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Re-documentation of Paleocene coralline algae of Austria, described by LEMOINE (1930)

Redokumentation paleozäner coralliner Rotalgen aus Österreich, beschrieben von LEMOINE (1930)

by

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RASSER, M. & PILLER, W.E., 1994. Re-documentation of Paleocene coralline algae of Austria, described by LEMOINE (1930). — Beitr. Paläont., **19**:219–225 1 Figure, 2 Plates, Wien.

Abstract

LEMOINE (1930) described 13 coralline algal taxa (Corallinaceae, Rhodophyta) from the Danian (Paleocene) of the Waschbergzone (Lower Austria) containing three new species (*Mesophyllum austriacum, Lithophyllum impositum, Lithothamnium Kühni)*. The discovery of the original material in the "Julius Pia-collection" (Museum of Natural History, Vienna) suggested a re-documentation of the poorly figured specimens.

Zusammenfassung

Im Jahre 1930 beschrieb LEMOINE 13 Taxa coralliner Rotalgen (Corallinaceae, Rhodophyta) aus dem Danium (Paleozän) der Waschbergzone (Niederösterreich), darunter auch drei neue Arten (*Mesophyllum austriacum, Lithophyllum impositum, Lithothamnium Kühni)*. Das Originalmaterial zu dieser Publikation wurde nun in der „Julius Pia-Sammlung" des Naturhistorischen Museums in Wien wiedergefunden, was eine Redokumentation der ungenügend abgebildeten Arten nahelegte.

1. Introduction

The aim of this paper is a re-documentation of the original material described by LEMOINE (1930) in order to provide a basis for future taxonomic revisions. Therefore, the original denomination is retained. The thin sections (see Fig. 1) of the Julius Pia-collection (stored at the Museum of Natural History, Burgring 7, A-1010 Vienna) which correspond to the figures and descriptions of LEMOINE (1930) are: no. 1 (=949) and 2 (=950) from Ernstbrunn, no. 275 and 275b from Bruderndorf.

Cell sizes were measured with PC-supported image analysis. Only representative cells were measured; branching zones of filaments and zones with atypical oblique sectional effects were avoided. Anatomical and morphological terms are applied according to WOELKERLING (1988), using "core filaments" instead of "hypothallus", and "peripheral filaments" instead of "perithallus". Cell fusions and secondary pit connections (for their use in fossil material compare BRAGA et al., 1993) are hardly visible owing to the thickness of the available thin sections.

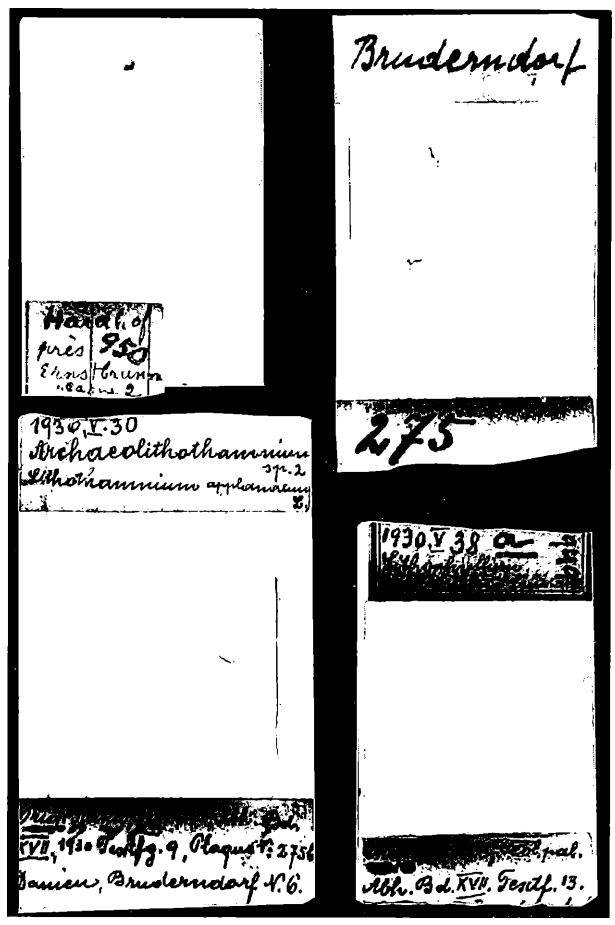

Figure 1: The original thin sections of LEMOINE (1930) in the "Julius Pia-collection" The numbers of the thin sections are (from the upper left to the lower right): 2 (= 950), 275, 275b and 1 (= 949).

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Beside the holotypes (*Mesophyllum austriacum, Lithophyllum impositum, Lithothamnium Kühni*), four species were rediscovered and figured: *Archaeolithothamnium* spec. 1, *Mesophyllum* spec., *Archaeolithothamnium* spec. 2, and *Lithothamnium applanatum* LEMOINE, 1923 (the two latter taxa were not figured by LEMOINE). Six species could not be found: *Archaeolithothamnim* spec. 3, *Lithothamnium* spec. 1, *Lithothamnium* spec. 2, *Lithothamnium* spec., *Lithophyllum* spec., and *Lithophyllum pisolithicum* LEMOINE, 1926; of these six, only *A.* spec. 3 was figured by LEMOINE.

It is conspicuous that LEMOINE only described a small fraction of the coralline algal flora in the available thin sections. A taxonomic revision and a general documentation of the coralline algae in the Paleogene of the Waschbergzone (Lower Austria) are in preparation.

2. Taxonomy

Division Rhodophyta WETTSTEIN, 1901
Class Rhodophycopsida RABENHORST, 1863
Order Corallinales SILVA & JOHANSEN, 1968
Family Corallinaceae LAMOUROUX, 1812

Archaeolithothamnium spec. 1
(Pl. 1, Figs. 1a-c)

1930 *Archaeolithothamnium* spec. 1 – LEMOINE, p. 535, Fig. 7, 8.

Thallus morphology The thallus encrusts a fragment of *Mesophyllum austriacum* (denomination according to LEMOINE). The crust is 100 to 200 µm thick. It forms a small protuberance (maximum thallus thickness: 500 µm) containing the sporangial sori.

Vegetative anatomy: The monomerous (some derivates of the branched filaments contribute to a core, others to a peripheral region) and plumose (cells of contiguous filaments are not aligned in tiers) core is only up to 20 µm thick and poorly developed. Some derivates of the branched core filaments curve outward, but they never curve toward the substrate. Cell length = 9–21 µm (mean (M) =14 µm, standard deviation (SD) = 4.1); cell diameter = 8–10 µm (M = 9 µm, SD = 0.7); ratio cell length/cell diameter = 1.1–2.3 (M=1.6, SD=0.5); number of measured cells (N) =10.

In the peripheral region, vertical cell walls are more distinct than horizontal walls. Therefore, cells appear to be elongated while, in fact, they are mostly nearly quadratic. Cell fusion is visible. Cell length = 9–13 µm (M =10 µm, SD = 1.0); cell diameter = 9–11 µm (M = 10 µm, SD = 0.7); ratio cell length/cell diameter = 0.9–1.2 (M =1.0, SD = 0.1); N = 15.

Sporangia: Forming rows composed of up to 6 sporangia. 1–3 filaments are interspersed between the sporangia. Height of sporangia = 58–80 µm (M = 67 µm, SD = 7.8); diameter = 32–46 µm (M = 39 µm, SD = 4.7); ratio height/diameter = 1.3–2.0 (M = 1.7, SD = 0.2); N = 9.

Remarks The figured specimen was found in thin section 275 from Bruderndorf. It corresponds to the thallus figured by LEMOINE (Fig. 7, 8) with regard to size, morphology and anatomy.

Archaeolithothamnium spec. 2
(Pl. 1, Figs. 2a–b)

1930 *Archaeolithothamnium* spec. 2 – LEMOINE, p. 535.

Thallus morphology: The described specimen is a fragmented thallus measuring 3x1 mm.

Vegetative anatomy: The thickness of the monomerous and plumose core generally does not exceed 50 µm. Some derivates of the branched core filaments curve outward, but they never curve toward the substrate. Cell length = 13–24 µm (M = 19 µm, SD = 4.2); cell diameter = 7–8 µm (M = 8 µm, SD = 0.5); ratio cell length/cell diameter = 1.9–3.0 (M = 2.4, SD = 0.5); N = 5.

In the peripheral region, vertical cell walls are more distinct than the horizontal ones. Cell fusions are present. Cell length = 12–20 µm (M =16 µm, SD = 2.7); cell diameter = 9–13 µm (M = 11 µm, SD = 1.1); ratio cell length/cell diameter = 1.1–2.2 (M = 1.5, SD = 0.3); N = 20.

Sporangia: Forming rows composed of more than 7 sori each. Height = 88–103 µm (M = 96 µm, SD = 5.4); diameter = 43–57 µm (M = 49 µm, SD = 5.0); ratio height/diameter = 1.6–2.3 (M = 2.0, SD = 0.3); N = 6.

Remarks LEMOINE mentioned two thalli, but only one was found in thin section 275b from Bruderndorf. She did not figure the specimen figured in the present paper, although size, morphology and anatomy correspond with one another.

Lithothamnium Kühni nov. spec.
(Pl. 1, Figs. 3a–d)

1930 *Lithothmanium Kühni* nov. spec. – LEMOINE, p. 536, Fig. 10.

Holotype No thallus has been detected corresponding totally with LEMOINE's drawing in Fig. 10. The part of the specimen of thin section no. 275 figured in Pl. 1, Fig. 3a matches best. This thallus is therefore interpreted as being the holotype.

Thallus morphology: Most of the subsequently growing thalli are more than 100 µm thick. No protuberances were found.

Vegetative anatomy Thallus monomerous with a plumose core. The core of the holotype is 70 µm thick, but usually – if present – the core-thickness does not exceed 20 µm. Derivates of the branched core filaments curve outward, but never toward the substrate. Cell length of core filaments = 9–25 µm (M = 15 µm, SD = 4.5); cell diameter = 5–8 µm (M = 6 µm, SD = 0.8); ratio cell length/cell diameter = 1.5–4.2 (M = 2.5, SD = 0.8); N = 20.

In the peripheral region, cell fusions are probable; cells are mostly quadratic. Cell length = 7–11 µm (M = 9 µm, SD = 0.9); cell diameter = 8–10 µm (M = 9 µm, SD = 0.5); ratio cell length/cell diameter = 0.8–1.2 (M = 1.0, SD = 0.1); N = 20.

Sporangia: No sporangia are present in the holotype. A fragment of *L. Kühni* in the same thin section contains three conceptacles measuring 58 x 155 µm to 71 x 248 µm (height x diameter). No pores are visible.

Remarks The holotype is part of an aggregate of subsequently growing thalli (thin section no. 275) occurring together with *Lithophyllum impositum*. LEMOINE stated that the thick core figured in her paper (Pl. 1, Fig. 3b of the present paper) is not typical for this species. A more typical core is shown herein in Pl. 1, Fig. 3c. The holotype represents a thallus with both types of cores (Pl. 1, Fig. 3a and 3c). LEMOINE's differentiation between quadratic median and even shorter marginal cells in the peripheral region cannot be confirmed. The latter should have a length of 5 µm and a diameter of 9 µm. Only a few cells with that size were found, but they are not arranged regularly.

Lithothamnium applanatum LEM.
(Pl. 1, Fig. 4)

1923 *Lithothamnium applanatum* n. sp. – LEMOINE, p. 66, Fig. 5.
1930 *Lithothamnium applanatum* LEM. – LEMOINE, p. 537.

Thallus morphology: Several small thallus fragments with a thickness of about 200 µm occur. There are no protuberances.

Vegetative anatomy: The monomerous and plumose core generally contributes more than 2/3 of the thallus. Derivates of the branched filaments curve outward and toward the substrate. As opposed to the peripheral filaments, cell walls are less rectangular and transversal cell walls are often curved; cell fusion is present. Cell length = 24–37 µm (M = 29 µm, SD = 3.6); cell diameter = 9–12 µm (M = 10 µm, SD = 1.1); ratio cell length/cell diameter = 2.1–3.7 (M = 2.9, SD = 0.4); N = 20.

Cells of the peripheral region are rectangular with distinct cell walls. Cell fusion is not visible, but cannot be excluded. Cell length = 8–14 µm (M = 11 µm, SD = 2.0); cell diameter = 7–11 µm (M = 10 µm, SD = 1.0); ratio cell length/cell diameter = 0.7–1.7 (M = 1.1, SD = 0.2); N = 20.

Sporangia: No sporangia were found.

Remarks Several thalli were found in thin section 275 from Bruderndorf. The figured thallus was measured.

Mesophyllum spec.
(Pl. 2, Figs. 1a–c)

1930 *Mesophyllum* spec. – LEMOINE, p. 538, Fig. 11.

Thallus morphology: One fragment measuring 1 x 1.5 mm.

Vegetative anatomy: Core filaments are absent in this fragment.

The peripheral region shows regularly arranged rectangular cells, cell fusion is not visible with certainty. Cell length = 9–18 µm (M = 13 µm, SD = 2.7); cell diameter = 6–9 µm (M = 8 µm, SD = 0.9); ratio cell length/cell diameter = 1.0–2.8 (M = 1.8, SD = 0.5); N = 30.

Sporangia: Two "*Palaeothamnium*"-like sporangia are present: 70 x 170 µm and 80 x 285 µm (height x diameter).

Remarks: The figured specimen comes from thin section 2 (= 950). Although it is poorly figured by LEMOINE, it corresponds with her description with respect to size, anatomy and morphology. Size and shape are comparable to *Mesophyllum austriacum*.

Mesophyllum austriacum nov. spec.
(Pl. 2, Fig. 2a–e)

1930 *Mesophyllum austriacum* nov. spec. – LEMOINE, p. 538–539, Fig. 12.

Holotype: The holotype was found in thin section 1 (= 949) from Haidhof. It corresponds with the original description in size, morphology and anatomy.

Thallus morphology The holotype consists of crustose portions (thickness 300 to more than 600 µm) and of protuberances (height = 0.6–0.8 mm, diameter = 0.75 mm).

Vegetative anatomy The monomerous and coaxial (cells of contiguous filaments are aligned in arching tiers) core is 100–300 µm thick. Derivates of the branched core filaments curve outward and toward the substrate. Cell length = 15–26 µm (M = 20 µm, SD = 3.3); cell diameter = 9–12 µm (M = 11 µm, SD = 1.1); ratio cell length/cell diameter = 1.4–2.4 (M = 1.9, SD = 0.2); N = 20.

The peripheral region in the crustose portions is 150–350 µm thick, cell fusions are probable. Cell length in the crustose peripheral region = 8–14 µm (M = 12 µm, SD = 2.1); cell diameter = 7–13 µm (M = 9 µm, SD = 1.5); ratio cell length/cell diameter = 0.9–2 (M = 1.4, SD = 0.4); N = 20.

In the protuberances, cells are elongated. Length = 18–24 µm (M = 21 µm, SD = 1.7); cell diameter = 9–11 µm (M = 10 µm, SD = 0.9); ratio cell length/cell diameter = 1.6–2.4 (M = 2, SD = 0.2); N = 20.

Sporangia: The holotype bears no sporangia. One thallus fragment in the same section (no. 1 (=949)), however, contains three conceptacles (Pl. 2, Fig. 2e) measuring 100 x 220 µm to 113 x 290 µm (height x diameter). No pores are visible.

Remarks: In addition to thin section 1 (=949), several specimens occur in thin section 275 from Bruderndorf.

Lithophyllum impositum nov. spec.
(Pl. 2, Fig. 3a–c)

1930 *Lithophyllum impositum* nov. spec. – LEMOINE, p. 540, Fig. 13.

Holotype: The holotype was found in thin section 1 (= 949) from Haidhof; it corresponds totally with LEMOINE's Fig. 13.

Thallus morphology The holotype belongs to an aggregate of thin, subsequently growing thalli with a thickness of 100–300 µm each.

Vegetative anatomy: The core is monomerous and plumose; it is typically less than 60 µm thick. This species can easily be recognized by a basal filament

consisting of long and thick cells arranged parallel to the substrate; these cells are 21–75(!) µm (M = 36 µm, SD = 12.6) long, their cell diameter is 10–13 µm (M = 12 µm, SD =1.1); ratio cell length/cell diameter = 1.6–6.8 (M = 3.1, SD = 1.2); N = 20. Cells of the overlying core filaments are distinctly smaller: length = 17–34 µm (M = 22 µm, SD = 5.0); cell diameter = 8–16 µm (M = 12 µm, SD = 2.2); ratio cell length/cell diameter = 1.1–3.0 (M = 1.9, SD = 0.6); N = 20.

The peripheral filaments consist of rectangular cells with distinct consecutive transversal cell walls. Cell fusion seems to be present. Cell length = 17–32 µm (M = 25 µm, SD = 4.3); cell diameter = 13–17 µm (M = 14 µm, SD = 1.3); ratio cell length/cell diameter = 1.1–2.4 (M = 1.8, SD = 0.4); N = 20.

S p o r a n g i a : The thallus of the holotype contains no sporangia. The subsequently overgrowing crust, however, contains one multiporate conceptacle (Pl. 2, Fig. 3c) measuring 788 x 190 µm.

R e m a r k s : Only the figured holotype was measured. In thin section no. 275 from Bruderndorf this species forms an aggregate with *Lithothamnium Kühni*.

Due to the non-coaxial core and the multiporate conceptacle the classification of this species within the genus *Lithophyllum* must be considered as incorrect.

Acknowledgements

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3. References

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PLATE 1

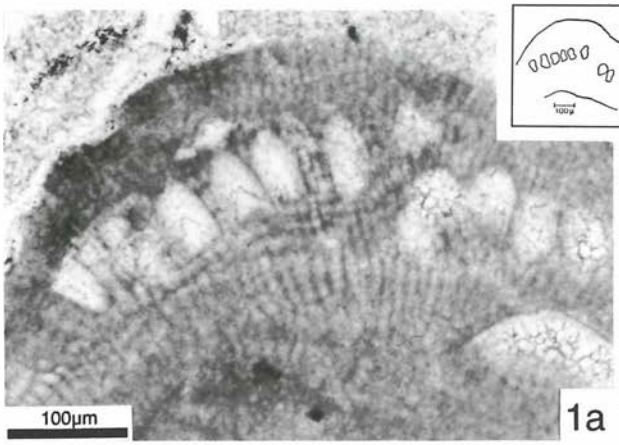
Figs. 1a–c: *Archaeolithothamnium* spec. 1.
- a: Crust with sporangial sori, corresponding to Fig. 7 in LEMOINE, overgrowing a fragment of *M. austriacus* (thin section no. 275).
- b: Figs. 7 (left) and 8 (right) in LEMOINE, 1930 ("h" denotes hypothallus, "p" denotes perithallus).
- c: Core filaments of *A.* spec. 1 (compare Fig. 1b) (thin section no. 275).

Figs. 2a–b: *Archaeolithothamnium* spec. 2.
- a: Sporangial sori (thin section no. 275b).
- b: Core filaments (thin section no. 275b).

Figs. 3a–d: *Lithothamnium Kühni* nov. spec.
- a: Holotype with core filaments (compare Fig. 3b) (thin section no. 275).
- b: Fig. 10 in LEMOINE, 1930 ("p" denotes perithallus); holotype of *L. Kühni*.
- c: Fragment with the more frequent small core filaments of *L. Kühni* which are described but not figured by LEMOINE (thin section no. 275).
- d: The same thallus as in 3c with one of the rare conceptacles (thin section no. 275).

Fig. 4: *Lithothamnium applanatum* LEMOINE, 1923 (thin section no. 275).

PLATE 1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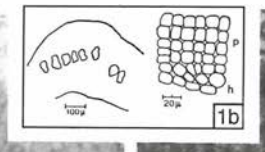
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h
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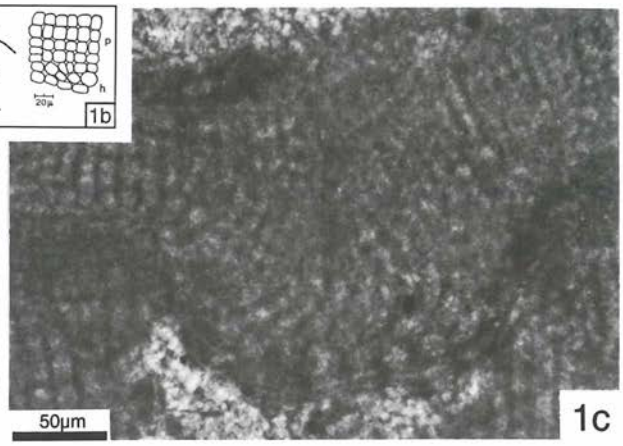
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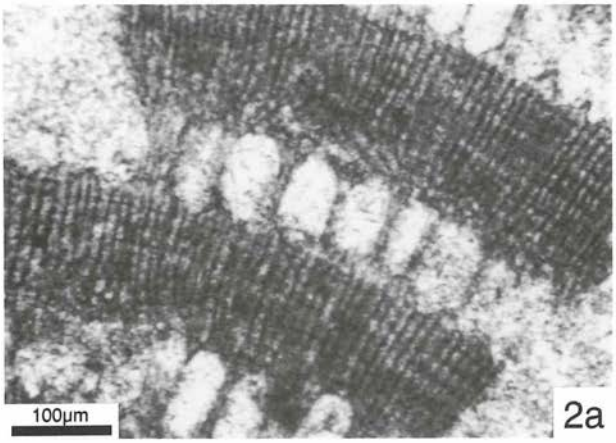
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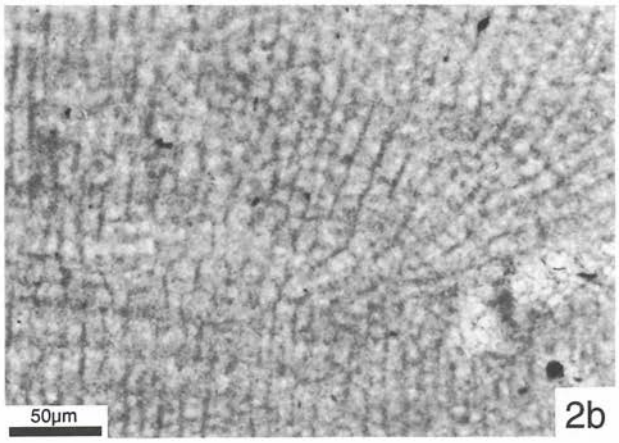
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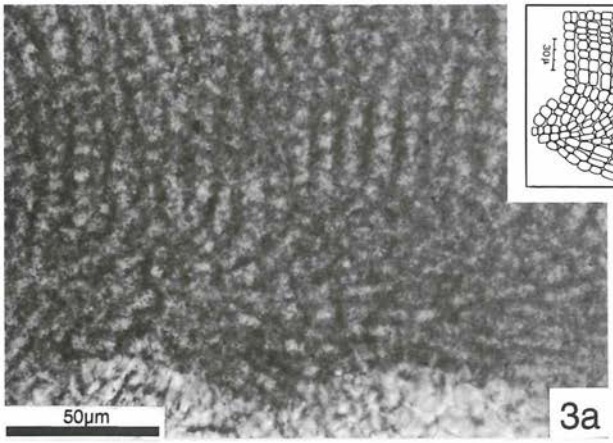
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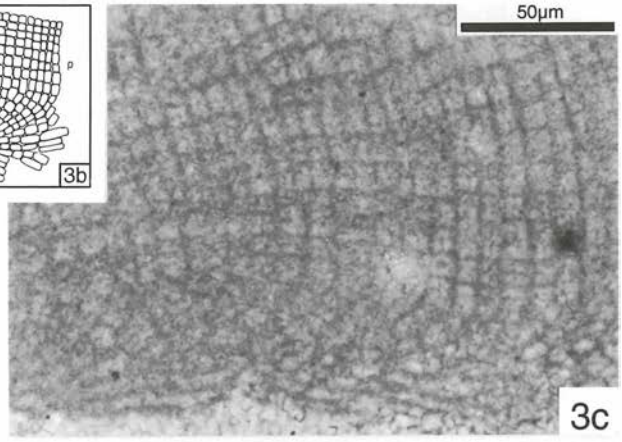
3a

30µ
p
3b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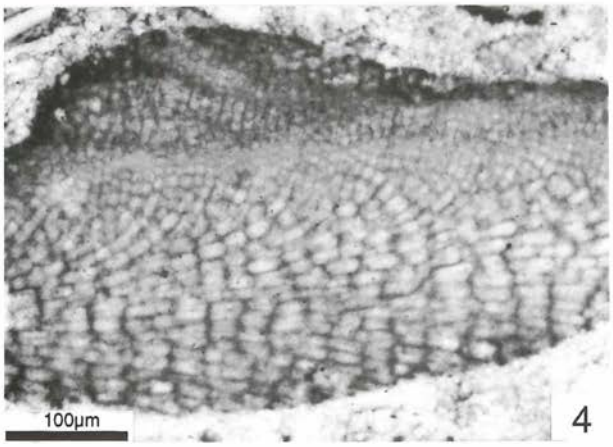
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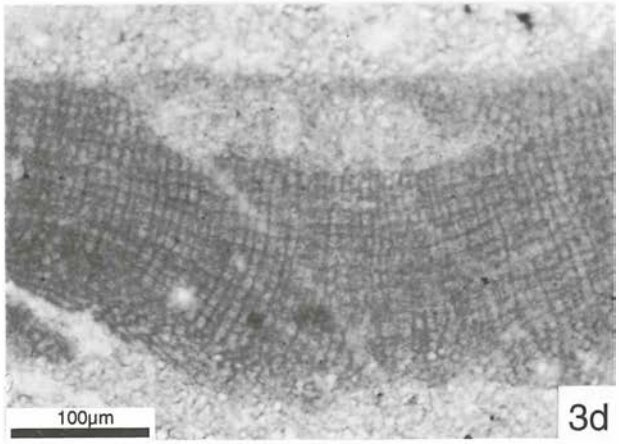
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3d

PLATE 2

Fig. 1a–c: *Mesophyllum* spec.

a: Typical cells of peripheral filaments (compare Fig. 1b) (thin section no. 2).

b: Fig. 11 in LEMOINE, 1930.

c: Conceptacles of the described thallus (thin section no. 2).

Fig. 2a–e: *Mesophyllum austriacum* nov. spec.

a: Holotype; typical peripheral cells in a protuberant portion of the thallus (compare Fig. 2c) (thin section no. 1).

b: Holotype with peripheral cells of a crustose portion (compare Fig. 2c) (thin section no. 1).

c: Fig. 12 in LEMOINE, 1930 showing the holotype of *M. austriacum* nov. spec. ("a" is the perithallus in protuberant portions of the thallus, "b" is the perithallus in crustose portions, "h" is the hypothallus and "l" means growth line); compare Figs. 2a, b and d of the present paper.

d: Characteristic coaxial core filaments (compare Fig. 2c) (thin section no. 1).

e: Thallus of *M. austriacum* with conceptacles (thin section no. 1).

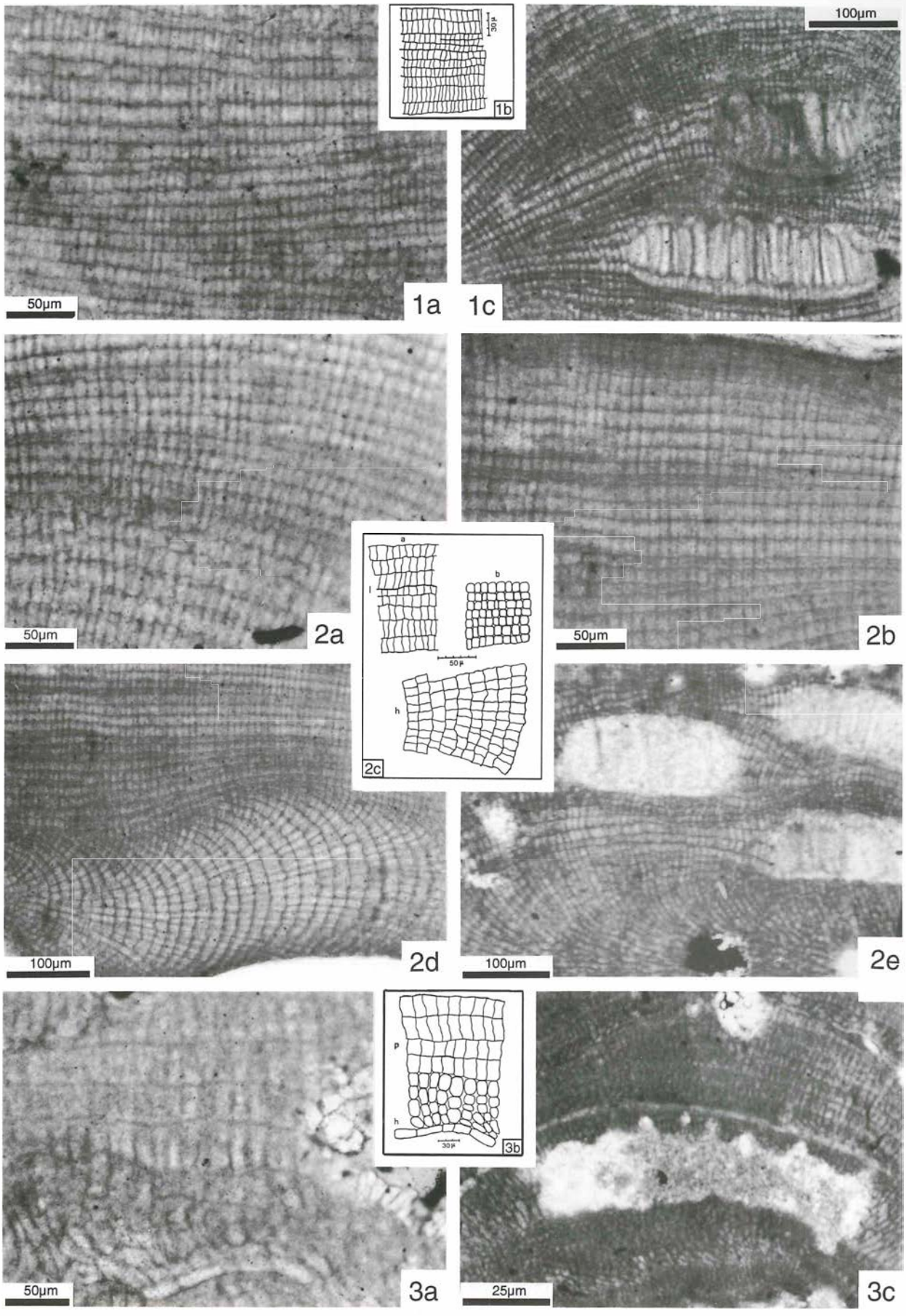
Fig. 3a–c: *Lithophyllum impositum* nov. spec.

a: Holotype showing the core filaments with a typical basal cell layer and the peripheral filaments of Fig. 13 in LEMOINE, 1930 (compare Fig. 3b of the current paper) (thin section no. 1).

b: Holotype of *L. impositum* nov. spec.; Fig. 13 in LEMOINE, 1930 ("h" denotes hypothallus, "p" denotes perithallus).

c: Multiporate conceptacle of *L. impositum* nov. spec. (thin section no. 1).

PLATE 2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