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Schlagintweitella inopinata, a new genus and species of Dasycladales (green algae) from the Upper Jurassic limestones of Romania

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Abstract

An outcrop identified within the Upper Jurassic deposits of the Cioclovina-Băniţa area (Southern Carpathians) most likely corresponds to a cavern fill. In several lithoclasts of this fill, including black-pebbles, a dasycladalean alga with morphological features that differentiate it from all other Jurassic–Cretaceous dasycladales with two orders of laterals was observed. It is described in the present work as a new species of a new genus: *Schlagintweitella inopinata* nov. gen., nov. sp.

1. INTRODUCTION

During the Late Jurassic, the Dasycladales (green algae) flourished during a period that followed crisis moments at the end of the Late Triassic and the final part of the Early Jurassic, as well as a very slow recovery in the Middle Jurassic (GRANIER & DELOFFRE, 1993; BUCUR, 1999; BUCUR & REOLID, 2024). In the Oxfordian–Tithonian interval, 86 dasycladalean species are known, 72 of which are mentioned in the Tithonian (BUCUR & REOLID, 2024). Thirty four species continued their evolution into the Early Cretaceous. Regarding the Upper Jurassic dasycladaleans, *Aloisalthella sulcata* (ALTH) [ex *Clypeina jurassica* FAVRE, ex *Clypeina sulcata* (ALTH), see GRANIER & LETHIERS, 2019] and *Salpingoporella pygmaea* (GÜMBEL) are among the most frequently encountered and, as such, the best known. A special place is occupied by *Neoteutloporella socialis* (PRATURLON), a dasycladalean alga that develops in the form of "mini-reefs"/ bioherms. These are actually agglomerations of thalli in the form of overlapping "bushes" that can reach from a few centimetres to a few decimetres in height and breadth.

The aim of the present work is to describe a new dasycladalean alga, *Schlagintweitella inopinata* nov. gen., nov. sp., which, like *Neoteutloporella*, develops in the form of thallus agglomerations. Although, agglomeration is not uncommon among extant Dasycladales, as evidenced by numerous recent illustrations of loose agglomerations (e.g., TROPICAL FISH PLUS (2024), for *Neomeris*), none develops *Neoteutloporella*-type “mini-reefs”.

2. GEOLOGICAL BACKGROUND

The Mesozoic deposits in the Cioclovina-Băniţa area (also known as the Haţeg-Pui area; Fig. 1) constitute a fragment of the sedimentary cover of the Getic nappe (STILLĂ, 1985; PLEŞ et al., 2019). The sedimentary succession of this area includes deposits from the Lower Jurassic to the Upper Cretaceous (pre-Maastrichtian). The terrigenous Lower Jurassic is developed in the Gresten facies. The Middle Jurassic is mainly represented by siliciclastic rocks followed by a carbonate sequence in the upper part. The Upper Jurassic and the lowermost Cretaceous are represented by carbonate rocks (Figs. 1, 2). Although initially included within an Upper Jurassic–Aptian carbonate succession (STILLĂ, 1985), the Barremian–Aptian is present only as clasts in the conglomeratic-breccia deposits in the lower part of the Cenomanian (PLEŞ et al., 2019). During the Albian, lateritic deposits formed, leading to the accumulation of bauxites. The Upper Cretaceous includes a marine succession that begins with Cenomanian breccias and conglomerates, and ends with Campanian marls. These are covered by the Maastrichtian continental deposits of the Haţeg Basin.

The limestones containing the new dasycladalean alga belong to the Upper Jurassic. The outcrop is located in the Lunca Ohabei plateau, near Albian bauxite lenses (Fig. 3). According to SĂSĂRAN et al. (2021), the outcrop represents a cavern fill. The clasts in the cavern fill originated from different depositional environments and were later transported into the karst void. They consist of bioclasts, intraclasts, calcrete clasts, fragments of altered carbonate rocks pigmented with iron oxides-hydroxides. Some of these represent black pebbles formed in subaerially exposed areas through impregnation with organic matter.

One of these clasts (Fig. 4) is mainly composed of an agglomeration of algal thalli. Their study revealed the discovery of a new genus and a new species of dasycladalean green algae.

3. MATERIAL AND REPOSITORY

The new alga was found in two samples, from which four thin-sections were made. Additionally, three other samples were collected from the type locality, resulting in thirteen thin-

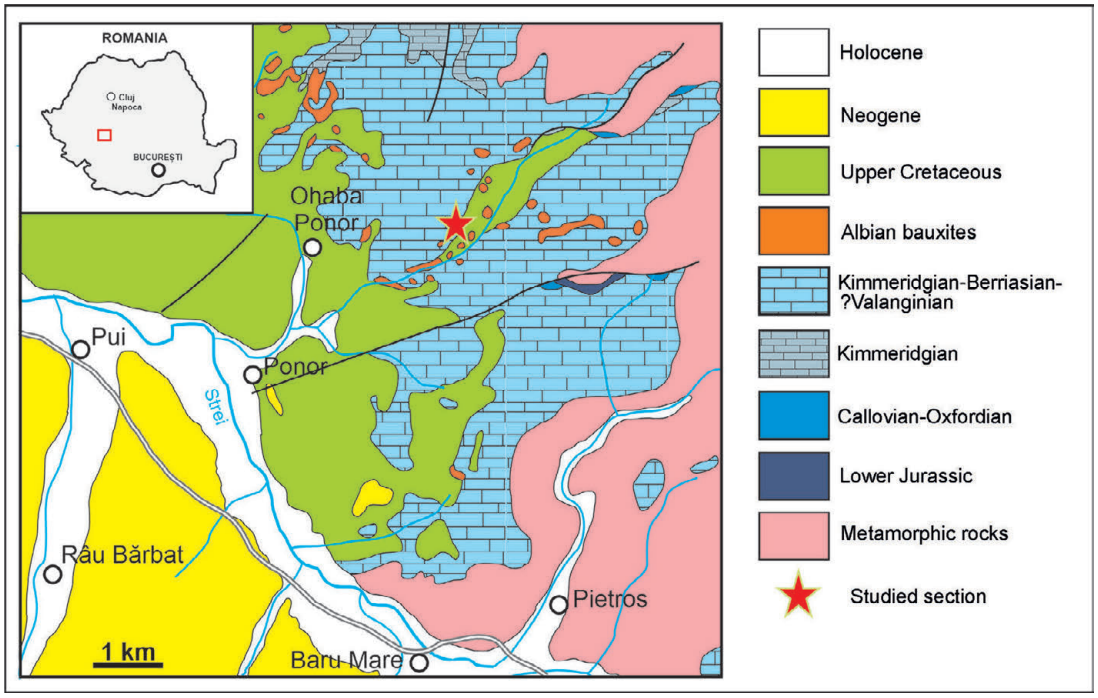

Figure 1. A geological map of the Cioclovina-Bănița area with the location of the studied section (red star). Modified after Pleş et al., 2019.

sections used for studying the accompanying micropalaeontological association. All thin-sections are stored in the collection of the Paleontology Museum of Babeş-Bolyai University, Cluj-Napoca.

4. PALAEONTOLOGICAL DESCRIPTION

Phylum Chlorophyta PASCHER, 1914

Class Ulvophyceae MATTOX & STEWART, 1984

Order Dasycladales PASCHER, 1931

Family Triploporellaceae (PIA, 1920) BERGER & KAEVER, 1992

Tribe Triploporelleae (PIA, 1920) BASSOULLET et al., 1979

Genus *Schlagintweitella* nov. gen.

Type species: *Schlagintweitella inopinata* nov. gen., nov. sp.

1997 Dasycladacean with unsegmented primary and segmented secondary laterals – DE CASTRO, p. 200, pl. 4, figs. 1-3.

Derivation of name: dedicated to Dr. Felix SCHLAGINTWEIT (München) for his significant contributions to the study of Mesozoic and Cenozoic calcareous algae.

Generic diagnosis: Dasycladalean algae with cylindrical thallus and two orders of laterals. The primary laterals are cylindrical or ovoid-elongated, shorter than the secondaries. The secondary laterals are also cylindrical and consist of two, rarely three successive segments separated by constrictions. The proximal part of the secondary laterals is covered by a common calcareous sheath (collective sheath).

Remarks and comparisons: In the Jurassic and Cretaceous fossil record, 29 genera of Dasycladales with two orders of laterals are known (e.g., BUCUR et al., 2010; Table 1; to the genera in this table we must add the genera *Steinmanniporella*, *Bakalovaella*, *Eodasycladus*, *Chinianella*, *Granieria*, *Distefanopolia*, and *Cylindroporella*? *liasica*). The differences between all these taxa are given by the shape and dimensions of the laterals, the differences in shape between the first and second order laterals, as well as the dimensional ratio between the two types of laterals. In addition, the type of reproduction is considered. The genus *Linoporella*, with the type species *Linoporella capriotica* (OPPENHEIM), presents three orders of laterals and thus differentiates itself from this group (BARATTOLO & ROMANO, 2005). We can also add to this list the genus *Palaeodasycladus*, which has segmented secondary laterals, but it presents three or more orders of laterals, and thus differs from the new genus. Three of the genera mentioned in Table 1 by BUCUR et al. (2010) (*Montenegrella*, *Crinella*, and *Helioporella*) are most likely recent synonyms of the genera *Suppiluliumaella* (the first two) and *Neomeris*, respectively. Of the remaining genera, those in the tribe Neomeree (*Genotella*, *Montiella*/*Bakalovaella*, *Neomeris*, and *Cymopolia*) are distinguished by the type of choristospore reproduction and/or by the shape of the thallus (e.g., *Cymopolia*). *Conradella*, *Chinianella*, *Eodasycladus*, *Granieria*, *Distefanopolia*, and *Cylindroporella*? *liasica* belong to the same group (cf. BARATTOLO & PARENTE, 2000; BARATTOLO et al., 2008, 2012, 2021a). Among the Dasycladales in the Triploporelleae tribe, *Acroporella*, *Rajkaella*, and *Triploporella* all have much longer first order laterals compared to second order laterals. *Dissocladella* (tribe Dissocladelleae) includes species with primary and secondary laterals that are comparable in dimension but differ in shape. *Selliporella* has short, globose first-order laterals and long, trichoform second-order laterals (see BARATTOLO et al., 2021b). *Tersella* and *Pseudocymopolia* are distinguished by the different general morphology of the thallus (club-shaped, very clearly differentiated into head and stipe, and moniliform, respectively).

The new genus *Schlagintweitella* shows the greatest similarity to the genus *Neoteutloporella* (BASSOULLET et al., 1978)

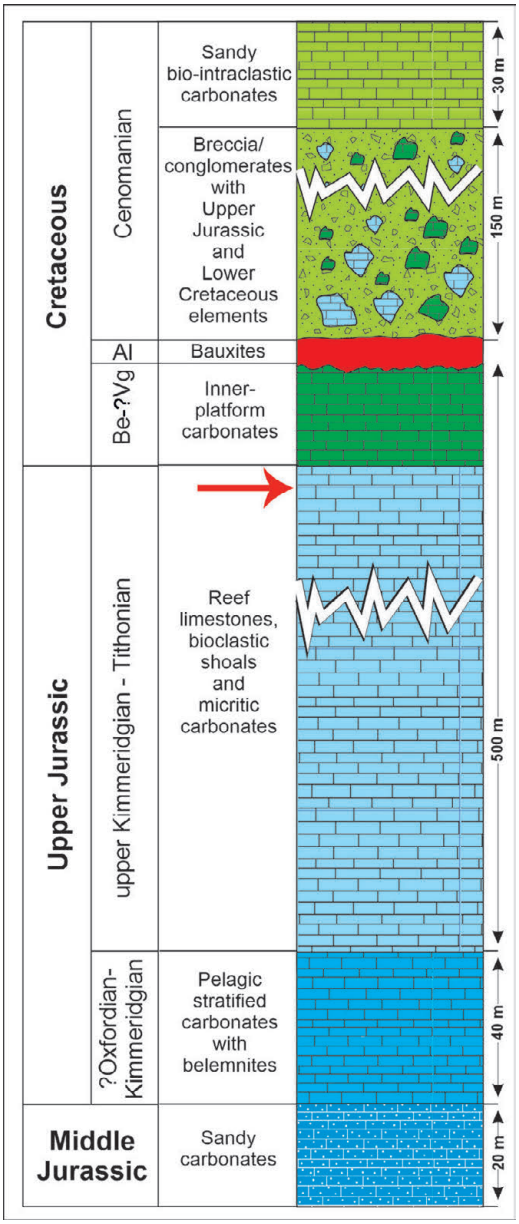

Figure 2. The general stratigraphic succession of the Jurassic and Cretaceous deposits from the Cioclovina-Băniţa area (Modified from PLEŞ et al., 2019). The arrow points to the stratigraphic position of the outcrop with the new alga.

DE CASTRO, 1993. The genus *Neoteutloporella* includes two species, both from the Upper Jurassic: *N. obsoleta* (CAROZZI, 1954) and *N. socialis* (PRATURLON, 1963). Both species have relatively short, globose or ovoid first order laterals and relatively long, acrophorous or slightly phloiophorous second order laterals that are segmented by several constrictions. Both species occur as dense agglomerations of thalli, often in overlapping generations in the case of *N. socialis*, with a "micro-reef"/bioherm appearance.

From the current material obtained, *Schlagintweitella* nov. gen. also develops as an agglomeration of thalli (Pl. 1, figs. A-C). However, it differs from *Neutloporella* by the more elongated cylindrical shape of the first-order laterals and acrophore-type second-order laterals, which have rarer constrictions and often an irregular arrangement. These laterals are included, at least in their lower part, in a collective sheath. Moreover, the skeleton of *Neoteutloporella* is formed „by a succession of very wide articles, roughly funnel-shaped" (DE CASTRO, 1993, p. 174), and the thallus is branched.

Schlagintweitella inopinata nov. sp.

Pls. 1-5

Derivation of name: *inopinatus* (latin) = unexpected.

Material: four thin-sections from two samples, containing more than 50 specimens.

Holotype: the specimen in Pl. 2 fig. A, thin-section 15207(2), stored in the collection of the Paleontology Museum, Babeş-Bolyai University Cluj-Napoca under the inventory number 24412.

Paratypes: Specimens in Pl. 2 fig. B, Pl.3, figs. E-G, thin-sections 3751(2), 15207(1) and 3751(1) stored in the same collection under the inventory numbers 24410, 24411 and 24409 respectivelly.

Type locality: Lunca Ohabei plateau, Cioclovina-Băniţa zone, Southern Carpathians, Romania (Fig. 1). GPS coordinates: 45°31'35.61"N; 23° 9'55.65"E.

Type level: Upper Jurassic, most probably upper Tithonian.

Diagnosis: Dasycladalean alga with an elongated cylindrical thallus, a relatively wide axial cavity and two orders of lateral branches arranged obliquely to the axial cavity. The first order laterals are cylindrical (acrophores) or ovoid to elongated and shorter than those of the second order. The second order laterals are also cylindrical, acrophorous, longer than those of the first order and have one or more constrictions that separate them into successive segments. The calcification consists of a calcareous sheath surrounding the central cavity and each lateral branch. In their lower part, the second order laterals are wrapped in a collective sheath.

Dimensions (in mm, except w_1 and w_2)

D (external diameter) = 1.30–2.60 (median = 1.97)

d (internal diameter) = 0.50–1.70 mm (median = 1.05 mm)

p_1 (diameter of the primary laterals) = 0.06–0.12 mm (median = 0.09 mm)

l_1 (length of the primary laterals) = 0.13–0.30 mm (median = 0.19 mm)

p_2 (diameter of the secondary laterals) = 0.05–0.10 mm (median = 0.06 mm)

l_2 (length of the secondary laterals) = 0.28–0.60 mm (median = 0.41 mm)

h (distance between two consecutive verticils) = 0.10–0.15 (median = 0.13)

w_1 (number of primary laterals in a verticil) = approx. 25 to 60

w_2 (number of secondary laterals per primary lateral) = 2–3

Description: The new alga occurs as agglomerations of thalli within calcareous clasts or black pebbles (Pl. 1, figs. A–C). Longitudinal and longitudinal-oblique sections (Pl. 2, figs. A–E) show a cylindrical thallus, sometimes slightly curved (Pl. 2A), with a relatively smooth axial cavity and a rather irregular external surface, marked by the different lengths (and sometimes different orientations) of the secondary laterals. These features are also visible in oblique or oblique-longitudinal

Figure 3. The outcrop from the Lunca Ohabei plateau (Cioclovina-Bănița zone) representing most probably a palaeo-cave filling where the sample with *Schlagintweitella inopinata* nov. gen., nov. sp. has been found.

sections (Pl. 3, figs. A–I; Pl. 4, figs. C, I, J) and in transverse sections (Pl. 2, fig. F; Pl. 4., figs. A, B, D, G, H). The primary laterals are tubular (most often cylindrical; e.g., Pl. 3, figs. C-F; sometimes they are ovoid-elongated, e.g., Pl. 5, fig. C). The primary laterals are provided at the lower part with a relatively wide pore that connects them with the axial cavity. From the primary laterals two (sometimes three) secondary laterals originate that are also cylindrical (acrophorous) (Pl. 5, figs. A, G, I) and present at certain intervals constrictions that separate them into successive segments delimited by a fine micritic fringe (Pl. 5, figs. A, D, E, arrows). The large number of laterals in a whorl makes it difficult to observe their arrangement around and along the axial cavity. However, some sections through smaller specimens (e.g., Pl. 3, figs. E-G; Pl. 4, figs. D, H, J), where the thallus is tangentially-obliquely sectioned, indicate a euspondyl arrangement. The secondary laterals, however, occasionally seem to orient themselves in various directions (Pl. 3, figs. C, D, F), giving an irregular appearance to the external part of the thallus. The calcification consists of a calcareous sheath, observable in some places around the axial cavity (Pl. 2, figs. A, F; Pl. 3, figs. A, F, H, I; Pl. 4, figs. B, H), but especially around the laterals, being clearly visible where the laterals are sectioned more or less transversely (Pl. 2, fig. B – lower part; Pl. 3, figs. A, D-I; Pl. 4, fig. G). One of the important characteristics of the new alga is the presence of a common calcareous sheath (collective sheath cf. DE CASTRO, 1997) that envelops the proximal part of the secondary laterals (e.g., Pl. 2, fig. G; Pl. 4, figs. E, J; Pl. 5, figs. H, J). The term collective sheath introduced by DE CASTRO (1997) was illustrated by this author in pl. 4, figs. 1–3 through two specimens of an alga defined as "Dasycladacean with unsegmented primary and segmented secondary laterals" and which actually represents the first illustration in the literature of *Schlagintweitela inopinata* nov. gen., nov. sp. It is worth mentioning that while some specimens present a calcareous sheath of sparitic calcite (Pl. 3, fig. G; Pl. 4, figs. D, F, G; Pl. 5, fig. H), sometimes with a yellowish-brown tint (Pl. 3, fig. B; Pl. 4, figs. E, H, J; Pl. 5, fig. J), most specimens have a strongly blackened sheath due, most likely, to the accumulation of organic matter during the blackening process that affected the black-pebbles in which they are contained. Reproductive structures were not encountered, but their presence in the first-order laterals cannot be excluded (cladospore).

Comparison: Within the large group of Jurassic–Cretaceous Dasycladales with two orders of laterals, *Schlaginweitella inopoinata* nov. gen., nov. sp. is most similar to species of the genus *Neoteutloporella* (*N. obsoleta* and *N. socialis*) and with some species of the genus *Steinmanniporella* (e.g., *S. kapelensis*, *S. taurica*). It differs from *Neoteutloporella* by the shape and dimensional ratio of the primary and secondary laterals, as well as the lack of articulation. It differs from *Steinmanniporella* by the segmentation of the secondary laterals.

Associated microfossils: In the outcrop from the Lunca Ohabei plateau, *Schlagintweitella inopinata* nov. gen., nov. sp. is accompanied by an assemblage of foraminifera and calcareous algae consisting of: *Everticyclammina virguliana* (KOECHLIN), *Everticyclammina* sp., *Redmondoides lugeoni* (SEPTFONTAINE), *Charentia* sp., *Coscinoconus alpinus* LEUPOLD (Pl. 6, figs. G, I), *Salpingoporella annulata* (CAROZZI) (Pl. 6, figs. A–D), *Salpingoporella pygmaea* (GÜMBEL) (Pl. 6, figs. E–F), *S.* cf. *praturloni* (DRAGASTAN), *Aloisalthella sulcata* (ALTH) (Pl. 6, fig. J), *Campbelliella striata* (CAROZZI), and rivulariacean-like cyanobacteria.

Figure 4. A pebble of the cave filling showing the new alga on a weathered surface.

Some of the microfossils in this association are coloured with a light brown tint, likely due to the partial incorporation of organic matter. The entire association indicates a Late Jurassic age, most likely late Tithonian.

5. CONCLUSION

A new dasycladalean alga, *Schlaginweitella inopinata* nov. gen., nov. sp. was identified in the Upper Jurassic limestones of the Cioclovina-Băniţa area (Southern Carpathians, Romania). By its morphological characteristics, the new alga differs from all other genera and species of Jurassic–Cretaceous Dasycladales with two orders of laterals.

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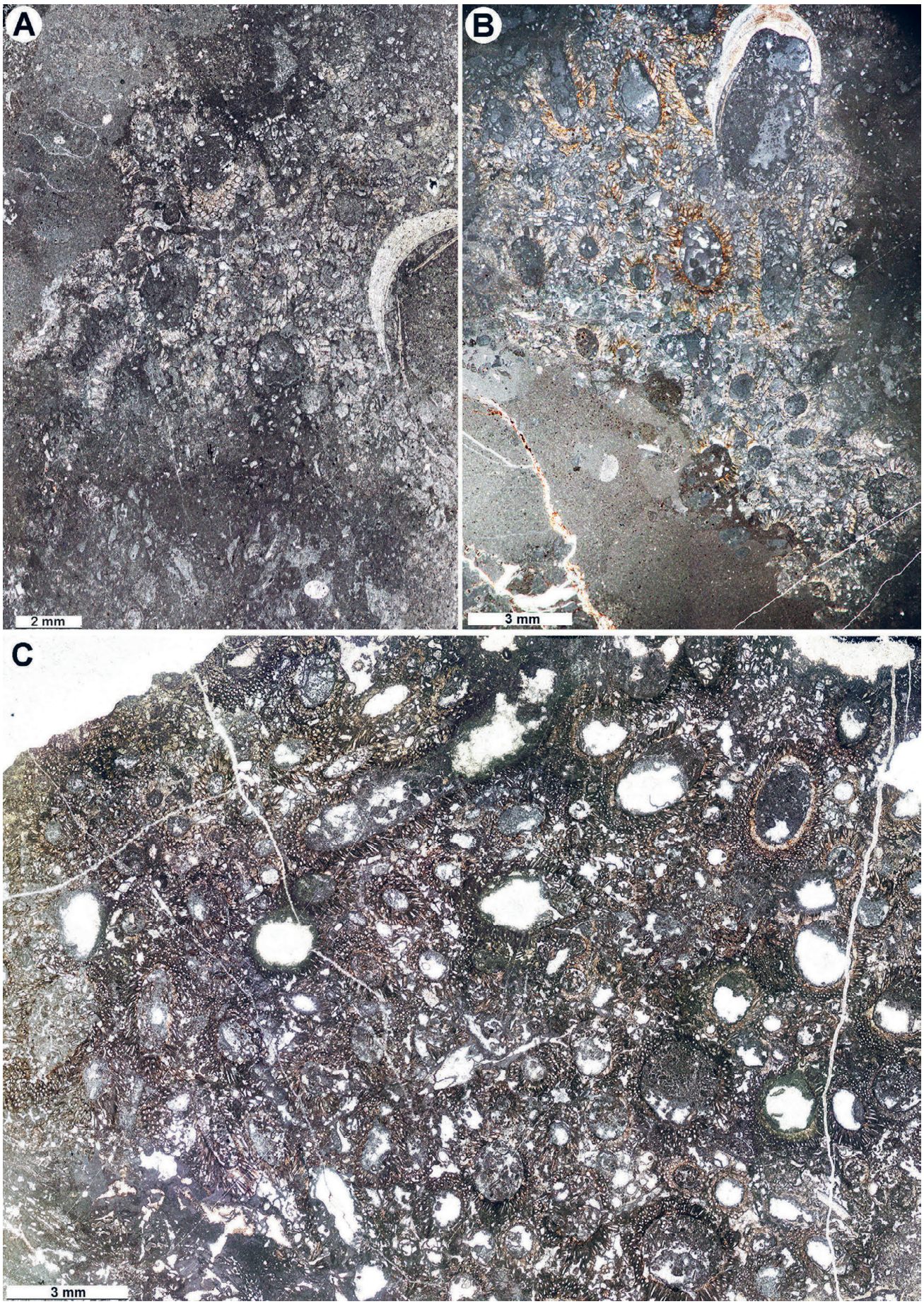

Plate 1. A–C general views of an agglomeration of thalli of *Schlagintweitella inopinata* nov. gen., nov. sp. Thin-sections: A, 3751(1); B, 3751(2); C, 15207(1).

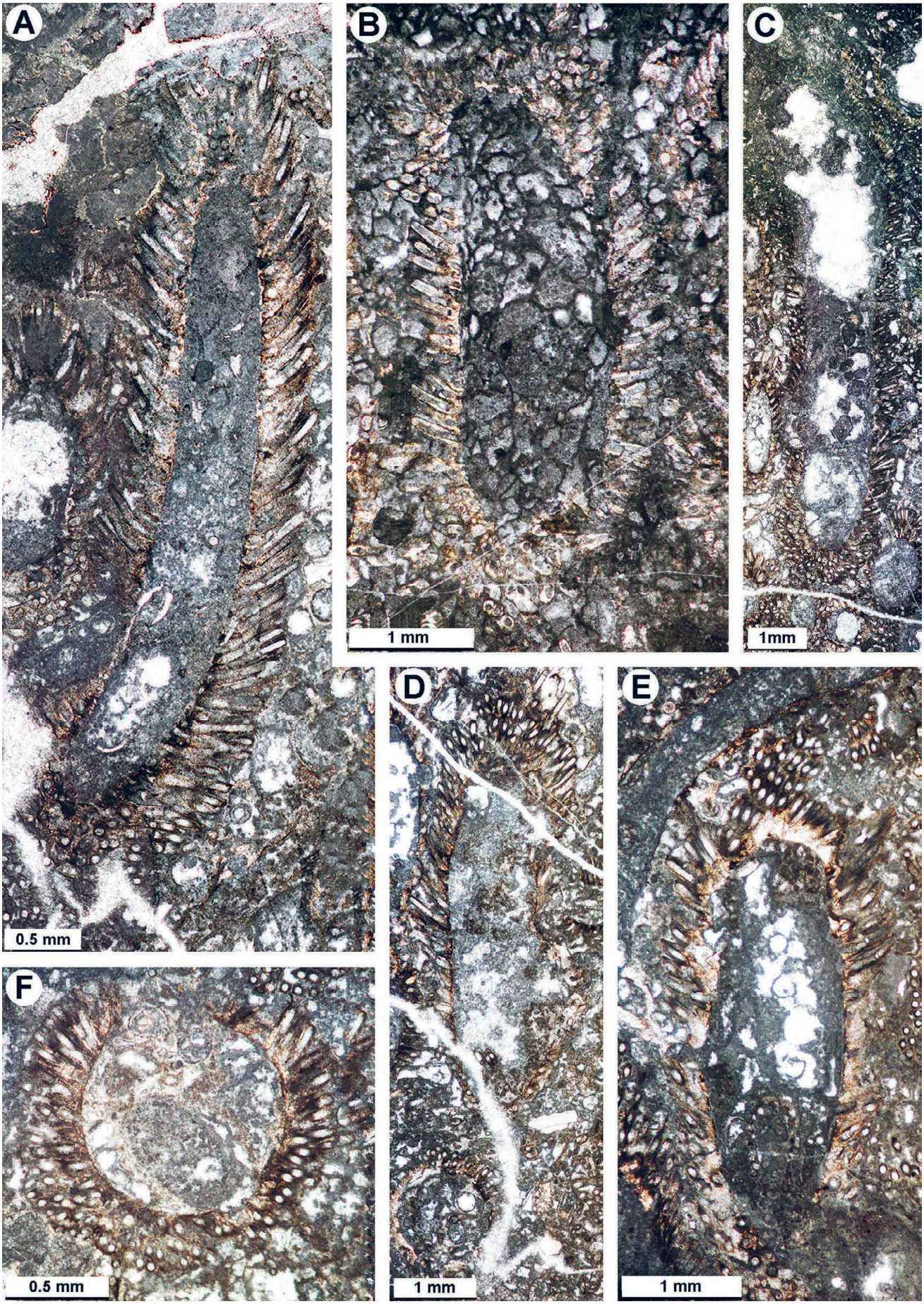

Plate 2. *Schlagintweitella inopinata* nov. gen., nov. sp. **A–E** longitudinal (A) and longitudinal oblique (B–F) sections. A = holotype; B = paratype; F = transverse section. Thin-sections: A, D-F, 15207(2); B, 3751(2); C, 15207(1).

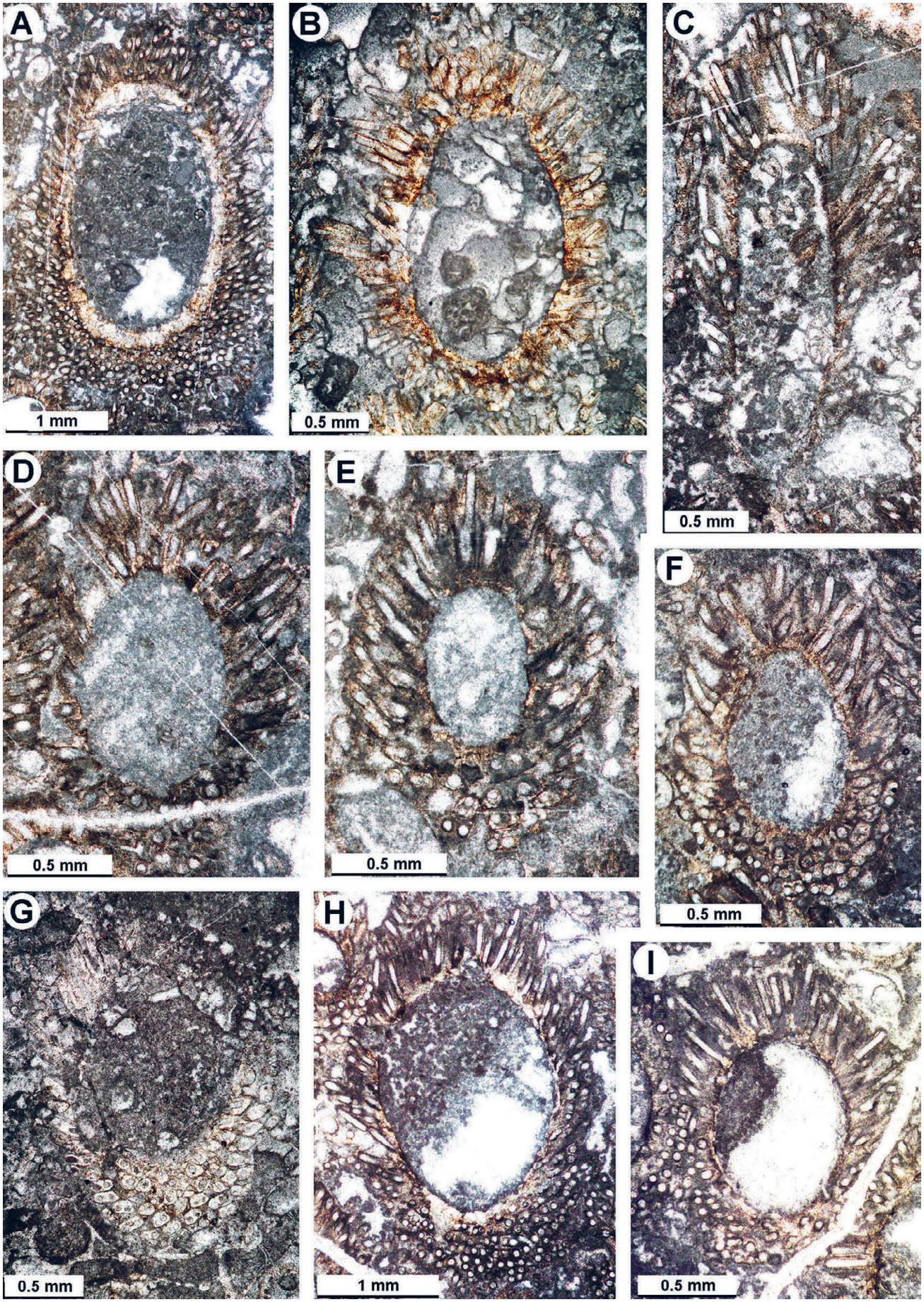

Plate 3. A-I *Schlagintweitella inopinata* nov. gen., nov. sp., oblique sections. E and G, paratypes. Thin-sections: A, C-F, H-I, 15207(1); B, 3751(2); G, 3751(1).

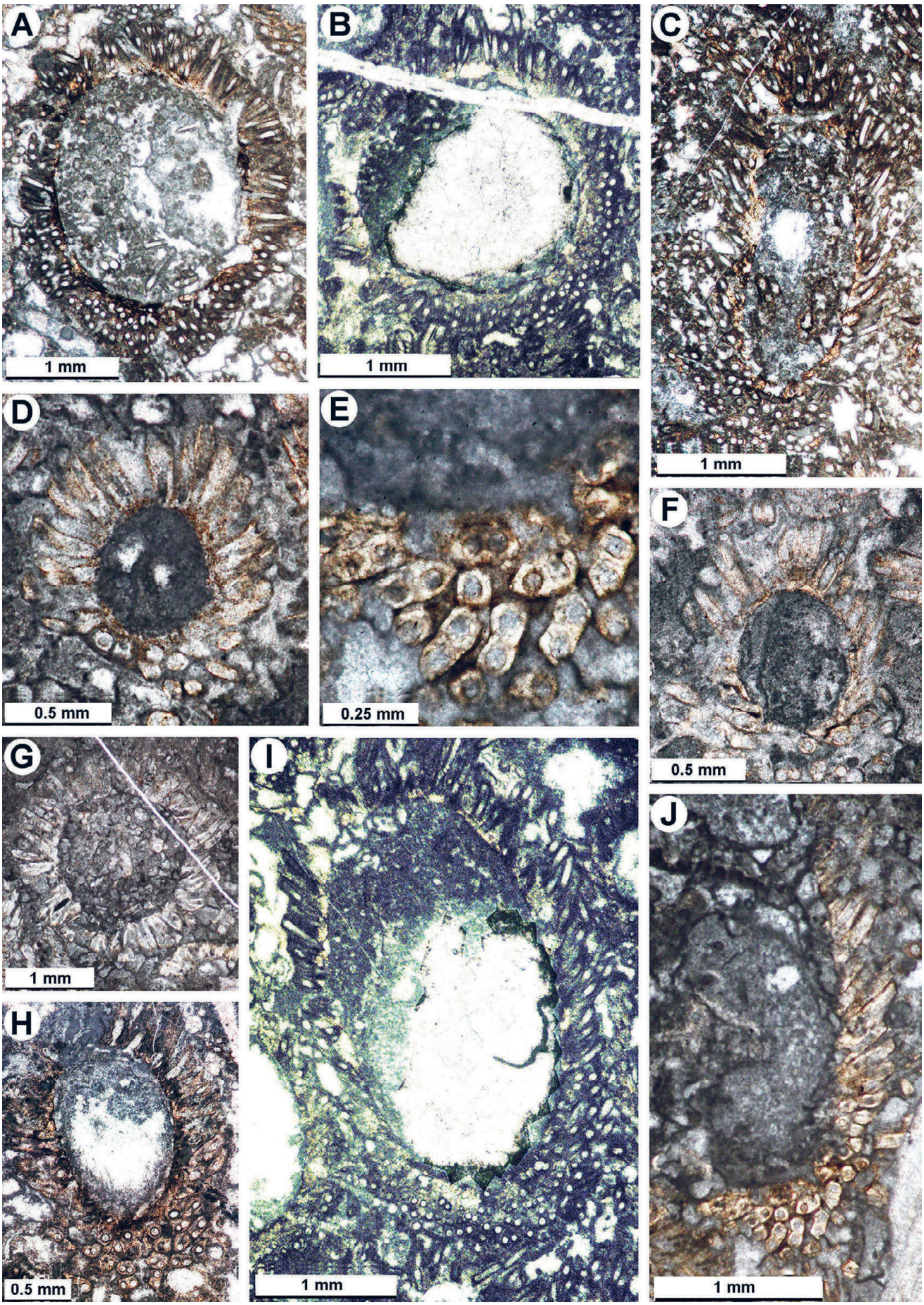

Plate 4. *Schlagintweitella inopinata* nov. gen., nov. sp. **A, B, D, G** transverse sections. **C, F, H-J** oblique sections. **E** is a close-up view of the lower part of **J**. Thin-sections: A-C, H-I, 15207(1); D-G, J, 3751(2).

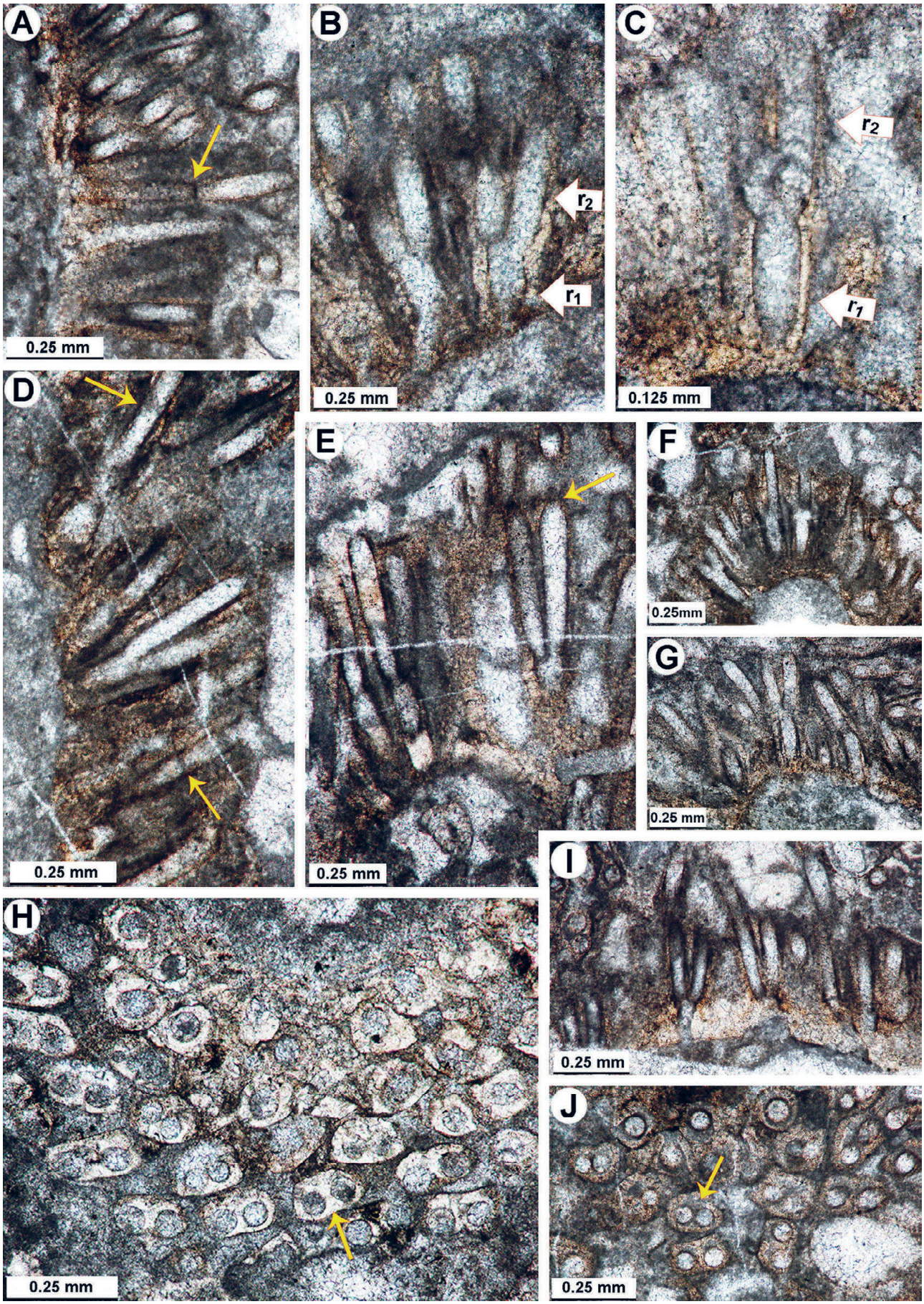

Plate 5. *Schlagintweitella inopinata* nov. gen., nov. sp. **A-J** details of laterals, showing the primary (r_1) and the secondary laterals (r_2). The arrows in A, D and E point to the constrictions separating segments inside the secondary laterals. The arrows in H and J point to the collective sheath around the secondary laterals. Thin-sections: A, D-G, I-J, 15207(1); B, 15207(2); C, 3751(2); H, 3751(1).

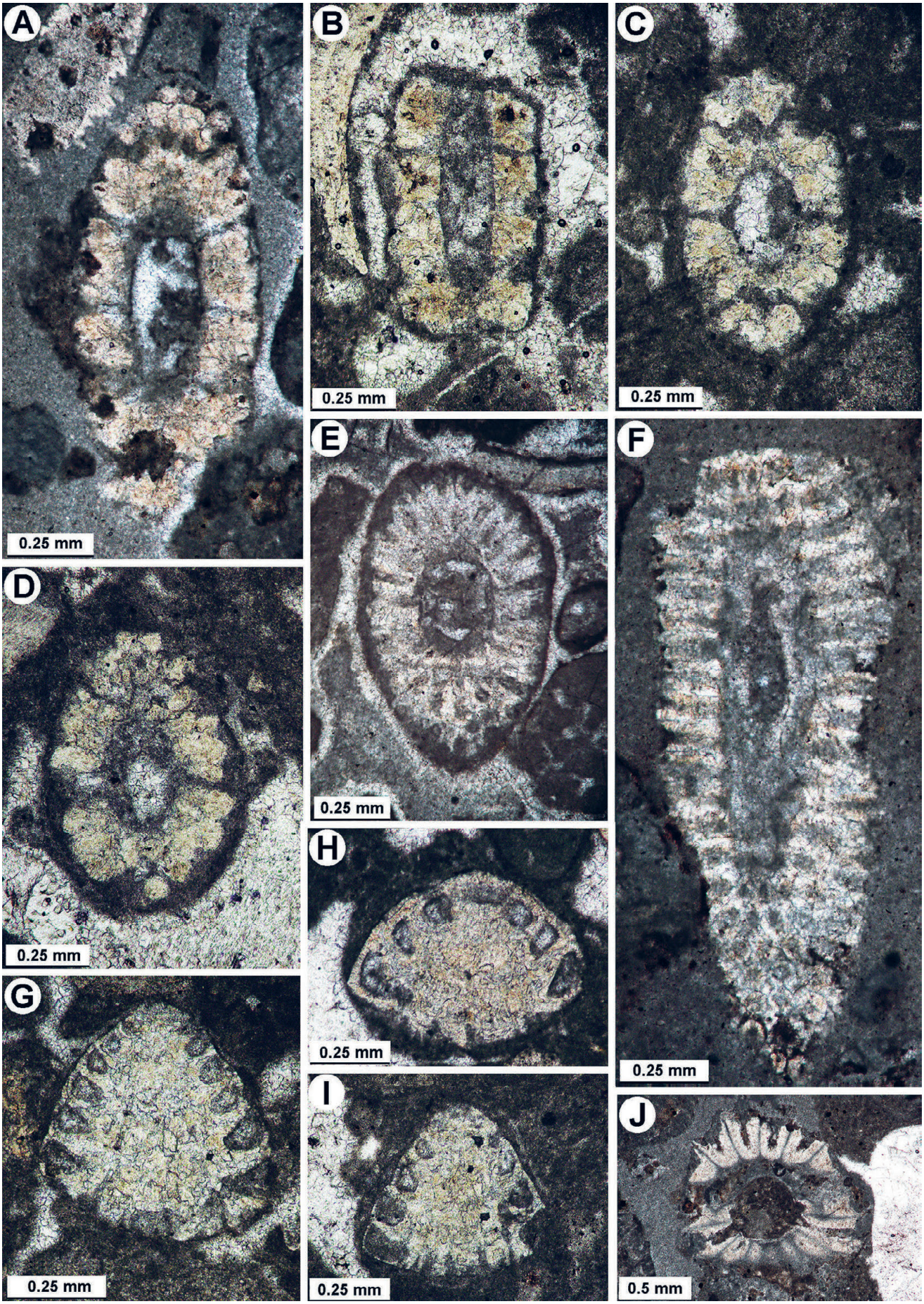

Plate 6. Microfossils associated with *Schlagintweitella inopinata* nov. gen., nov. sp. **A-D** *Salpingoporella annulata* (CAROZZI); **E-F** *Salpingoporella pygmaea* (GÜMBEL); **H** *Frentzenella involuta* (MANTSUROVA); **G-I** *Coscinoconus alpinus* LEUPOLD. **J** *Aloisalthella sulcata* (ALTH). Thin-sections: A, 3747(2); B-D, G-I, 3767; E, 3751(9); F, 3751(6); J, 3747(5).