

## Early Barremian dasycladalean algae from Serre de Bleyton (Drôme, SE France)

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(With 7 plates and 3 figures)

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### Abstract

Dasycladalean calcareous algae are described from the Barremian deposits from Serre de Bleyton (Drôme, France). The association consists of 15 taxa and is characteristic for the Lower Barremian series of the northern margin of the Tethys. The algae have been transported by gravitational flows (turbidites) from a shallower area, *i.e.* a carbonate platform margin, to a deeper, basinal setting.

**Keywords:** calcareous algae, dasycladales, Early Barremian, SE France

### Zusammenfassung

Dasycladale Kalkalgen aus Ablagerungen des Barremium von Serre de Bleyton (Drôme, Frankreich) werden beschrieben. Die Vergesellschaftung besteht aus 15 Arten und ist typisch für das Untere Barremium des Tethys Nordrandes. Die Algen stammen aus Flachwasserbereichen (z.B. dem Rand einer Karbonatplattform) und wurden durch Turbidite in tiefere Beckensedimente verfrachtet.

**Schlüsselworte:** Kalkalgen, Dasycladales, Unteres Barremium, Südost-Frankreich

### Introduction

This paper is part of a larger project dealing with the description of the micro- and macropaleontologic assemblages from Serre de Bleyton (SE France), and refers to a rich assemblage of isolated, nicely-preserved specimens of dasycladalean algae. The samples have been collected by GERO MOOSLEITNER (Salzburg) from Lower Cretaceous turbiditic sediments cropping out in a small area on the southeastern flank of the Serre de Bleyton

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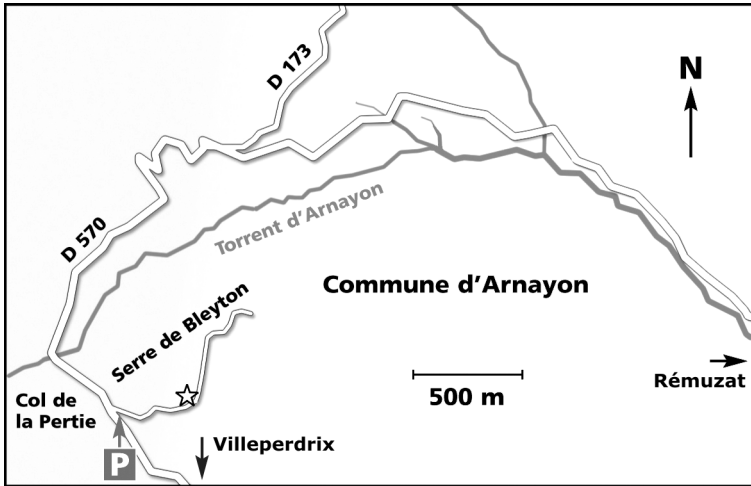


Fig. 1. Location of the study area (asterisk indicates sampling site).

Range (Fig. 1). Besides algae, foraminifers and numerous other fossils assigned to various groups of invertebrates have been also recovered. Some of these have been already studied, the results having been published in 2010 by JÄGER (crinoids), JANSSEN (belemnites), LÖSER (corals), LUKENDER (ammonoids), RIEGRAF & MOOSLEITNER (rhyncholites), TAYLOR (bryozoans), and VILLIER (asteroids). For the general characteristics of the sediments providing the Serre de Bleyton fossils, see KROH et al. (2010). Calcareous algae were collected from the sample profiles 1 and 2 described by KROH et al. (2010).

## Material and Methods

The selected paleontological material has been washed and sorted by Gero MOOSLEITNER; it was recovered from the alteration area of outcrops 1 and 2 (KROH et al. 2010). The algae have been studied under a stereomicroscope. Images of the studied material were obtained using both the stereomicroscope, and scanning electron microscope (SEM). In order to achieve a better assignment at species level, a large number of specimens were embedded in synthetic resin and thin sectioned. These samples were studied under a petrographic microscope and images made by using a digital camera. The identified algal association consists of 15 taxa (11 determined at species level, while 4 at the genus level, with an uncertain assignment in the case of one of them). No quantitative evaluation has been performed, but one can estimate that the most frequent species within the association are represented by *Actinoporella podolica*, *Salpingoporella muehlbergii* and *Pseudoactinoporella fragilis*.

**Repository:** The studied specimens and thin sections are housed at the Paleontological Museum, Department of Geology, Babeş-Bolyai University Cluj-Napoca, under the inventory numbers 23813 to 23837.

## Systematic Palaeontology

Order Dasycladales PASCHER, 1931

Family Polyphysaceae KÜTZING, 1843

Genus *Actinoporella* GÜMBEL in ALTH, 1882

***Actinoporella podolica* (ALTH, 1878), emend. CONRAD, PRATURLON & RADOIČIĆ, 1974**  
(Pl. 1, Figs 1–5; Pl. 3, Figs 1–3; Pl. 4, Figs 1–6; Pl. 6, Figs 6, 7, 11; Pl. 7, Figs 1–6)

### Selected synonymy

- 1878 *Gyroporella podolica* ALTH – ALTH: 83, Pl. VI, Figs 1–8  
 1970 *Verticiloporella dalmatica* RAVIV & LORCH – CONRAD: 69, Pl. 5, Figs 1–3.  
 1974 *Actinoporella podolica* GÜMBEL in ALTH, 1882 – CONRAD et al.: 4, Figs 1(1–8), 2 (1–7), 4–6, 8–12.  
 1974 *Actinoporella* sp. – CANÉROT, Pl. X, Figs 4–6.  
 1978 *Actinoporella podolica* (ALTH, 1878) emend. CONRAD, PRATURLON & RADOIČIĆ, 1974 –  
 BASSOULLET et al.: 30, Pl.2, Figs 4–7 [with extended synonymy].  
 1980 *Ainoporella podolica* GÜMBEL – ARNAUD-VANNEAU, Pl. 112, Fig. 4.  
 1989 *Actinoporella podolica* (ALTH, 1878) – DRAGASTAN: 28, Pl. 14, Figs 4–5.  
 1992 *Actinoporella podolica* GÜMBEL, emend. CONRAD et al., 1974 –  
 RAVIV & LORCH, Pl. 2, Figs a-o, Text-fig. 7.  
 1994 *Actinoporella podolica* (ALTH) – GRANIER, Pl. 1, Figs 1, 4, 8–10.  
 1996 *Actinoporella podolica* (ALTH) – CLAPS et al., Pl. 3, Fig. 14.  
 1996 *Actinoporella podolica* CONRAD, PRATURLON & RADOIČIĆ, 1974 – SOKAČ: 27, Pl. XX, Figs 1–3, 5–13.  
 2001 *Falsolikanella* sp. – BUCUR, Pl. 12, Figs 3–7  
 2001 *Actinoporella?* sp. – BUCUR, Pl. 12, Fig. 8  
 2006 *Actinoporella podolica* – HUSINEC & SOKAČ, Figs 4H(c), 4I.  
 2006 *Actinoporella podolica* (ALTH) – SCHLAGINTWEIT et al., Fig. 3 (3).  
 2008 *Actinoporella* sp. gr. *podolica* – GRANIER, Pl. 2, Figs F, G.  
 2008 *Actinoporella podolica* (ALTH) – HOSSEINI & CONRAD, Pl. 3, Figs B-E.  
 2010 *Actinoporella podolica* (ALTH) – TAHERPOUR et al.: 4, Fig. 6f.

**Description and remarks:** Isolated verticillated discs resulted from breaking of the thallus at interverticillar space level (Pl. 1, Figs 1–5; Pl.3, Figs 1–3). The verticils consist of long, well-interconnected phloioporous laterals within the verticil and slightly inclined towards the top. The axial cavity is relatively narrow compared to the external diameter of verticils, and is surrounded by circular bulges on both upper and lower sides resulting from calcification of the small secondary laterals located on one side and the other of the coronae. This feature allows a relatively straightforward identification of this alga by examining the external morphology of verticils only.

Nevertheless, the thin sections cross-cutting through numerous isolated verticils (Pl. 4, Figs. 1–6; Pl. 6, Figs. 6, 7, 11; Pl. 7, Figs. 1–6) do not always reveal the diagnostic features

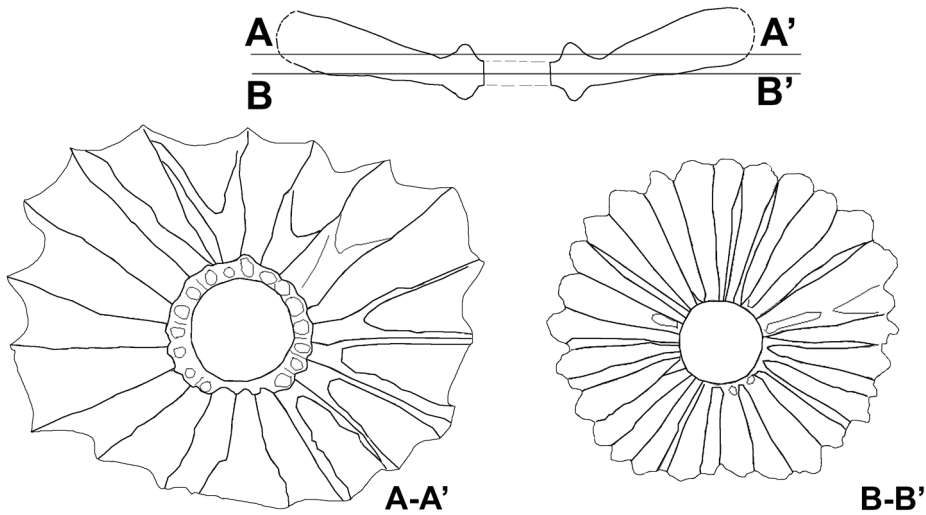


Fig. 2. Two different types of transverse (horizontal) sections through verticillar discs of *Actinoporella podolica*. A-A' – the section cut the corona-like structure; B-B' – the section don't cut the corona-like structure.

of the species. In some longitudinal or diagonal sections to the thallus axis (Pl. 7, Figs 3, 6) the corona-type structures can be recognized, which allow a relatively simple identification. Transversal sections to the thallus axis (*i.e.* horizontal sections at verticil level) do not always expose corona-type structures. Fig. 2 illustrates two types of transversal sections that differ by the level at which the verticil is segmented. In the case of an A-A' section, the segmentation plane cross-cuts the corona-type structures, thus they are clearly visible (*e.g.*, Pl. 4, Figs. 1–3). In the case of a B-B' section, the corona-type structures are not intercepted, while the general aspect of the alga may be mistaken as similar sections through the verticils of other species (*e.g.* *Clypeina* or *Falsolikanella*) (*e.g.* Pl. 4, Figs 4–6). It is also worth mentioning that in some large specimens with numerous laterals, the latter show a certain degree of imbrication that imprints a peculiar aspect to the sections shown (*e.g.*, Pl. 6, Figs 6, 7, 11; Pl. 7, Figs 1, 2, 4, 5).

CONRAD *et al.* (1974) presented a detailed description of *Actinoporella podolica* as well as a thallus reconstruction. When considering that calcification is more intense in the verticil (the laterals being closely connected), one can easily relate this to the frequent breaking of the thallus at interverticilar level, leading to the frequent presence of this alga only as isolated verticils. The general thallus morphology with verticils in vertical succession is fossilised only in internal platform, low energy depositional environments (*e.g.* RADOIČIĆ 1968: Pl. XVI, Fig. 1, as “*Dasykladacea*” *dalmatica*).

**Dimensions:**

$D = 0.72\text{--}2.45$  mm  
 $d = 0.30\text{--}0.82$  mm  
 $d/D = 0.20\text{--}0.47$   
 $l = 0.5\text{--}1.02$   
 $p(\text{distal}) = 0.15\text{--}0.40$   
 $w = 16\text{--}26$

Genus *Clypeina* MICHELIN, 1845

***Clypeina* sp.**  
 (Pl. 6, Figs 12–13)

**Remarks:** Two of the sectioned disc-like verticils proved to belong to a *Clypeina* species. Even if not very frequent, *Clypeina* specimens are present in the assemblage together with *Actinoporella*, as isolated discs.

**Dimensions:**

$D = 1.0$  mm  
 $d = 0.52$  mm  
 $l = 0.30$  mm  
 $p(\text{diatal}) = 0.12$  mm

Genus *Pseudoclypeina* RADOIČIĆ, 1975, non 1970

***Pseudoclypeina* sp.**  
 (Pl. 1, Figs 1– pars, 8; Pl. 4, Figs 15–17; Pl. 5, Figs 1–3)

**Remarks:** A relatively large amount of fragments of disc-like verticils, characterised by a distal “bulbous” enlargement was found in the *Actinoporella*-type assemblage (Pl. 1, Fig. 1). The thin sections (Pl. 4, Figs 15–17; Pl. 5, Figs 1–3) point to the existence of some long primary laterals that carry a bush of shorter secondary laterals. This type of verticillated discs can be assigned to two genera: *Rajkaella* (DRAGASTAN & BUCUR 1988) and *Pseudoclypeina* (RADOIČIĆ 1975). As a rule, *Rajkaella* is characterized by verticillated discs with free primary laterals along most of the lateral length (DRAGASTAN & BUCUR 1993), while in the case of *Pseudoclypeina* species the laterals of one verticil coalesce over the whole length (RADOIČIĆ 1970). The differences between *Rajkaella* (as *Radoiciciella*) and *Pseudoclypeina* were emphasized by DRAGASTAN & BUCUR (1993) and GRANIER (1990), even if some of the specimens originally assigned by DRAGASTAN & BUCUR (1993) to *Radoiciciella* (= *Rajkaella*) could be more likely attributed to *Pseudoclypeina* (e.g., MASSE 1976: Pl. 5, Fig. 16; FOURCADE et al. 1972: Pl. 2, Figs 5–8). We have assigned the specimens identified at Serre de Bleyton to the genus *Pseudoclypeina* exactly based on the compact aspect of the verticillated discs. However, it is clear that a review

of all algae assigned to the two genera would be needed for a final clarification of their relationships.

#### Dimensions

$$l_1 = 0.70\text{--}0.85 \text{ mm}$$

$$l_2 = 0.15\text{--}0.30 \text{ mm}$$

$$p_1 = 0.10\text{--}0.20 \text{ mm}$$

$$p_2 = 0.05\text{--}0.10 \text{ mm}$$

Family Triploporellaceae BERGER & KAEVER, 1992

Genus *Angioporella* CONRAD, MASSE & RADOIČIĆ, 1973

***Angioporella fouryae* CONRAD, MASSE & RADOIČIĆ, 1973**

(Pl. 2, Figs 1, 2; Pl. 3, Fig. 4; Pl. 4, Figs 7–11)

#### Selected synonymy

1973 *Angioporella fouryae* n. gen., n. sp. – MASSE et al.: 384, Text-fig. 1, Pl. 1, Figs 1–8.

1976 *Angioporella fouryae* MASSE et al., 1973 – CONRAD & PEYBERNÈS: 180, Fig. 5(a)

1980 *Angioporella fouryae* MASSE, CONRAD & RADOIČIĆ – ARNAUD-VANNEAU, Pl. 112, Fig. 9.

1994 *Angioporella* aff. *fouryae* MASSE, CONRAD & RADOIČIĆ – BUCUR: 151, Pl. II, Fig. 28.

2007 *Angioporella fouryae* MASSE, CONRAD & RADOIČIĆ – BUCUR et al., Fig. 4 (11).

**Description and remarks:** Thallus cylindrical, externally slightly undulated, made up of a succession of verticils of fertile laterals (large and less numerous) and sterile laterals (tubular, and more numerous). The supposed fertile laterals cannot be observed at the exterior because they are surrounded by the distal parts of the sterile laterals, vertically oriented. Specimens submitted to advanced dissolution with acetic acid (Pl. 2, Fig. 1) show the morphology of the fertile laterals, the distal part of which is quadrangular, higher than wider. The thin sections (Pl. 4, Figs 7–10) provide supplementary data on the internal structure. The central cavity is also slightly undulated, but if the external constrictions are set at the level of sterile laterals, the axial cavity is larger at this level and thinner at the level of the fertile laterals. Longitudinal and longitudinal-oblique sections from Pl. 4, Figs 7–10 illustrate also the morphology of the fertile laterals, higher than wide, and almost trapezoidal in outline. The sterile laterals, tubular, slightly enlarged to the exterior, are visible in the transverse section of Pl. 4, Fig. 11.

I did not observe any elements that can be ascribed to reproductive structures within the cavities corresponding to the fertile laterals. Also, I can not observe with certitude the peduncular pore linking the fertile laterals to the axial cavity. The possible connection visible at the upper-left two verticils of the specimen in Pl. 4, Fig. 10 could represent the effect of secondary dissolution. A possible explanation for the absence of the link pore between fertile laterals and the axial cavity is given by MASSE et al. (1973) by the relatively late calcification of the fertile ampulae.

## Dimensions

L (maximum observed) = 3.6 mm

D = 0.75–1.55 mm

d = 0.18–0.90 mm

h = 0.78–0.90 mm

l (sterile) = 0.35 mm

p (sterile) = 0.07–0.10 mm

p (fertile) = 0.35–0.70 mm

w (sterile) = 29–30

w (fertile) = approx. 8

Genus *Deloffrella* GRANIER & MICHAUD, 1987

### *Deloffrella quercifoliipora* GRANIER & MICHAUD, 1987

(Pl. 6, Fig. 1)

#### Selected synonymy

1987 *Deloffrella quercifoliipora* n. gen., n. sp. – GRANIER & MICHAUD: 1093, Text-fig. 3, Pl. I, Figs 1–10.

2001 *Deloffrella quercifoliipora* GRANIER & MICHAUD – BUCUR, Pl. 3, Figs 4–6.

2002 *Deloffrella quercifoliipora* GRANIER & MICHAUD – BUCUR: 42, Pl. 3, Figs 1–5 [with synonymy].

2003 *Deloffrella quercifoliipora* GRANIER & MICHAUD – BUCUR et al.: 218, Pl. I, Figs 1–3.

2005 *Deloffrella quercifoliipora* GRANIER & MICHAUD – SCHLAGINTWEIT, Pl. II, Figs 8, 10, 12.

**Description:** The only specimen in longitudinal-oblique section was found accidentally, when sectioning *Salpingoporella* samples. Specimens of *Deloffrella* could not be identified by external morphological examination only, given their scarcity in the association, on the one hand, and the possibility of taking them as less well-preserved specimens of *Salpingoporella*, on the other. The specimen illustrated in Pl. 6, Fig. 1 provides insight into the structure of the laterals. At least three orders of laterals are visible, the relatively larger primary ones being clearly noticeable both in the longitudinal and oblique parts of the section.

**Remarks:** Based on the available published information, this represents the first mention of the species *Deloffrella quercifoliipora* in Lower Cretaceous deposits in southeastern France. Following CONRAD (pers. comm.) although rare, *Deloffrella quercifoliipora* is present in Berriasian and upper Barremian deposits of Switzerland (CLAVEL et al., unpublished).

## Dimensions

L (maximum observed) = 1.65 mm  
 D = 0.46 mm  
 D = 0.12 mm  
 H = 0.10 mm

Genus *Falsolikanella* GRANIER, 1987

### ***Falsolikanella danilovae* (RADOIČIĆ ex BARATTOLO, 1978) GRANIER et al., 2000**

(Pl. 2, Figs 9–12; Pl. 3, Fig. 7; Pl. 4, Figs 12–14)

#### Selected synonymy

- 1968 *Likanella?* *danilovae* n. sp. – RADOIČIĆ: 238, Pl. I, Figs 1–3; Pl. II, Figs 1–6; Pl. III, Figs 1–6; Pl. IV, Figs 1–4; Pl. V, Figs 1–4; Pl. VI, Figs 1–5; Pl. VII, Figs 1–4.  
 1973 *Likanella(?) danilovae* RADOIČIĆ, 1968 – JAFFREZO: 81, Pl. 2, Figs 12, 13.  
 1978 *Likanella?* *danilovae* RADOIČIĆ, 1968 – BASSOULLET et al.: 142, Pl. 16, Fig. 9–11 [with synonymy].  
 1979 *Likanella(?) danilovae* – ARNAUD-VANNEAU, Pl. 110, Figs 1–2  
 1989 *Likanella?* aff. *danilovae* RADOIČIĆ, 1968 – CONRAD & MASSE: 282, Pl. II, Fig. 7  
 1993 *Likanella?* *danilovae* – LUPERTO SINNI & MASSE, Pl. 1, Figs 14, 15.  
 1994 *Praturlonella danilovae* (RADOIČIĆ) 1968 – BUCUR: 153, Pl. VII, Figs 1–8.  
 2000 *Falsolikanella danilovae* (RADOIČIĆ, 1975) – BUCUR: 58, Pl. V, Figs 1–11, 13, 14.  
 2000 *Falsolikanella danilovae* RADOIČIĆ ex BARATTOLO, 1978, n. comb. – GRANIER et al.: 177, Pl. I, Figs 1–4, 6.  
 2007 *Falsolikanella danilovae* (RADOIČIĆ) – BUCUR et al.: 133, Fig. 4(13).

**Description and remarks:** *Falsolikanella* is present in the dasycladalean association as subspherical or thick-discoidal corpuscles with rounded borders (“segments” or “rings” of the moniliform-type thallus; see RADOIČIĆ 1968: Fig. 1). Externally, (Pl. 2, Figs 9–12; Pl. 3, Fig. 7) the laterals distal termination can be noticed. The thin sections illustrated in Pl. 4, Figs 12–14 represent horizontal-subhorizontal sections through the subspheroidal segments (*i.e.* transversal sections at the level of the segments of laterals as related to the axis of the thallus).

A short comment on the generic assignment of this alga (*Likanella*, *Selliporella*, *Praturlonella*, *Falsolikanella*) is given by BUCUR (2000). Further discussion on this assignment is beyond of the scope of this paper, even if maybe necessary, taking into account that some authors still attribute this species to other genera.

## Dimensions

D = 0.8–1.9 mm  
 D = 0.25–0.70 mm  
 L = 0.35–0.60 mm  
 P (distal) = 0.12–0.25 mm



Genus *Montiella* MORELLET & MORELLET, 1922*Montiella? elitzae* (BAKALOVA, 1971)

## Selected synonymy

- 1970 *Cylindroporella elitzae* sp. – BAKALOVA: 126, Pl. III, Figs 1–8.  
 1973 *Cylindroporella maslovi* n. sp. – SRIVASTAVA: 699, Figs 16–18.  
 1974 *Cylindroporella barnesii* (cf. SAINT-MARC, 1970) – PRESTAT, Pl. 8, Fig. 3.  
 1978 *Cylindroporella elitzae* BAKALOVA, 1971 – BASSOULLET et al.: 71, Pl. 7, Figs 6, 7.  
 1979 *Cylindroporella* sp. cf. *C. sugdeni* ELLIOTT – AZEMA et al., Pl. XXXI, Figs. 1–4.  
 1980 *Montiella? elitzae* (BAKALOVA) nov. comb. – RADOIČIĆ: 114, Pl. 1, Figs 1, 2; Pl. 2, Figs 1–4; Pl. 3, Figs 1–4.  
 1986 *Cylindroporella* cf. *elitzae* BAKALOVA – MU: 86, Pl. V, Figs 3, 4, 6–8.  
 1989 *Montiella? elitzae* (BAKALOVA, 1971) RADOIČIĆ, 1980 – CONRAD & MASSE: 282, Pl. II, Figs 1–3.  
 1993 *Bakalovaella elitzae* (BAKALOVA), nov. comb. – BUCUR: 100, Pl. &, Figs 1–18  
 [with extended synonymy]  
 1994 *Bakalovaella elitzae* (BAKALOVA, 1971) – BUCUR: 156, Pl. XIII, Figs. 3–12.  
 2000 *Bakalovaella elitzae* (BAKALOVA) – BUCUR et al.: 442, Pl. 3, Figs 1–5.  
 2000 *Bakalovaella elitzae* (BAKALOVA, 1971) – DRAGASTAN: 129, Pl. 2, Figs 16–17.  
 2001 *Bakalovaella elitzae* (BAKALOVA) – BUCUR, Pl. 13, Figs 1–3.  
 2003 *Bakalovaella elitzae* (BAKALOVA, 1971) – BUCUR et al.: 218, Pl. I, Fig. 6.  
 2007 *Montiella elitzae* (BAKALOVA) – BUCUR et al.: 133, Fig. 4(8).  
 2010 *Montiella? elitzae* (BAKALOVA, 1971) RADOIČIĆ, 1980 – TAHERPOUR et al., Fig. 8 (a-d).

**Description and remarks:** As in the case of *Deloffrella*, *Montiella? elitzae* has been identified only in thin sections, in the attempt to obtain sections through specimens of *Piriferella paucicalcareia* – a species that is essentially similar based only on external morphology. The longitudinal-tangential sections in Pl. 6, Figs 2–3 show the arrangement of the large ovoidal, fertile ampoules in relationship to the subjacent tubular, sterile laterals showing a significantly-smaller diameter. The section illustrated in Pl. 6, Fig. 2 crosscuts, in its central part, the two types of laterals, close to the point where these diverge from the primary lateral.

*Montiella? elitzae* has been described in detail by BUCUR (1993, under *Bakalovaella elitzae*). Additional data on the general morphology of its thallus have been published by TAHERPOUR et al. (2010) by the description and illustration of a complete, exceptionally well-preserved specimen in longitudinal section. This presented both the lower, pedunculate side lacking fertile ampoules, and the upper, terminal side lacking sterile secondaries.

Concerning the generic assignment, the genus *Bakalovaella* and the combination *Bakalovaella elitzae* proposed by BUCUR (1993) has not been well-received by most subsequent authors. It is however worth to include here the comment in Taherpour et al. (2010): “In the Paleocene type-species *M. munieri*, the presence of two types of secondary laterals is inferred, yet not physically demonstrated. In view of this equivocal situation, the genus *Bakalovaella* BUCUR, 1993 (type-species *B. elitzae*) will possibly prove to be a well founded taxon rather than a junior synonym of *Montiella*”.

## Dimensions

L (maximum observed) = 3.7 mm (up to 7 mm in Taherpour et al., 2010)

D = 0.85–1.1 mm

P (sterile) = 0.09 mm

P (fertile) = 0.25–0.30 mm

Genus *Piriferella* SOKAČ, 1996

### ***Piriferella paucicalcare* (CONRAD, 1970) CONRAD, SCHLAGINTWEIT & BUCUR, 2009**

#### Selected synonymy

1970 *Heteroporella?* *paucicalcare* n. sp. – CONRAD: 68, Text-fig. 5, Pls III, IV.

1970 *Heteroporella* (?) *paucicalcare* CONRAD, 1970 – JAFFREZO: 80, Pl. 3, Figs 9, 11, 16.

1978 *Heteroporella?* *paucicalcare* CONRAD, 1970 – BASSOULLET et al.: 133, Pl. 15, Figs 5–8.

1978 *Heteroporella?* *paucicalcare* CONRAD – ARNAUD-VANNEAU, Pl. 111, Figs 3–5.

1989 *Heteroporella?* *paucicalcare* CONRAD, 1970 – CONRAD & MASSE: 281, Pl. II, Fig. 11.

1994 *Heteroporella?* *paucicalcare* CONRAD, 1970 – BUCUR: 152, Pl. VI, Fig. 13.

2000 *Similiclypeina paucicalcare* (CONRAD, 1970) nov. comb. – BUCUR: 60, Pl. IV, Fig. 7.

[with extended synonymy]

2007 *Similiclypeina paucicalcare* (CONRAD) – BUCUR et al.: 133, Fig. 4(6, 9).

2009 *Piriferella paucicalcare* (CONRAD, 1970) n. comb. – CONRAD et al.: 28(c)

**Description:** The detached specimens show large and somehow irregular pores at the periphery (Pl. 1, Figs 6, 7), representing the distal termination of the laterals. They are better noticed in the broken specimen illustrated in Pl. 2, Fig. 13. The thin sections (Pl. 6, Figs 5, 8) do not provide additional information. For a detailed description see CONRAD (1970) and BASSOULLET et al. (1978).

Genus *Pseudoactinoporella* CONRAD, 1970

emend. CONRAD & PEYBERNES, 1976

### ***Pseudoactinoporella fragilis* CONRAD, 1970, emend. CONRAD & PEYBERNES, 1976**

(Pl. 2, Figs 3–6; Pl. 3, Figs 9, 10; Pl. 5, Figs 4–6)

#### Selected synonymy

1970 *Pseudoactinoporella fragilis* n. gen, n. sp. – CONRAD: 66, Text-fig. 4, Pl. I, Figs 1–3; Pl. II; Pl. VIII, Fig. 4.

1972 *Pseudoactinoporella fragilis* CONRAD – FOURCADE et al.: 240, Pl. 3, Figs 7–9.

1973 *Triploporella* sp. – SRIVASTAVA: 702, Fig. 21.

1974 *Pseudoactinoporella fragilis* – CANÉROT, Pl. XVII, Fig. 2.

1976 *Pseudoactinoporella fragilis* CONRAD – CONRAD & PEYBERNES: 188, Fig. 12 (a, b, d-f),

1978 *Pseudoactinoporella fragilis* CONRAD, 1970 – BASSOULLET et al.: 212, Pl. 25, Figs 6–8.

1980 *Pseudoactinoporella fragilis* CONRAD – ARNAUD-VANNEAU, Pl. 111, Figs 1, 2.

1989 *Pseudoactinoporella fragilis* CONRAD, 1970 – CONRAD & MASSE: 283, Pl. II, Fig. 8.

1994 *Pseudoactinoporella fragilis* CONRAD, 1970 emend CONRAD & PEYBERNES, 1976 – BUCUR: 153, Pl. VIII, Figs 9–17.

1994 *Actinoporella fragilis* CONRAD, 1970, n. comb. – GRANIER: 115. [with extended synonymy]

2000 *Pseudoactinoporella fragilis* CONRAD, 1970 – BUCUR: 60, Pl. IV, Figs 1–6. [with extended synonymy]

2001 *Pseudoactinoporella fragilis* CONRAD – BUCUR, Pl. 13, Figs 5, 6, 8.

**Description and remarks:** *Pseudoactinoporella fragilis* is one of the most frequent species in the dasycladalean association from Serre de Bleyton. The detached specimens (Pl. 2, Figs 2–5; Pl. 3, Figs 9, 10) show the general funnel-, or trumpet-like morphology, with a dominantly cylindrical lower side and a splayed upper side. The same morphology is noticeable also in thin sections (Pl. 5, Figs. 4–6). Moreover, the shape of the phloiophorous laterals, shorter in the lower part of the thallus and longer in the upper one is visible. The diameter of the axial cavity is relatively constant along the thallus. Thin sections also give evidence that the small lateral “appendices” connected to the proximal side of the laterals, were located on either their upper, or their lower side. These “appendices” have been noticed by Fourcade et al. (1972), and they were used as emendation criteria by CONRAD & PEYBERNÈS (1976).

GRANIER (1994) has transferred the species *fragilis* to the genus *Actinoporella*, considering that the small secondary laterals used for the genus emendation practically represent elements of a “corona”-type structure. On the other hand, BUCUR (2000) brought forward arguments for maintaining the species in the genus *Pseudoactinoporella*, which are considered by the author to be still valid.

#### Dimensions

L (maximum observed) = 4.56 mm

D (upper part) = 1.4 mm

D (lower part) = 0.72–0.80 mm

d = 0.28–0.35 mm

l = 0.25 mm

p (distal) = 0.12 mm

h = 0.12–0.15 mm

#### Genus *Salpingoporella* PIA in TRAUTH, 1918 emend. CARRAS et al., 2006

Recently, CARRAS et al. (2006) presented the species in detail belonging to the genus *Salpingoporella*, including extended synonymy lists and complete descriptions. Accordingly, I will present only brief synonymy-related selections mainly including additional citations, and I will add some general remarks on the three identified species of *Salpingoporella*.

***Salpingoporella genevensis* (CONRAD, 1969) CONRAD et al., 1973**  
(Pl. 2, Fig. 7(sg), 8; Pl. 3, Fig. 8; Pl. 5, Figs 10, 11)

Selected synonymy

- 1969 *Pianella genevensis* n. sp. – CONRAD: 571, Figs 1–9  
 1970 *Salpingoporella genevensis* CONRAD, 1969 – JAFFREZO: 79, Pl. 1, Figs 6, 8, 10.  
 1978 *Salpingoporella genevensis* (CONRAD) 1969 – BASSOULLET et al.: 239, Pl. 29, Figs 5–8.  
 1980 *Salpingoporella genevensis* (CONRAD) – ARNAUD-VANNEAU, Pl. 113, Figs 6, 7.  
 1989 *Salpingoporella genevensis* (CONRAD) 1969 – CONRAD & MASSE: 283, Pl. II, Figs 9, 10.  
 1989 *Salpingoporella genevensis* (CONRAD, 1969) – DRAGASTAN: 15, Pl. 6, Figs 1–6.  
 1993 *Salpingoporella genevensis* – LUPERTO SINNI, Pl. 2, Fig. 11.  
 1996 *Salpingoporella genevensis* CONRAD – CLAPS et al., Pl. 2, Figs 4, 7.  
 2000 *Salpingoporella genevensis* (CONRAD) – BUCUR, Pl. 1, Figs 12, 13.  
 2006 *Salpingoporella genevensis* (CONRAD, 1969) – CARRAS et al.: 473, Pl. II, Figs 5–9  
 [with extended synonymy]  
 2006 *Salpingoporella genevensis* – HUSINEC & SOKAČ, Fig. 5A.  
 2007 *Salpingoporella genevensis* (CONRAD) – BUCUR et al.: 133, Fig. 4(10).

***Salpingoporella melitae* RADOIČIĆ, 1975**  
(Pl. 2, Fig. 7(A),?Pl. 5, Fig. 8)

Selected synonymy

- 1967 *Salpingoporella melitae* n. sp. – RADOIČIĆ, Pl. 1, Figs 1–4; Pl. 2, Figs 1, 2; Pl. 3, Figs 1–3; Pl. 4, Figs 1, 2 (*nomen nudum*: syntypes)  
 1975 *Salpingoporella melitae* – RADOIČIĆ: 277. [designation of a lectotype]  
 1978 *Salpingoporella melitae* RADOIČIĆ, 1967 – BASSOULLET et al.: 244, Pl. 29, Figs 16, 17.  
 [with synonymy]  
 1980 *Salpingoporella melitae* RADOIČIĆ – ARNAUD-VANNEAU, Pl. 113, Figs 3–5.  
 1989 *Salpingoporella melitae* RADOIČIĆ, 1965 – CONRAD & MASSE: 283, Pl. II, Fig. 12.  
 1989 *Salpingoporella melitae* RADOIČIĆ, 1967 – DRAGASTAN: 13, Pl. 5, Figs 3, 4.  
 1993 *Salpingoporella melitae* – LUPERTO SINNI & MASSE, Pl. 2, Figs 8–10.  
 1994 *Salpingoporella melitae* RADOIČIĆ, 1967 – BUCUR: 154, Pl. X, Figs 1–7, 10, 11.  
 1996 *Salpingoporella melitae* – CLAPS et al., Pl. 3, Figs 1–6.  
 1996 *Salpingoporella melitae* RADOIČIĆ, 1967 – SOKAČ: 3, Pl. II, Figs 6–13; Pl. III, Figs 1, 2; Pl. XIX, Fig. 7; Pl. XX, Figs 2(B), 3(B). [with selected synonymy]  
 2000 *Salpingoporella melitae* RADOIČIĆ – BUCUR, Pl. I, Figs 7, 8.  
 2001 *Salpingoporella melitae* RADOIČIĆ – BUCUR & COCIUBA, Pl. 3, Figs 3, 4.  
 2001 *Salpingoporella melitae* RADOIČIĆ – BUCUR, Pl. 5, Figs 2, 4.  
 2006 *Salpingoporella melitae* RADOIČIĆ, 1975 – CARRAS et al.: 478, Pl. VI, Figs 6–8.  
 [with extended synonymy]  
 2007 *Salpingoporella melitae* RADOIČIĆ – BUCUR et al.: 133, Fig. 4(7).

***Salpingoporella muehlbergii* (LORENZ, 1902) PIA in TRAUTH, 1918**  
(Pl. 2, Fig. 7; Pl. 5, Fig. 7)

Selected synonymy

- 1902 *Diploporella muehlbergii* n. sp. – LORENZ: 52–54, Figs 3–6,?7.  
 1918 *Salpingoporella muehlbergii* – PIA in TRAUTH: 211–213, Fig. 4(a).

- 1978 *Salpingoporella muehlbergii* (LORENZ), 1902 – BASSOULLET et al.: 245, Pl. 30, Figs 1–4.  
 1980 *Salpingoporella muehlbergii* (LORENZ) – ARNAUD-VANNEAU: 113, Figs 1, 2.  
 1989 *Salpingoporella muehlbergii* (LORENZ) 1902 – CONRAD & MASSE: 283, Pl. II, Fig. 6.  
 1989 *Salpingoporella muehlbergii* (LORENZ, 1902) CONRAD, 1970 – DRAGASTAN: 13, Pl. 5, Figs. 5–6.  
 1991b *Salpingoporella muehlbergii* (LORENZ) – SCHLAGINTWEIT, Pl. 18, Figs 3–5.  
 1993 *Salpingoporella muehlbergii* – LUPERTO SINNI & MASSE, Pl. 2, Figs 1, 2.  
 1994 *Salpingoporella muehlbergii* (LORENZ, 1902) emend. CONRAD, 1970 – BUCUR: 154, Pl. IV, Fig. 19; Pl. IX, Figs 7–12, 16, 18.  
 1996 *Salpingoporella muehlbergii* – CLAPS et al., Pl. 4, Figs 4, 5.  
 1996 *Salpingoporella muehlbergii* (LORENZ, 1902) PIA in TRAUTH, 1918 – SOKAČ: 2, Pl. I, Figs 1–13; Pl. XX, Figs 4(B0, 5(B)).  
 2000 *Salpingoporella muehlbergii* (LORENZ) – BUCUR, P. I, Figs 9–11.  
 2001 *Salpingoporella muehlbergii* (LORENZ) – BUCUR, Pl. 5, Fig. 1.  
 2001 *Salpingoporella muehlbergii* (LORENZ) – BUCUR & COCIUBA, Pl. 3, Figs 1, 2.  
 2006 *Salpingoporella muehlbergii* (LORENZ, 1902) PIA in TRAUTH, 1918 – CARRAS et al.: 480, Pl. VII, Figs 1–4 [with extended synonymy].  
 2006 *Salpingoporella muehlbergii* – HUSINEC & SOKAČ, Fig. 5(C, D).  
 2008 *Salpingoporella muehlbergii* (LORENZ, 1902) PIA, 1918 – SOKAČ & GRGASOVIĆ: 263, Pl. VI, Figs 9–11, Pl. VII.  
 2010 *Salpingoporella muehlbergii* – TAHERPOUR et al., Fig. 7 (f-g)

Remarks: Among the three species, the most frequent one is without doubt *Salpingoporella muehlbergii*. Moreover, it is also one of the most frequent Hauterivian-Aptian dasycladalean algae from the Tethys area. *Salpingoporella melitae* is much scarcer in the association and attempts to section specimens of this species have failed. Nevertheless one can mention the presence of some specimens (Pl. 5, Fig. 8) that according to their sizes can be assigned at the limit between *S. muehlbergii* and *S. melitae*. *Salpingoporella genevensis* is also rarely found in the association; however it is easily recognizable given the quadrangular appearance of its laterals (Pl. 2, Fig. 8, Pl. 3, Fig. 8; Pl. 5, Fig. 10). The close-up view in Pl. 5, Fig. 11 illustrates the aspect of the laterals in tangential section and shows the fingerprints of the reproductive cysts in the calcitic wall around the laterals.

? Genus *Salpingoporella* PIA in TRAUTH, 1018, or

? Genus *Neogyroporella* YABE & TOYAMA 1949

**?*Salpingoporella*?*Neogyroporella* sp.**

(Pl. 1, Figs 9, 10; Pl. 3, Figs 11, 12; Pl. 5, Fig. 9; Pl. 6, Fig. 4; Pl. 7, Fig. 10)

Remarks: This relatively large alga (external diameter between 1.2 and 1.65 mm) shows individualized verticillar discs with laterals that do not seem to alternate from one verticil to the other (a typical feature for *Salpingoporella* species). Moreover, one can notice (Pl. 1, Fig. 9; Pl. 6, Fig. 4) a kind of spacing of verticils along the algal axis. The laterals seem to be phloioiphlorous but their exact shape is difficult to observe given a general marginal abrasion affecting the identified specimens. However, the specimen illustrated in Pl. 5, Fig. 9 seems to show more vesiculiform laterals, resembling the typical

	Kimm.	Tithon.	Berr.	Valan.	Hauterivian	Barremian	Aptian
<i>Deloffrella quercifoliipora</i>	—————						
<i>Actinoporella podolica</i>		—————					■ ■
<i>Angioporella fouryae</i>					—————		
<i>Falsolikanella danilovae</i>					—————		■ ■ ■ ■ ■
<i>Montiella? elitzae</i>					—————		
<i>Piriferella paucicalcareae</i>					—————		■ ■ ■ ■ ■
<i>Pseudoactinoporella fragilis</i>					—————		
<i>Salpingoporella genevensis</i>					—————		
<i>Salpingoporella melitae</i>					—————		
<i>Salpingoporella muehlbergii</i>					—————		■ ■ ■

Fig. 3. Generalized stratigraphic range of ten dasycladalean algae from Serre de Bleyton identified at specific level (based on CONRAD & MASSE 1989; GRANIER & DELOFFRE 1993; BUCUR 1999; CLAVEL et al. 2010).

feature of the species of genus *Neogyroporella* (algae with vesiculiform-type laterals with euspondyl arrangement, as compared to species of the genus *Gyroporella* showing an aspondyl pattern of the vesiculiform laterals (cf. BASSOULLET et al. 1978, p. 172). It is also worth mentioning the relatively large diameter of the axial cavity compared to the external diameter ( $d/D = 0.60–0.75$ , for values of the external diameter ( $D$ ) between 1.2–1.65 mm and of the axial cavity diameter ( $d$ ) between 0.85–1.05 mm).

#### Genus *Triploporella* STEINMANN, 1880

##### *Triploporella* sp.

(Pl. 3, Figs 5, 6; Pl. 7, Figs 7–9)

Remarks: Some specimens of a large alga (external diameter between 2.1–2.3 mm) show features characteristic of the genus *Triploporella*: verticils consisting of large, tubular laterals of quadrangular-oval section. Within the laterals (Pl. 7, Figs 8, 9) lens-shaped, cyst-containers –type reproductive structures are noticeable, with sizes of 0.2/0.1 mm, the diameter of the cysts being 0.04–0.05 mm. Most probably, the advanced degree of erosion of the external surface is the cause for the lack of secondary laterals located at the distal end of the primary ones. Based on general morphology, sizes, and internal structure, the specimens from Serre de Bleyton can most probably be assigned to *Triploporella praturlonii* BARATTOLO, 1982.

Forma-genus *Russoella* BARATTOLO, 1984

***Russoella radoicicae* BARATTOLO, 1984**

(Pl. 6, Figs. 9–10)

**Remarks:** Rare, small-sized (equatorial diameter = 0.17–0.19; axial diameter = 0.12–0.14 mm; diameter of the cysts = 0.04–0.05 mm) lens-shaped corpuscles have been identified in the sediment filling the axial cavity or the inner space of some *Actinoporella* specimen laterals (e.g., Pl. 7, Figs 2, 4). These correspond, morphologically, and in terms of size, to the species *Russoella radoicicae*. Most probably, such corpuscles originate from specimens of *Triploporella* where, inside the laterals, similarly shaped and sized cyst-containers have been identified (e.g. Pl. 7. Figs 8, 9).

## Discussion

### Stratigraphic significance of the dasycladalean assemblage from Serre de Bleyton

Figure 3 illustrates the generalized stratigraphic distribution of the ten dasycladalean species identified at Serre de Bleyton. It is worth mentioning that most of these species have been identified in Barremian deposits from various regions in southern France (CONRAD 1970; CONRAD & PEYBERNES 1976; ARNAUD-VANNEAU 1980; CONRAD & MASSE 1989; MASSE 1993; BUCUR et al. 2007; CLAVEL et al. 2010). The association of species *S. genevensis*, *P. paucicalcareia*, *A. fouryae*, *P. fragilis* and *F. danilovae* is typical for the Late Hauterivian–Early Barremian (cf. CONRAD & MASSE 1989; GRANIER & DELOFFRE 1993; BUCUR 1999; CLAVEL et al. 2010). Most probably, an Early Barremian age can be assigned to the dasycladalean-bearing deposits from Serre de Bleyton.

### Paleoenvironmental interpretation

The dasycladalean association from Serre de Bleyton is contained in turbiditic sediments within a basinal succession. The dasycladalean algae have been transported from a carbonate platform margin towards a deeper, basinal setting. Also in talus (slope) deposits they are calibrated by ammonites and echinoids (CLAVEL et al. 2007). CONRAD (1970; 1979) considered that the corresponding species inhabited the median and external area of a carbonate platform. The same type of environment was assumed also for such relatively large dasycladalean by BUCUR & SĀSĀRAN (2005). It is noteworthy that the same species in the association from Serre de Bleyton have been identified in Lower Barremian shallow waters deposits (carbonate platforms) in the entire area around the Vocontian Basin (CONRAD 1970; MASSE 1976, 1993; ARNAUD-VANNEAU 1980; BUCUR et al. 2007; CLAVEL et al. 2007; CLAVEL et al. 2010).

## Conclusions

The dasycladalean association from Serre de Bleyton consists of 15 taxa, of which 11 have been identified at the species level. The association is typical for peri-Vocontian carbonate platform deposits of early Barremian age, having been transported from shallower waters at the platform margin to deeper, basinal areas.

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## Plate 1

Isolated specimens of dasycladalean algae from Serre de Bleyton. Stereomicroscope photomicrographs.

Fig. 1. Dasycladalean assemblage dominated by *Actinoporella* (A) specimens. Disc fragments of *Pseudoclypeina* sp. (Pc) are also present.

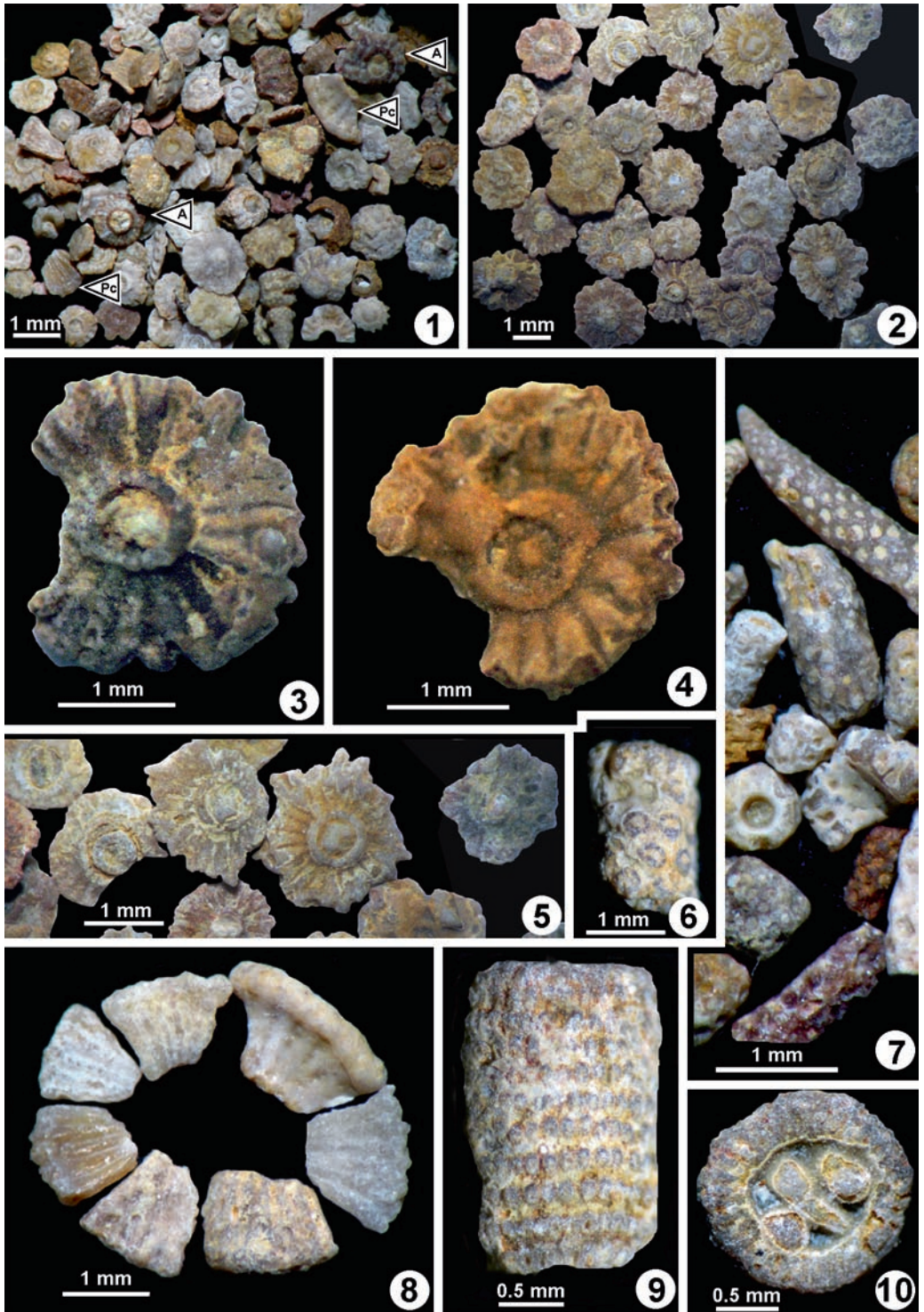
Figs 2–5. *Actinoporella podolica* (ALTH, 1878). Isolated verticils of laterals showing corona-like protuberances made up by the small secondary laterals around the central stem, and the phloiophorous large secondary laterals. Fig. 3 represents an enlargement of the specimen in the lower-central part of Fig. 2, and Fig. 5 an enlargement of the upper part of Fig. 2.

Fig. 6. *Piriferella paucicalcareia* (CONRAD, 1970). View of the external surface.

Fig. 7. Assemblage dominated by *Piriferella paucicalcareia* (CONRAD, 1970). Most diagnostic is the broken specimen in the center-right part of the photo.

Fig. 8. Fragments of verticillar discs of *Pseudoclypeina* sp. The fragments originating from different specimens are arranged to suggest the shape of a verticil.

Figs 9, 10. Unidentified dasycladalean alga (?*Salpingoporella*-?*Neogyroporella*). See the thin section through the specimen from Fig. 9 in Pl. 6, Fig. 4.



## Plate 2

Isolated specimens of dasycladalean algae from Serre de Bleyton. Stereomicroscope photomicrographs

Figs 1–2. *Angioporella fouryae* MASSE, CONRAD & RADOIČIĆ, 1973. Assemblage with isolated specimens artificially corroded (with acetic acid) showing the successive alternance of sterile and fertile verticils (Fig. 1); a small specimen in external view showing two verticils of sterile laterals and the thin vertical “bulges” between the vertical parts of the sterile laterals covering the fertile ampoulae.

Figs 3–6. *Pseudoactinoporella fragilis* CONRAD, 1970. Assemblages with isolated specimens in figs. 3 and 4; Fig. 5 shows the external morphology of the specimen in the lower-central part of Fig. 4, and Fig. 6 shows the upper part of the same specimen.

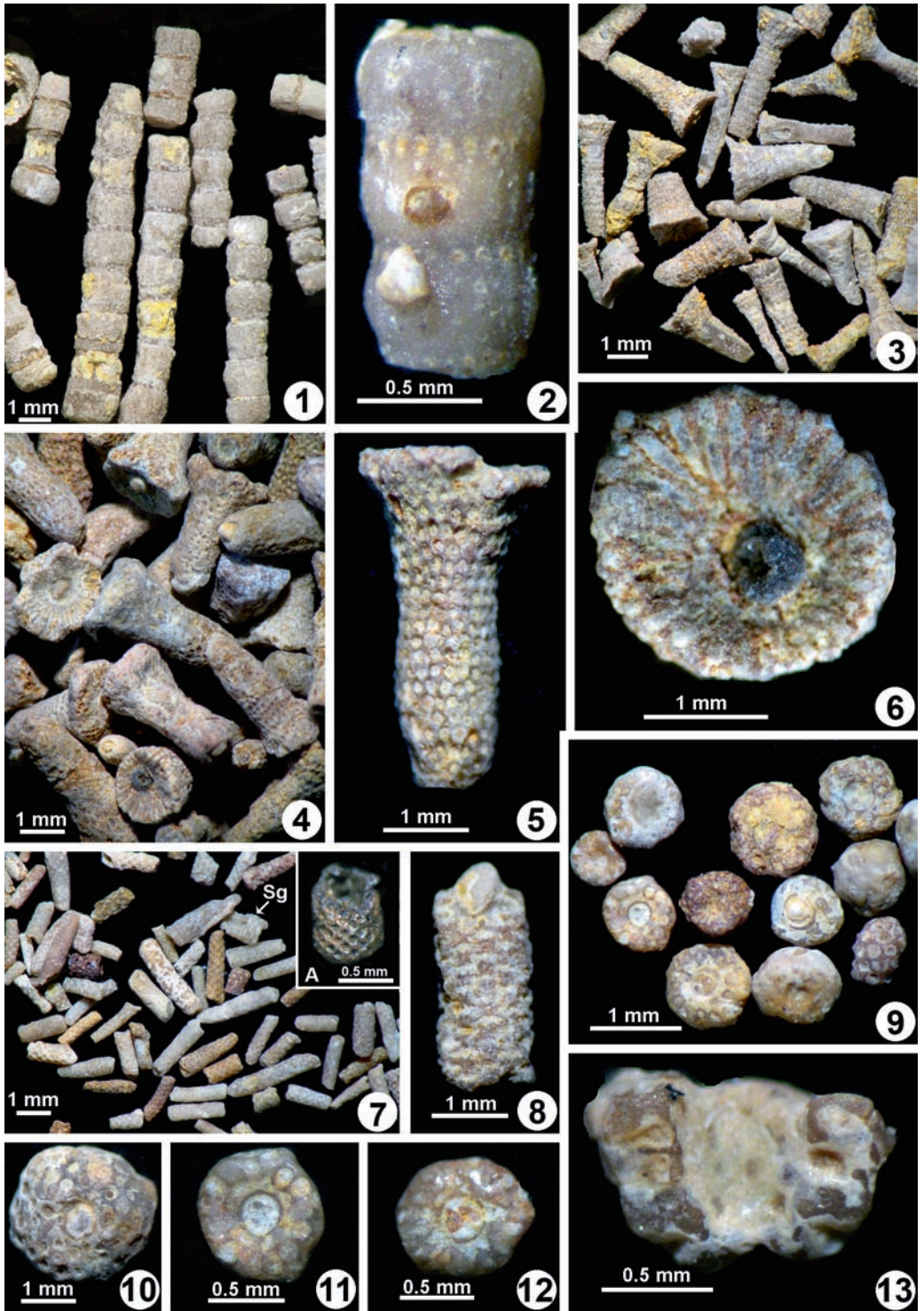
Fig. 7. Assemblage with isolated specimens of *Salpingoporella*. Most specimens belong to *Salpingoporella muehlbergii* (LORENZ, 1902). Rare *Salpingoporella genevensis* (CONRAD, 1969) (Sg) and *Salpingoporella melitae* RADOIČIĆ, 1975 (A) are also present.

Fig. 8. *Salpingoporella genevensis* (CONRAD, 1969). External view of an isolated specimen.

Figs 9–12. *Falsolikanella danilovae* (RADOIČIĆ). Assemblage dominated by relatively small specimens (see enlargements in figs 11 and 12). Fig. 10 presents an external view of a larger annular segment of laterals.

Fig. 13. *Piriferella paucicalcareae* (CONRAD). Close-up view of the specimen in Pl. 1, Fig. 7 (center-right).





### Plate 3

SEM photomicrographs of dasycladalean algae from Serre de Bleyton.

Figs 1–3. *Actinoporella podolica* (ALTH, 1878). Corona-like structure developed by the small secondary laterals is clearly visible on both sides of the verticillar discs.

Fig. 4. *Angioporella fouryae* MASSE, CONRAD & RADOIČIĆ, 1973. Artificially slightly corroded specimen showing the verticils of thin sterile laterals surrounding the larger fertile laterals.

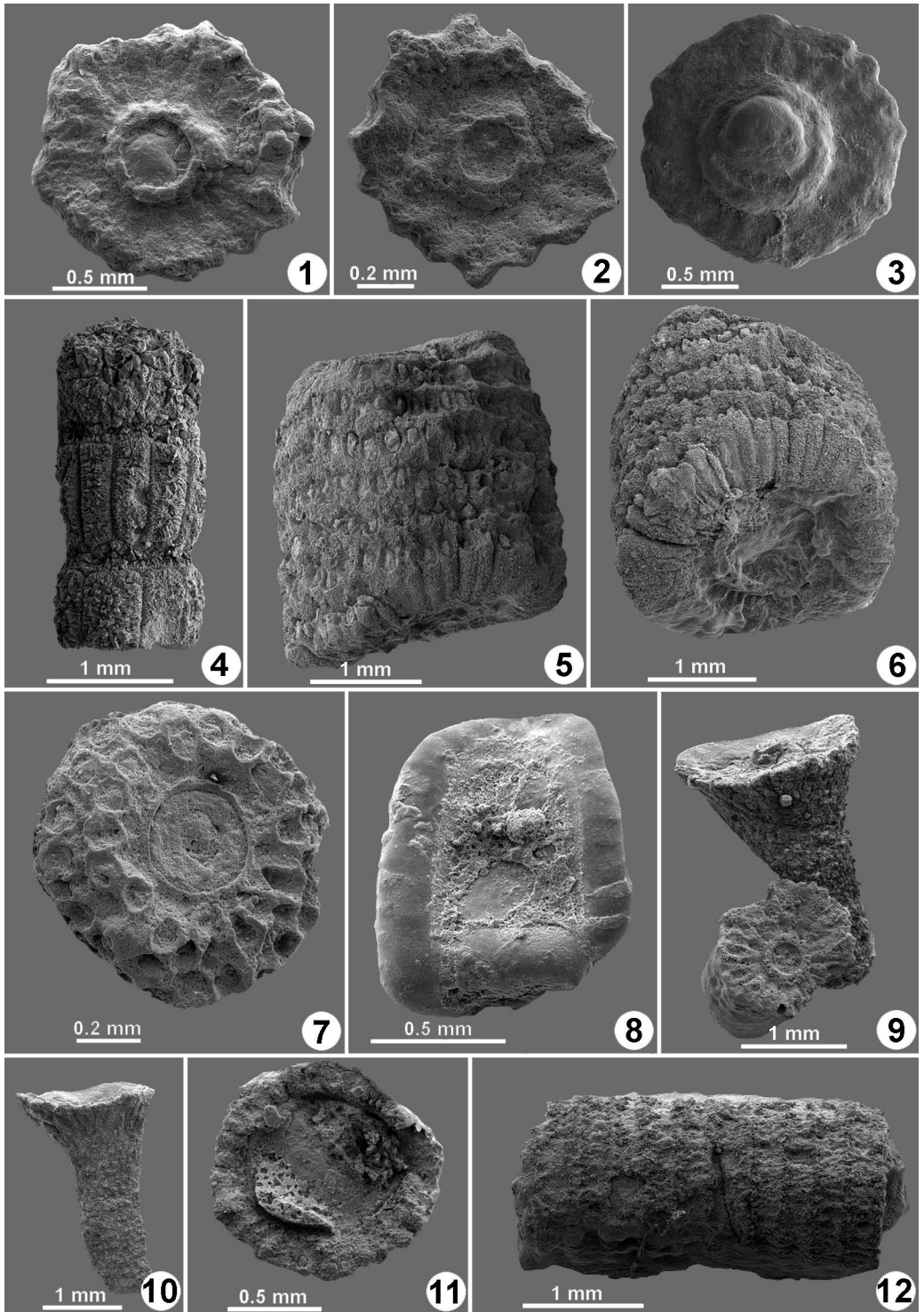
Figs. 5–6. *Triploporella* sp. Specimen in two different views showing only the first-order laterals.

Fig. 7. *Falsolikanella danilovae* (RADOIČIĆ, 1978). Annular segment made up of divergent arranged laterals.

Fig. 8. *Salpingoporella* gr. *genevensis* (CONRAD, 1969). Broken specimen showing the arrangement of laterals.

Figs 9–10. *Pseudoactinoporella fragilis* CONRAD, 1970. Lateral (Fig. 9, upper specimen and Fig. 10), and upper side (Fig. 9, lower specimen) view showing the characteristic enlargement of the thallus in the upper part, and the arrangement of the laterals in a verticil, respectively.

Figs 11, 12. Unidentified dasycladalean algae (?*Salpingoporella*-?*Neogyroporella*). See the thin section through the specimen from Fig. 11 in Pl. 7, Fig. 10.



### Plate 4

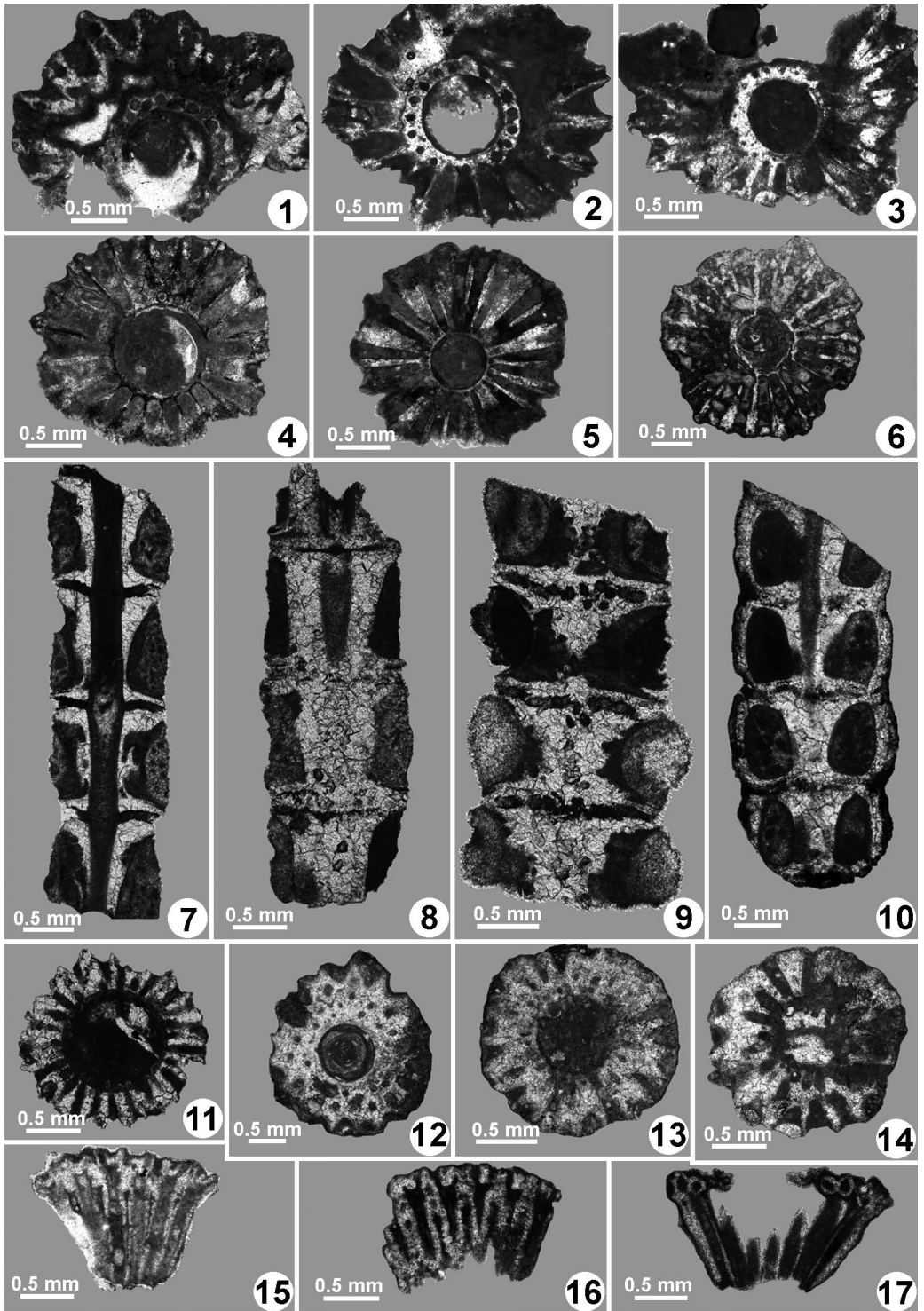
Thin sections through isolated specimens of dasycladalean algae from Serre de Bleyton.

Figs 1–6. *Actinoporella podolica* (ALTH, 1878). Transverse sections through isolated verticils. The corona-like structure is very well visible in Figs 1-3, but in less visible, even if still present, in the other specimens (Figs 4-6).

Figs 7–11. *Angioporella fouryae* MASSE, CONRAD & RADOIČIĆ, 1973. Figs 7–9, longitudinal (7) and longitudinal-oblique (8, 9) sections through corroded specimens showing the alternate arrangement of sterile and fertile laterals. Fig. 10 illustrates a longitudinal-oblique section through a non-corroded specimen. The possible connection between the fertile laterals and the main stem is visible in the case of the upper two verticils (left side). Fig. 11 is a transverse section through a verticil of sterile laterals.

Figs 12–14. *Falsolikanella danilovae* (RADOIČIĆ, 1978). Thin sections through isolated annular segments.

Figs 15–17. *Pseudoclypeina* sp. Thin sections through fragments of disc-like verticils. Long primary laterals, and shorter secondaries are visible.



## Plate 5

Thin sections through isolated specimens of dasycladalean algae from Serre de Bleyton.

Figs 1–3. *Pseudoclypeina* sp. Thin sections through fragments of verticillar discs showing the primary and secondary laterals.

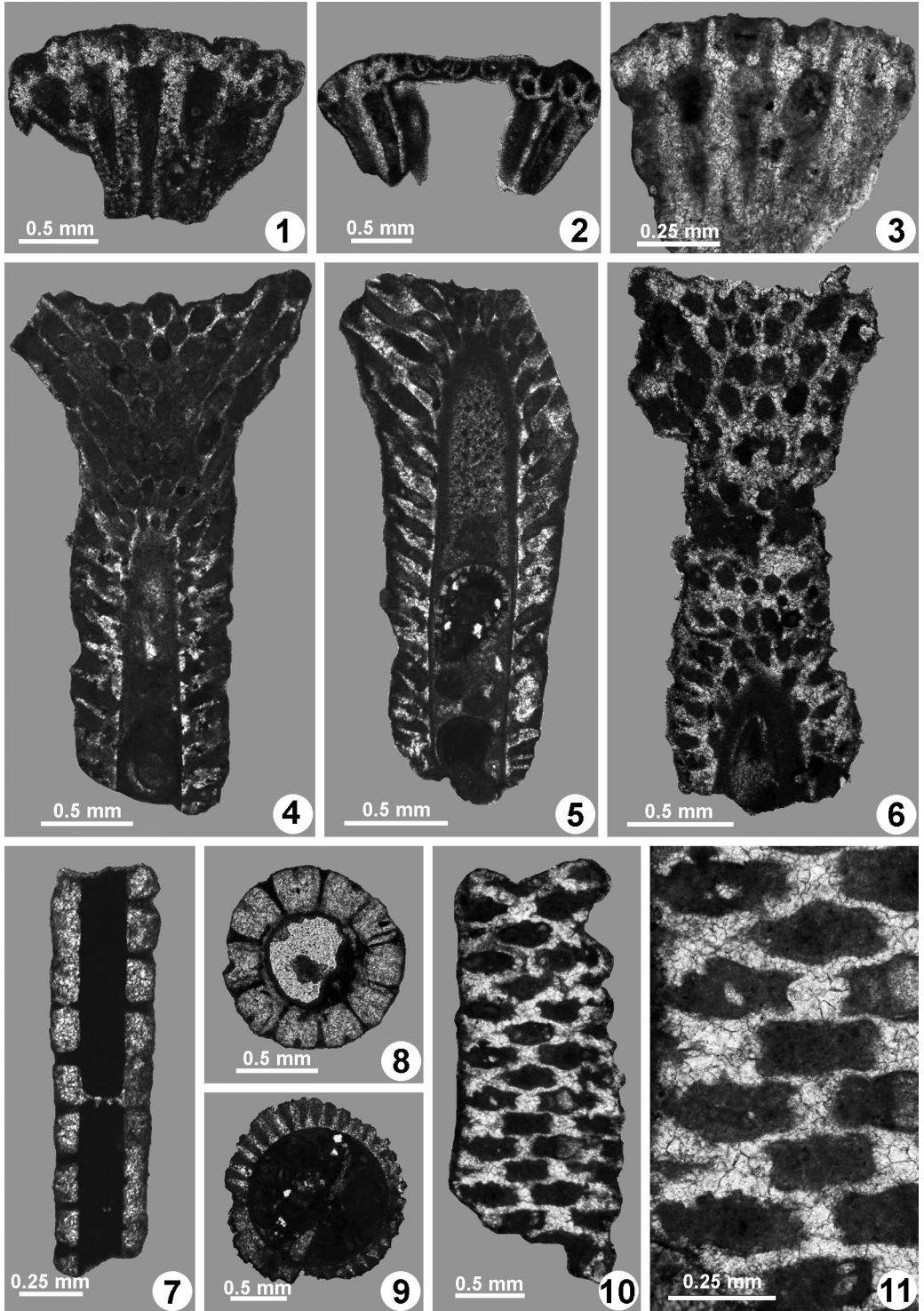
Figs 4–6. *Pseudoactinoporella fragilis* CONRAD, 1970. Longitudinal-oblique sections showing the enlargement of the thallus in the upper part, as well as the shape and arrangement of the laterals.

Fig. 7. *Salpingoporella muehlbergii* (LORENZ, 1902). Longitudinal section.

Fig. 8. *Salpingoporella* gr. *muehlbergii* (LORENZ, 1902) – *melitae* Radoičić. Transverse section.

Fig. 9. Unidentified dasycladalean alga (?*Salpingoporella*-?*Neogyroporella*). Transverse section.

Figs 10, 11. *Salpingoporella genevensis* (CONRAD, 1969). Tangential section. Fig. 11 is a close-up view of the left side of Fig. 10 showing the characteristic morphology of the laterals in tangential section, as well as the imprint of reproductive cysts.



## Plate 6

Thin sections through isolated specimens of dasycladalean algae from Serre de Bleyton.

Fig. 1. *Deloffrella quercifoliipora* GRANIER & MICHAUD, 1987. Longitudinal-oblique section showing the typical morphology of the laterals.

Figs 2, 3. *Montiella? elitzae* (BAKALOVA, 1971). Longitudinal-tangential sections showing the position of the fertile and sterile secondary laterals.

Fig. 4. Unidentified dasycladalean alga (?*Salpingoporella*-?*Neogyroporella*). Longitudinal-tangential section through the specimen in Pl. 1, Fig. 9.

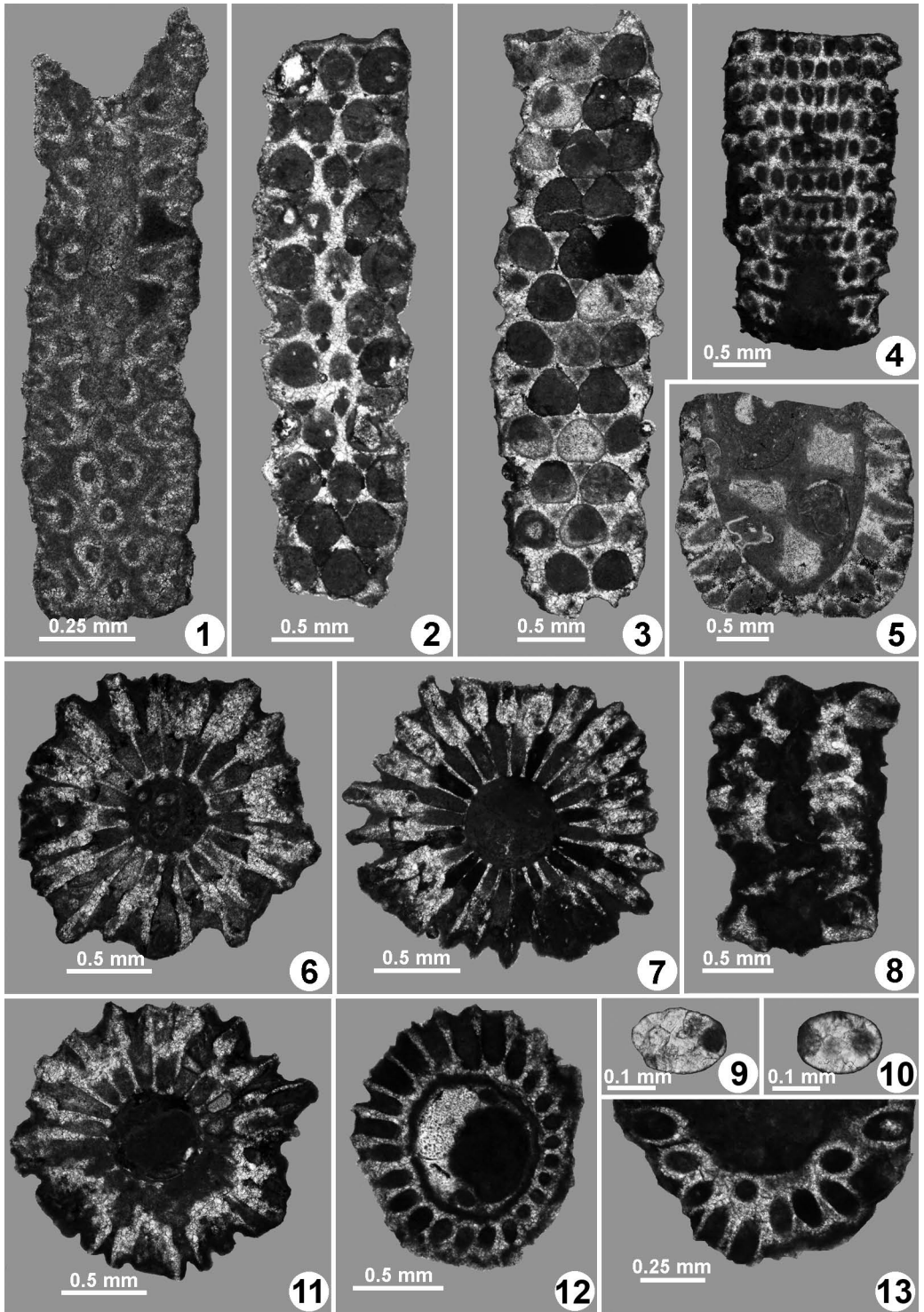
Figs 5, 8. *Piriferella paucicalcareae* (CONRAD, 1970); oblique (5) and tangential (8) sections.

Figs 6, 7, 11. *Actinoporella podolica* (ALTH, 1878). Transverse (horizontal) sections through isolated verticillar discs with a large number of laterals partly overlapping each other.

Figs 9, 10. *Russoella radoicicae* BARATTOLO, 1984. Small reproductive structures deriving most probably from *Triploporella* specimens.

Figs 12, 13. *Clypeina* sp. Transverse, slightly oblique (Fig. 12) section, and oblique-tangential (Fig. 13) section.





## Plate 7

Thin sections through isolated specimens of dasycladalean algae from Serre de Bleyton.

Figs 1–6. *Actinoporella podolica* (ALTH, 1878). Transverse (horizontal) sections (1, 2, 4, 5), longitudinal (vertical) section (3), and longitudinal-oblique (vertical-oblique) section (6) through isolated verticils of laterals. The corona-like structures are visible in figs 3 and 6.

Figs 7–9. *Triploporella* sp. Transverse (7) and longitudinal-tangential (8) sections (Fig. 8 is a thin section of the specimen illustrated in Pl. 3, Fig. 6). Fig. 9 is a close-up view of the lower-right part of Fig. 8, showing the presence of *Russoella*-like reproductive structures inside the laterals.

Fig. 10. Unidentified dasycladalean alga (?*Salpingoporella*-?*Neogyroporella*). Thin sections of the specimen illustrated in Pl. 3, Fig. 11.

