerous and have a rather limited range. They are so far known only from the Lower Carboniferous of China (Chu, 1934) and occur in the Silurian and Lower Carboniferous deposits of the Arctic areas of Russia (Sokolov, 1962, p. 239). Forms of this genus have not been found in Devonian deposits before. Few species of the genus *Armalites* were found in the upper Lower and lower Middle Devonian of the Kuznetsk Basin (Kuzbass) (Tchudinova, 1964, p. 63), and two species were established in the Lower Devonian of Gornyi Altai (Mironova, 1974, pp. 107–108). The following remarks are necessary concerning the genus *Armalites*. This genus was first discussed by I.I. Tchudinova in the work of Dubatolov (1963, p. 62), who has attributed it to the family Syringolitidae (order Favositida). Later, Tchudinova (1964, p. 63) described it based on its type species *A. novellus* Tchudinova and referred it to the family Syringoporidae (order Syringoporida). Mironova (1974, p. 107) included the genus *Armalites* into Syringolitida, leaving the question of its family level relationships open. In the *Treatise...* Hill (1981) presented a system of Tabulata that is completely different from that accepted by the majority of Russian paleontologists, i.e., the system proposed by Sokolov (1962). For example, Hill (1981) included the genus *Armalites* into the family Roemeridae of the superfamily Syringoporicae of the order Auloporida. Thus, there is no consensus of opinion on the taxonomic position of *Armalites*. This is apparently explained by the fact that the described species of the genus are few in number and that their morphology is inadequately understood. In this case, it is more logical to tentatively retain the genus *Armalites* within the family Syringoporidae, where it was placed by the author of the genus.

The description of new species of tabulate corals from the Syv'yu assemblage is given below. The system of Tabulata proposed by Sokolov (1962) serves as a basis for the classification.

MATERIAL

The material described is housed in the A.A. Tchernov Geological Museum (GM) (Institute of Geology, Komi Research Center, Ural Division, Russian Academy of Sciences, Syktyvkar), collection no. 144.

SYSTEMATIC PALEONTOLOGY

Order Syringoporida Sokolov, 1947

Family Syringoporidae Nicholson, 1879

Genus *Syringopora* Goldfuss, 1826

Syringopora parva Lukin, sp. nov.

Plate 3, fig. 1

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

H o l o t y p e. Specimen GM, no. 144/1; Subpolar Urals, middle reaches of the Syv'yu River, right bank, exposure 6; Eifelian Stage, Malyi Patok Formation.

D e s c r i p t i o n. The corallum is globular, no more than 20 mm in diameter. The corallites fan out from the base, are slightly curved, and terminate in rounded or slightly angular apertures of irregular shape. They are unevenly distributed over the corallum surface. The inter-corallite distance varies from the complete contact up to 0.5–0.75 mm. The diameter of corallites is 0.5–0.6 mm or, sometimes, slightly more. The walls are thick, two-layered. The thickness of the dark wrinkled epitheca is about 0.03 mm, and the wall itself is 0.1–0.15 mm thick. The connecting tubes are randomly distributed. Their diameter is 0.3–0.35 mm. The tabulae are rather widely spaced (0.2–1.0 mm), thin, oblique, concave, and funnel-shaped. Spines have not been observed.

C o m p a r i s o n. The described species belongs to the fine-meshed representatives of *Syringopora*. From *S. expansa* Maurer (Maurer, 1885, p. 77, pl. 1, figs. 2–4), it differs in the more closely spaced corallites, more widely spaced connecting tubes, and thinner walls. From *S. compacta* Billings (Lambe, 1899, p. 54) from the Lower Devonian of North America, it differs in the less angular corallites, thinner walls, and the absence of spines. In addition, the descriptions of *S. expansa* and *S. compacta* show that these species formed fairly large coralla (about 100 mm), i.e., they were larger than in the described species.

M a t e r i a l. Holotype.

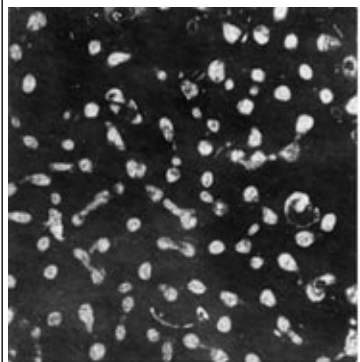
Syringopora insueta Lukin, sp. nov.

Plate 3, fig. 2

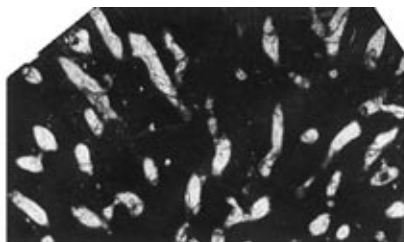
E t y m o l o g y. From the Latin *insueta* (unusual).

H o l o t y p e. Specimen GM, no. 144/2; Subpolar Urals, middle reaches of the Syv'yu River, right bank, exposure 6; Eifelian Stage, Sibiryakovskaya Formation.

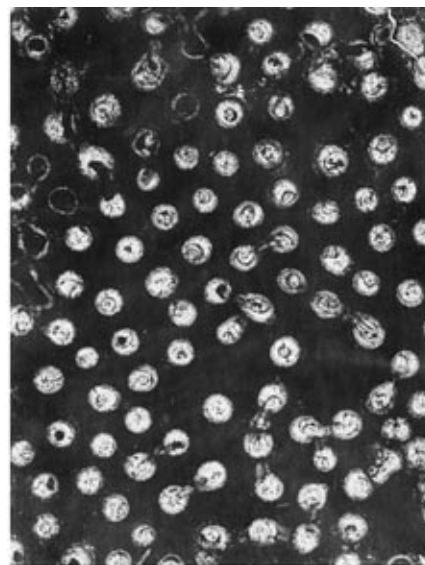
D e s c r i p t i o n. The coralla are lens-shaped, 35–55 mm high, measures from 60 × 100 to 50 × 80 mm. In cross section, the corallites are circular and 0.7–0.8 or, more rarely, 1.0–1.25 mm in diameter. They are fairly closely spaced (0.6–1.0 mm). In very rare cases corallites can contact. The walls are 0.1–0.15 mm thick or, in some coralla with larger corallites, up to 0.2–0.25 mm thick. The epitheca is thin and dark and stands out sharply against the light-colored wall. The connecting tubes are 0.5–0.8 mm in diameter and unevenly spaced. The distance between them varies from 1.5 to



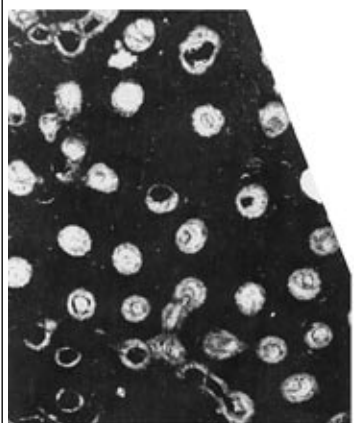
1a



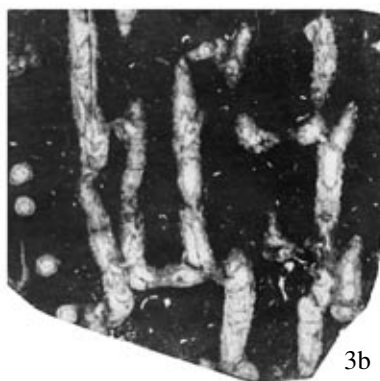
1b



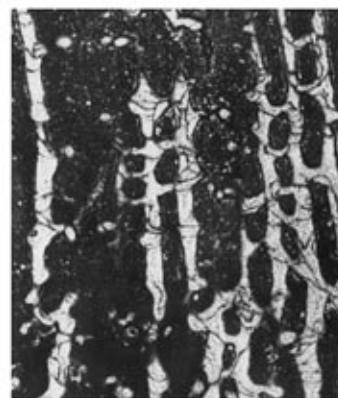
2a



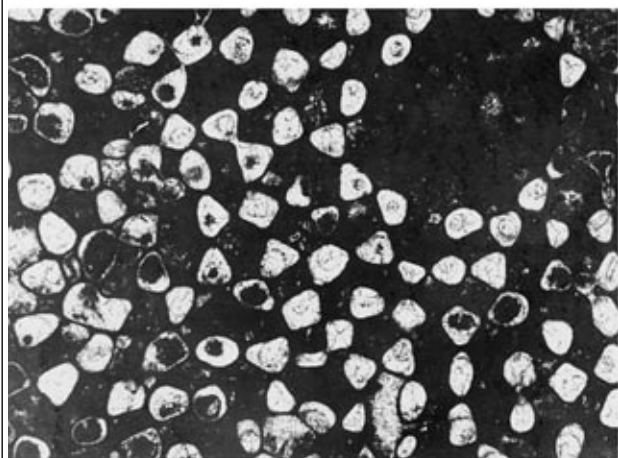
3a



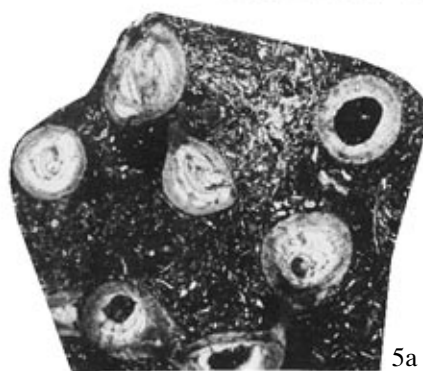
3b



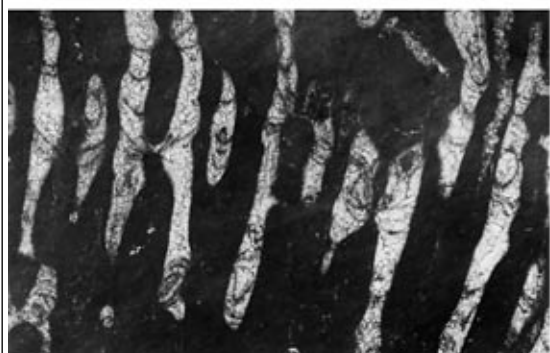
2b



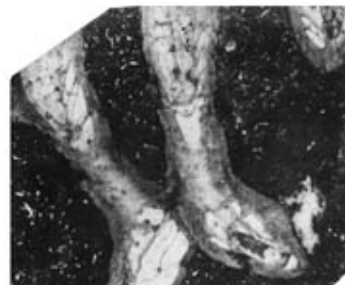
4a



5a



4b



5b

3.0 mm. The tabulae are thin and distinctive in structure. Sometimes they are funnel-shaped and vesicular with an incipient axial canal. They become horizontal or weakly concave where the axial canal ends blindly. No zonation in the distribution of tabulae is observed. The distance between the tabulae measured along the wall varies from 0.3 to 1.5 mm or, less often, to 2.0 mm. The spines are small and rarely occur.

Comparison. The species described has a vague similarity to the species *S. yavorskyi* Tchernychev described from Eifelian deposits of Kuzbass (Tchernychev, 1951, p. 76, pl. 19, figs. 7, 8) and from the Biya deposits of the western slope of the northern Ural Mountains (Sokolov, 1952, p. 123) in the size of corallites and in the structure of coralla. However, *S. insueta* differs from this species and other closely related forms in the slightly larger maximal diameter of corallites, the distinctive structure of tabulae, thick connecting structures, and the presence of spines.

Material. The holotype and two specimens: GM, nos. 144/2-1, 2-2; Sibiryakovskaya Formation, Eifelian Stage; Syv'yu River, Subpolar Urals.

Syringopora indecora Lukin, sp. nov.

Plate 3, fig. 3

Etymology. From the Latin *indecora* (ugly).

Holotype. Specimen GM, no. 144/3; Subpolar Urals, middle reaches of the Syv'yu River, right bank, exposure 5; Eifelian Stage, Malyi Patok Formation.

Description. The corallites radiate from the basis of the corallum at random to form a bushy colony of a rounded form 30–45 mm in diameter. The corallites are 0.7–1.0 mm in diameter. They are distributed unevenly: either in contact with each other or separated by a distance of 1.0–1.5 mm. The walls are thick (0.15–0.25 mm) with dark thin external epitheca (0.03 mm). The connecting tubes are randomly distributed, 0.6–0.7 mm in diameter. At the contact points between corallites, pore canals are observed. The tabulae are thin, funnel-shaped, with an incipient axial canal, the distance between the tabulae measured along the wall varies from 0.3 to 1.5–2.0 mm. Some corallites have small spines at the colony surface.

Comparison. The new species differs from *S. insueta* in the smaller colonies, irregular growth of corallites, and thicker walls. In addition, corallites of the species described contact more frequently in the course of growth than in *S. insueta* and can communicate through pore canals in these places.

Material. The holotype and two specimens: GM, nos. 144/3-1, 3-2; Malyi Patok Formation, Eifelian Stage; Syv'yu River, Subpolar Urals.

Genus *Armalites* Tchudinova, 1964

Armalites serotinus Lukin, sp. nov.

Plate 3, fig. 5

Etymology. From the Latin *serotinus* (late).

Holotype. Specimen GM, no. 144/4; Subpolar Urals, middle reaches of the Syv'yu River, right bank, exposure 9; Eifelian Stage, Malyi Patok Formation.

Description. The corallum is bushy, of medium size. The corallites are cylindrical, 2.25–2.6 mm in diameter in some colonies and 2.5–3.0 mm in the others. The distance between corallites varies from a full contact up to 3.0 mm, more typically, 0.5–2.0 mm. The walls are thick, two-layered. The wall is up to 0.75 mm thick or, more often, about 0.5 mm thick. The dark rugose epitheca is 0.08–0.1 mm thick. The pore canals are about 0.5 mm in diameter and connect closely spaced corallites. The connecting tubes are widely spaced, 0.75–1.5 mm in diameter. The spines are inserted fairly deeply into the wall sclerenchyma. They form vertical rows spaced 0.3–0.5 mm, sometimes up to 1.0 mm. The tabulae are typically funnel-shaped, with an axial canal about 0.7 mm in diameter. The distance between tabulae measured along the wall is 0.25–1.5 mm (more often 0.5–1.0 mm).

Comparison. The species described resembles *A. venustus* Tchudinova (1964, p. 65, pl. 33, figs. 2) from the Salairka Horizon of Kuzbass in the diameter of cylindrical corallites and in the wall thickness. However, the new species differs from the Kuzbass form in the diameter of pore canals, their arrangement pattern, vertical distance between spines, and distribution of tabulae. Additionally, all previously known species of this genus occur in older deposits.

Material. The holotype and three specimens: GM, nos. 144/4-1, 4-2, 4-3; Malyi Patok Formation, Eifelian Stage; Syv'yu River, Subpolar Urals.

Family Tetraporellidae Sokolov, 1950

Genus *Tetraporinus* Sokolov, 1947

Tetraporinus syvjuensis Lukin, sp. nov.

Plate 3, fig. 4

Etymology. From the Syv'yu River.

Explanation of Plate 3

Fig. 1. *Syringopora parva* sp. nov., holotype GM, no. 144/1: (1a) cross section, $\times 3.5$; (1b) longitudinal section, $\times 3.5$.

Fig. 2. *Syringopora insueta* sp. nov., holotype GM, no. 144/2: (2a) cross section, $\times 4$; (2b) longitudinal section, $\times 4$.

Fig. 3. *Syringopora indecora* sp. nov., holotype GM, no. 144/3: (3a) cross section, $\times 4$; (3b) longitudinal section, $\times 4$.

Fig. 4. *Tetraporinus syvjuensis* sp. nov., holotype GM, no. 144/5: (4a) cross section, $\times 6$; (4b) longitudinal section, $\times 6$.

Fig. 5. *Armalites serotinus* sp. nov., holotype GM, no. 144/4: (5a) cross section, $\times 4$; (5b) longitudinal section, $\times 4$.

Holotype. Specimen GM, no. 144/5; Subpolar Urals, middle reaches of the Syv"yu River, right bank, exposure 9; Eifelian Stage, Malyi Patok Formation.

Description. The colonies are of spherical form, about 40 mm in diameter. The corallites fan out from the base of the corallum and terminate at the surface in tri- or tetragonal apertures with rounded corners. The corallites vary from 0.6 to 0.75 mm in diameter. The walls are thin and two-layered with a dark-colored external layer and a lighter internal one. The total thickness of the wall is about 0.08 mm. Connecting structures are represented by pore canals in places of tight contact of corallites and by connecting tubes between more widely spaced corallites. They occur at the corners of corallites. The diameter of the pore canals does not exceed 0.25 mm; that of the connecting tubes, 0.4 mm. The connecting structures are distributed unevenly, at intervals of 0.5–2.0 mm or even at greater intervals. The tabulae are thin and concave or oblique to the walls. The distance between tabulae varies from 0.2 to 0.75 mm. There are vesicles formed by tabulae along the walls of some corallites. Septal structures have not been observed.

Comparison. The species described resembles *T. singularis* Sokolov (Sokolov, 1947, p. 24, pl. 1, figs. 11, 12, text-figs. 3–4) from the Lower Carboniferous of the Taimyr Peninsula in the structure of the colony and dimensions of corallites. They differ in wall thickness, diameter of connecting tubes, and in the structure of tabulae. *T. syvjuensis* has two-layered walls twice as thick as those of the Taimyr form. The diameter of the connecting structures is also almost twice as large, and they are more widely spaced. In addition, *T. singularis* has projections on the walls that end blindly and represent rudimentary connecting tubes not known in the Ural species. The tabulae in the Taimyr species are vesicular, less often oblique and horizontal, whereas *T. syvjuensis* has concave tabulae, which are more often oblique to the axis of the corallites.

Material. The holotype and three specimens: GM, nos. 144/5–1, 5–2, 5–3; Malyi Patok Formation, Eifelian Stage; Syv"yu River, Subpolar Urals.

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