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AXOPORA AGGTELEKENSIS SCHOLZ, 1972, ORIGINALLY DESCRIBED AS HYDROZOA, IS ATTRIBUTED TO THE NEW GENUS *ANISOPHYTES* (CYANOPHYTA?)

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Abstract. Examination of the calcareous microfossil from the Anisian reef limestones of the Aggtelek Mountains, northern Hungary, described as *Axopora aggtelekensis* by Scholz, supports the cyanobacterian nature of this organism. It is not a Hydrozoa as originally thought by Scholz. For this microfossils, occuring in Triassic shallow water carbonates the new genus *Anisophytes* is proposed. The differences between *Anisophytes*, as gregarious microfossil composed of tubes, and other similar looking organisms, like *Tubiphytes*, *Aeolisaccus kotori* Radoicic, *Koivaella* Tchuvashov or *Proaulopora* Vologdin is discussed. *Anisophytes* is attributed tentatively to Cyanophyceans.

Riassunto. Viene riesaminato il microfossile calcareo proveniente dai calcari di piattaforma carbonatica delle Montagne di Aggtelek, Ungheria settentrionale, originariamente descritto da Scholz come *Axopora aggtelekensis*. Non si tratta di un Hydrozoa, come originariamente indicato da Scholz, ma piuttosto di un cyanobatterio. Viene proposto il nuovo genere *Anisophytes* per questo microfossile, che si trova in carbonati Triassici di acque basse. Vengono ugualmente discusse le differenze tra *Anisophytes*, un microfossile gregario composto di tubuli ed altri organismi di aspetto simile, quali *Tubiphytes*, *Aeolisaccus kotori* Radoicic, *Koivaella* Tchuvashov or *Proaulopora* Vologdin. *Anisophytes* viene tentativamente attribuito alle Cyanophyceae.

Introduction

Scholz (1972) described from the Anisian reef limestones of the Aggtelek Mountains, northern Hungary the calcareous microfossil *Axopora aggtelekensis* with the following diagnosis: "Massive, nodule-like colony with very thin, equal and closely spaced pores penetrating into the spongy coenenchyma. There are only gastropores in each of which a gracious, smooth-faced, spongy gastrostyle can be found" (p. 344). *Axopora aggtelekensis* was attributed to the hydrozoans by Schloz.

Apparently, the "nodule-like colony" of this fossil, composed of numerous tubes, growing more or less parallel with each other, was interpreted as a "coenenchyma" of hydrozoans and the individual tubes as "gastropores". The cements between the tubes ("gastropores") were interpreted as "spongy coenenchyma which had been dissolved and replaced by fibrous calcite". As a hydrozoa the Anisian fossil was attributed to *Axopora*, a genus known from the Eocene-Oligocene time interval, also reported as the species *A. kolosvaryi* from the Hungarian Eocene (Scholz 1972).

The investigations of Scholz were based on polished slabs only. His type material is deposited in the Geological Museum of Hungary in Budapest. Scholz did not make any thin section from his material in order to study the fossil in detail. We finished three thin sections from two of his paratypes that are absolutely identical to the holotype of Scholz. A detailed description of *Anisophytes aggtelekensis* (Scholz) is presented in this paper.

Geological setting and stratigraphy of the Aggtelek reef

The Aggtelek reef forms a 1.8 km wide belt in the karstified Aggtelek Plateau which strikes NW/SE over a distance of about 7 km (3.5 km "A reef", plus 3.5 km "B reef") between the villages Aggtelek, Jósvafő and Égerszög in NE Hungary (Fig. 1).

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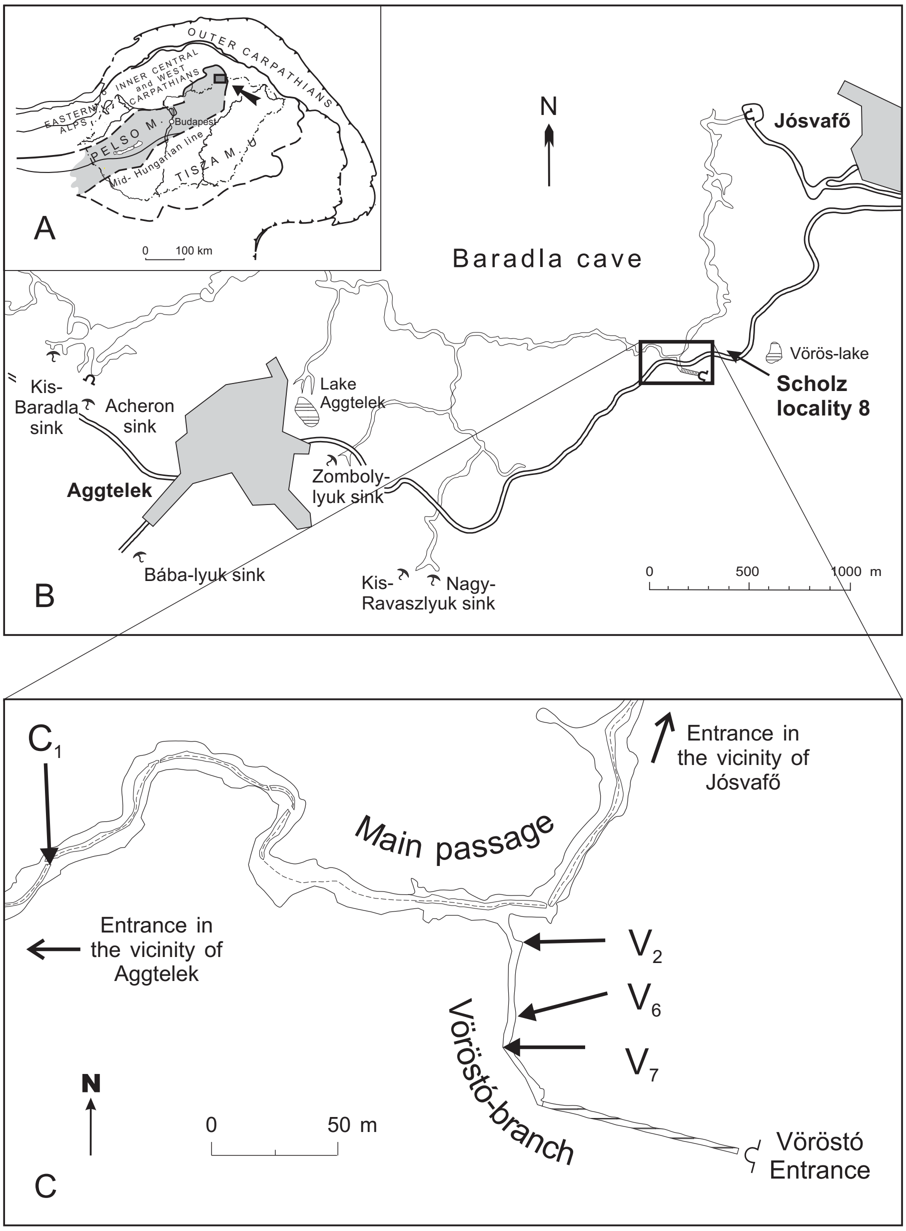

Fig. 1 - A) Location of the Aggtelek reef and the major geological units of the Pannonian Basin. B-C) Location of the type material [(1B: Surface: Scholz locality 8) and our samples (1C: Baradla cave) (for more information see text)].

The Triassic platform formations which constitute the Aggtelek karst belong to the Silica Nappe, which forms the uppermost nappe of the Inner West Carpathians (Kozur & Mock 1973). In Triassic times the West Carpathians were situated on the northern shelf of the opening Vardar-Meliata branch of the Neotethys ocean (Kovács 1982; Tollmann 1987; Haas 2001). Its rifting strongly influenced the evolution of the Silica Nappe. Due to the lack of both tectonic activity and reef-building organisms from the Lower Triassic through to Pelsonian times, a homoclinal ramp existed in the area until the Pelsonian (Hips 2003).

By the beginning of the Middle Triassic an euxinic lagoonal environment had come into existence (Gutenstein ramp stage, Hips 2003). Later this abruptly changed into an open lagoonal environment rich in calcareous algae (Steinalm ramp stage, Piros et al. 2001). The beginning of rifting in the Pelsonian resulted in the break-up of the carbonate ramp and due to the differentiation three different facies were formed (Kovács 1997): 1) a rimmed platform (Aggtelek Unit); 2) a slope (Szőlősardó Unit); and 3) a deep pelagic basin environment (Bódva Unit).

Evolution of the Aggelek Unit in the Anisian-Ladinian

In the late Pelsonian the development of the Steinalm lagoon was terminated by a tectonic event, which was the manifestation of the Reifling event in the Northern Calcareous Alps (Schlager & Schnöllnberger 1975). This event caused the drowning of the Steinalm platform, and dissected the basement. From that time onward two different facies existed. On the NW part of the Aggtelek platform reef limestone was deposited (first reef stage: "A reef"), whereas on the SE part of the area an intraplatform basin existed during the late Pelsonian-earliest Ladinian interval.

In the Ladinian the reef prograded to the SE, consequently above the Pelsonian-Early Ladinian basin sediments reef limestone appeared (second reef stage: "B reef"), whereas on the NW part of the Aggtelek platform lagoonal sediments were deposited above the Anisian reef limestone.

I. On the NW part of the area during the Late Anisian-Early Ladinian a barrier reef developed. We can follow the reef over a distance of 35 km in a NW-SE direction.

The drowning of the Steinalm Platform is represented by the so called "ammonoid layer". It is some 10 m thick. The lowest part contains conodonts of the Binodosus Subzone (*Gondolella bulgarica*, *G. hanbulogi*, *G. bifurcata*, *G. preszaboi bystryckyi*, *G. preszaboi preszaboi* and *G. bulgarica*→*G.excelsa* transitional forms. All conodonts mentioned in this contribution were determined by S. Kovács). The upper part contains conodonts from the Trinodosus Subzone (i.e. *Gondolella szaboi*, *G. excelsa*, *G. liebermani* and *Gladigondolella tethydis*). This "ammonoid layer" constitutes the base of the reef limestone.

The reef development was first interrupted by a drowning event in the Avisianum Subzone. The age is verified by conodonts: *Gondolella excelsa*, *G. fueloepi*, *G. trammeri* and *Gladigondolella tethydis*. After this deep water event reef limestones reappeared for a short time and this were then covered again by basinal sediments. In the Ladinian peritidal lagoonal sediments were deposited above the reef limestones. The age of the lagoonal limestone is determined by Dasycladaceans (*Diplopora annulata*, *Teutloporella peniculiformis* and *Aciculella bacillum*. All dasycladaceans mentioned in this paper were identified by O. Piros).

II. In the basin (i.e. the SE part of the platform) we can find distal turbidites. The lowest layers of the basin contains a very rich, mixed conodont fauna of the Binodosus-Trinodosus Subzone (i.e. *Gondolella bulgarica*, *G. hanbulogi*, *G. constricta cornuta*, *G. preaszaboi bystrickyi*, *G. preaszaboi preszaboi*, *G. szaboi*, *G. excelsa*, *G. liebermani*, *G. trammeri*, *Gladigondolella budurovi* and *Gl. tethydis*). The uppermost layer contains conodonts from the Curionii Zone (i.e. *G. constricta* juv., *G. szaboi*, *G. fueloepi*, *G. trammeri*, and *G. "pseudolonga"*). The distal turbidites filled up the basin. At the top of the turbiditic layers crinoidal limestone appeared, which constitutes the transition to the reef limestone covering the basinal sediments. Around the Curionii Zone the platform prograded to the SE. This is the second stage of the reef development ("B reef") in the Aggtelek platform, which started in the Curionii Zone, and the lagoon behind the reef evolved above the earlier reef limestone, on the NW part of the area.

The investigated type-material of Scholz (1972) was collected by him about 1000 m SW of Jósvafő (Fig. 1.B), above Vöröstó (locality 8 of Scholz). Several samples, containing *Anysophytes aggtelekensis*, were collected by ourselfs from the following localities (Fig. 1.C): Baradla cave: sample C1: in the main passage of the cave, 4400 m from the entrance at Aggtelek. Sample V2: in the Vöröstó branch: 8 m south of the crossing of the main passage of the cave, and the Vöröstó branch, Eastern wall. Sample V6: in the Vöröstó branch, 43 m south of the crossing of the main passage of the cave, and the Vöröstó branch, Eastern wall. Sample V7: in the Vöröstó branch, 50 m south of the crossing of the main passage of the cave, and the Vöröstó branch, Western wall.

All samples, mentioned above originated from the lower part of the "A-reef", which existed between the Binodosus/Trinodosus and Avisianum Subzones.

Palaeontology

Class **Cyanophyta?**

Family uncertain

Genus *Anisophytes* nov. gen.

Type species: *Axopora aggtelekensis* Scholz, 1972.

Derivatio nominis. Named from the Triassic stage Anisian and -phyto (from ancient Greek meaning concerning the plants).

Diagnosis. Nodular forming colonies of gregarious calcareous fossils composed of more or less oriented in a parallel way and with dichotomously multibranched tubes. Each hose-like tube is characterized by a thick wall with a micritic appearance (dark in transmitted light, Mg-calcite), and a narrow axial cavities. The internal surface of the tube wall is smooth, but the outer surface is irregular. Spherical elements (sporangia) may occur at branching points.

Comparison. Based on polished slabs only and without the finishing of thin sections the individual tubes of *Axopora aggtelekensis* were erronously interpreted as "gastropores" and the space between the individual tubes as a "coenenchyma" of hydrozoans by Scholz (1972). *A. aggtelekensis* was attributed as uniform organism to the hydrozoans. Detailed investigations of this fossil in thin sections exhibit clearly the characteristics of the individual tubes as described below. Therefore the attribution of *A. aggtelekensis* to the hydrozoans cannot be accepted. Already Payne et al. (2006: 325) have rejected the hydrozoan nature of *A. aggtelekensis* and note that the "problemaic organism (*Axopora aggtelekensis*) described by Scholz as hydrozoans may be *Tubiphytes*".

Tubiphytes [= *Shamovella* Rauser-Chernousova, 1950, according to Riding (1993) and Riding & Barkham (1999) the name *Shamovella* is a valid name and therefore has priority over the names *Tubiphytes* Maslov, 1956 or *Nigriporella* Rigby, 1958, but we use still the current name *Tubiphytes* in this paper] is one of the most abundant problematic organisms, described from numerous Upper Paleozoic and Mesozoic shallow water deposits (e. g. Riding & Guo 1992; Senowbari-Daryan & Flügel 1993a; Wang et al. 1994; Schmid 1995; Vennin et al. 1997). *Tubiphytes* is composed morphologically by cylindrical, oval, lobate, elongated or irregulary spaced individual or several spar-filled cativies; the latter may be foraminifers, tubes or even an irregular cavity of uncertain origin. Individual cavities are surrounded by a fine web-like network envelope that appears dark in transmitted light. The following characteristics illustrate the differences between *Tubiphytes* and the new genus *Anisophytes*:

a) The whole shape of *Tubiphytes* is very variable, but the shape of individual tubes, forming the nodules of *Anisophytes*, is more or less constant.

b) *Anisophytes* is composed of erect gregarious tubes oriented parallel to others. Incrusted specimens, like *Tubiphytes*, were not observed.

c) In lobate specimens of *Tubiphytes* each lobe has a separate cavity (see Senowbari-Daryan & Flügel 1993a), in cylindrical specimens the cavity may be annulated, thus being interpreted as foraminifers or cylindrical systematically unknown tubes. The cavity in *Anisophytes* is always cylindrical and annulation does not occur.

d) The irregular micritic network in the envelope of *Tubiphytes* (see Riding & Guo 1992: fig. 1, pl. 1, figs. 1-4; Senowbari-Daryan & Flügel 1993a: figs. 2, 7, pl. 1, figs. 1-4) is totally lacking in *Anisophytes*.

e) The outer surface of *Tubiphytes* is smooth; "spine-like" elements on the outer surface of *Anisophytes* in not present in *Tubiphytes*. Some mamelone-like elevations (see Senowbari-Daryan & Flügel 1993a: fig. 7), as observed in some specimens of *Tubiphytes*, are totally absent in *Anisophytes*.

f) The fine and oblique lamination in the envelope of some Triassic "*Tubiphytes*" and in Jurassic-Cretaceous organisms – described as *Tubiphytes morronensis* Crescenti – has no trace whatsoever in *Anisophytes*.

g) Spherical elements at the branching points of *Anisophytes* are lacking in *Tubiphytes*.

Because of the above mentioned criteria, *Anisophytes* – with type species *A. aggtelekensis* (Scholz) – is an independent genus and can not be identical with *Tubiphytes*, nor with any Palaeozoic or Mesozoic representatives.

Morphologically there are some organisms, which look similar to *A. aggtelekensis*, known from Triassic shallow water carbonates that could be confused with *A. aggtelekensis* in naturally weathered rock surfaces or in polished slabs. For example the dichotomously branched and dendroid alga *Cladogirvanella cipitensis* (Ott, 1966) has respective appearance which is like *A. aggtelekensis*. Individual branches of *C. cipitensis* differ, however, from the tubes of *A. aggtelekensis* by numerous filaments, usually running more or less parallel to the axis of the branches (compare Ott 1966: pl. 14). Details of the thallus of this alga are illustrated in Senowbari-Daryan & Flügel (1993b).

The growth pattern of *A. aggtelekensis* is very similar to that fossil described as *Tubiphytes multisiphonatus* by Schäfer & Senowbari-Daryan (1983). "*T*". *multisiphonatus* is an abundant organism in Wetterstein (Ladinian-Carnian) reef limestones. "*T*". *multisiphonatus* is differentiated from *A. aggtelekensis* by several branches composed of bundles of longitudinally oriented tubes, by the size of these branches and by the surrounding envelope. Morphologically the individual branches in "*T*". *multisiphonatus* do not run strongly parallel to others as is the case with the tubes in *A. aggtelekensis*. In contrast to *A. aggtelekensis* the branches in "*T*". *multisiphonatus* are usually connected laterally with the neighbouring branches.

Lehrmann et al. (1998) and Payne et al. (2006) described from the Anisian of Guizhou Province, China, a fossil, which is composed of gregarious tubes, as with *Tubiphytes*, but there has been no determination of the species. According to the growth pattern (Lehrmann et al. 1998: figs. 8.C-D; Payne et al. 2006: fig. 10.F), the non-parallel course of individual branches and the lateral connections of the branches (Payne et al. 2006: figs. 10.C-D), the Chinese material seems to be "*T*". *multisiphonatus* Schäfer & Senowbari-Daryan. Payne et al. (2006: as shown in fig. 18.A) documented several transverse sections of "*Tubiphytes*" illustrating the presence of small spore-like structures of about 50-75 µm in diameter. They noted also that "these spherical structures most commonly occur at the branch junctions of *Tubiphytes* tubes" (p. 335) like the spore-like spherical elements in branching points of *A. aggtelekensis*, described below. However, the "spores" in *A. aggtelekensis* are twice to three-times (about 150 µm) larger than those in the "*Tubiphytes*" described from China. Payne et al. (2006) interpreted the spherical elements as algal sporangia. These spherical elements in the Chinese material could be the transverse sections of several tubes in "*T*". *multisiphonatus* Schäfer & Senowbari-Daryan (1983).

Similarities also exist between *A. aggtelekensis* and *Aeolisaccus* Elliott (1958) (particularly *Aeolisaccus kotori* Radoicic, 1959) and the genus *Koivaella* described by Chuvachov (1974) from the Upper Carboniferous and Lower Permian of the western Ural Mts. in Russia. The systematic position of *Aeolisaccus* and similar organisms is uncertain. The type species *A. dunningtoni* was thought to "be shells of a small and extensive pteropod" by Elliott (1958: 424). Hecht (1960) points to the algal nature of the genus. Brönnimann et al. (1972) and Zaninetti (1976) mention similarities between *Aeolisaccus* and the foraminiferal genus *Earlandia* Plummer. Other authors (e. g. Flügel 1972; Borza 1975; Misik & Borza 1976; Senowbari-Daryan 1984) deny this assignment. The assignment of some species of *Aeolisaccus* (e. g. *A. tintinniformis* Misik, 1971 or species described by Pantic 1972) to foraminifers is conceivable, but the placement of others species (e. g. *A. kotori*) to foraminifers seems to be improbable. A detailed investigation and description of *A. kotori* was carried out by De Castro (1975). He suggests that the last species is of an algal nature and attributes it to Cyanophyta (Hormogonophycidae).

Chuvashov (1974) rightly compared *Koivaella* with *Aeolisaccus* and mentions the relationship of both genera. According to Chuvachov, *Koivaella* differs from *Aeolisaccus* with respect to the branched tubes and in several ways (up to 4). This differences may be true if it is compared with the type species *A. dunningtoni,* documented as having single tubes by Elliott (1958), but, as shown by De Castro (1975: pl. 5, figs. 1-9), branchings also occur in *A. kotori*. However, the respective branching modi in *A. kotori*, *Koivella* and in *A. aggtelikensis* are different. Tabulae-like elements (see De Castro 1975: pl. 1, figs. 1-2, 6, pl. 4, fig. 2, pl. 5, fig. 3) within the tubes of *A. kotori* cannot observed in *A. aggtelekensis*. Chuvachov (1974) pointed out the algal nature of *Koivaella* albeit with an uncertain assignment. In agreement with R. Riding (see below) we query the cyanobacterial nature of both genera, *Koivella* and *Aeolisaccus*. Concerning the systematic position of the new genus *Anisophytes* to cyanobacteria, Robert Riding (Cardiff) – a reviewer of the manuscript – denied our assignment of *Anisophytes* to cyanobacteria arguing in a mail to the editor of the Journal that "the relatively large thickness of the wall, its irregular outer surface, and the presence of spine-like elements, are unusual. In addition, the sporangia-like bodies are also very unusual in calcified cyanobacteria.[.....] *Axopora aggtelekensis* is a Problematicum". Riding doubts also the cyanobacterian nature of *Aeolisaccus kotori* and *Proaulopora*. He wrote in a mail to one of the authors (BSD): "Piero de Castro and Boris Chuvashov may be correct, but – still –*Aeolisaccus kotori* and *Proaulopora* are unusual for cyanobacteria, and regarding them as cyanobacteria is not an easy decision I think". Accepting the comments of Riding we consider the systematic position of *Anisophytes* to cyanobacteria as uncertain.

Anisophytes differs from *Koivella* due to the gregarious occurrence and its thick and narrow axial cavity. *Aeolisaccus kotori* differs from *Anisophytes* by its branching pattern and by the presence of tabulae-like elements within the internal cavity. Spherical elements, observed in *Anisophytes*, are not known in *Aeolisaccus* or in *Koivella*.

Another fossil, very similar to *Anisophytes* or *Aeolisaccus kotori* is *Proaulopora* Vologdin. The last genus and similar looking organisms were revised by Luchinina (1971). *Proaulopora* differs from *Anisophytes* by similar criteria to those, discussed above for *Aeolisaccus* or *Koivella*.

The fossil described as *Perforitubus buseri* from the Norian-Rhaetian reef carbonates of Sicily by Senowbari-Daryan (1984) is certainly similar to *Anisophytes*, but the wall of *Perforitubus* is pierced by narrow and oblique running pores which are absent in *Anisophytes*.

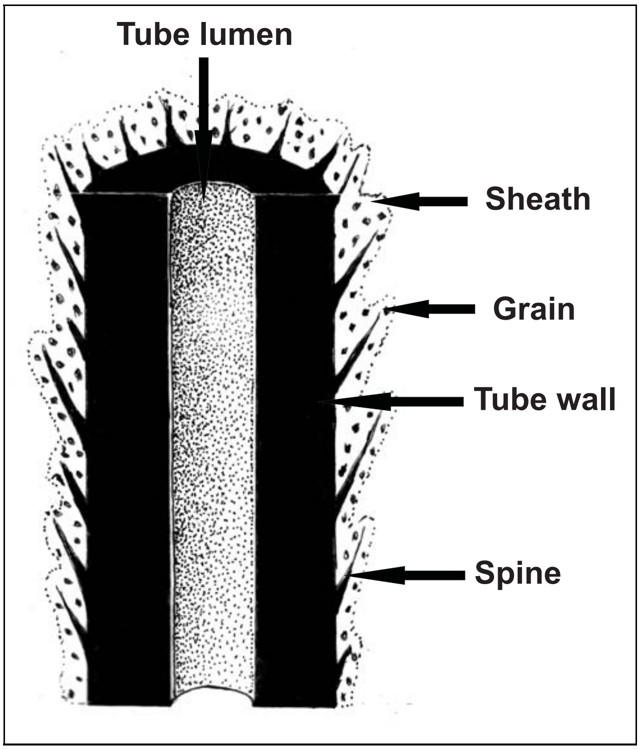

Fig. 2 - Processes of the calcification of *Anisophytes aggtelekensis* (Scholz). Organosedimentary secretion of "dusty" microcrystalline cement and the trapping of sedimentary particles directly around the tube and the spine-like elements at the tube surface during the lifetime of the organism. Schematic, not to scale.

Anisophytes aggtelekensis (Scholz, 1972)

Pl. 1, figs 1-2, Pl. 2, figs 1-5, Pl. 3, figs 1-4, Text-figs 2-3

v. 1972 *Axopora aggtelekensis* Scholz, p. 344-345, pl. 4, fig. 4, pl. 5, figs. 3-6.

? 2005 "*Tubiphytes*" *obscurus* Maslov - Emmerich et al., figs. 12.4, 12.10.

Diagnosis: As for the genus.

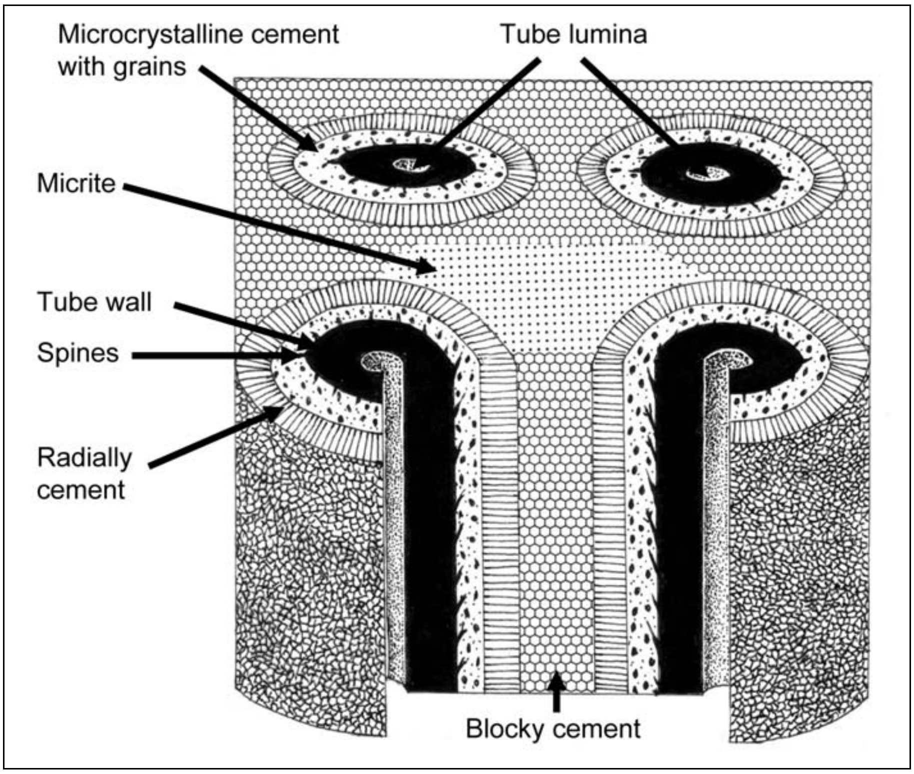

Fig. 3 - Different cement types around the tubes of *Anisophytes aggtelekensis* (Scholz) and the sedimentary micrite in the remaining spaces. Schematic, not to scale.

Description. Nodules of this gregarious organism are composed of numerous, more or less parallel oriented tubes. The colonies reach several centimetres in diameter; according to Scholz (1972) the diameter can reach 15 cm. The individual tubes usually grow parallel to each other and are straight or weakly curved, reaching a diameter between 0.18 mm and 0.5 mm. The axial internal cavity of the tubes is filled with secondary calcite cement. The cavity has a maximum diameter of 0.06 mm (usually 0.04 mm). The tube wall, 3-4-time thicker than the internal cavity, appears micritically dark in transmitted light (white in polished slabs or in naturally weathered rock surfaces) and does not show any perforation or distinct structure. However, in well preserved tubes some very fine and smaller tubes of irregular arrangement are hardly recognizable within the wall. In contrast to the outer surface of the tubes the internal boundary of the axial cavity is smooth. The outer surface is irregular and exhibit spine-like elements that are oriented obliquely to the tube axis (Pl. 1, fig. 1; Pl. 2, fig. 1-5). Tubes may be single- or multi-branched dichotomously (Pl. 2, fig. 5; Pl. 3, fig. 3). The diameter of the tubes increases at branching points by up to 1 mm. At branching points some spherical elements of about 0.15 mm in diameter occur within the axial cavity (Pl. 2, fig. 3; Pl. 3, fig. 3). In agreement with Payne et al. (2006) these elements are interpreted as sporangia.

Between the individual tubes three types of cement are recognizable. These cement types were interpreted as "coenenchyma which had been dissolved and replaced by fibrous calcite" by Scholz (1972: 345). The first one, directly surrounding the tubes, is "dusty" microcrystalline cement (dark appearing and generally about 0.2-0.5 mm thick, marked with Nr. 1 in Pl. 1, fig. 2) containing tiny micritic sedimentary particles. This type of cement does not show the distinct orientation of crystals (Pl. 1, fig. 2; Pl. 2, fig. 4). Furthermore, it is interpreted as an organosedimentary secretion created by the trapping of sedimentary particles around and within the sheath that surrounded the tube and the spine-like elements at the tube's surface during the lifetime of the organism. Processes of such calcification and cementation in Cyanobacteria are described in detail by Pentecost (1991) and Riding (1991). With respect to *A. aggtelekensis,* these processes are shown schematically in Fig. 2.

The second type of the cement, marked with Nr. 2 in Pl. 1, fig. 2, is surrounded by radially arranged calcite cement, generally thinner than the first type. The remaining spaces between the radially arranged cement is filled with the third type of calcite cement or with micritic sediment (Pl. 1, fig. 1-2; Pl. 3, figs. 1, 4). We interpret the second and third cement types as secondary inorganic secreted types.

Between the individual tubes, some other small organisms, like worm tubes or the problematic organism *Plexoramea cerebriformis* Mello, 1997 occur. Fig. 3 shows four individual tubes of *A. aggtelekensis* with different cement types or with sedimentary micrite around or between the tubes.

Occurrence. In addition to the type locality in the Aggtelek Mountains (Hungary) *Anisophytes aggte-*

lekensis may occur in the Anisian reef carbonates in the Dolomites (Italy).

Stratigraphic range. *Anisophytes aggtelekensis* (Scholz) seems to be limited to the Anisian.

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PLATE 1

Fig. 1-2 - *Anisophytes aggtelekensis* (Scholz) from the Anisian Aggtelek reef in northern Hungary. Both figs are thin section photographs.

Fig. 1 - Longitudinal section through numerous parallel oriented and straight tubes of a colony. Note the spine-like elements of the outer surface of the tubes. T5084/L/2.

Fig. 2 - Transverse section through numerous tubes of a colony. Number 1 indicates the first generation of dark appearing cement without the orientation of crystals around the tubes. Number 2 indicates the second generation of white appearing cement with radially arranged crystals around the cement of the first generation. Number 3 indicates the blocky cement and 4 the sedimentary micrite filling the remaining cavities. T5084/Q.

PLATE 2

Fig. 1-5 - *Anisophytes aggtelekensis* (Scholz) from the Anisian Aggtelek reef in northern Hungary. All figs are thin section photographs.

Fig. 1 - Longitudinal section through numerous, partly branched tubes. For magnification see fig. 3. T5084/L/1.

Fig. 2 - Longitudinal sections through two tubes exhibiting the spine-like elements at the outer surface and the dusty cement around the long tube. T5084/L/2.

Fig. 3 - Magnification from fig. 1 (quadrangle) showing the spherical elements (sporangia) at the branching point of a tube. T5084/L/1.

Fig. 4 - Magnification of a branched tube showing the axial cavity and the spine-like elements at the outer surface. T5084/L/1.

Fig. 5 - Longitudinal section through a tube showing clearly the spine-like elements, possibly branched. T5084/L/1.

PLATE 3

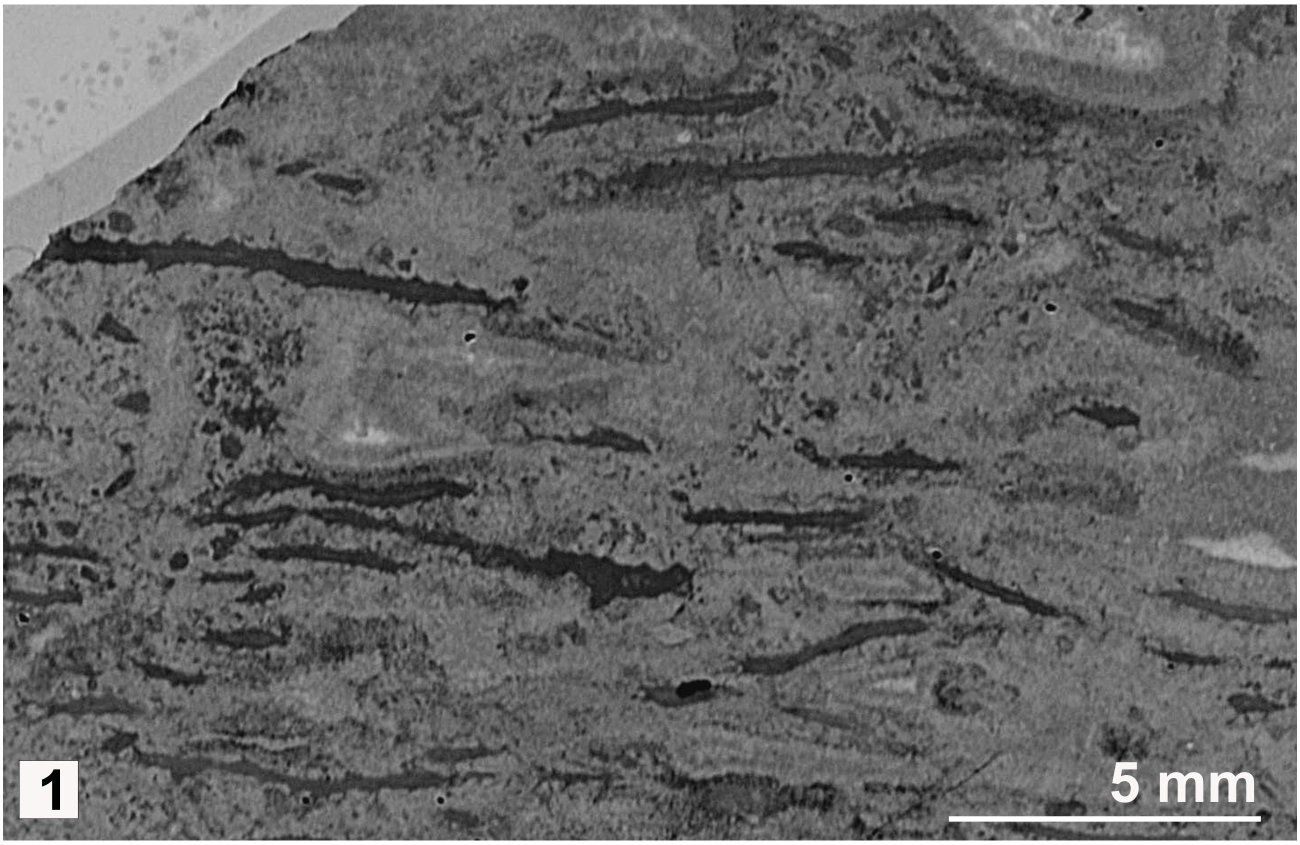
Fig. 1-4 - *Anisophytes aggtelekensis* (Scholz) from the Anisian Aggtelek reef in northern Hungary. All figs are thin section photographs.

Fig. 1 - Transverse sections through three tubes showing a thick tube wall and small internal cavity. Note the spine-like prolongations of the outer surface. Number 1 indicates the dark appearing cement (type 1) without orientation of the crystals around the tubes. Number 2 indicates the white appearing cement (type 2) with radially arranged crystals. T5084/Q.

Fig. 2 - Transverse section through numerous tubes of a colony. Note the spine-like prolongations of the outer surface. T5084/Q.

Fig. 3 - Longitudinal section of a branched tube. Note the wavy outer surface produced by the spine-like elements. Below the branching point several spherical elements (sporangia) are cut. T5084/L/2.

Fig. 4 - Transverse section through numerous tubes of a colony. M points to the micritic filling of the remaining cavity between the tubes. T5084/L/Q.



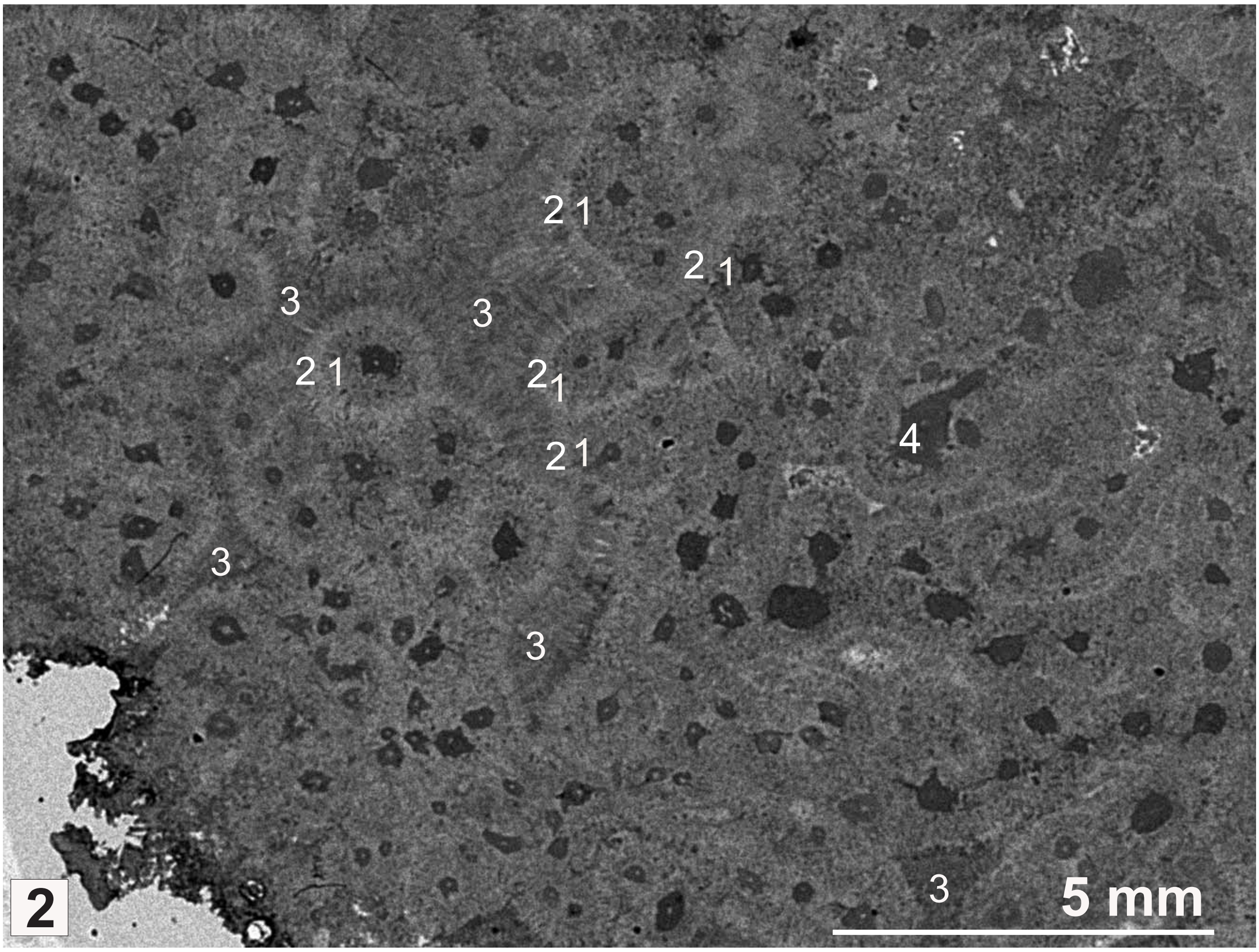


PLATE 1

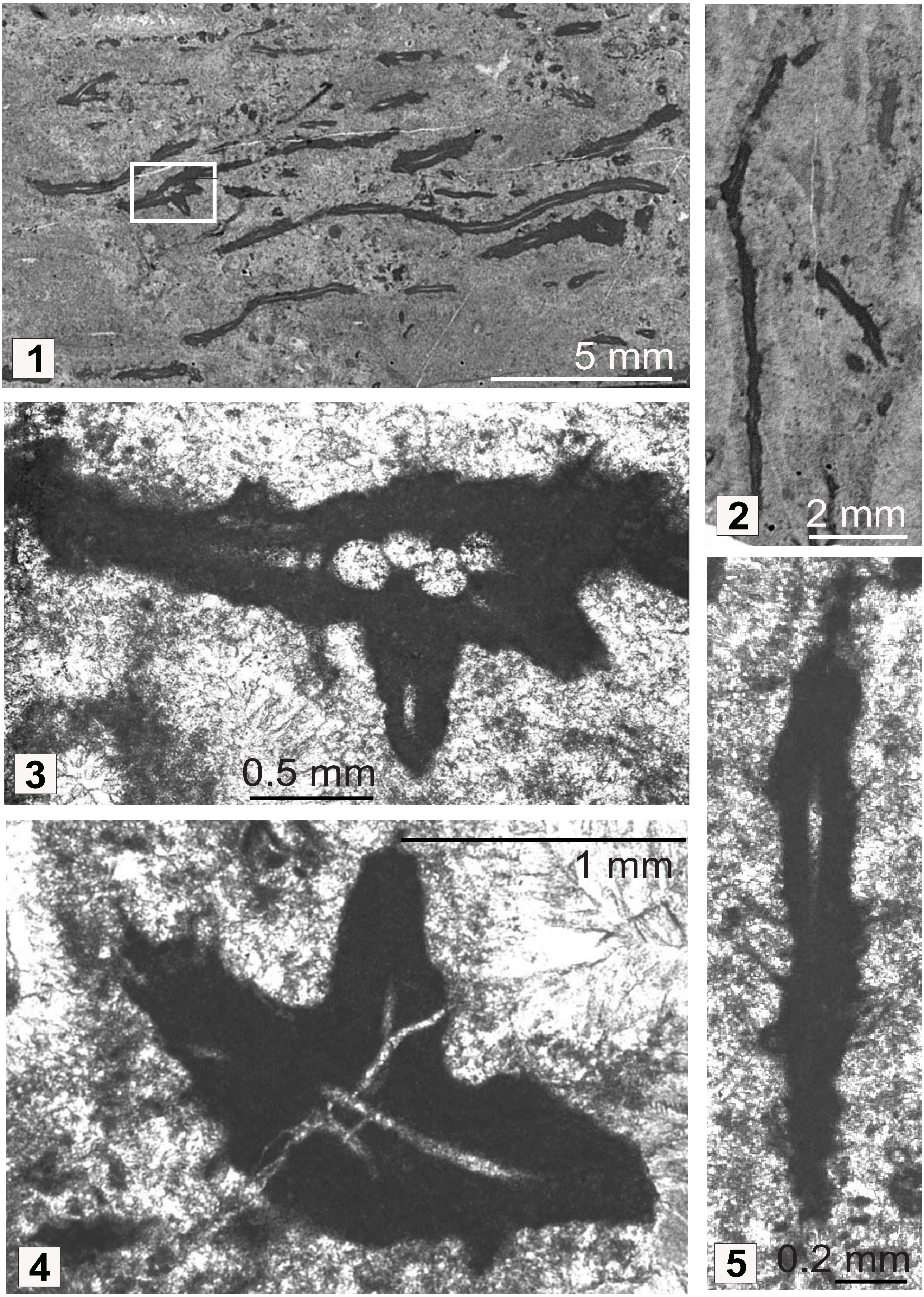


PLATE 2

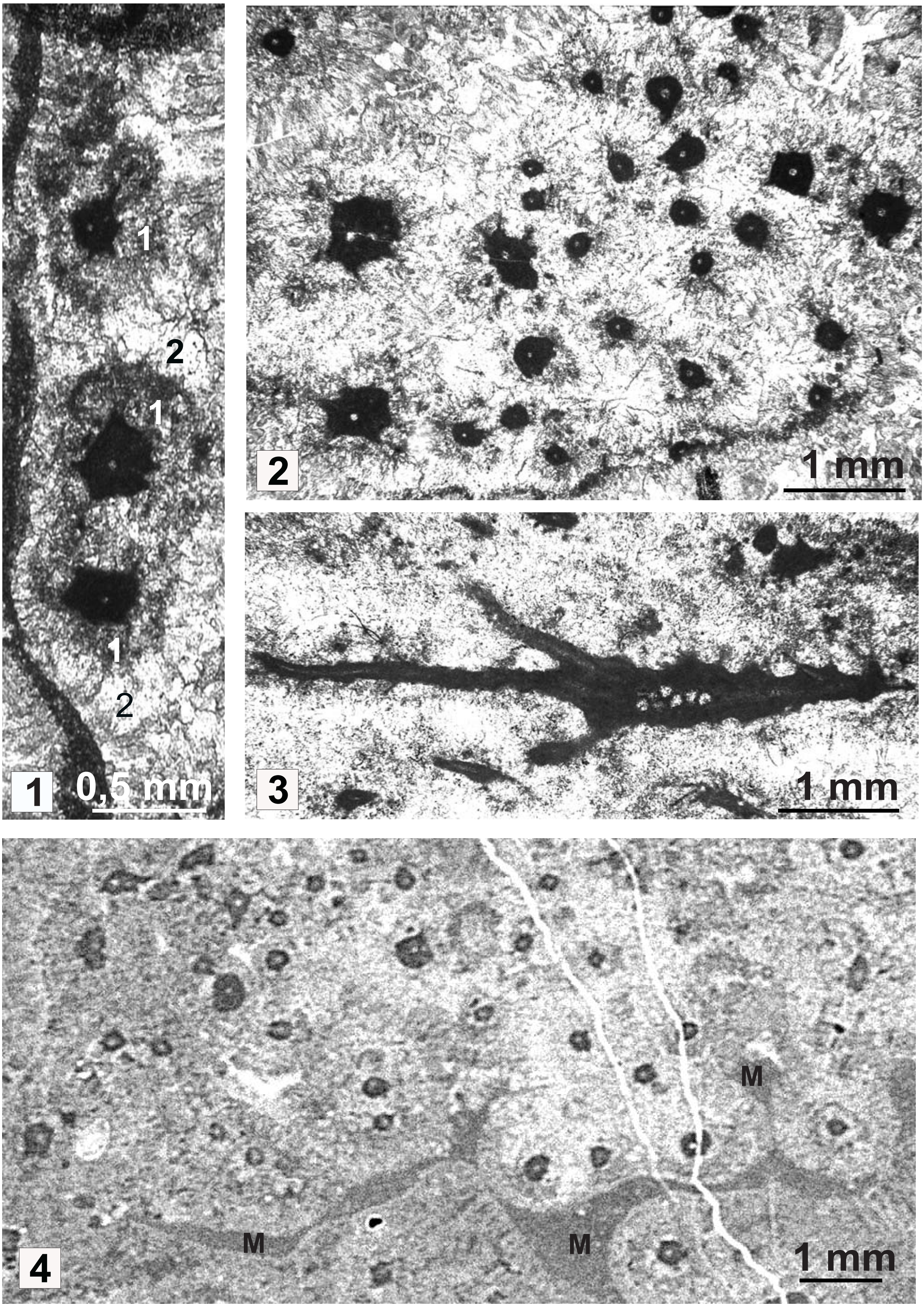


PLATE 3

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