Mesozoic dasycladalean algae from Romanian Carpathians: diversity, environment and palaeogeographic context

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Dasycladalean algae are important constituents of the shallow-water carbonate sediments of the Mesozoic. The Romanian Carpathians contain such deposits with an extensive development during the Triassic, Late Jurassic and Early Cretaceous.
From the Middle Triassic (Anisian-Ladinian) carbonate platform deposits are known in the Eastern Carpathians (Rarau and Persani Mountains), Southern Carpathians (Sasca zone) and Apuseni Mountains (Padurea Craiului massif). During Anisian the dasycladalean assemblages are dominated by species of the genera *Oligoporella* and *Physoporella*, and in Ladinian by *Diplopora* si *Teutloporella*. These assemblages developed most frequently in internal platform environments (lagoons) and comprise species with limited stratigraphical range, important for biostratigraphy. It is worth mentioning the global uniformity of these associations.

During the Upper Jurassic the dasycladalean assemblages of the Romanian Carpathians are related to the development of the carbonate platforms that generated to so-called Stramberk-type limestones (e.g., Haghimas, Piatra Craiului and Vanturarita Mountains in the Eastern and Southern Carpathians; Trascau massif in Apuseni Mountains). The dasycladalean assemblages developed either in inner platform environments, with dominance of the genus *Salpingoporella*, or in platform margin environments, where large species of the genera *Petrascula*, *Steinmanniporella* or *Triploporella* are dominant. The late Jurassic carbonate platforms extended also in the Neocomian.

A new stage of the shallow-water carbonate sedimentation developed during the Barremian-Aptian giving rise to the Urgonian carbonate platforms. In the Romanian Carpathians such platforms are known from Rarau, Haghimas and Persani Mountains (Eastern Carpathians), Dambovicioara and Resita-Moldova Noua zones (Southern Carpathians) and Apuseni Mountains (e.g., Bihor-Padurea Craiului unit). During the Early Cretaceous the dasycladalean algae reached their maximum of diversity, and beside *Triploporellaceae* (mostly *Salpingoporella* species) frequent *Dasycladaceae* are known (e.g., *Neomeris* and *Montiella*), present in both internal and external parts of the platforms. The Early Cretaceous seems to represent also a time interval with more dasycladalean provincialism. It is well known the southern-Tethyan affinity of *Salpingoporella dinarica* (a species which is not known from the Romanian Carpathians) as well as the existence of some species with limited palaeogeographic range to the Carpatho-Pontic area (e.g., *Kopetdagaria sphaerica* or *Conradella bakalovae*).

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Calcareous algae from the olistoliths at Poiana Zanoaga, northern part of Piatra Craiului Syncline (Southern Carpathians, Romania)

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The Piatra Craiului Massif is a major syncline structure in the Southern Carpathians. Its flanks consist of Middle and Upper Jurassic-Neocomian carbonate deposits, while the filling is represented by conglomerates assigned either to the Upper Aptian, or to the terminal

Albian (Vraconian)-Cenomanian (SANDULESCU et al. 1972, BUCUR et al. 2009). In the northern area of the syncline (Poiana Zanoaga) these conglomerates include large limestone olistoliths. The olistoliths were assigned by POPESCU (1967) and SANDULESCU et al. (1972, map 1:50.000, sheet 110b Zarnesti) partly to the Tithonian and partly to the Barremian. Most of blocks consist of peritidal deposits with frequent fenestral limestones. They contain relatively rare microfossils, including cuneolinid foraminifers documenting the Barremian age. Nevertheless, some of the olistoliths proved to be very rich in fossils, with the dominance of large dasycladaleans easily noticeable on alteration surfaces (eg., the olistolith from the peak known as 'Silha lui Caita').

The following microfacies types dominate the fossil-rich olistoliths from Poiana Zanoaga: coarse bioclastic grainstone, ooidic grainstone, fine peloidal bioclastic fenestral grainstone, intraclastic grainstone/packstone, bindstone with bacinellid structures and various bioclasts, coral-microbial boundstone, intraclastic wackestone (microbreccia).

The microfacies types indicate various sectors of the carbonate platform: from the platform margin (bioconstructions), to the external platform/open internal platform with high hydrodynamics (coarse bioclastic shoals), and to peritidal environments (microbial mats and fenestral structures).

The foraminifers we have identified: *Pseudocyclammina lituus*, *Charentia evoluta*, *Coscinophragma cribrosa*, *Mohlerina basiliensis*, *Protopeneroplis ultragranulata*, *Nautiloculina bronnimanni*, *Andersenolina alpina*, *Andesenolina* cf. *sagittaria* and *Andesenolina perconigi* document an Upper Tithonian-Berriasian age (eg., ARNAUD-VANNEAU et al. 1988, BUCUR & SASARAN 2005) for these limestones.

The calcareous algae are represented by *Petrascula bursiformis* (Etallon) (very frequent), *Petrascula* sp., *Pseudocymopolia* cf. *jurassica* Dragastan), *Salpingoporella pygmaea* (Guembel), *Suppiluliumaella* sp., *Terquemella* sp., and rare specimens of *Clypeina sulcata* (Alth), *Nipponophycus* sp. *Diversicallis dianae* Dragastan & Bucur as well as rivulariacean-type cyanobacteria. Among the problematic microorganisms, we have notices *Lithocodium aggregatum*, sometimes associated with the foraminifer *Troglotella incrustans*.

The above-mentioned calcareous algae are also typical for the Upper Tithonian-Berriasian interval (eg., BUCUR 1999).

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Lower Cretaceous calcareous algae form the Khur area, Central Iran

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Cretaceous strata are very thickly developed, widely distributed and superbly exposed in the Khur area of Central Iran. They are part of the sedimentary succession of the so-called Yazd Block, the western structural element of the Central-East Iranian Microcontinent (CEIM), an independent microplate within the complex Mesozoic plate tectonic mosaic of the Middle East. During the Cretaceous, the CEIM was detached from Eurasia and surrounded by small oceanic basins which opened and closed in response to (inferred) counter-clockwise rotational movements of the microplate.