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MEGAPORELLA NIKLERI N. SP., A NEW CALCAREOUS ALGA (DASYCLADALES) FROM THE UPPER BARREMIAN OF MT. BIOKOVO, CROATIA

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Abstract. The genus *Megaporella* Deloffre & Beun, 1986, is emended, and a new species, *Megaporella nikleri* n. sp., is established. The species is characterized by vesiculiferous and sporadically phloiophorous branches, arranged in whorls. Their number per whorl is variable and their distribution in consecutive whorls is unequal, giving a picture of a seemingly aspondyl arrangement in tangential section. The new species occurs in Upper Barremian.

Riassunto. Il genere *Megaporella* Deloffre & Beun, 1986, viene qui emendato e ne viene descritta una nuova specie, *Megaporella nikleri* n. sp.. La specie è caratterizzata da branche vesiculifere e sporadicamente floiofore, disposte in anelli. Il loro numero per anello è variabile e la loro distribuzione in anelli contigui non è omogenea, offrendo un'immagine di disposizione apparentemente aspondila in sezione tangenziale. La nuova specie è presente nel Barremiano superiore.

Introduction

During geological prospecting of the Lower Cretaceous deposits of Mt. Biokovo, fossiliferous samples have been collected along the road between the mountain hut Vošac and the Sv. Jure peak (Fig. 1). Although this prospecting and provisionally collected samples have not enabled detailed sedimentological and stratigraphic interpretation, they enable determination of stratigraphic age and basic sedimentological characteristics of particular intervals within complete range of Upper Neocomian – Aptian carbonate succession. The main lithological characteristics and depositional environments are illustrated by the schematical geological column of the Lower Cretaceous platform deposits (Fig. 2), modified after Tišljar et al. (2002, fig. 5).

After preliminary micropaleontological investigations of collected samples, particular interest was given to the sample KJ-18 with abundant remains of dasycladalean algae, belonging to different taxa. The sample was sliced into 250 thin-sections. Beside numerous differently oriented sections of twelve known and few unknown taxa, one form was particularly prominent with extraordinary large branches. Study of 30 specimens of this alga enabled us to determine its belonging to the genus *Megaporella*, and describe as a new species. Investigation of this material, together with comparison with previously published data, enabled us to propose the emendation of genus *Macroporella*.

Genus *Megaporella* Deloffre & Beun, 1986, emend.

In the original description, Deloffre & Beun (1986) mentioned the main characteristics of the genus as follows: undivided cylindrical thallus, with large axial cavity, walls made of dense calcite, and having only primary branches of vesiculiferous type and aspondyl arrangement.

However, on the basis of the sections illustrated by Deloffre & Beun (1986, pls. 1-2), as well as those of Kuss (1990, pl.17, figs. 5, 11-13) and our own sections (Pls. 1-2), we propose a modified generic diagnosis: undivided, cylindrical thallus with large and variable axial cavity; undivided vesiculiferous, sporadically phloiophorous, primary branches arranged in whorls; variable number of branches per whorl and unequal distribution of branches in neighbouring whorls produce a seemingly irregular - aspondyl arrangement in tangential sections.

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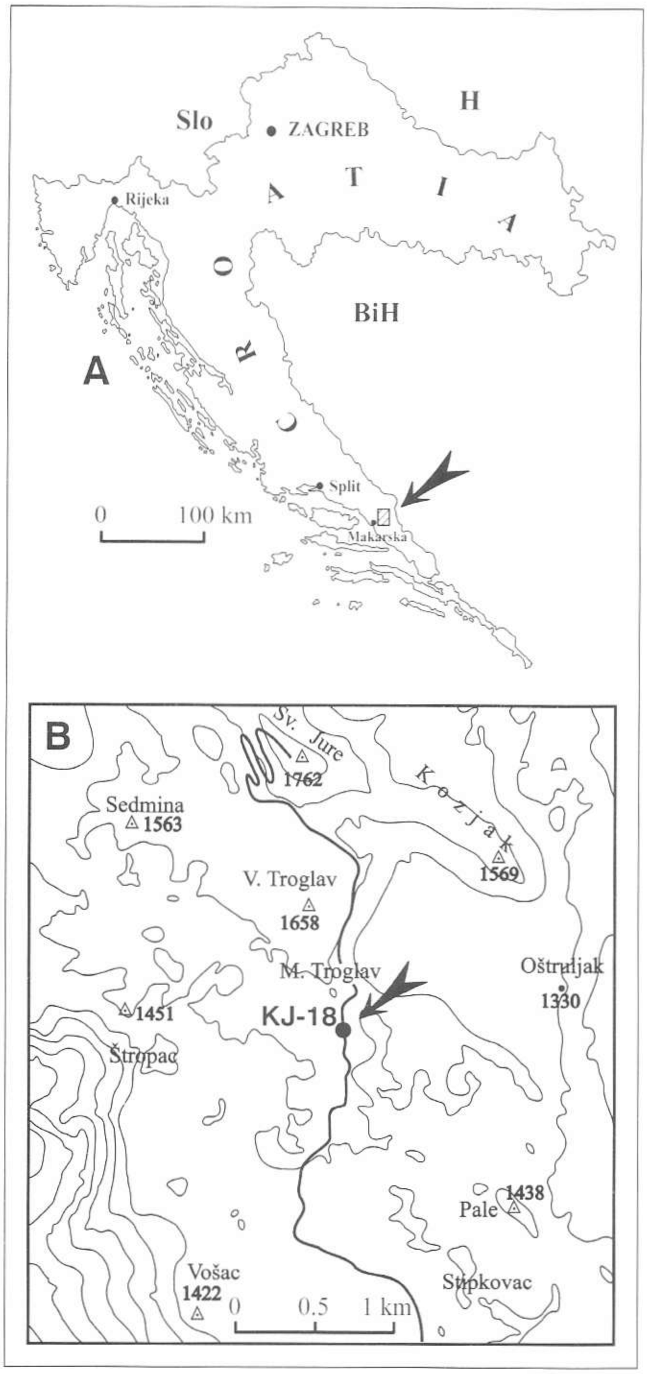

Fig. 1 - A) General position of the type-locality of *Megaporella nikleri* n. sp. B) Simplified topographic map of the area in the central Biokovo Mt. Arrow point to the outcrop of sample KJ-18 with *Megaporella nikleri* n. sp..

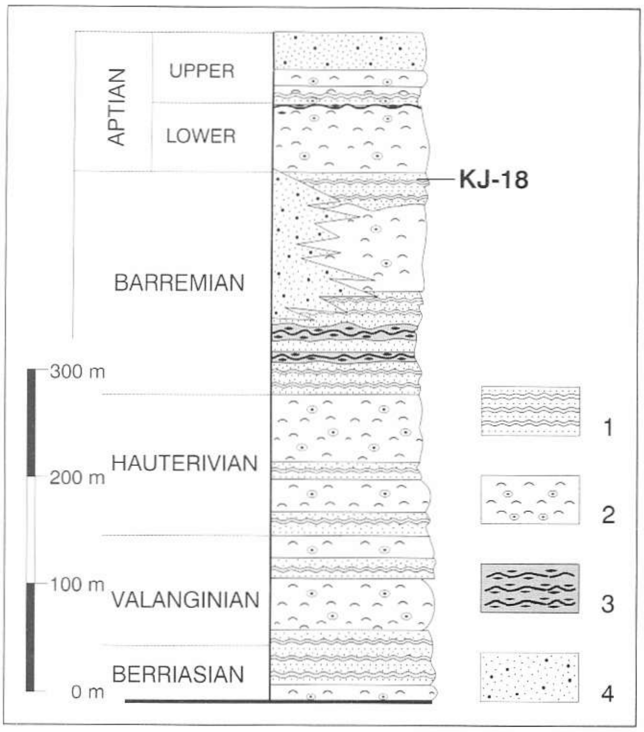

Fig. 2 - Schematical geological column of the Lower Cretaceous carbonate platform deposits (modified after Tišljar et al. 2002). Legend: 1) Peritidal-tidal flat pelletal and stromatolitic limestones forming shallowing-upward cycles; laterally carbonate sand bars, at the top with vadose features; 2) Inner platform lagoonal and shallow subtidal oncoid and peloidal micritic limestones; 3) Peritidal and vadose limestones, black-pebble breccia/conglomerates, emersion breccia, swamp clays and palaeosols; 4) Intraclastic/peloidal and skeletal foreshore and shoreface grainstones and packstones.

Megaporella nikleri n. sp.

Pls. 1-2

Origin of the name. The species is dedicated to the memory of late Leon Nikler, a long-year field-colleague and co-author of several joint papers.

Type locality. Mt. Biokovo, in a road cut situated approximately in the middle between the mountain hut Vošac and the Sv. Jure peak (1762 m).

Coordinates. x = 64 23 980, y = 47 98 490.

Type stratum. The sample with the new alga belongs to the level of light brown, well-bedded, more or less karstified limestone, with bed thickness ranging from 0.3 to 1.2 m. The microfacies types are fenestral skeletal- and oncoid-bearing intraclastic grainstone and skeletal-peloid packstone. The allochems include irregular intraclasts, small pellets, micritised skeletons of benthic foraminifera and gastropods, and less common oncoids, skeletons and bioclasts of dasycladalean algae, and centripetaly micritised shell bioclasts. The lithological succession is represented by alternation of mudstone, algal and foraminiferal wackestone, and sporadical occurrences of skeletal-intraclastic grainstone.

Holotype. Oblique section in thin section KJ-18/30, figured in Pl. 1, fig. 5. Isotypes are represented by variously oriented sections, figured in Pl. 1, figs. 1-4, 6-9; Pl. 2, figs. 1-12. The original material is kept at the Institute of Geology, Zagreb.

Diagnosis. Cylindrical thallus has a broad but variable axial cavity. Branches are vesiculiferous, clearly differentiated into a short stalk and a well pronounced bubble-shaped swelling, slightly horizontally flattened at the distal end, or, more rarely, club-shaped, e.g. phloiophorous type. Branches are grouped into whorls, but unequally distributed in neighbouring whorls, which often gives a picture of a seemingly aspondyl arrangement in tangential sections.

Description. The cylindrical calcareous thallus has walls built up of fine to medium-grained mosaic calcite, originated by the heteroaxial transformation of original,

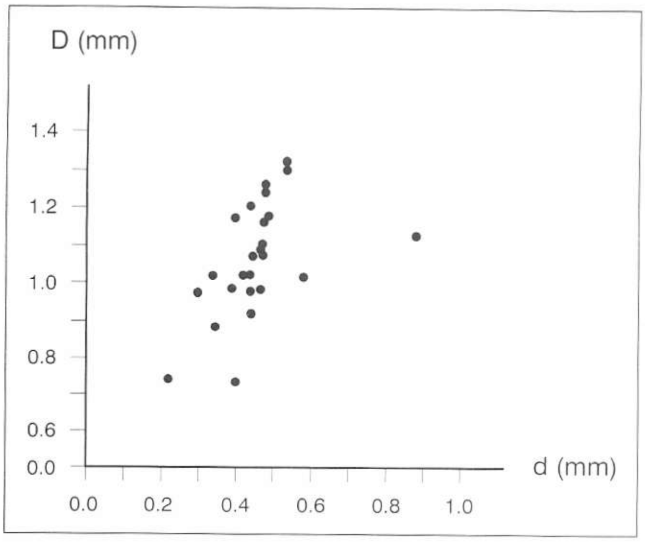

Fig. 3 - Scatter-diagram of outer (D) and inner (d) thallus diameter for *Megaporella nikleri* n. sp.. Number of measurements: n = 24.

Dimensions in mm:	*M. nikleri*	*M. boulangeri*
Maximum observed length (L)	3.38	2.05
Outer diameter (D)	0.73-1.32 (1.06)	0.275-0.475
Inner diameter (d)	0.22-0.88 (0.45)	0.163-0.275
d/D relation	0.300-0.785 (0.425)	0.600-0.607
Distance between whorls (h)	0.20-0.32 (0.27)	
Maximum diameter of branches (p)	0.14-0.34 (0.20)	0.10
Length of branches (l)	0.24-0.40 (0.32)	
Thickness of the calcitic envelope (e)	0.25-0.45 (0.28)	0.075-0.100
Diameter of the entrance pore	0.04-0.10 (0.06)	0.025
Number of branches per whorl (w)	3-6	?3-5
Angle of inclination of branches (α)	0^0	up to 20^0

Tab. 1 - Comparison of biometric parameters between *Megaporella nikleri* n. sp. and type-species *M. boulangeri* Deloffre & Beun. Data in parentheses are mean values.

probably aragonitic thallus. Axial cavity greatly varies in diameter, occupying 30-75% of the total (outer) thallus diameter (Table 1; Fig. 3).

Main generic characters, including shape and distribution of branches, are also characteristic of the species. The branches are undivided, mostly of vesiculiferous, sporadically of club-shaped phloiophorous, type. In vesiculiferous branches, a short and thin stalk can be clearly distinguished from the pronouncedly swollen, bubble-shaped to spherical, part of the branch (Pl. 1, figs. 5, 9; Pl. 2, figs. 10-12). The pore is sometimes slightly funnel-shaped at its proximal end (Pl. 1, fig.1; Pl. 2, fig. 3). As already stated, the phloiophorous type of branches occurs more rarely (Pl. 1, figs. 1, 6; Pl. 2, figs. 3, 5); the entrance pore in this type is about twice as wide as in the other type (Pl. 1, fig. 1) and the branch gradually and regularly becomes thicker towards its distal end, assuming a characteristical club-shaped form (Pl. 1 , fig.1; Pl. 2, figs. 3, 5). The appearance of the phloiophorous type in the sections, in some cases, might be the result of secondary enlargement of entrance pore and stalk (Pl. 2, ?fig. 5). In some other cases, it might be considered as an effect of sectioning. However, in several examples (Pl. 1, fig. 1; Pl. 2, fig. 3) the club-shape of the branches is so apparent, that can hardly be attributed to one of the mentioned possibilities. Both types of the branches are very similar, and their shape depends on the length and the form of the widening of the proximal part of the branch, maintaining identical biological function. Closeness or openness of pores are of subordinate importance, since it is the result of extent of calcification, that is influenced by ecological factors and post-mortem digenetic changes. The similar phenomenon of variability in the shape of the branches, e.g. existence of phloiophorous type, is clearly visible also in some sections of *Megaporella boulangeri* (Deloffre & Beun 1986, pl. 1, fig. 4; pl. 2, figs. 4-5). Presence of differently shaped branches within the same taxon is not rare among Dasycladales, and is the result of variability common to all living organisms. The only problem here is the limited number of terms we use to describe this variability.

Branches are arranged in whorls and directed perpendicularly to the outer surface. The number of branches in the whorls of the same specimen varies from 3-6. Most characteristically, the branches in a whorl are unevenly spaced, which results in their unequal distribution in neighbouring whorls (Fig. 4A). In tangential sections, this produces a seemingly aspondyl arrangement of branches (Fig. 4B). Nearly identical cross-sections of pores belonging to the same whorl (Pl. 1, fig. 9; Pl. 2, figs. 8, 10), in addition to the same level of pores at opposite sides of longitudinal sections (Pl. 1, fig. 8; Pl. 2, fig. 3), confirm euspondyl arrangement of branches. The similar case, in our opinion, is present in the type-species *Megaporella boulangeri* (Deloffre & Beun 1986, pl. 1, figs. 3-4; pl. 2, figs. 2, 4, 9-11; Kuss 1990, pl.17, figs. 5, 11-12), that lead us to modify the generic diagnosis (see above), and include this genus within group of euspondyl algae.

Comparable uneven arrangement of branches in a whorl is present in Triassic species *Physoporella leptotheca* Kochansky-Devidé. Cross sections of that species (Kochansky-Devidé 1967, pl.1, fig. 6, 12), and some longitudinal ones (Kochansky-Devidé 1967, pl.1, fig. 3) point to aspondyl arrangement of branches, but tangential sections (Kochansky-Devidé 1967, pl.1, fig. 4) and especialy isolated thalli (Fois 1979, pl. 5) proved euspondyl arrangement.

Regardless of being either of vesiculiferous or of a phloiophorous type, the branches are slightly horizontally flattened at their distal ends, which in shallow tangential sections produces the elliptical shape of pores (Pl. 1, figs. 3, 5). In some sections, mostly in longitudinal ones, thin fissures within the calcareous envelope are visible; these fissures are mostly perpendicular or slightly inclined to the outer surface and may be even or irregular (Pl. 1, fig. 8; Pl. 2, fig. 2). Cysts have not been identified with cer-

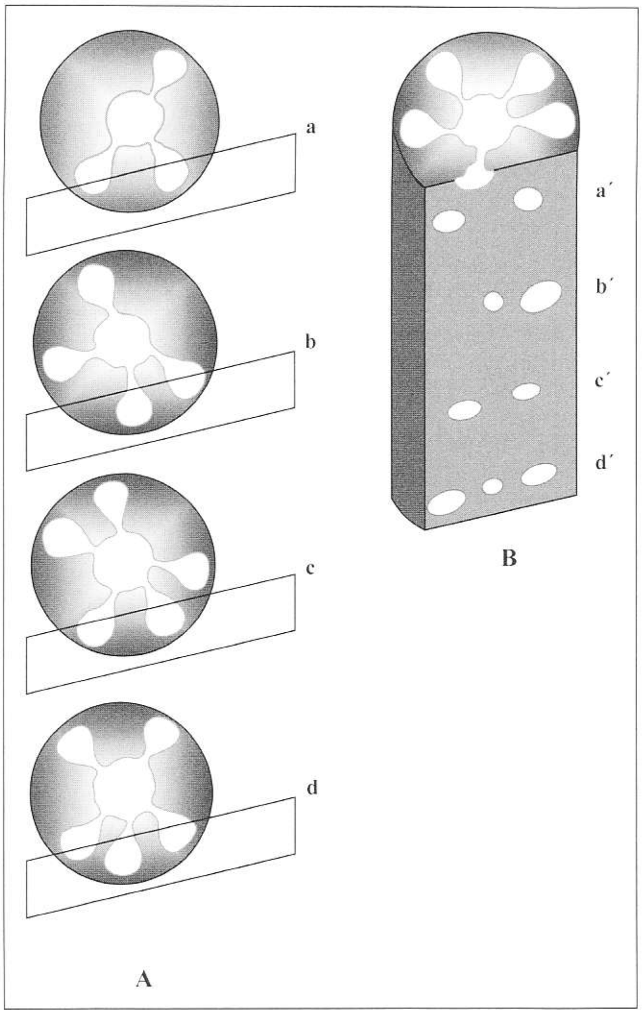

Fig. 4 - A) a - d: tangential planes cutting through individual whorls with different number and unequal arrangement of branches. B) a' - d': irregular distribution of pores of branches of neighbouring whorls as seen in a longitudinal-tangential section.

tainty, though the large, swollen branches, as well as the existence of some small, unidentified, rounded structures (Pl. 1, fig. 1, 5; Pl. 2, fig. 6), indicate the cladospore character of that species and belonging to the family Triploporellaceae Berger & Kaever.

Similarities and differences. In the original description, Deloffre & Beun (1986) gave a detailed analysis of the new genus and species and therefore a repeated detailed comparison with similar or related species appears superfluous. Hence the comparison may be restricted to the type species *M. boulangeri* Deloffre & Beun. *Megaporella nikleri* n. sp. has the same general shape of the thallus, but both the outer and the inner diameter are approximately three times larger then in the type species (Table 1). Branches in *M. nikleri* n. sp. are perpendicular to the talus axis, and at their distal ends slightly horizontally flattened. In *M. boulangeri* the branches are directed slightly upwards and remain circular in transverse sections. This produces elliptical pores in shallow tangential sections of *M. nikleri*, and rounded pores in *M. boulangeri*. Spiral arrangement of the pores on the outer thallus surface, stated in the diagnosis and shown on the reconstruction of *M. boulangeri* (Deloffre & Beun 1986, fig. 4) is not visible in the figured specimens, neither in specimens of *M. nikleri* n. sp.. Irregular arrangement of pores in tangential sections is not the consequence of spiral growth of the branches, but of the variable and unequal distribution of the branches in the successive whorls. Another difference between these two species is mineralogy of thallus walls. While *M. boulangeri* has wall of yellowish fibrous calcite of presumably primary origin, as stated by Kuss (1990), the new species has wall of secondary mosaic calcite originated by the replacement of original, probably aragonitic mineralogy. Importance of different mineralogy in dasycladal taxonomy is not clear yet, and needs separate detail investigations. Concerning the species originally described as *Salpingoporella fluegeli* by Dragastan (1978), and later transferred by the same author (Dragastan 1989) into the genus *Megaporella*, differences are well visible. This species is characterised by exclusively phloiophorous branches, arranged in clear whorls with regularly and evenly distributed branches (Dragastan 1989, pl.7, fig. 2). Spiral arrangement of the pores, shown also in the reconstruction of this species (Dragastan 1989, pl. 7, fig. 4), can not be seen in the figured specimens, as well. According to the mentioned characteristics there was no reason to keep this species in the genus *Megaporella*, and it was later (Granier & Deloffre 1993; Sokač 1996) returned to the genus *Salpingoporella*.

The comparison with the specifically undefined specimen, probably belonging to the genus *Megaporella*, mentioned and figured by Sotak & Mišik (1993) from the Tithonian-lowermost Berriasian, is impaired due to the lack of its description. However, a visual comparison with the figured sections (Sotak & Mišik 1993, pl.8, figs. 9-14), shows that this species has exclusively spherical bubble-like shaped branches, that are likely to be evenly distributed within a whorl, and can not be considered identical to the new species.

Facies. The microfacies type of the sample KJ-18 is skeletal-intraclastic grainstone, composed of poorly sorted intraclasts, micritic peloids, fragments and skeletons of dasycladal algae, and rare benthic foraminifera and gastropod bioclasts. Dasycladal skeletons are outlined with thin micritic envelopes. Intergranular and intraskeletal pores are filled up with typical beach-rock cement. This microfacies type is characteristic for the lowermost member of shallowing upward cycle, interpreted as peritidal with carbonate sand bar influence, and followed by subtidal skeletal-peloid wackestone and intertidal fenestral wackestone with stromatolites and vadose features (Tišljar et al. 2002).

Dasycladal algae (including *Megaporella nikleri* n. sp.) were living in adjacent shallow lagoon environment, probably between fairweather and storm-weather wavebases, and were removed by storm waves and redeposited on sand bars, together with other carbonate particles. This microfacies is therefore not indication of the living environment of the alga, but the result of sedimentary and diagenetic processes.

Stratigraphic position. The algal-bearing sample, in addition to *Megaporella nikleri* n. sp., contains plenty of variously preserved and oriented sections of numerous other dasyclad species: *Salpingoporella muehlbergii* (Lorenz), *S. verticillata* (Sokač & Nikler), *S. patruliusi* Bucur, *S. dinarica* Radoičić, "*Salpingoporella*" *robusta* Sokač, *Cymopolia velici* Sokač & Nikler, *Praturlonella dalmatica* (Sokač & Velić), *Korkyrella texana* (Johnson), *Cylindroporella lyrata* Masse & Luperto Sinni, *Falsolikanella nerea* (Dragastan, Bucur & Demetre), *Triploporella ? sarda* Jaffrezo, Bassoullet, Chabrier & Fourcade, and *Neomeris cretacea* Steinmann, beside some yet undetermined taxa. The sample also contains several taxa of benthic foraminifera: *Praechrysalidina infracretacea* Luperto-Sinni, *Varcorsella scarselai* (De Castro), *Pseudocyclamina* sp., and undetermined Miliolidae and Textulariidae.

According to the afore mentioned fossil assemblage, and first occurrence of *Palorbitolina lenticularis* in the strata immediately above the investigated sample, the stratigraphic position of the new species at its type locality may be quite reliably defined as the Upper Barremian.

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PLATE 1

Megaporella nikleri n. sp., Upper Barremian, x 34

Fig. 1 - Part of the longitudinal, slightly oblique section of specimen with phloiophorous branches. Arrow points to possible cyst. Slide KJ-18/26. Fig. 2 - Oblique section. Slide KJ-18/28. Fig. 3 - Tangential section. Partly irregular pore arrangement is visible. Slide KJ-18/173. Fig. 4 – Longitudinal, slightly oblique section. Slide KJ-18/54. Fig. 5 - Tangential-oblique section. Holotype. Arrow points to possible cyst. Slide KJ-18/30. Fig. 6 - Longitudinal section. Slide KJ-18/10. Fig. 7 - Oblique section. Slide KJ-18/40. Fig. 8 - Longitudinal section. Irregular fissures in the calcareous thallus are visible (arrow). Slide KJ-18/156. Fig. 9 - Transversal section. Bubble-shaped branches are well visible. Slide KJ-18/36.

PLATE 2

Megaporella nikleri n. sp., Upper Barremian, x 34

Fig. 1 - Oblique section with large pores of the branches. Slide KJ-18/14. Fig. 2 - Oblique-tangential section. Slide KJ-18/50. Fig. 3 - Longitudinal section. Phloiophorous shape of the branches is well visible. Slide KJ-18/28. Fig. 4 - Tangential-oblique section . Slide KJ-18/173. Fig. 5 - Oblique section with phloiophorous shape of the branches. Slide KJ-18/185. Fig. 6 - Oblique section. Arrow points to possible cysts. Slide KJ-18/23. Fig. 7 - Oblique section. Slide KJ-18/28. Fig. 8 - Oblique section. Slide KJ-18/234. Figs. 9-12 - Transversal sections showing bubble-shaped branches with short stalks, irregularly arranged in whorls. Slides KJ-18/27, KJ-18/140, KJ-18/28, KJ-18/153.

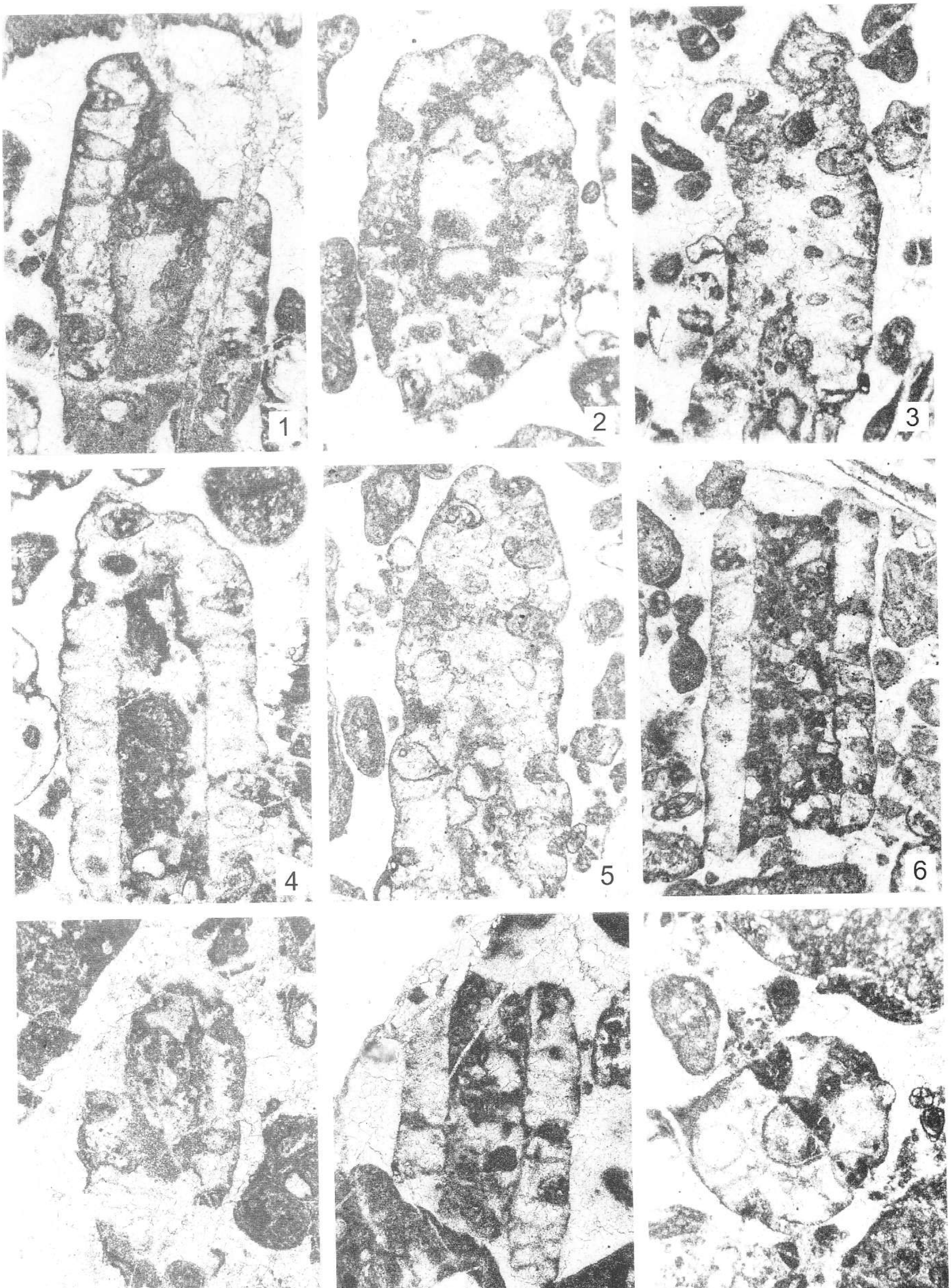

PLATE 1

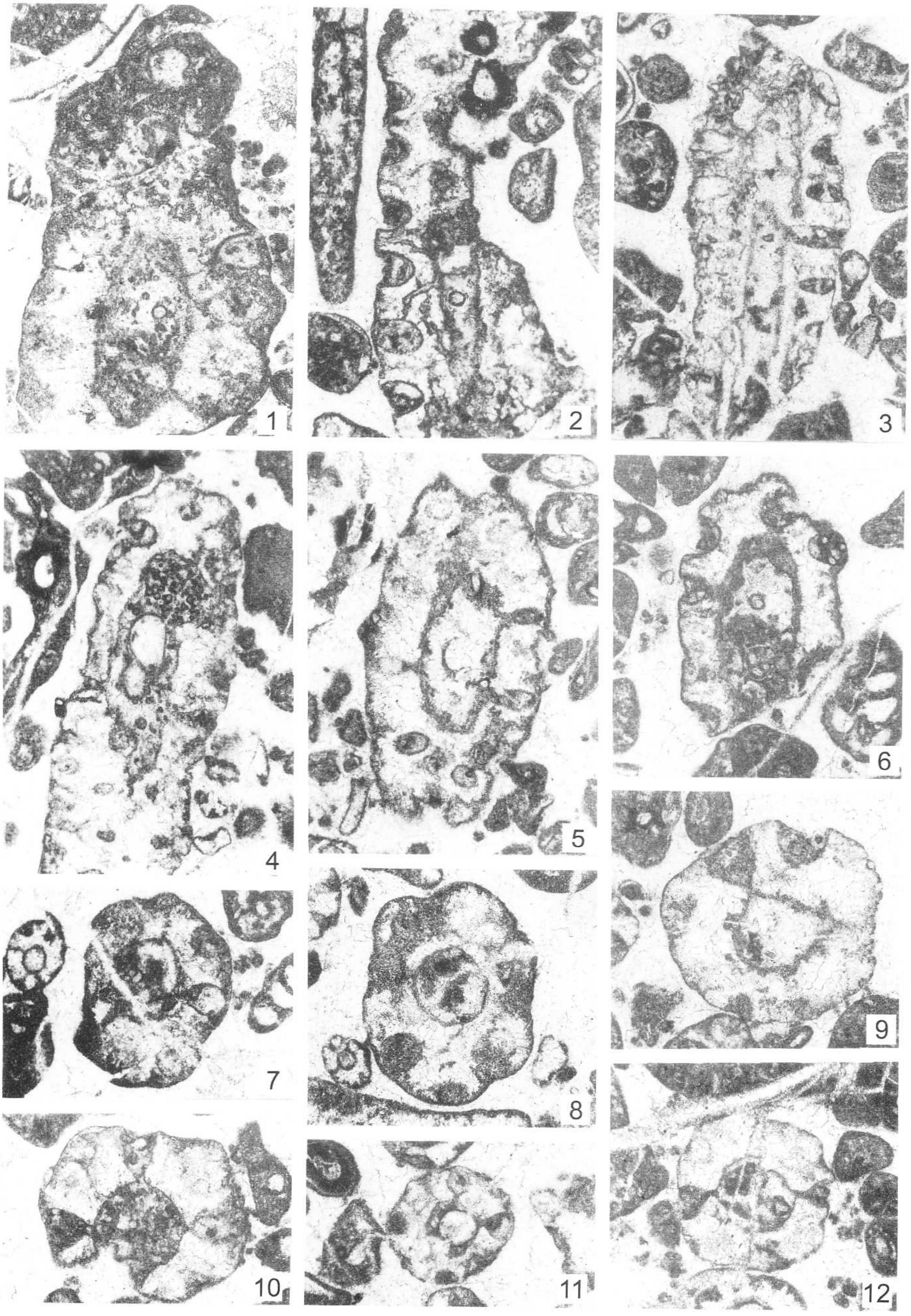

PLATE 2

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