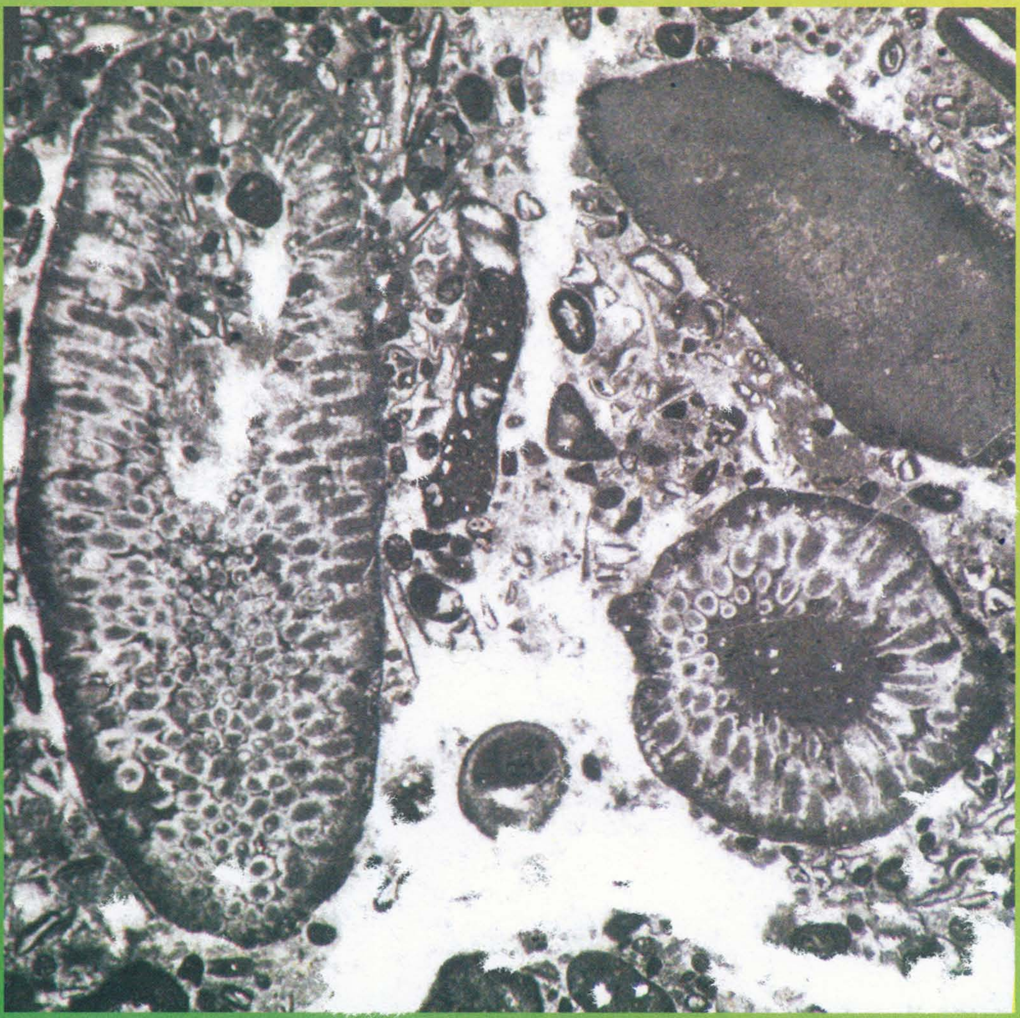
Ioan I. Bucur, Emanoil Săsăran (eds)

10th International Symposium on Fossil Algae
Cluj-Napoca, Romania, 12-18 September 2011

ABSTRACTS



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Abstracts

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In Memoriam Erik Flügel

The Pliocene vermetid-coralline algal buildup of Sant Onofre, Baix Ebre Basin (Tarragona, NE Spain)

Julio AGUIRRE[1], Jordi M. de GIBERT[2], Jordi MARTINELL[2] and Rosa DOMÈNECH[2]

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Key words: *Red algae, corallinales, vermetids, Pliocene, Spain*

In the Pliocene deposits of the Sant Onofre area, Baix Ebre Basin (Tarragona, NE Spain), a wonderfully exposed vermetid-coralline algal buildup is found. It developed on the top of a flat palaeotopographic high constituted by pre-Pliocene conglomerates. The Sant Onofre bioconstruction constitutes the only record of marine carbonates of the Catalan Pliocene basins. Blocks derived from the basement were deposited in the talus surrounding the palaeohigh. They are embedded in silt and very fine-grained sand. Coralline algal-serpulid patches form in the talus, binding together boulders and cobbles. These patches extend continuously down slope colonizing gutter-like structures among the blocks of the talus. The vermetid-coralline algal buildup was generated by the vertical growth of the gastropod *Petaloconchus*. Coralline algae coated on and intergrew with the vermetid shells. Their combined growth produced a rigid framework but with numerous voids in between, which were filled up with micrite carbonate (wakestone). *Spongites fruticulosus* is the most abundant coralline algal species followed by *Neogoniolithon brassica-florida* in lesser abundance. *S. fruticulosus* forms fruticose plants, with branches up to 1.5 cm long, while *N. brassica-florida* shows an encrusting growth habit. Other invertebrates, such as pectinids (*Manupecten, Chlamys*), endolithic bivalves (*Lithophaga*), gastropods (cerithids, nassarids, olivids, epitonids, etc.), colonial corals (*Cladocora* ?), barnacles (*Balanus, Creusia*), and regular echinids, inhabited the vermetid-coralline algal buildup. The pectinid *Hinnites*, dense clusters of the oyster *Neopycnodonte cochlear*, and balanid barnacles grew attached to the blocks of the talus as well as directly on the substrate. Taphonomy of the studied fossil assemblage indicates an *in situ* preservation of the whole palaeocommunity. Besides the presence of encrusters, blocks of the talus and part of the substrate are intensely bored with *Gastrochaenolites* and *Entobia*, ichnofossils produced by bivalves and sponges, respectively. Such a fossil assemblage is characteristic of shallow rocky shores, what is consistent with the presence of *S. fruticulosus* and *N. brassica-florida*, two mastophoroid species typically inhabiting very shallow waters. In this context, the vermetid-coralline algal buildup can be considered as a fossil analogue of the present-day Mediterranean *Dendropoma* reefs. Nevertheless, in these recent counterparts, the most abundant algal species is *N. brassica-florida*, while *S. fruticulosus* is the most important one in the Sant Onofre buildup. So far, *S. fructiculosus* has not been described as a major builder in recent shallow-water vermetid buildups.

The buildup developed as a response to the submersion of the rocky outcrop and thus, corresponds to the transgresive system tract. Afterwards, progradation of terrigenous sediments during highstand suffocated and buried the buildup. Burial had to be rapid since fossils are well preserved and they show no signs of transport. Thus, the vermetid buildup and the associated body fossils can be considered as recording a single, hard-substrate palaeocommunity, which was preserved *in situ* by obruption.

Reassessment of Lemoine's types of fossil corallines (Rhodophyta; Sporolithales and Corallinales) at the Muséum national d'histoire naturelle, Paris

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Key words: *Red algae, Corallinales, Sporolithales, systematics*

Madame Marie Lemoine was one of the most prolific taxonomists on fossil coralline algae during the 20th Century. She described 140 taxa of non-geniculate corallines, of which 3 genera and over 90 species are fossil corallines. Samples from all over the world were sent to her and she usually sent them back to the collectors. Therefore, a significant number of her types are housed in different institutions or might be lost. However, some are housed in the national herbarium at the Muséum national d'histoire naturelle in Paris (PC) where she worked for most of her life. We found the original material of nine fossil coralline species at PC: 1) five coralline species from Albania: *Lithothamnium corallinæforme*, *Lithothamnium Bourcarti*, *Lithophyllum Koritzæ*, *Lithophyllum sphæroides* and *Lithophyllum (?) albanense*; 2) Three species from Haute-Savoie: *Lithothamnium Moreti*, *Lithophyllum simplex* and *Jania nummulitica*; and 3) One species from SW France but originally described from the Carpathian Mountains: *Lithothamnium Abrardi*. The species *koritzae* was transferred to *Mesophyllum* by Lemoine (1928) and Braga et al. (1993) proposed the new combination *Spongites albanensis*. The aim of this paper is to reassess the species types of newly discovered original material in a modern taxonomic perspective and to typify the species for which Lemoine did not establish a holotype.

Several of these species have been frequently reported by palaeophycologists. The species *albanensis*, either within *Lithophyllum* or *Spongites*, and *Lithothamnion moretii* are among the five most cited species of fossil corallines. *Lithophyllum simplex* is among the nine most cited fossil coralline species but its taxonomic circumscription cannot be confidently established because no reproductive structures can be identified in the type.

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Keynote lecture

To be or not to be, the question of reproduction in Late Triassic/Early Jurassic dasycladaleans

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Key words: *Green algae, reproductive structures, evolution*

Upper Triassic (Norian) probably constitutes a key-period in the evolutive history of the green algae community. Actually this stage is placed between end-Ladinian and end-Norian extinctions, thus it can be viewed as a period of re-organization of structural schemes of dasycladaceans. The new lineages originated in the Norian widely develop during the Early Jurassic. It is a matter of fact that, within Mesozoic, dasycladalean assemblage show so much a feature that a “Liassic facies” can be singled out. The early attempts to ascribe species of this period to younger Jurassic and Cretaceous genera (*Dissocladella*, *Petrascula*, *Uragiella*, *Linoporella, Heteroporella,* etc.) have shown to be affected by the Walcott’s shoehorn. An explication of the bias is seemingly related to the evolutive radiation occurred in the Early Jurassic and the birth of new lineages followed by the Middle Jurassic crisis. The inspection of Late Triassic/Early Jurassic species belonging to genera *Chinianella*, *Palaeodasycladus*, *Eodasycladus* and *Cylindroporella* will display unsuspicious aspects mostly related to reproductive features. The result is an incredible diversity intermingled to a striking similarity, thus opening the door to a scenery where Late Triassic -Early Jurassic period be less ordinary as it may appear: a marine paradise for dasycladaleans?

Triploporella remesi (Steinmann) from the Tithonian of Štramberk revisited (Green algae, Dasycladales)

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Key word: *Calcareous algae (dasycladales), systematics, Šttramberk, Czech Republic*

The studied algae come from the Štramberk Limestone from a huge Kotouč quarry (Outer Carpathians, Moravia, Czech Republic). The Štramberk Limestone occur in this quarry as large blocks derived from the carbonate platform, including reefs. They are embedded in base-of-slope conglomerates and slump bodies with Cretaceous of the Silesian unit (Eliáš & Eliášová, 1986). Tithonian–early Berriasian age is assumed for these limestones based on calpionellids and ammonites (e.g. Houša, 1990).

Triploporella remesi was erected in 1903 by Gustav Steinmann which was ascribed to the new genus *Tetraploporella*, then transferred to the genus *Triploporella by* Pia (1920).

The new material from the vicinity of type locality (?) allows to enrich the already meticulous Steinmann's description with further data. In detail the alga shows characters of reproductive organs which are contained within the large primary laterals and look like to those observed in *Triploporella steinmannii* Barattolo (cyst containers). The arrangement of cyst containers seems to recalls what happens in *Triploporella praturlonii* Barattolo. As a whole Triploporella remesi from Kotouč quarry shows secondary laterals less preserved than Steinmann's material.

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Recent deep-water macroid beds from southwest of Kikai-jima in the northern Ryukyu Islands, southern Japan: ecology and taphonomy

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Key words: *Macroids, ecology, taphonomy, Recent, Ryukyu Islands, Japan*.

The Ryukyu Island Arc extends from Kyushu to Taiwan, a distance of 1,200 km, along the Ryukyu Trench where the Philippine Sea Plate is subducting beneath the Eurasian Plate. The formation of the Okinawa Trough, a back arc basin formed behind the Ryukyu Island Arc in the Late Pliocene to Early Pleistocene, is one of the most important factors for initiation and development of coral reefs in the Ryukyus (Iryu et al., 2006).

The survey area is a shelf (island shelf) southwest of Kikai-jima, northern Ryukyu Islands (southern Japan) where water depth varies between 61 and 105 m. The location of the area off Kikai-jima enables it to be continually submerged in clear, oceanic waters with normal marine salinities. The sea floor is characterized by a flat topography and consists mainly of coarse bioclastic carbonate sediments. The sedimentation rates within the study area are low (Arai et al., 2008).

Here we report on a case of deep-water macroids and related ichnocoenoses from southwest of Kikai-jima. Here, macroids with foraminiferal and coralline algal frameworks occur within fore-reef environments down to fringing reefs in discontinuous belts from 60 m down to about 100 m water depth. We illustrate the EGTM (i.e. *Entobia*, *Gastrochaenolites*, *Trypanites*, and *Maeandropolydora*) ichnocoenosis from deep reef-related settings (>60 m). As a consequence, it is shown that this ichnocoenosis may be significantly less precise as a very shallow water sea-level indicator (<10 m) for paleoenvironmental reconstructions than previously claimed.

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Keynote lecture

Palaeoenvironmental models of Paleogene shallow-water carbonate platforms in north-east Italy, Western Tethys

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Key words: *Shallow water carbonates, rhodoliths, palaeoecology, platform depositional system, Eocene, Oligocene, Western Tethys*.

Middle-Upper Eocene (Bartonian-Priabonian) to Upper Oligocene (Chattian) shallow water carbonate platforms are located on the Lessini Shelf at the northern Western Tethyan margin. The sedimentary successions show an extensive geographic distribution of at least 150 km x 60 km, from the Lake Garda to the west, through the Monti Berici to the Venetian foreland basin to the East, in the southern margin of the Southern Alps. Biogenic components are dominated by larger foraminifera and coralline algae along with bryozoans and bivalves. These carbonates were formed in carbonate ramps. The depositional profile and local hydrodynamic conditions in each setting controlled the occurrence of diverse facies at similar positions within the ramp. Carbonate sediments dominated by coralline red algae include rhodolith pavements, crustose coralline pavements, as well as rhodoliths, coralline algal branches and their detritus.

The Bartonian-Priabonian successions consist of a variety of facies including coralline crust-wackestone facies, small *Nummulites* and rhodolith facies, rhodolith mound wackestone/packstone, rhodolith pavement facies, coral-algal facies and crustose coralline pavement facies. Most coralline algae observed belong to the subfamily Melobesioideae Bizzozzero with *Lithothamnion* being the most abundant genus. The subfamily Mastophoroideae Setchell is absent to rare in the orthophragminid packstone/rudstone facies and is more abundant at genus level in small *Nummulites* and rhodolith facies. The Peyssonneliaceae (*Polystrata*) are only present in small *Nummulites* and rhodolith facies. In the middle-ramp trough, cross-bedded small *Nummulites* and rhodolith packstones pass laterally into coralline algal crust wackestones. These rhodoliths exhibit two well-differentiated growth-phases: the first occurring during low-water energy periods, followed by a second developed during high-energy events during which they were reworked and partially destroyed. These facies pass laterally into orthophragminid rudstones and packstones characterised by orthophragminid tests and channel structures. Further toward the distal part of the middle-ramp, the coralline crustose pavement develops. This is characterised by rhodoliths typically discoidal in shape (up to 10 cm in diameter) with a loose inner arrangement consisting of encrusting-to-foliose growth-forms.

The Chattian carbonate and mixed siliciclastic-carbonate deposits formed in a homoclinal ramp depositional system. Ten facies can be distinguished based on variations in lithology and carbonate microfacies as defined by fabric characteristics as well as dominating biotic components. Both siliciclastics and carbonate fabrics are present and include sandstones, wackestones, grainstones, packstones and rudstones. The general facies succession shows a transgressive sequence from the proximal inner- to proximal middle ramp. A shoal belt of trough cross-bedded sandstones occurs in a proximal inner ramp position in all of the studied areas. In a gentledipping homoclinal ramp, most benthic organisms inhabited the relatively quite environments off these shoals in a distal inner ramp setting. Basinward environments (proximal middle ramp) constitute areas of maximal carbonate production and consist primarily of larger foraminiferal facies and rhodolith pavements. Larger foraminifera, represented by two larger foraminiferal assemblages, are most diversified in the shallower settings (near the fair-weather wave base, distal inner/proximal middle ramp), whereas coralline algae predominate in deeper areas (proximal middle ramp) constituting extensive rhodolith pavements. Coralline red algae are common and are represented by members of families Corallinaceae with the subfamilies Mastophoroideae and Melobesioideae and the family Sporolithaceae. Rhodolith range in size from a few centimetres up to 13 cm in diameter. Rhodolith shapes range from spheroidal, through sub-spheroidal to sub-ellipsoidal shapes. Inner and outer parts of the rhodolith can show different growth-forms. Rhodoliths can be multigeneric (no more than two genera) and multispecific (no more than two species). The inner arrangement of the rhodoliths is dominated by massive dense, thinly encrusting thalli with low constructional void spaces. Both symmetrical and asymmetrical accretionary inner arrangements are present. The outer parts of the rhodoliths mainly consist of encrusting growth-forms; warty growth-forms can be frequent while lumpy growth-forms are rare. The distribution of the Chattian deposits along depositional strike is at least 150 km and shows variation from thinner, carbonate dominated sequence in the west (Monti Berici and Monti Lessini) to a more variable, mixed carbonate–siliciclastic dominated environment to the east (Vittorio Veneto, Alpago). This west-to-east decreasing gradient in carbonate productivity indicates a lower siliciclastic sedimentation supply in the western Southern Alpine area.

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Coralline algae as active coral killers: implications for reef ecology and paleoecology

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Key words: *coralline algae, reef ecology, coral-algal interactions, space competition*

Crustose coralline red algae (CCA) are considered the second most important reef builder and binder in modern reef ecosystems, contributing directly and indirectly to the reef growth, cementation, spatial heterogeneity and total biodiversity (Perrin, 2002). Non-geniculate corallines are of particular significance in the ecology of modern coral reefs, where they are also important sources of primary production and induce larval settlement of many benthic organisms, including sclereactinian corals. The ecology of crustose corallines is often explained by the interplay of presence of macro and turf algae, grazing intensity by herbivores, sedimentation and productivity (Steneck, 1997). Spatial competition between algae and corals is widespread on reefs. However, it is believed that algae replace corals simply as the consequence of coral mortality due to other detrimental factors (excess sedimentation, excess nutrients, pollution, mechanical disturbance ecc.), that is to say that healthy corals commonly outcompete coralline algae on reefs (McCook *et al*., 2001). Recent investigations on *Porites*-corallines interaction in the coral carpets of the Yemeni coast revealed that some corallines may behave as active coral killer on otherwise healthy coral colonies (Benzoni *et al.,* in press). The paleoecological implications of this observation are discussed.

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Modern microbialites of southern Sinai (Egypt) and their environment

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Key words: s*tromatolites, oncolites, Red Sea, cyanobacteria, purple sulphur bacteria*

Recent studies show that stromatolite formation can be both abiogenic (sediments trapping in bacterial mucilaginous sheaths) and biogenic (microbially-induced mineralization) (Riding, 2007). The knowledge of modern microbialites is mandatory to palaeobiology and palaeoecology, although the stromatolite-dominated environments of the past were hardly comparable with those of the present.

Samples were collected in Nabq Bay and in Ras Mohamed (southern Sinai, Egypt) in a marine intertidal tropical environment. The studied material included agglomerated, unconsolidated sand, organic mats, oncolites and crusts at different levels of consolidation/lithification.

The sand was analyzed with light microscopy, oncolites were observed with SEM (Scanning Electron Microscopy) and crusts were studied throughout SEM and thin sections. Thin sections were stained with Alizarin Red.

The poorly lithified crusts show evidence of bacteria (cyanobacteria and purple sulphur bacteria) among the constituent grains, in the form of gelatinous filaments (green and red sheaths), while fully-lithified crusts show presence of microalgal colonies along the outer edge, accompanied by a very high degree of clast alteration. In addition, at the surface and/or inside some crust samples we observed the alternation of planar or irregular dark, superposed layers and clastic layers. Crusts were internally laminated, although it was not always macroscopically obvious.

Southern Sinai stromatolites show evidence of both sediment trapping in bacterial mucilaginous sheaths and microbially-induced mineralization, supporting the hypothesis of their biogenic nature. In particular, we observed widespread filaments of (?) *Schizothrix* among grains, EPS (Extracellular Polimeric Substance) sheaths connecting particles, calcareous tubes possibly grown around cyanobacteria cells and acicular aragonite. Fringes of acicular aragonite occur around particles and appear locally dissolved. Staining with Alizarin Red confirms the calcareous composition of constituent grains. The presence of magnesium has been confirmed by EDS (Energy Dispersive Spectrometer) analysis. Investigation on cement occurrence and mineralogy are in progress.

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The Pleistocene coralligenous build-ups of Le Castella and Capo Colonna terraces (Calabria, Southern Italy)

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Key words: *Corallinales, coralline red-algae facies, Pleistocene, Marine Terraces, Crotone.*

Autochthonous coralligenous build-ups are mainly formed by encrusting coralline algae, currently develop on Mediterranean hard and soft bottoms with a patch distribution along the coast.

However, few fossil examples have been described in the literature and their evolution in the context of a stratigraphic cycle has seldom been modelled in detail (Basso et al., 2007; Titschack et al., 2008).

Wide marine terraces are preserved in the area of the Crotone peninsula, Ionian Calabria, southern Italy (Zecchin *et al*., 2004; Nalin *et al*., 2006; Nalin *et al*., 2009). They are related to the interplay between Pleistocene sea-level changes and the progressive uplift of the Calabrian arc from the middle Pleistocene onwards (Massari *et al*., 2002).

The deposits are up to 10 m thick and consist of mixed carbonate and siliciclastic sediments, in which coralligenous build-ups and other red algal facies are dominant.

Usually the terraces are characterized by 3 layers: 1) a blocked basal conglomerate, forming by the erosion of ancient terrace deposits; 2) the algal reefs; 3) the biogenic sandstone-grainstone bodies, which occupy the cavities between the coralligenous bodies and/or cover them at the top. These 3 layers are the result of the shallow deposition during an entire sea-level cycle.

The two youngest marine terraces are related to Marine Isotopic Stage (MIS) 3 and 5.1 (Gliozzi, 1987; Belluomini *et al*., 1988; Palmentola *et al*., 1990; Zecchin *et al*., 2004; Nalin, 2006). The MIS 3 terrace outcrops in the area of Le Castella, S of Isola di Capo Rizzuto village whereas the MIS 5.1 is placed along the Capo Colonna cape, placed in the NE part of the peninsula.

Their major stratigraphic features and facies have been already described but very few details exist on their paleontological content.

Stratigraphic sections in both terraces have been measured and sampled. Thin sections have been prepared for red algae identification and to measure the diagnostic anatomical microfeatures of the algal thalli in order to conduct statistical analysis. Sandstone and grainstone associated to build-ups have been disgregated in order to separate particles in a conservative way and conduct paleontological analysis of the algal fragments forming the sediment.

The coralligenous build-ups are dominated by the coralline algae *Mesophyllum alternans* (Foslie) Cabioch & Mendoza and *Titanoderma pustulatum* (Lamouroux) Nägeli usually alternated with bryozoan crusts. Other red algae species like *Lithophyllum stictaeforme* (Areschoug) Hauck, *Phymatolithon calcareum* (Pallas) W.H. Adey & D.L. McKibbin and *Neogoniolithon* sp. rarely occur.

A quantification of the dominant coralline species involved in the bioconstruction and forming the sediment is provided, in order to define the coralline assemblage variation in a shallowing-upward paleoenvironment. The relative abundance of each coralline species provides more details on the behaviour of the identified species and allows a better correlation with the sea-level cycle.

The paleontological results have been framed in the context of a genetic-stratigraphic interpretation of the marine terraces.

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Upper Jurassic-Lower Cretaceous calcareous algae from the western Bulgaria and eastern Serbia

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Key words: *Calcareous algae, dasycladales, carbonates, Bulgaria and Serbia*

The Upper Jurassic and Lower Cretaceous carbonate rocks are of wide occurrence in the area across the Bulgarian–Serbian border (western Bulgaria and eastern Serbia). The sediments deposited in a bathymetrically differentiated basin, associated with the gradual emergence of the southern landmass and the formation of the Central Moesian Basin. The shallow-water sections are located in the south western prolongation of the Western Moesian Carbonate Platform (Patrulius et al., 1976) and belong to the West Srednogorie Unit in Bulgaria (Dabovski, Zagorchev, 2009) and to the Vidlić/Tepoš Zone in Serbia. The main part of the carbonate platform is represented by the limestones of the Slivnitsa Formation (Bulgaria) and the Crni Vrh Limestones (Serbia). Both formations are built up by thick-bedded to massive light gray to whitish organogenic and less common micritic limestones containing a large number of benthic foraminifers and algae, colonial corals, rudists, brachiopods, crinoids, gastropods and other benthic forms. The age interval is Callovian? to Valanginian. The carbonate platform deposits are covered by the Clayey Limestones (Serbia) and marls of the Salash Formation (Bulgaria) of Valanginian to Early Hauterivian age.

The Upper Jurassic-Valanginian limestones were sampled in two localities: Between Kalotina and Berende Izvor, in Bulgaria (Slivnitsa Formation), and close to Kozaritsa, in Serbia (Crn Vrh Limestone).

The Upper Jurassic limestones from Kalotina section are represented by allodapic slope deposits, or coral-microbial boundstones, with relatively scarce algae: *Clypeina sulcata*, ?*Campbeliella* sp., *Salpingoporella pygmaea*, *Nipponophycus ramosus*, "*Solenopoa*" *jurassica*, *Terquemella* sp., *Thaumatoporella parvovesiculifera* and the microproblematicum *Crescentiella moronensis.*

The Berriasian-Valanginian limestones are mainly represented by shallow subtidal to intetidal carbonates with benthic foraminifera accounting for their Berriasian-Valanginian age, and an assemblage of calcareous algae frequent within the same time-interval: *Actinoporella podolica, Clypeina parasolkani,* ?*Pseudocymopolia jurassica Salpingoporella annulata, Salpingoporella circassa* ?*Selliporella neocomiensis* ("*Coptocampylodon*"). The microproblematica *Bacinella* (bacinellid structures)-*Lithocodium* are also present.

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Representatives of the genus *Triploporella* in the Lower Cretaceous limestones from Romania

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Key words: *Calcareous algae, Dasycladales, Lower Cretaceous, Romania*

In the Romanian Carpathians, the species of *Triploporella* genus are relatively rare in the Lower Cretaceous limestones. Recent studies on various areas of development of urgonian limestones allowed us to identify dasycladalean algae that we assigned to *Triploporella* in four regions:

1. Reşiţa-Moldova Nouă Zone. Here we have identified *Triploporella carpatica* BUCUR (Bucur, 1993) characterized by a wide axial cavity and primary laterals with poorly calcified proximal and distal extremities. No secondary laterals were observed. Nevertheless, the primary laterals contain cyst containers that support our assignment to genus *Triploporella*.
2. Perşani Mountains. Numerous fragments also belonging to species *Triploporella carpatica* BUCUR have been identified in the Urgonian limestones from Perşani (Marian et al., 2008). These show a relatively more advance degree of calcification, corresponding to the entire length of the primary laterals; still, the secondary laterals were not calcified. The morphology and sizes of the cyst containers correspond to those of the type species. More than that, in this area some specimens of *Triploporella* were assigned with reserves to species *Triploporella marsicana* PRATURLON.
3. Dâmbovicioara couloir. In the Barremian patch-reefs from Dâmbovicioara couloir we have recognized rare fragments of *Triploporella*, most probably belonging to species *Triploporella praturlonii* BARATTOLO.
4. Pădurea Craiului Mountains (North Apuseni Mountains). Recently we have identified specimens of *Triploporella* in Barremian limestones. Based on the morphology of the primary and secondary laterals, it is highly probable that they belong to a new species. Further studies and possible new material are needed in order to allow a final decision in this respect.

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Examples of applications of fossil microorganisms in the ecologic evolution of Irati Subgrupo (Upper Permian, Paraná basin, Brasil)

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Key words: *sporomorphs, acritarchs, algae, Permian, Brasil*

The Permian Irati Subgroup (Paraná Basin, Brazil) was deposited in a huge thick basin at the middle southeast platform, located at the southwest of the Gondwana Supercontinent. Due the co-occurrence of lithologies and fossils in Irati and Whitehill Formation (South Africa) they are thought as a unique restricted and wide body of water. The micropaleontology studies have been use only the sporomorphs in shale for biostratigraphic zonation. On the other hand, the important aspect of biological succession and the paleoenvironment are beginning be knolled by the research of fossil microorganisms both in shale and in silicified carbonate. The samples of chert and shale were collected at different levels from seventeen localities of the states of São Paulo and Paraná, in Brazil. They were studied through palynologic techniques and petrographic thins sections. Acritarchs, prasinophyte algae, cryptarcs and fragile cells of cyanobacteria and chlorophytes were recovered by this research. The acritarchs and prasinophyte algae are common in some levels of basal beds, becoming sparse upward. This is in accord with the concept of gradual closing of the ocean during early Permian. The delicate cells found in extremely abundance and most concentrates in perturbed shale-dolostone rhythmites of a bed on north portion of basin, where massive, contiguous colonies of cyanobacteria that may make up predominantly organic microbial mats comprising a significant part of the original sediment. This is indicative of formation of restricted environments in regression times. The concentration of salt in these places might also have favored the preservation of the delicate cell. These all prove, that the studies of fossil microorganisms mean a front of investigation which can increase the knowledge of the biological succession and the paleoenvironment in the Irati Subgroup.

Carbonate facies with rhodoliths from Vălenii Şomcutei (NW Transylvanian basin)

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Key words: *Limestones, rhodoliths, Transylvanian basin, Romania*

The Badenian carbonate deposits from the NW Transylvanian basin consist of shallow-water limestones. The sequence studied is located near Vălenii Şomcutei (Maramureş county), between Preluca and Ţicău crystalline massifs.

The carbonate rocks outcropping at the entrance of Valea Rea Cave consist of: bioclastic extraclastic wackestone/packstone, bioclastic extraclastic packstone with rhodoliths, bioclastic extraclastic grainstone/packstone and extraclastic ooidic grainstones. Rhodoliths have millimetric to centimetric dimensions in the lower part of the sequence and are associated with large benthic foraminifera and rare planktonic foraminifera, sponge spicules and fragments of bivalves. In the middle part, coralline algae form rhodoliths up to 15 cm in diameter. These are mostly composed by *Spongites*, with protuberant thalli and encrusting bryozoans, in a bioclastic extraclastic packstone-grainstone microfacies. The bioclastic extraclastic grainstones from the lower and upper parts of the sequence, contain rhodolith fragments and coaxial core filaments, probably of *Neogoniolithon*. The coralline algal flora consists of species from the *Mastophoroideae* and *Melobesioideae* subfamilies. The assemblages are dominated by *Spongites albanense* and *Lithothamnion*, but encrusting *Lithoporella melobesioides* and probably *Neogoniolithon* and *Mesophyllum* are also present. Protuberant, encrusting and lamellar growth as well as occasionally fragmented forms also occur and form spheroidal and discoidal rhodoliths. Bryozoans may occasionally represent the core of the rhodoliths.

Erosional overlayed limestone layers with cross laminations, horizontal stratifications, and HCS-like structures form the upper part of the sequence. All these features emphasize the action of storm waves. Coralline algae form rhodoliths that gradually decrease in dimensions below the layer with HCS structures. The high-energy wave currents had the most important role in developing the spheroidal forms. Also, the intense bioturbation under the sandy limestones and in the lower part of the sequence influenced the rhodoliths development, usually found in association with serpulids, gastropods and lamelibranches.

The study of calcareous nannoplankton emphasizes a cooling interval during the Badenian (NN5 biozone) and in association with the presence of agglutinated foraminifera we can say that these deposits belong to Middle Badenian (the upper NN5 biozone).

The carbonate sequence is shallowing upward, indicating an increasing depositional energy. There is a transition from open medial - distal shelf environment (at the bottom of the sequence) to shelf ramp environment (in the middle of the sequence), respectively proximal/littoral shelf in the top sequence.

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Revision of the holotype of *Lithocodium aggregatum* ELLIOTT, 1956 (Lower Cretaceous, Iraq): new interpretation as sponge-calcimicrobial consortium

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Key words: *microproblematica, Lithocodium, sponge, calcimicrobes*

The microproblematicum *Lithocodium aggregatum*, regarded in the past as codiacean alga, red alga, loftusiacean foraminifer, calcimicrobes or heterotrichale filamentous-septate green alga (order Ulotrichales?), is now interpreted as sponge-calcimicrobial consortium.

Algae-bearing limestones from the Vârciorog Formation (Pădurea Craiului Mountains) in the context of Mid- Cretaceous oceanic anoxic events

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Key words*: limestone, calcareous algae, Lower Cretaceous, Pădurea Craiului, Apusenui Mountains, Romania*

The present work is based on C- and O-isotope data from the Early Cretaceous carbonate rocks of Pădurea Craiului (Apuseni Mountains, Romania) and is aimed to identify changes in the isotope geochemistry that might have paleoenvironmental significance for algae-bearing limestone deposition.

The Late Aptian – Albian Vârciorog Formation is defined as a succession of gray to black marls, marly and glauconitic sandstone and gray to black limestone with orbitolinids and rudists, unconformably covering a slightly unlevelled paleorelief developed on the Valea Măgurii limestone where small iron-bauxite gatherings are also found. The entire succession is 400 to 500 m in thickness (Fig. 1). In some areas, where the transgressive character is more prominent, and where it covers even older formations, a subaerial slide breccia occurs. It consists of large Jurassic and Cretaceous limestone blocks and even of some bauxite randomly disposed, cemented with sparitic calcite and red siltic material and it is known as Gugu Breccia Member.

The limestone intercalations of the Subpiatră Quarry display a typical carbonate platform facies. The total thickness of the Late Aptian – Middle Albian limestones in the Subpiatră Quarry is more than 150 m (Bucur et al., 2010). They display three major facies types according to dominant biota: (1) rudistid limestones; (2) limestones with *Bacinella*; (3) limestones with corals. This sequence records the passage from restricted conditions (wackestone/packstone with levels or oncoids of cyanobacteria and/or *Bacinella*) to an open-marine environment (wackestone/packstone with dasycladales, rudists, and corals in situ), and then a return to restricted conditions (Bucur et al., 2010). The depositional cycles are delimited by erosional surfaces, condensation, or by abrupt changes in the microfacies. The micropaleontological association identified in the quarry consists of foraminifers and calcareous algae. Among the foraminifers we mention: *Girariarella prismatica* Arnaud-Vanneau, *Glomospira urgoniana* Arnaud-Vanneau, *Mesorbitolina texana* (Roemer), *M. Subconcava* (Leymerie), *Pseudolituonella conica* Luperto Sinni and Masse, *Sabaudia minuta* (Hofker), *S. auruncensis* Chiocchini and Di Napoli Alliata, *Troglotella incrustans* Wernli and Fookes. The calcareous algae assemblage consists of *Cylindroporella ivanovici* (Sokač), *Griphoporella cretacea* (Dragastan), *Montiella elitzae* (Bakalova), *Neomeris cretacea* Steinmann, *Polystrata alba* (Pfender), *Parachaetetes asvapatii* (Pia), and newly found *Zittelina massei* n. sp. (Bucur et al., 2010).

The Mid- to Late Cretaceous is generally characterized by a repeated occurrence of quasi-global deposition of organic-rich sediments (black shale). These short-lived (~0.5-1 My) events are referred to as the Oceanic Anoxic Events (OAEs). Such events occurred in the early Aptian (~120.5 Ma; OAE1a), across the Aptian/Albian boundary (~113-109 Ma; OAE1b), in the early Late Albian (~101 Ma; OAE1c), in the latest Albian (~99.5 Ma; OAE1d), across the Cenomanian/Turonian boundary (~93.5 Ma; OAE2). Isotope studies represent a major tool in understanding the causes of

Cretaceous OAEs (Jenkins, 2003). In addition to the widespread distribution of organic carbon-rich sediments, OAEs are also characterized by low abundances or absence of benthic foraminifera and concomitant positive $\delta^{13}C$ excursion. These features have been collectively explained by extensive (ocean-wide) water-column stratification, bottom water anoxia, increased primary production and/or burial of isotopically light organic matter, and probably a resultant draw-down of atmospheric CO_2 (van Breugel, 2006).

The lower part of the Subpiatră limestones belonging to the Vârciorog Formation (Late Aptian – Albian) are characterized by lower $\delta^{13}C$ values (from 2.95 to 2.97‰) compared to the values recorded in its upper part (from 3.75 to 4.70‰) (Fig. 1). Such a considerable increase of the $\delta^{13}C$ values from 2.95‰ to 4.70‰, followed by a small drop down to 3.75‰, and then another increase up to 4.23‰ is characteristic of the OAE1b (Weissert & Erba, 2004 and literature therein). During the latest Aptian and Early Albian there is a general trend of increasing $\delta^{18}O$ values, suggesting cooling episodes and or an increase in salinity.

Within the Pădurea Craiului Mountains, the positive C-isotope spikes recorded in Late Aptian – Albian correspond to the level of limestones with *Bacinella* and include the level with *Zittelina massei* n. sp. (Bucur et al., 2010). It is important to note that the main feature of the newly described calcareous algae species is that it shows both an internal and external calcified wall. As this feature correlates with positive C-isotope excursion, as well as with significant temperature changes it could indicate climat-induced perturbation of the global carbon system which provoked changes in biocalcification pattern.

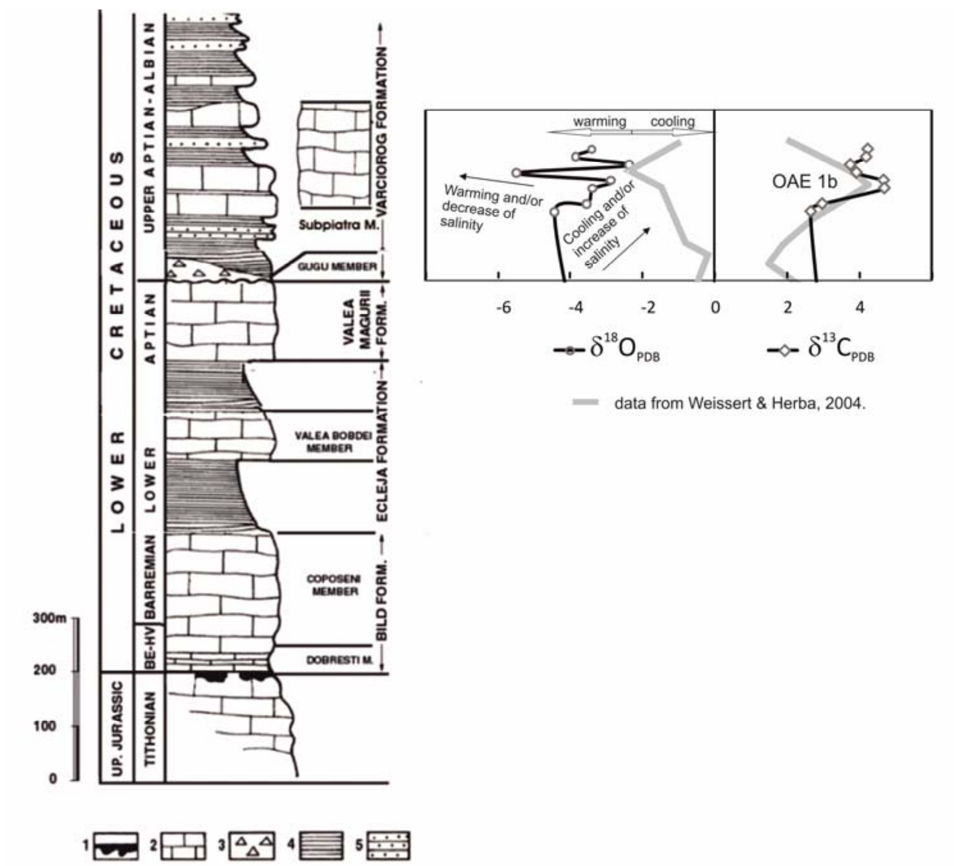

Fig. 1. Late Aptian to Albian O- and C-isotope stratigraphy from the Vârciorog Formation after Papp & Cociuba, *in press*). Lithology of the Early Cretaceous deposits in the Pădurea Craiului Mountains (after Bucur, 2000): 1 bauxite lenses; 2 limestone; 3 breccia; 4 shales; 5 sandstone.

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Calcareous algae from the Upper Cretaceous of eastern Morocco. Preliminary results

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Key words: *calcareous algae, Dasycladales, Bryopsydales, Upper Cretaceous, Morocco*

The Upper Cretaceous (Senonian) deposits from the table mount of Tendara (Hauts Plateaux, eastern Morocco) buildup a more than 100 m thick, predominantly siliciclastic sequence. It is composed of white and red, sometimes calcareous, fine-grained sandstones and red siltstones and mudstones. Only few carbonate horizons are intercalated. The uppermost carbonate horizon ("calcaire a pinces de crabbes" of authors) is an about 2 m thick, predominantly oolitic bar with remains of bryozoans, crustaceans, bivalves and gastropods, from which our samples have been derived. The horizon is overlain by another 35 m of red, fine-grained, calcareous sandstones. Conformably overlying lacustrine/palustrine limestones are the youngest rocks exposed in the region.

We have collected and investigated 14 samples, of which some were very rich in calcareous algae. In the investigated samples, the following facies types have been observed (1) alternating grainstone and packstone with dasycladaleans and bryopsidales; additionally they contain fragments of bivalves, gastropods, bryozoans and annelids; (2) oolitic grainstone with dasycladaleans, foraminifers, fragments of bivalves and gastropods; (3) fine calcareous sandstones; (4) fine-grained, laminitic grainstone; (5) wackestone/packstone with terrigenous material, with dasycladaleans, bryopsidales, foraminifers, fragments of bivalves, gastropods, bryozoans and annelids; (6) grainstone/packstone with dasycladaleans, bryopsidales, fragments of bivalves, gastropods, bryozoans and annelids, and (7) laminated wackestone with bivalves and rare foraminifers.

The calcareous algae identified are represented by dasycladaleans (cf. *Holosporella*? *nkosensis* P. MASSE, *Salpingoporella* cf. *milovanovici* RADOIČIĆ, *Salpingoporella* sp., *Montiella*? sp., *Clypeina*? sp.) and bryopsidales (*Boueina* cf. *pygmaea* PIA, *Halimeda*? sp., *Permocalculus* sp.).

Undoubtedly, the specimens resembling *Holosporella*? *nkosensis* are the most frequent in the studied samples. We can perform a detailed morphological investigation on the various sections through numerous specimens mainly located in the lower part of the succession. Our preliminary results suggest that this species should be assigned to another genus then *Holosporella*.

Dating Calcareous Algae of the Mobarak Formation (Mississippian), Sari, North of Iran

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Key words: *Calcareous algae, Iran, Lower Carboniferous, Mobarak Formation*

The Mobarak Formation in the Sari area, Kiyasar region (North of Iran) consists of alternatingthin and thick-bedded limestones, dolomitic limestones, and interbedded shales and dark marls. Facies investigation shows that this formation is organized in shallowing upward cycles deposited on a ramp-type carbonate platform. The Mobarak Formation is disconformably overlain by Lower Permiansandstones of the Dorud Formation. Thickness of the Mobarak Formation in the Sarir region is 250 m. Four lithostratigraphic units have been recognized and in the field. Amicrobiostratigraphy of the Lower Carboniferous Mobarak Formation was carried out in the Kiyasar region, resulting in the recognition of 12 genera and species of calcareous algae. These calcareous algae belong to the Rhodophycophyta phylum (Red algae) and the Chlorophycophyta phylum (Green algae). Among the calcareous algae, the Green algae are most common. In the Sarir area, based on comparisons with the foraminiferal biozonation, the algal assemblages are dated Lower Tournaisian to Early Middle Visean (V2a). Identificationsare as follows. Chlorophycophyta: *Calcisphaera laevis, Kamaena tenuisepta, Koninckopora inflata, Anthracoporella* sp., *Palaeobresella* cf. *lahuseni, Palaeoberesella* sp., *Atractyliopsis minima, Issinella* sp., *Nanopora* cf. *fragilissima*. Rhodophycophyta: *Epistacheoides nephroformis, Stacheia skimoensis and Fourstonella fusiformis*. The aim of this paper is to investigate the algal assemblages found in the Mobarak Formation, Kiyasar area and discuss their distribution as well as their biostratigraphical significance.

3-D-reconstruction of the microfossil *Halysis* of the Late Ordovician of South China

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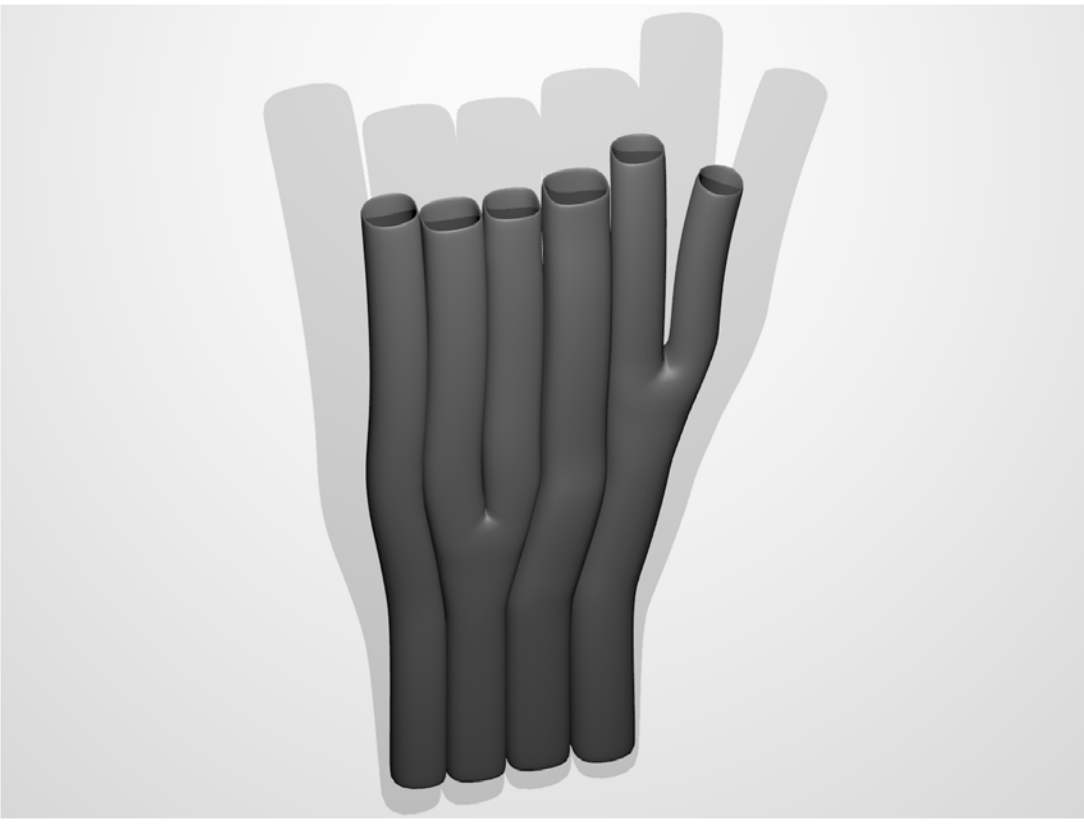
Key words: *calcareous algae, Late Ordovician, 3-D-reconstruction, Halysis, South China*

Halysis is a microfossil known from Ordovician, Silurian and Devonian shallow marine carbonates. Up to now it is only known from thin sections and therefore its 3-dimensional shape and its systematic position are controversial. *Halysis* is described as a chain-like microfossil with a shape of the single “chain links” ranging from circular to rounded rectangular. Because *Halysis* commonly occurs together with calcareous algae, all authors assume *Halysis* to be an alga as well. Interpretations on the anatomy propose a filiform or tubiform shape. Even a unistratose sheet of cells has been discussed. Since *Halysis* is comparatively rare, there is no concluding answer to this question up to now. For the present study more than 50 specimens from a Late Ordovician shallow-water limestone from South China have been investigated in detail, which for the first time offers the opportunity to analyse a great number of sections through *Halysis*. A 3-dimensional computer model of *Halysis* has been constructed in order to set up layers cutting through the model. These simulated sections have been compared to those from *Halysis* in thin sections. The results show, that *Halysis* represents a microfossil with a morphology consisting of parallel juxtaposed, partly branching tubes. A single sheet of cells, which was recently proposed as *Halysis’* shape, can clearly be excluded.



Keynote lecture

Onset of Late Jurassic carbonate platforms in an evolving thrust belt (Neotethyan realm)

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Key words: *carbonate platforms, Northern Calcareous Alps, Neotethyan thrust belt, stratigraphy, facies*

After the formation of the Neotethyan thrust belt, formed in a lower plate position due to the obduction of the accreted Neotethyan ophiolites (Gawlick et al. 2008, Missoni & Gawlick 2011), shallow-water carbonate platforms evolved on top of the rising nappe fronts, but still in a tectonic active geodynamic regime. We present the onset, evolution and the general palaeogeography of these platforms exemplified by the Northern Calcareous Alps (Austria). Similar platforms were formed also in the Western Carpathians, the Dinarides/Albanides/Hellenides, but still with more information needed (Haas et al. 2010).

Tectonic shortening in the Neotethyan realm started in the late Early Jurassic. The onset of ophiolite obduction can be dated as Bajocian/Bathonian. Due to this event, a north-westward propagating thrust belt with different deep-water trench-like basins in front of the nappes evolved on the lower plate. The first cluster of nappe fronts is formed by the accreted ophiolites, the second cluster by the accreted distal shelf area of the lower plate (Hallstatt facies zone). These nappes were formed during Bajocian to Oxfordian times. In a later stage of thrust belt evolution also the more proximal shelf areas (Dachstein and Hauptdolomite facies belts) were incorporated in the nappe stack, mainly in Oxfordian times. Thrusting decreased in Oxfordian times and the timespan latest Oxfordian to Early Tithonian is characterized by a period of relative tectonic quiescence, before around the Early/Late Tithonian boundary again tectonic movements started. From latest Oxfordian onwards the whole area is characterized by the uplift of the nappe fronts (rises) and the onset of independent carbonate platforms on top of them.

In the Northern Calcareous Alps, only the accreted Hallstatt facies zone and the Dachstein and Hauptdolomite nappes are preserved, whereas the ophiolite nappe stack is well preserved in the Dinarides/Albanides/Hellenides. The Kimmeridgian-Tithonian platform on top of the ophiolite nappe stack was eroded rather quickly after its formation (e.g., Kurbnesh Carbonate platform in the Albanides: Schlagintweit et al. 2008), whereas the other platforms are fairly well preserved – Plassen Carbonate Platform sensu lato. On top of the accreted Hallstatt nappes the Lärchberg Carbonate platform as south-easternmost platform starts to establish in ?Late Oxfordian or Early Kimmeridgian times, in a central position the Plassen Carbonate Platform *sensu stricto* starts to form in Late Oxfordian times on top of the Trattberg Rise and in the north-westernmost position the Wolfgangsee Carbonate Platform starts it progradation in Early Kimmeridgian times from the top of the Brunnwinkl Rise. Between these platforms deep-water radiolaritic basins prevailed, e.g. the Sillenkopf Basin between the Lärchberg and the Plassen Carbonate Platforms, the younger part of the Tauglboden Basin between the Plassen and Wolfgangsee Carbonate Platforms and the Rofan Basin northwest of the Wolfgangsee Carbonate Platform (Details in Gawlick et al. 2009). The Sillenkopf and the younger Tauglboden Basin are interpreted as deep-water remnant basin in between the two prograding carbonate platforms. Into the Sillenkopf Basin Late Jurassic shallow-water debris together with exotic clasts (e.g. from the ophiolite nappes) was transported through channels coming from the southeast, mobilized and redeposited since the latest Oxfordian or the Early Kimmeridgian. In contrast, sediment supply into the younger Tauglboden Basin was very low; this basin was shielded by a topographic high in the south-east against carbonate shedding from the Plassen Carbonate Platform. In contrast, the Rofan Basin to the northwest carries a thick succession of resedimented shallow-water carbonates derived from the Wolfgangsee Carbonate Platform.

Deep-water carbonates in the basinal areas as well as shallow-water carbonates of the Plassen Carbonate Platform *sensu lato* (Kimmeridgian to Early Berriasian) formed on top of the rises. This sedimentary cover sealed the Jurassic nappe stack but did not imply far-reaching tectonic quiescence. In the late Early Tithonian the Plassen Carbonate Platform *sensu stricto* degraded in an extensional collapse. This event produced high- and low-angle normal faults and probably also large scale strike-slip movements. The already deeply eroded ramp anticline of the former Trattberg Rise became sealed by the hemipelagic sediments of the Oberalm Formation and the Barmstein Limestone layers at the base and contained therein. In contrast, the south-eastern rim with the Kimmeridgian to Tithonian Lärchberg Carbonate Platform became uplifted around the Jurassic/Cretaceous boundary. Contemporaneously the Wolfgangsee Carbonate Platform in the northwest drowned.

All these platforms provide complete sedimentary successions with slope, reef and lagoonal carbonates. In all facies zones high diverse fossil assemblages are well preserved showing also pronounced differences between different platforms (Schlagintweit, in press). For a detailed systematic description of the floral/faunal content of the Plassen Carbonate Platform *sensu stricto* see Schlagintweit et al. (2005). A detailed description of the different formations in this complex platform-basin pattern is described in Gawlick et al. (2009).

The evolution of the Late Jurassic platforms and basins will be presented during a field trip within the framework of the next meeting in 2013, which will take place in Austria. This field trip will focus on the shallow-water carbonates of the three preserved platforms and their resediments: the Lärchberg, the Plassen, and the Wolfgangsee Carbonate Platform.

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Upper Eocene to Lower Miocene Dasycladales of France

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Key words: *Calcareous algae, Dasycladales, Upper Eocene, Oligocene, Miocene, France*

The richest Cenozoic Dasycladales communities known in France have been discovered in the Middle Eocene sediments (mainly Lutetian and Auversian) of the Paris Basin, Brittany and Normandy (Génot, 1980, 1987, 1989, 2009; Génot & Le Renard, 2011; Morellet & Morellet, 1913, 1917, 1922). In return, few data concern the Dasycladales living in this area during the Upper Eocene. The assemblage recovered in the bioclastic sands of Rauville (Normandy) is particularly interesting because these algae lived at the boundary Eocene-Oligocene. The first study of some species coming from Rauville has been realized by L. and J. Morellet (1939a). The age of the sediments – top of Eocene or lower part of Oligocene - is still debated but seems to be Priabonian: Foraminifers and Ostracods are clearly Eocene and molluscs are Eocene with Oligocene affinities.

Dasycladales are not frequent in these sediments. However, several species may be recognized:

- *Acicularia* cf. *archiaci* appears as fragments of discs composed of gametophores with flat or slightly rounded faces, closely joined side by side;
- *Acicularia marginata* has very elongated and flat isolated gametophores with pronounced emarginate distal ends;
- *Acicularia micropora* has elongated, thick and hollow isolated gametophores with more or less emarginate distal ends;
- *Acicularia* sp., an undetermined species, shows fragments of discs with gametophores separated by thick lamellae widened at their external ends;
- *Neomeris alternans* is preserved as fragments of cylinders or rings characterized by a very large axial cavity, strong ridges and deep furrows on both faces of the rings, and elongate ovoid gametophores;
- *Neomeris larvarioides* is represented by rare fragments of cylinders containing the location of the two orders of laterals and the very large gametophores;
- *Cymopolia elongata*, a classical species of the Cenozoic sediments is also present, with its strong calcification covering the thin primary and secondary laterals and the small rounded gametophores;
- *Cymopolia* sp., probably a new species, is characterized by short primary laterals bearing very large spherical gametophores and a little number of secondary laterals. The widening of the distal ends of the secondary laterals is particularly important in this species.

This assemblage of Dasycladales is the richest Priabonian one known in France.

Stampian Dasycladales have been collected in calcareous sands from the areas of Etampes (Paris Basin) and Gaas (Aquitain Basin) (Morellet & Morellet, 1913, 1922; Génot, 1987). Some species are the same as those previously described: *Acicularia archiaci*, *A.micropora* and *Cymopolia elongata. Clypeina marginiporella,* a small species with funnel-shaped articles, appeared during the Eocene, is present in

Stampian sediments. The only species that seems to be typical of the Stampian is *Neomeris courtyi* looking as cylinders with a very large axial cavity and a calcareous wall containing ovoid gametophores and regularly arranged secondary laterals (the main stem and the primary laterals are never preserved).

Lastly, only four species have been recovered in the Lower Miocene sediments of France, in the Aquitanian calcareous sands of Gironde (Aquitain Basin): *Cymopolia elongata, C. rarifistulosa* and two undetermined species of *Acicularia* and *Neomeris* (Morellet & Morellet, 1939b). Main features of *C. rarifistulosa* are now known thanks to new specimens recently discovered: each article contains few whorls composed of short primary laterals bearing several fine secondary laterals and spherical gametophores.

Even if the inventory of the algal flora is not ended and if the development of the Dasycladales mainly depends on the parameters of the local environments, the decreasing number of Dasycladales from the Upper Eocene probably reflects the progressive cooling of the oceanic waters during Cenozoic.

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Facies characterization and palaeoenvironmental significance of reef-forming coralline algae dominated sediments: A case study from the Guitar Formation (Middle Pliocene) of Car Nicobar Island, India

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Key words: *Facies, Palaeoenvironment, Coralline Algae, Middle Pliocene, Car Nicobar, India*

The facies and palaeoenvironment of Middle Pliocene carbonate sediments of the Guitar Formation from the Kakana Cliff Section in Car Nicobar Island have been investigated in the present study. In the history of earth's evolution Neogene period has been one of the most significant periods in this part of the world. During this period, the Tethys Sea completely emanated with the uplift of Himalayas and evolution of vast Bengal Deep Sea Fan in the eastern part of India. Neogene succession of Andaman and Nicobar Islands has great importance because of their strategic position in the Northern Indian Ocean where only a few good Neogene marine sequences exist in isolated outcrops.

Car Nicobar is the northernmost island of the Nicobar group of islands and is largely a flat island with low relief. Principle rock types found in this island lack too much diversity and consist of mudstones and limestones only. Three lithostratigraphic units (formations) viz., Sawai Bay Formation (Srinivasan & Azmi, 1976), Guitar Formation (Srinivasan & Azmi, 1976) and Malacca Limestone Formation (Srinivasan & Sharma, 1973) are developed in the Car Nicobar Island. The middle one i.e., Guitar Formation conformably overlies the Sawai Bay unit and consists of arenaceous and chalky limestone along with occasional presence of molluscan shell fragments.

Conventional thin-section analysis of the carbonates reveals that these sediments are largely dominated by both geniculate and non-geniculate coralline algae. Multivariate biostatistical techniques have been used for the identification of the corallines (Rasser & Piller, 1999).

The analysis indicates that the studied facies are mainly dominated by wackestone-packstones while rudstones and grainstones are moderately represented. Wackestones gradually grading into packstones is the major lithofacies type.

Coralline red algae are the dominating biogenic components of the carbonates with small and large benthic foraminifera along with some echinoid spines and bivalve shells acting as the subordinate constituents. Based on our study, 3 types of carbonate facies have been distinguished i.e., nummulitic, foraminiferal - coralline algal and coralline algal facies.

The algal assemblage of the Middle Pliocene succession implies a shallow bathyal level of approximately 40 meters with prevalence of moderate energy conditions.

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Palaeodiversity of fossil algae and benthic foraminifera with special allusion to taphonomy and growth-form analyses of coralline algae from the Late Middle Miocene Sediments of Long Formation, Little Andaman Island (Hut Bay), India

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Key words: *Palaeodiversity, Taphonomy, Growth-form, Coralline algae, Late Middle Miocene, Little Andaman, Hut Bay, India*

Palaeodiversity depends on taxonomic identification applying preserved diagnostic characters relevant to palaeontological and botanical systematics. Growth-form determination in thin-section analysis is influenced by orientation and sectioning effects. Coralline algal taphonomy is highly dependent on the initial growth-form and the specific environment in which they are found (Nebelsick & Bassi, 2000). Some taphonomic processes like encrustation are positive in their effect while others like fragmentation and abrasion are certainly detrimental to the preservation and recognition of vegetative and growth-form features.

Various phenomena e.g., fragmentation, abrasion, encrustation and diagenesis etc. have been encountered in the present work dealing with taphonomical studies of coralline algae from the Late Middle Miocene sediments of Little Andaman Island (Hut Bay), India.

Differences in growth-form have been widely applied to delimit and identify genera, species and infraspecific taxa of various coralline algae (Woelkerling et al. 1993). The present analysis marks the presence of six growth-forms i.e., warty, unconsolidated, encrusting, lumpy, ribbon-like and arboresecent that represents quite a wide array of shapes characterizing the concerned taxa.

Palaeodiversity of the algal forms and benthic foraminifera has been extensively studied from the Late Middle Miocene sediments outcropping in the Little Andaman Island (Hut Bay) of the Andaman Group of islands. The Little Andaman Island is the southern-most island of the Andaman, lying between South Andaman and Car Nicobar islands. The algae and foraminifera described here have been recovered (studied by thin-section analysis) from the hard, creamish white, fossiliferous limestone samples belonging to the Long Formation from the Hut Bay Limestone Quarry. A total of nine coralline algal genera (three geniculate and six non-geniculate) along with fourteen different forms of benthic foraminifera have been reported.

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Tersella incompleta, new finds from the type-area

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Key words: *Dasycladales, Lowe Jurassic, Vendée, France*

In 1951, Mireille Ters, maiden name Fouyé, publishes a short paper based on the notes of the late Jean Morellet. While studying the rich Gastropod associations of the Liassic in Vendée, the second author (MC) collected a number of new specimens that allowed us to make new observations. In addition the material collected by Mme Ters was located in the former Collection of the École des Mines de Paris, currently hosted by the Université Claude Bernard Lyon 1.

New Solenoporaceae (Rhodophyta) from the middle Cretaceous of Brazil

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Key words: *Red calcareous algae, Solenoporacae, taxonomy, new taxa, Cretaceous, Brazil*

The current taxonomic knowledge of the Solenoporaceae requires a major revision. The re-study of the type-material of species ascribed to the genera *Solenopora*, *Parasolenopora*, *Pseudosolenopora*, and *Parachaetetes* reveals a number of erroneous generic ascriptions as well as a number of synonyms. However this ongoing revision is beyond the scope of the present study for the new forms have discrete features that make them easy to identify and sort from those described to date.

Dasycladalean calcareous algae in the Upper Jurasic- Lower Cretaceous limesone deposits from Calatea (Padurea Craiului, Apuseni Mountains, Romania)

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Key words: *Calcareous algae, dasycladales, Upper Jurassic-Lower Creaceous, Apuseni Mountains, Romania*

The area under study is located in the North Western part of Padurea Craiului between the localities Fâşca and Gălăşeni.

The Upper Jurassic-Lower Cretaceous deposits from Pădurea Craiului were separated into the following lithostratigraphical units (according to Bucur & Cociuba, 2001): (1) Vad Formation, (2) Cornet Formation, (3) Astileu Formation and (4) Albioara Formation (for the Upper Jurassic), and (1) Blid Formation, (2) Ecleja Formation, (3) Valea Măgurii Formation, (4) Vârciorog Formation (for the Lower Cretaceous).

We studied two sections of Upper Jurassic-Lower Cretaceous limestones from Şerbota hill and Ciuras hill in the proximity of Câlățea locality.

In the Ciuras hill section the outcrop shows the terminal part of the Cornet Formation (Upper Jurassic), and the lower part of the Blid Formation (Lower Cretaceous). The microfacies of the limestones from the Ciuras hill are represent by peloidal intraclastic grainstone, and fenestral wackstone-packstone.

The dasycladalean algae assemblage is represented by: *Salpingoporella pygmaea* GUMBEL, *Salpingoporella annulata* CAROZI, , *Neoteutloporella* sp., and *Cylindroporella eliptica* BAKALOVA. The foraminiferal association consists of: *Andersenolina alpina* (LEUPOLD), *Trocholina* sp., *Charentia evoluta* (GORBATCHIK), *Vercorsella* sp. and *Paracoskinolina jourdanensis* FOURY & MOULLADE.

The microfacies of the Lower Creatceous limestones from the Serbota hill section are represented by fenestral mudstone-wackestone, bioclastic fenestral wackestone-packestone, peloidal bioclastic grainstone, and oncoidic fenestral grainstone with fenestral structures (keystone-vugs).

The dasycladalean assemblage identified in this section is represented by: *Salpingoporella muehlbergii* (LORENZ), *Salpingoporella melitae* RADOIČIĆ, *Salpingoporella hispanica* CONRAD & GRABNER, *Salpingoporella genevensis* (CONRAD) *Suppiluliumaella* sp., *Neomeris* sp., *Clypeina* sp., *Clypeina solkani* CONRAD & RADOICIC. The foraminiferal assemblage accompanying the algae from the Serbota hill consists of:: *Orbitolinopsis* sp., *Vercorsella scarsellai* (DE CASTRO), *Debarina hahounerensis* FOURCADE, RAOULT & VILA, *Glomospira urgoniana* ARNAUD-VANNEAU, *Paracoskinolina*? *jourdanensis* FOURY & MOULLADE, *Nautiloculina broennimanni* ARNAUD-VANNEAU & PEYBERNES, *Vercorsella* sp and *Pfenderina globosa* FOURY.

The studied carbonate deposits are characteristic for carbonate platform facies,. The depositional facies of the Upper Jurassic limestones were mainly characteristic for the external carbonate environment, while during the Lower Createaceous the facies are characteristic for the shallow water, internal platform.

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Iranella inopinata Gollestaneh 1965 ex. Hosseini & Conrad, n. comb. A puzzling dasycladalean alga from the Lower Cretaceous formations of the Zagros fold- thrust belt, SW Iran

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Key-words: Iranella, Dasycladalean algae, Lower Cretaceous, Zagros fold-thrust belt, Iran

Abstract

*Iranella inopinata g*en. and sp. nov. was first described by A. Gollestaneh in its unpublished thesis dated 1965, as an "incertae sedis" from the Lower Cretaceous formations of the Zagros fold-thrust belt. More recently, the taxon was formally, although provisionally described by Hosseini & Conrad (2008) as a dasycladalean alga named *Salpingoporella* ? *inopinata*. Here, based on the new interpretation of quite abundant although scattered debris, it is assigned to *Iranella*, a stalked, capitulum-shaped new genus of Dasycladales. The lower, stalked part of the thallus is cylindrical, strongly calcified, with first order phloiophorous laterals. The capitulum is only partly calcified, hypothetically with a single order of club-shaped to spherical laterals.
Iranella inopinata looks like to be endemic to the southwestern part of the Tethyan realm, in the Zagros area and, also, south of the Persian Gulf. In the Zagros, it extends from the Berriasian to the Aptian, with an Acme zone in the Valanginian.
Sequential interpretation proves the presence of this species in the late transgressive and early highstand stages of system tracts and reveals a low energy lagoonal (open lagoon) and back-reef depositional environment in an inner platform setting.

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Function of epithallial cells of nongeniculate coralline algae unraveled by time-series observations on thallus reconstruction of *Lithophyllum pallescens* (Foslie) Foslie

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Key words: *Nongeniculate coralline algae, Lithophyllum pallescens, thallus reconstruction, epithallial cell, meristem.*

Reconstruction of nongeniculate coralline algal thalli was investigated. Horizontal and vertical scars were artificially given on the branch tips of *Lithophyllum pallescens* (Foslie) growing as up to boulder-sized nodules in Kabira Cove, Ishigaki-jima, Ryukyu Islands. Time-series observations on the course of the recovery of scars have revealed followings.

(1) When the horizontal scars were given, in most cases, those cells located several-cell-layers beneath the broken cells became meristem cells that produced new epithallial cells outwardly and vegetative cells inwardly. Then the dead cells above the new epithallial cells were sloughed off. New tissues were rarely generated from undamaged parts encircling the scars ; the scars were recovered by subsequent lateral growths of the new tissues.

(2) In the case of the reconstruction of vertical scars, new cells were formed at the edges. sides, and bottoms of scars. Newly-formed tissues are dimerous at the edges and sides, while those at the bottoms are monomerous or dimerous.

These results demonstrate that coralline algal thalli possess excellent capability of recovering scars by herbivores and that epithallial cells play positive role for sloughing off dead parts of coralline algal thallus, although they have been regarded as those cells terminating filaments or having a function for removing hannful objects such as other algal spores by sloughing .

Differentiation of microbolites in the Oxfordian carbonate buildups from the southern part of the Kraków Upland (southern Poland)

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Key words: *microbolites, sedimentary environment, Upper Jurassic, Oxfordian, Kraków Upland, Poland*

The Oxfordian carbonate buildups from the southern part of the Kraków Upland (southern Poland) were formed on shelf, which separated a carbonate platform from the Tethys Ocean. The buildups, whose main components are microbolites, show differentiated initial structure, size and development of microbolites. In terms of internal structure, the buildups can be subdivided into: low relief carbonate mud mounds, segment reefs, spaced cluster reefs, filled frame reefs, open frame reefs, and agglutinated microbial reefs. The size of carbonate buildups ranges from several to several tens of metres in diameter.

Leiolites occur in all types of carbonate buildups. Common are also thrombolites, which are absent from low relief carbonate mud mounds and open frame reefs only, as well as stromatolites, which do not occur in low relief carbonate mud mounds, but are present in all other types of buildups. Analysis of heavy rare earth elements present in all types of microbolites indicate that they were formed in well-oxygenated sea water comparable, as far as alkalinity is concerned (pH≤8.2), to the recent one.

It seems likely that differentiated development of microbolites depended on the content of fine-grained nutrient suspension and the energy of sedimentary environment. The main components of leiolites were semi-lithified micropeloids derived from soft-tissue calcification of siliceous sponges (sponge „container automicrites"; after Reitner et al., 1995), which, due to early-diagenetic mechanical compaction, turned into microbial envelopes. In a low-energetic environment invulnerable to compaction, columnar thrombolites forming microrelief on the sea bottom developed. In a higher-energetic environment, thrombolites were replaced by stratiform stromatolites. Significant differentiation in the development of microbolites in carbonate buildups of similar age (Middle to Upper Oxfordian) and situated in a relatively small area indicate that their development was controlled by local sedimentary conditions.

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Spheroidal, nanobacteria-like objects as possible sample etching artifacts

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Key words**:** *nanobacteria, spheroidal structures, artifacts, SEM, Jurassic, Cretaceous.*

There is the debate about nanometer-scale (50–200 nm) objects which have been hypothesized by Folk (1993, and further papers – see references in Kirkland *et al*., 1999; Pacton *et al*., 2010) as fossilized microbes (nanobacteria or nannobacteria). Alternative explanations of these structures include products of bacterial degradation of organic matter, nucleation of calcium carbonate on microbial cell, result of the early stage of nucleation within the EPS or artifacts related to sample preparation (Kirkland *et al*., 1999; Pacton *et al*., 2010, and references therein).

Our observations on the scanning electron microscope (Hitachi S-4700) of Upper Jurassic (Oxfordian, Tithonian) and Lower Cretaceous (Barremian) limestones revealed spectacular nano-scale objects (Fig. 1), resembling nanobacteria illustrated by Folk (1993). We examined samples pieces and mostly polished thin sections etched for ca. 1 min in diluted HCl, and coated by carbon. We used the same acid, to our knowledge 3 % HCL solution, for samples preparation for four SEM sessions in the period of four months. The observed objects were abundant, regular spheroids, 100–400 nm (0.1–0.4 μm) in diameter, rarely smaller or larger, commonly in clusters. EDS analyses indicated that Ca was the main component of spheroids. Some of these structures were found in limestones which origin is related to microbial mediation (sponge-microbial and coral-rudist-microbial boundstones). However they were recognized also in Oxfordian peloidal limestones (in central parts of peloids), glauconitic marls and soft, grey marls. Because acid etching can produce rounded nanometer-scale objects we performed experiments using different solution of HCl (1 to 5 %) and different time of etching (30 sec to 2 min). Surprisingly, these objects were not observed again, although were still recognized in these parts of the thin sections which were etched in the previous solution of HCl. Possible explanation is that the strength of HCl solution was different during the first experiments.

Acid etching can accentuate existing nano-scale objects (Folk, 1993; Kirkland *et al*., 1999). However, although microbial contribution to formation of some of the studied limestones is known or probably (peloids), we suppose that the nano-scale structures in our material were rather artifacts related to etching. It is worth to underline, that in contrast to artifacts observed by Kirkland *et al.* (1999) the objects recognized in our samples were much more regular and rounded. Moreover, they occurred not only on the surfaces of large crystals, but also along the edges of the calcite crystals and within micritic matrix. Our observations confirm that caution must be taken when nanometer-scale objects observed in SEM are interpreted as fossilized microbes, particularly when microbial genesis of analysed rocks is known based on other evidences. Further experiments using HCl with different strength and duration of etching are required to confirm that etching was a factor producing nano-scale objects in the material studied.

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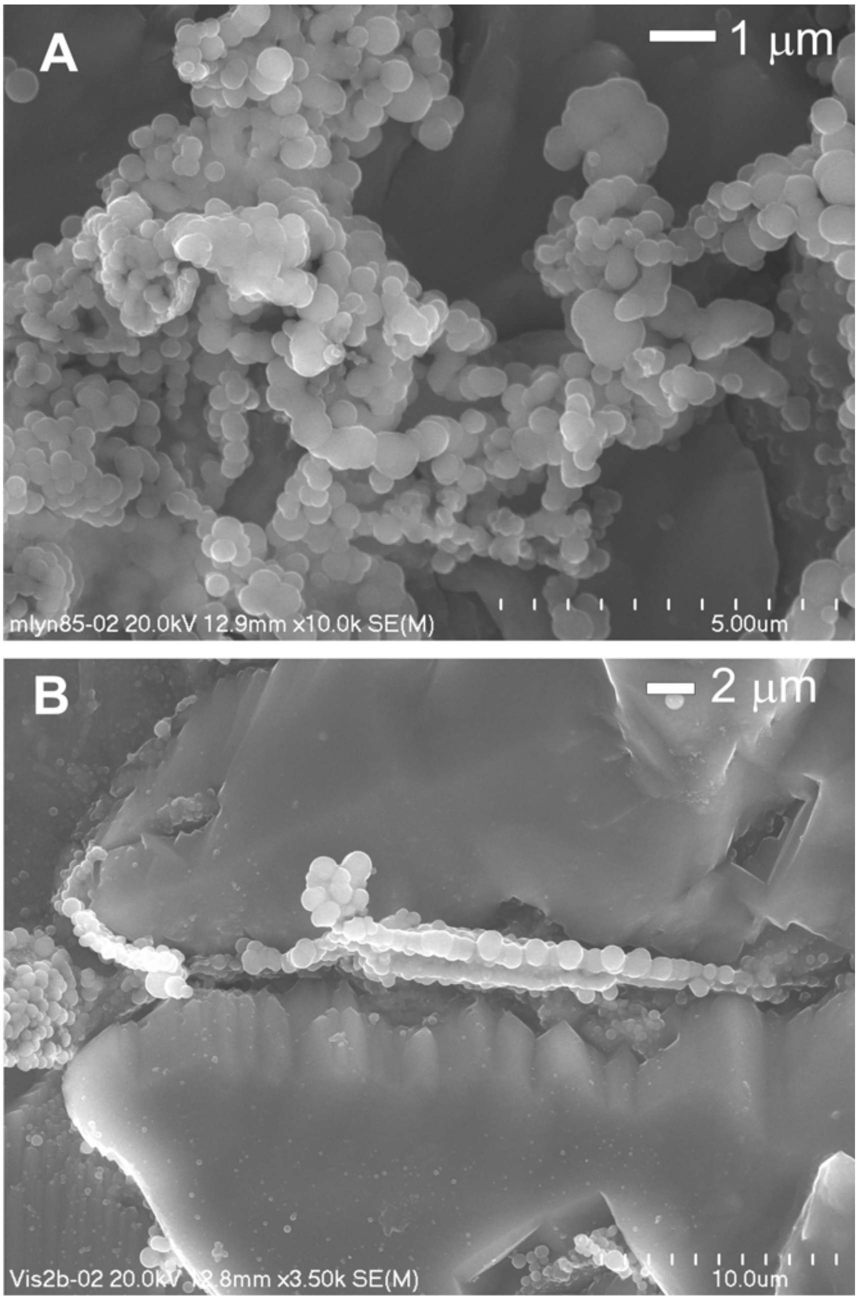

Fig. 1. Nano-scale spheroidal objects in middle Oxfordian peloidal limestones, Młynka near Kraków, Poland (A), and in upper Barremian coral-rudist-microbial biostromes, Vishovgrad, near Veliko Tarnovo, Bulgaria (B). On B spheroids along the edges of the calcite crystals are larger, even 1 μm. Much smaller ones occur on the crystal surface (lower part of the picture).

Freshwater stromatolites and large oncoids from Elovdol locality at Kraishte, SW Bulgaria (Late Cretaceous?, Palaeogene?)

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Key words: *Continental microbialites, Late Cretaceous?, Palaeogene?, Bulgaria*

The Strouma unit in Kraishte (SW Bulgaria) is a narrow, complex Alpine structure located at the junction of Balkanides, Serbo-Macedonian and Rhodope massives (Zagorchev, 2001). In the locality Elovdol (ca. 40 km WSW of Sofia) Triassic limestones are unconformably overlain by coarse-grained conglomerates of possible fluvial origin and an uncertain age.

Conglomerates contain brownish stromatolites and large oncoids. Isolated bodies of planar or dome-shaped stromatolites attain 20 cm in thickness. Oncoids display a variety of morphologies and size. Longest axis in cylindrical oncoids can be over a dozen centimeters. This type of oncoids is a result of encrustation around wood branches (Fig. 1A). The wood nuclei has been dissolved and filled by reddish sediments (including small or fragmented oncoids) and/or sparry calcite (Fig. 1B). Smaller oncoids were developed around phytoclasts or clasts of Triassic? carbonates. Stromatolites and oncoids show similar basic internal laminar fabric which consists of alternation of fenestral and more denser laminae. The porous laminae are commonly composed by microcolumnar structures. Erect filaments are well visible in some places. Both dense as well as some microcolumnar structures may show a very thin internal microlamination. The space between microcolumnar structures is filled by sparry calcite, and in the outermost part also by quartz grains.

Analogous oncoids and stromatolites are common within fluvio-lacustrine Palaeogene deposits, particularly in foreland basins, for example in Spain, France, Germany (Freyet & Plaziat, 1982; Zamarreno *et al*., 1997, and references therein), and recently were described from Poland (Gradziński *et al*., 2006). Similar deposits are also known from Campanian–Maastrichtian of France and Spain (Freyet & Plaziat, 1982; Mäcker, 1997). Microstructures and gross morphology of the latest Cretaceous and Palaeogene continental microbialites show much more similarities with Neogene examples than with less known older ones.

Intercalations of non-marine oncoidal limestones and stromatolites of Late Campanian age (Priabonian–Oligocene according to older data) are known (but not studied yet) from the lower part of mixed siliciclastic-marly deposits of the Shabanitsa Formation, in localities ca. 25 km SES of Elovdol (Ivanov *et al*., 2007). On this stage of our studies we consider Late Cretaceous (Campanian?) or Palaeogene as possible age of the analysed conglomerates bearing oncoids and stromatolites.

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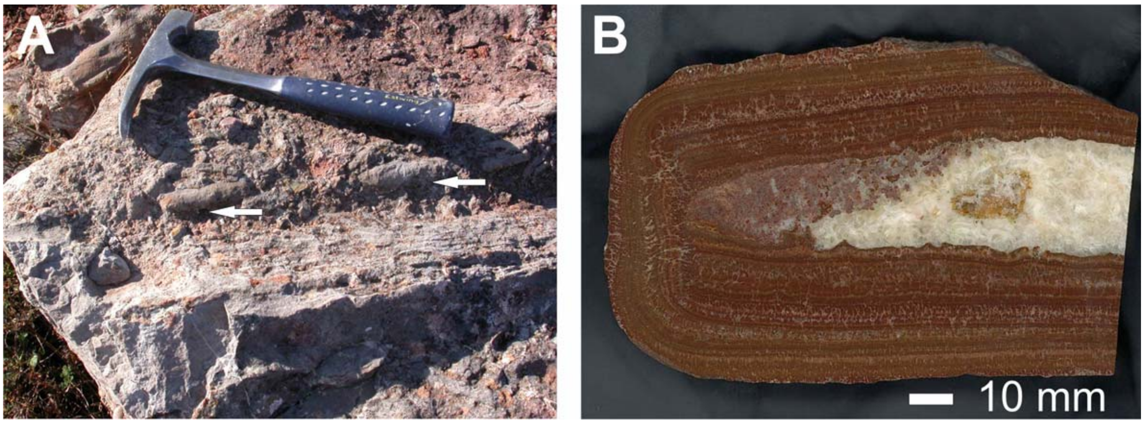

Fig. 1. **A.** Wood branch with cyanobacterial encrustations (arrows). **B.** Fragment of elongated oncoid. The wood nuclei has been dissolved and filled by sediment and sparitic calcite cement.

Uppermost Jurassic–Lower Cretaceous exotic limestones with algae from the Silesian Nappe, Polish Outer Carpathians (Żegocina, Olszyny and Lanckorona area)

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Key words: *exotic limestones, algae, microfossils, Uppermost Jurassic, Lower Cretaceous, Grodziszcze Beds, Silesian Nappe, Outer Carpathians, Poland.*

In the Polish Outer Carpathian, the Upper Jurassic–Lower Cretaceous limestones occur in the form of klippes (e.g. Andrychów Klippen), boulders and pebbles. These exotic rocks, being the subject matter of our studies, are located among the deposits of younger age, belonging to various formations. The limestones were formed both in deep-water and shallow-water conditions (Tithonian-Berriasian are known as the Štramberk-type limestones, see Bucur *et al.,* 2005).

The studied rocks were collected in three localities situated within the Silesian Nappe of the Polish Outer Carpathians, from deposits of Lower Cretaceous age (Hauterivian – Aptian).

The first location is Żegocina, situated in place where the Grodziszcze Beds, belonging to the Silesian Nappe, crop out in the old quarry. The Grodziszcze Beds, investigated in this area, are partially developed as pebbly mudstone containing pebbles of exotic rocks such as limestones, shales, coals and crystalline rocks. In some of the exotic limestones of shallow-water origin the Dasycladalean green algae were observed, and these can be classified as microbial–bioclastic, intraclastic–bioclastic or peloidal-bioclastic grainstone or packstone. The algae occur rarely and are represented in majority by fragments difficult to assign. Species such as *Salpingoporella annulata, Salpingoporella* cf. *pygmaea*, *Actinoporella podolica* and *Clypeina* sp. were identified. The exotic limestones with algae are of the Uppermost Jurassic – the Lowest Cretaceous (predominantly Tithonian) age. The most significant associated fossils are: *Andersenolina alpina, Haghimashella arculata, Mohlerina basiliensis, Protomarssonella kummi, Protopeneroplis ultragranulata, Scythiloculina confusa, Siphovalvulina variabilis, Neotrocholina conica, Neotrocholina molesta, Uvigerinammina uvigeriniformis*, *Crassicolaria brevis.* In addition, Porostromata calcimicrobes, *Solenopora* sp., *Lithocodium aggregatum, Crescentiella morronensis, Muranella sphaerica, Terebella lapilloides* and numerous fragments of benthic macrofossils were found.

Exotic limestones with algae, collected from the second location- Olszyny, were also situated among the Grodziszcze Beds. In this area, deposits belonging to the Grodziszcze Beds, consist in majority of sandstones and shales, but layers with sandstones and conglomerates also occur. The samples were collected from some exotic pebbles and from one bigger exotic boulder (1m in diameter). Algae were recognized in the intracastic–bioclastic and peloidal-bioclastic grainstones (of Tithonian age) and they were represented by: *Actinoporella podolica*, *Griphoporella jurassica* and some small fragments of dasycladalean green algae. Other important associated fossils: *Andersenolina perconigi, Belorusiella taurica, Decussoloculina mirceai, Mayncina bulgarica, Protopeneroplis striata, Dobrogellina ovidi,* *Nautiloculina oolithica, Pseudocyclammina lituus, Quinqueloculina podlubiensis, Quinqueloculina verbizhiensis, Rumanoloculina miczurini, Scythiloculina confusa, Comittosphaera sublapidosa, Colomisphaera lapidosa, Colomisphaera carpathica* as well as *Crescentiella morronensis*, *Terebella lapilloides* and fragments of benthic macrofossils.

The last described samples originate from conglomeratic boulder with exotic pebbles found in Lanckorona, third location, in a transition zone between the Grodziszcze Beds and the Verovice Beds. In thin section the Beriassian calpionellid limestone bordered on echinoderm packstone and sandy bioclastic–lithoclastic grainstone with relatively numerous fragments of corallinacean red algae *Sporolithon rude* were observed. The assignment of the age of grainstone, on the basis of foraminifera assemblages, more precise than the Lower Cretaceous age, was impossible to achieve, whereas the occurence of *Sporolithon rude* gave evidence for the age not older than the Lower Hauterivian (Tomás *et all.,* 2007).

Furthermore, in the samples from all localities, especially in these collected from pelagic limestones, planktonic green algae *Globochaete* sp. and sporadically *Globochaete alpina* were identified.

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Record of Coralline Algae from Bassein Formation (Middle to Late Eocene), Bombay Offshore Basin, India: Implication on Paleoenvironment

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Key words*:Coralline algae, Bassein Formation, Paleoenvironment,Bombay Offshore Basin, India*

The Bombay Offshore Basin is a pericrtonic basin which covered an area near about 1,20,200 sq km and is located on the continental shelf of Western India. Zutshi et al. (1993) have lithostratigraphically classified the sediments of the Bombay Offshore Basin into nineteen formations ranging in age from Late Paleocene to Recent.

Kundal et al. (2005) documented six coralline algal species from the Alibag Formation of the Bombay Offshore Basin. Futher Kundal et al. (2007) recorded seven coralline algal species from the Bombay Foramtion of this basin.

The present paper documnets 5 non geniculate coralline algal species, viz. *Lithoporella melobesioides, l. minus, lithothomanion sp., Sporolithon sp.1, Sporolithon*

Sp. 2, and 3 geniculate coralline algal species, viz. *Arthrocardia sp., Corallina sp., Jania sp.* from the Bassein Formation (Middle to Late Eocene) of Bombay Offshore Basin, India. The algal assemblage points that the core samples representing Bassein Formation were deposited in low to moderate energy, clear and calm tropical water condition at depth of 40- 50m.

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Lower Cretaceous deposits from Vârciorog-Dobreşti area (Pădurea Craiului Mountains). Microfacies and calcareous algae

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Key words: Lower Cretaceous, calcareous algae, carbonate microfacies, Pădurea Craiului Mountains

The area under study is located in the northwestern part of Pădurea Craiului Mountains, (Northern Apuseni Mountains).

The studied deposits belong to the so called "Bihor Autochtonous Domain". The Mesozoic succession in Pădurea Craiului Mountains includes Triassic, Jurassic and Cretaceous deposits. They were studied by many geologists including: Bordea & Istocescu (1970), Patrulius (in Ianovici et al., 1976), Patrulius et al. (1982), Dragastan et al. (1988), Bucur & Cociuba (1996), Cociuba (1999, 2000), Bucur (2000), Bucur & Cociuba (2001), Avram et al. (2001). There are different opinions, among these authors, related to the Lower Cretaceous succession. We adopt here the opinion on the Lower Cretaceous succession, as defined by Cociuba (1999, 2000), Bucur (2000), Bucur & Cociuba (2001). This succession consists of the following stratigraphic terms: (1) Blid Formation (?Berriasian–Valanginian–Barremian) with two members: Dobreşti Member (?Berriasian–Valanginian–Hauterivian) and Coposeni Member (Barremian); (2) Ecleja Formation (Lower Aptian), consisting of marls including two members of different lithologies: Gugu Breccia Member (Basal Aptian) and Valea Bobdei Limestone Member (Lower Bedoulian); (3) Valea Măgurii Limestone Formation (Upper Bedoulian) and (4) Vârciorog Formation (Upper Aptian (Gargasian)–Albian).

In Vârciorog-Dobreşti area the Valea Măgurii Formation and the Vârciorog Formation have been studied. Valea Măgurii Formation is entirely calcareous and crop out on Todii Valley, Copilului Valley, Râului Valley, Urzicarilor Valley, and Măgurii Valley. Tthe identified carbonate microfacies types are mainly represented by bioclastic oncoidic wackestone, bioclastic oncoidic peloidal wackestone/packstone, and oncoidic peloidal packstone/wackestone. Subordinately, other facies types have been recognized: mudstone with bioclasts, fenestral mudstone with bioclasts, bioclastic oncoidic bioturbated wackestone, bioclastic fenestral and bioturbated wackestone/packstone, bioclastic oncoidic bioturbated packstone/wackestone, bioclastic oncoidic peloidal packstone/grainstone, oncoidic peloidal intraclastic wackestone/packstone and extraclastic grainstone/packstone with angular clasts. These deposits formed in areas belonging to the subtidal depositional environment: subtidal with law, or high hydrodynamics, or restrictive subtidal („lagoon-type"). The intertidal environment was also identified (by the presence of fenestral structures), as well as the supratidal environment with hardground-type surfaces, near the Valea Măgurii quarry.

The micropaleontologic assemblage is represented by large and small benthic foraminifera, green algae (dasycladaleans), cyanobacteria, fragments of rudists, corals, sponges, echinoid fragments. Among the foraminifera, the following species have been identified: *Orbitolinopsis* sp., *Orbitolinopsis buccifer* ARNAUD VANNEAU & THIELOY*, Paracoskinolina maynci* (CHEVALIER), *Palorbitolina lenticularis* (BLUMENBACH), *Vercorsella scarsellai* (DE CASTRO)*, Charentia cuvillieri* (NEUMANN)*, Sabaudia minuta* (HENSON), *Debarina hahounerensis* FOURCADE, RAOULT & VILA*, Mayncina bulgarica* PEYBERNES, *Nautilocullina cretacea* PEYBERNES, *Vercorsella* sp., and *Dobrogelina* sp., *Nezzazatinella* sp., *Novalesia producta* (MAGNIEZ), *Glomospira urgoniana* ARNAUD-VANNEAU, *Bolivinopsis* sp., *Paracoskinolina* sp., *Paleodictyoconus cuvillieri* FOURY. The green dasycladalean algae are represented by: *Salpingoporella* sp., *Salpingoporella popgrigorei* BUCUR, *Salpingoporella heraldica* SOKAČ, *Salpingoporella muehlbergii* (LORENZ), *Salpingoporella melitae* RADOIČIĆ, *Salpingoporella* gr. *muehlbergii–melitae,* and ?*Clypeina* sp.

The Vârciorog Formation is mainly terrigenous, and consists of alternating siliciclastic deposits (composed of shales, sandstones and conglomerates) and carbonate deposits (marly-limestones, and bioconstructed and bioaccumulated limestones). The siliciclastic deposits have a flysh-like character (turbidites). Within the marls, fragments of gastropods, rudists, echinoderms, bryozoans, corals and benthic foraminifera (probably reworked from the carbonate platform) have been identified.

The bioaccumulated and bioconstructed limestones (bioconstructions with rudists and corals) are located in the middle and upper part of the succession and they develop on the top of siliciclastic deposits. Within bioconstructions, the internal sediment is represented by either bioclastic mudstone/wackestone, or clayey siltstone with fragments of corals, rudists and orbitolinids. The bioaccumulated limestones display various microfacies types, from mudstone and wackestone, to grainstone with orbitolinids, encrusting organisms and rudists, but also with terrigenous detrital material. The micropaleontological association identified within the carbonate rocks consists of: *Mesorbitolina texana* (ROEMER), *Sabaudia minuta* (HOFKER), *Charentia cuvillieri* NEUMANN, *Charentia nana* ARNAUD-VANNEAU, *Mayncina bulgarica* PEYBERNES, *Meandrospira* sp., *Bolivinopsis* sp., *Vercorsella* sp., *Everticyclammina* sp., *Nezzazatinella* sp., *Debarina* sp., *Dobrogelina* sp., *Arenobulimina* sp., *Carpathoporella occidentalis* DRAGASTAN, *Neomeris* sp., *Boueina hochstetteri* (TOULA), *Permocalculus* sp., *Sporolithon rude* (LEMOINE), *Polystrata alba* (PFENDER), *Marinella lugeoni* (PFENDER), "*Solenopora* " sp., *Bacinella irregularis* RADOICIC, *Lithocodium aggregatum* ELLIOTT, rivulariacean-type cyanobacteria, and *Carpathocancer* sp. The association (especially *Mesorbitolina texana*) indicates the Upper Aptian–Albian time interval.

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Stromatolites from the Middle Jurassic condensed horizon and hardgrounds of Southeastern Carpathians, Romania

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Key words: *stromatolites, Frutexites, hardgrounds, Middle Jurassic, Southeastern Carpathians, Romania.*

Ferroan crusts and macro-oncoids within the Middle Jurassic succession that crop out in the Southeastern Carpathians are represented by distinctive and various structures: stromatolites, cortex of the macro-oncoids, ooids, coatings, infillings with endolithic microorganisms and *Frutexites*-like structures. All these structures are located on the top or toward the upper part of a heterochronous condensed horizons corresponding to Lower Bathonian or to Lower Bathonian - Lower Callovian intervals (according to Patrulius, 1969). We investigated five stratigraphic sections from the Bucegi Mountains (Gaura Valley, Grohotişu Peak, Strunga Pass, Tătarului Gorges) and Dambovicoara Basin (Purcăretelui Valley). The Jurassic sections from the studied areas are represented by mixed siliclastic-carbonate sequences developed within Bajocian – Tithonian interval and belong to the sedimentary cover of the Getic Nappe, one of the geotectonic units of the Median Dacides (according to Săndulescu, 1984). The presence of the Fe oxyhydroxide crusts and hardgrounds within the Middle Jurassic succession that crop out in the Bucegi Mountains and Dambovicioara Basin has been outlined by numerous previous authors. However, this is one of the first detailed studies concerning the textural and compositional features of these ferroan structures. The main microfacies present in the studied succesions are: bioclastic grainstone/packstone, ooidal grainstone, bioturbated wackestone/packstone and stromatolitic bindstone. Stromatolites and the cortex of macro-oncoids are constituted by microbial laminae with domal and columnar or planar morphologies characterized by dark micritic layers rich in organic content alternating with spary calcite layers. The thickness of the stromatolitic crusts range from 0,5 to 3 cm. The microbial laminae show planar or arborescent or dendrolitic morphologies. The arborescent to dendrolitic micro-structures are very similar to *Frutexites arboriformis* MASLOV, 1960. Petrographical microscopy study and scanning electron microscopes (SEM) reveal that the stromatolites are formed by microbial mats dominated by bacterial and possibly fungal filaments. Several types of ferruginous microbial filaments and microorganisms of different sizes and shapes were recognized in almost all the ferruginous coatings, microstromatolites and cavities. The mineralogical composition of hardground stromatolitic crusts shows that the dominant minerals are goethite, hematite and calcite with subordinate amounts of phosphate. The chemical composition of the crusts is mainly dominated by Fe_2O_3, CaO and SiO_2 with low amounts of Mg, Al, P and Mn. Mineralogy was determined through a combination of standard petrographic techniques and X-Ray fluorescence analysis (XRF) using a Horiba XGT 7000 device for major elements, and X-ray diffraction data were obtained from powders using a Philips (microXRD) diffractometer. The studied microbial ferruginous structures are accretionary synsedimentary stromatolites or hardground crusts related to a condensed horizon generated in subtidal environments with low energy bellow wave base, characterized by low sedimentation rates with a gradual transition to a hemipelagic setting.

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Riphean stromatolithes and preservation degree of fossil organic matter's

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Key words: *stromatolites, fossilized organic matter, Riphean, South Ural, Russia*

The most ancient carbonate deposits of South Ural are represented by the dolomites and the limestones. Benthic cyanobacteria have played an important role in the formation of these rocks and their lithified structures (stromatolites, bacteriolytes) appear within carbonate series of several stratigraphic levels from Lower, Middle and Upper Riphean. The forms present within Lower Riphean deposits are *Conophyton garganicus Kor.*, *Paniscollenia satka Kom.*, *Gongylina differenciata Kom.*, *Kussiella kussiensis Kryl.*, *Con. punctatus Kom.*, *Con. lituus Masl.*, *Con. cylindricus Masl.*, *Gaya ircuskanica Kryl*. The Middle Riphean stromatolites characterise carbonates of Avzyan suite and are represented by *Baicalia aborigena Schap.*, *Svetliella Kom.*, *Conophyton kusha Kom.*, *Con. culindricus Masl.*, *Con. metula Kirich.*, *Baicalia nova Kryl. et Schap.*, *Colonella formosa Kul.*, and *Cryptophyton convolutum Kom*. Upper Riphean stromatolites (Katav, Inzer and Myniar suites) are represented by the two sets, one of *Inzeria tjomusi Kril.*, *Con. reticulatus Kom.*, *Gymnosolen giganteus Kril.*, *Katavia karatavica Kryl.*, *Gym. ramsayi Steinm.*, and second one of *Parmites meridionalis Raab.*, *Con.miloradoviĉi Raab.*, *Con. asymmetricus Raab.*, *Parmites concrescens Raab.*, *Minjaria uralica Kryl.*, *Heterostilia zilimica Raab.*, *Patomella kelleri Raab.*, *Linella ukka Kryl.*, *Tungussia bassa Kryl*.

Riphean stromatolites were studied in details for biostratigraphic purposes (Kozlov, 1986), but the problem of preservation degree for organic matter itself was not discussed. The purpose of our investigation is to distinguish between phytogenic and zoogenic organic matter residues fossilized within mineral matrices by the use of electron paramagnetic resonance (EPR) technique.

The collection of about 300 Riphean stromatolite samples from stratotype section (Kozlov, 1986) were studied. X-band EPR spectra of powder raw and heat-treated (at 350 °C and 600 °C for 30 min) samples were recorded at room temperature on a PS100.X spectrometer with the magnetic field modulation frequency of 100 kHz.

The wide-range (0.285 ÷ 0.375 mT) EPR spectrum of Mn^{2+} ions substituted at both the Ca and Mg sites in dolomite structure (Fig. 1a, 1b) dominates in Riphean stromatolites. The narrow-range (0.3235 ÷ 0.3285 mT) near central part of the Mn^{2+} spectrum (Fig. 1c) show a set of lines from thermally unstable radiation induced radicals related to the C-, S-, and P- associated anion complexes [Franco, 2003] and organic radicals (Fig. 1d - 1h).

The EPR spectrum of carbon-centered free organic radical ($g = 2.0027$, $\Delta H = 0.14$ mT) was observed in both the raw and the heat-treated samples of Lower and Middle Riphean, and in the heat-treated samples of Upper Riphean stromatolites which is characteristic for zoogenic organic matter residues [Galeev, 2009]. The more intense signals were typical for Upper Riphean stromatolites after treatment at 600 °C. In two Upper Riphean samples treated at 350 °C we observed signal with $g = 2{,}0030$, $\Delta H = 0.4$ mT, which is characteristic for phytogenic organic matter residues [Galeev, 2009]. The EPR spectra of SO_2^- and SO_3^- radicals were observed in Lower (12 samples), Middle (8 samples), and Upper (44 samples) Riphean stromatolites.

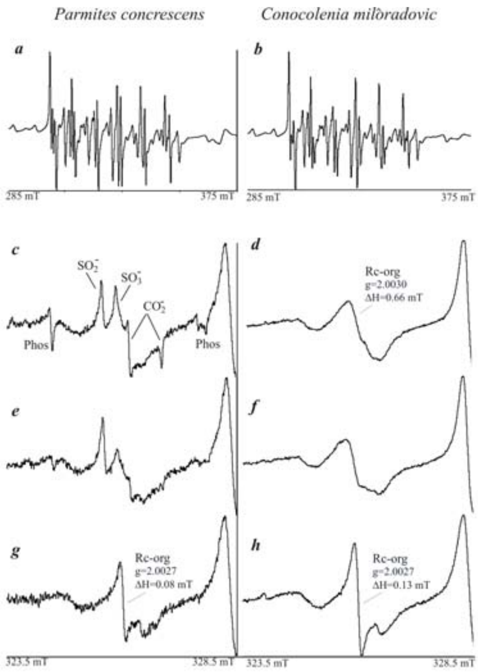

Fig.1. EPR spectra of Upper Riphean stromatolites.

The results obtained allow one to relate the dominance of zoogenic organic matter residues with the active role of cyanobacteriae algal cenosises in Riphean carbonate sedimentation. The fact that zoogeic organic radical in Lower and Middle Riphean rocks appear in raw samples, whereas for Upper Riphean it needs preheating, correlates with higher metamorphic grade of Lower and Middle Riphean rocks hypothetically due to magmatic intrusion in the studied area [Kozlov, 1989].

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Algae in the Urgonian limestones from Perşani Mountains (Romania)

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Key words: *Limestone, Algae, Foraminifera, Lower Cretaceous, Perşani Mountains*

Perşani Mountains as a part of the Eastern Carpathians have a complicated nappe structure (Patrulius et al., 1966, Patrulius et al., 1996 ; Săndulescu, 1984). The Cretaceous limestones belong to the eoautochtonous (postectonic, *sensu* Săndulescu, 1975) cover of the Transylvanian nappe or to the paleoautochtonous (Patrulius et al.,1966).

This study shows preliminary data about the algae and other microfossils from the Urgonian limestones from Olt valley to Veneția Valley the central sector of the Perşani Mountains.

Among calcareous algae, we identified frequent dasycladaleans [(*Anisoporella*? *cretacea* (DRAGASTAN), *Triploporella carpatica* BUCUR, *Triploporella* cf. *marsicana* PRATURLON , ?*Triploporella* sp., *Neomeris cretacea* STEINMANN, *Neomeris* sp., *Terquemella* sp.] and red algae ["*Solenopora*"-*Parachaetetes* sp., *Polystrata alba* (PFENDER), *Sporolithon rude* (LEMOINE)]. The microproblematica *Carpathoporella occidentalis* DRAGASTAN (= *Coptocampylodon fontis* PATRULIUS), *Lithocodium aggregatul* ELLIOTT and "*Bacinella irregularis*" RADOICIC were also identified.

This assemblage is accompanied by a foraminiferal association with *Charentia cuvillieri* NEUMANN, *Coscinophragma cribrosa* REUSS, *Everticyclammina hedbergi* (MYNC), *Sabaudia minuta* (HOFKER), *Nezzazatinella* sp., *Vercorsella* sp., small textulariids, *Mesorbitolina minuta* (DOUGLASS) and *Mesorbitolina texana* (ROEMER).

The facies types and associated biota also indicate a shallow water environment, moslty shallow subtidal (external as well as internal part of the carbonate platform). The two orbitolinid foraminifera (*Mesorbitolina minuta* and *Mesorbitolina texana*) indicate a Middle-Late Aptian age for the Urgonian limestone in the studied region

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Similarity of the Paleoproterozoic stromatolites and modern microbial mats forming in the hypersaline coastal lagoon

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Key words: *Proterozoic, Stromatolites, microbial mats, paleoenvironment*

Laminated carbonate sedimentary structures representing fossilized microbial mat or stromatolite development are remarkable organic remains from the early Earth and reflect microbial biomineralization processes, which have been operate from the Paleoarchean to the Recent. In modern microbial mats, a complex biological and biochemical organization leads to several zones of photoautotrophic organisms with layers of aerobic and anaerobic heterotrophs metabolizing within variable amounts of extracellular polymeric substances (EPS) (Spadafora et al., 2010). Modern lithifying microbial mats produce a range of carbonate precipitates resulting from the interplay of the biological activities of microorganisms and the environmental conditions. Microbial mediation is the only demonstrated mechanism to precipitate dolomite under Earth surface conditions.

Purpose of the research work was to compare Paleoproterozoic (2.2-2.1 Ga) dolomite stromatolites (fossilized microbial buildups) from Eastern Fennoscandian Shield, which are considered had been formed under evaporate conditions (Melezhik et al., 1999) with modern microbial mats forming in environment of the hypersaline coastal lagoons (e.g. Lagoa Vermelha in Brazil) by primary dolomite precipitation induced by microorganisms (Vasconcelos et al., 2006).

The main results obtained within the study are:

1. Light microscopy of the thin sections taken from Paleoproterozoic stromatolites, revealed clotted fabric, which resembles peloidal fabric of Lagoa Vermelha stromatolites (Spadafora, 2010).
2. Numerous traces of microbial activity preserved within the rock e.g. deformed fragments of the exopolymeric substances (EPS) have been recognized during SEM-EDX investigations of selected stromatolite samples.
3. Data obtained from stable isotope composition analysis show enrichment of the stromatolite samples in $^{13}C_{carb}$ up to 9.69‰ vs PDB. The same enrichment was observed in the modern microbial mats from hypersaline environment of the Lagoa Vermelha in Brazil (Vasconcelos et al., 2006).

Preliminary results demonstrate environmental similarities between modern microbial mats growing in hypersaline coastal lagoons and Paleoproterozoic stromatolites from Eastern Fennoscandian Shield.

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The dasycladacean alga *Halicoryne morelleti* from Borod Basin (Romania) and its paleoecologic significance

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Key words: *calcareous algae, paleoecology, Borod Basin, Romania*

The Sarmatian sedimentary record of the Borod Basin consists of marine deposits with continental influence. The microfossils assemblages show a low diversity but high abundances of specimens and include dasycladacean algae, foraminifers, ostracods, moluscs, crabs and vertebrate remains.

Two sections were studied, one located on Vişinilor Valley near Vârciorog village where Sarmatian deposits are dominant, and the second on Vința Valley close to Luncşoara village. *Halicoryne morelleti* has been identified in both locations as isolated cysts, while a large number of aggregates occur in one bed from Luncşoara.

The rare algal cysts from Vişinilor Valley are part of microfossil assemblages indicating fluctuating salinity conditions (*Ammonia* sp., *Elphidium* sp., *Congeria* sp., *Pirenella picta*). The assemblages from Luncşoara consist only of miliolid foraminifera and dasycladacean algae, suggesting a higher level of the salinity compared to Vârciorog area.

The occurrence of *Halicoryne morelleti* together with the particular Sarmatian microfossil assemblages of the Borod Basin indicate fluctuating salinity conditions, from normal marine to brackish. Observations on the ecology of recent dasycladales do not exclude their adaptation to fluctuating salinity conditions.

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Coralline algae in the Paleogene flysch of the Polish Outer Carpathians: a review

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The Upper Jurassic–Lower Miocene deposits of the Polish Outer Carpathians consist mostly of deep-sea siliciclastics, generally named *flysch*. Shallow marine benthic biota occur only as re-deposited biodetritic material and in pebbles to boulders (exotics) of carbonate rocks within sandstones and conglomerates of turbiditic and debris-flow origin. These biogenic components provide information about the sedimentary environments at the little-known margins of the Outer Carpathian flysch basins.

Coralline red algae occur in different amount in Paleogene deposits of all tectonic nappes of the Polish Outer Carpathians. They have been found mostly as thallial fragments within sandy and bioclastic limestones, rarely as rhodoliths and exotics of algal limestones. *In situ* coralline algal facies have been never recognized. The algal material usually occurs together with bioclasts of bryozoans, echinoderms, foraminifera (including larger ones), corals, bivalves, brachiopods and serpulids. Usually coralline algae predominate. Corals are rare, and green algae are missing.

Most coralline-bearing lithostratigraphic units (e.g., Paleocene formations: the Szydłowiec Sandstone, the Czerwin Sandstone, the Bircza Limestone) contain exclusively coralline algal debris. The algal debris is formed by angular to subrounded fragments and coralline crusts up to several millimetres in size (e.g., Książkiewicz, 1951; Alexandrowicz *et al.*, 1966; Rajchel and Myszkowska, 1998a). Together with other biota, this debris occurs segregated according to size in normally graded beds (e.g. "*Lithotamnion* sandstones" in Magura Nappe; Alexandrowicz *et al.*, 1966), is horizontally arranged in stratified beds or is dispersed chaotically in non-graded beds. The content of algal material varies from single particles to almost 50% of the rock mass (e.g. Rajchel and Myszkowska, 1998a). The re-deposited coralline algal debris within flysch deposits were not subject of taxonomic papers. *Lithothamnion*, *Archaeolithothamnium*, *Lithophyllum*, *Paleothamnium* and *Ethelia* are mentioned in the literature (Książkiewicz, 1951; Rajchel and Myszkowska, 1998a).

Rhodoliths are much less common in the Palaeogene of the Polish Outer Carpathians. In the Silesian Nappe the most abundant rhodolith concentration is recorded in the Upper Paleocene of the Upper Istebna Sandstone (Leszczyński *et al.*, in review; Minor, in prep.), the Upper Paleocene–lowermost Eocene Ciężkowice Sandstone (Leszczyński, 1978) and the Middle–Late Eocene exotic limestone pebbles to boulders occurring within the Oligocene olistostrome of the Krosno Beds (Bassi *et al.*, 2005); all of them in the Silesian Nappe. Rhodoliths occur mostly mixed with siliciclastic material in different concentration, rarely within pebbles to boulders of rhodolith limestones. They range in size from 1 to several centimetres and show spheroidal and ellipsoidal shapes with a warty to lumpy growth forms. Rhodoliths are made up mostly by *Sporolithon*, *Lithothamnion* and *Mesophyllum.* Subordinately

Neogoniolithon, *Spongites*, *Lithoporella, Karpathia* and the peyssonneliacean *Polystrata alba* are also present. Rare exotics represent algal biolithites, developed as crustose coralline facies (Bassi *et al.*, 2000).

The stratigraphic occurrence of coralline algal material in flysch deposits of the Polish Outer Carpathians indicates that the Late Paleocene–Eocene was a particularly suitable time for its carbonate production (Alexandrowicz *et al.*, 1966; Leszczyński, 1978; Rajchel and Myszkowska, 1998a, b; Cieszkowski *et al.*, 2005; Leszczyński *et al.*, in review). The Oligocene shallow-water carbonate sedimentation in the Polish Outer Carpathians (as well as in other parts of Outer Carpathians – e.g. Sahy *et al.*, 2008) is poorly developed in contrast to Mediterranean area. Re-sedimented shallow-marine carbonate material occurs scattered basically in the Lower Oligocene.

Some authors assume that the source for Palaeocene organodetritical limestones were carbonate platforms and reef limestones (e.g. Golonka *et al.*, 2005). Such interpretation is not justified and not supported by detailed studies. Although detritus of coralline algae is important component of some lithostratigraphic formations, there is no evidence of large-scale carbonate shallow-water sedimentation at the margins of the Polish Outer Carpathian flysch basins during the Palaeogene. Clasts of algal biolithites are rare (Bassi *et al.,* 2000). Relatively diversified colonial corals occur only locally in clays. The occurrence of algal material mainly in form of thallial fragments and rhodoliths mixed with siliciclastic material indicates provenance from mostly thin covers on siliciclastic substrate and not from carbonate platforms. Such occurrence implies, that increased concentration of calcareous material in shallow-marine, nearshore areas of the flysch sedimentary basins originated in short periods. These were mainly times of sea-level rise and areas temporarily located outside of main routes of intensive coarse, siliciclastic transfer. It was proposed for Upper Paleocene rhodoliths from the Upper Istebna Sandstone (Silesian Nappe) that they grew on moderately mobile siliciclastic substrates under low net sedimentation rates during the sea-level rise up to early highstand. During the sea-level fall up to lowstand the rhodoliths and associated siliciclastic sediments were re-sedimented by mass-gravity processes into deeper settings (Leszczyński *et al.*, in review).

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Subterraniphyllum thomasii Elliott, fossil calcareous alga from Lower-Middle Miocene sediments of the Porbandar Basin, SW India

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Key words: *Subterraniphyllum thomasii, Fossil Calcareous Alga, Porbandar Basin, India*

The Neogene-Quaternary sediments of the Porbandar Basin (SW India) constitute the Gaj Formation (Early Miocene), the Dwarka Formation (Early-Middle Miocene), the Miliolite Formation (Early Middle-Late Pleistocene) and the Chaya Formation (Late Pleistocene-Late Holocene) (Mathur et al. 1988). The Neogene-Quaternary sediments exposed along the coast of Saurashtra in the Porbandar Basin are characterized by well preserved diversified fossil coralline algae (e.g. Mude and Kundal, 2010). The *Subterraniphyllum thomasii* Elliott, a fossil calcareous alga, has been identified from the Dwarka Formation (Early-Middle Miocene) from the Porbandar Basin, Saurashtara. This species has been documented earlier from Late to Middle Eocene sediments of Kuchchh Basin, Gujarat (Kundal and Humane, 2005). This is the first report of *Subterraniphyllum thomasii* Elliott from Lower-Middle Miocene sediments from the Indian subcontinent. Taxonomy, biostratigraphy and palaeogeography of this record are discussed.

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The shallow-water Recent rhodoliths from Abrolhos Bank, Brazil: tomography, taphonomy and geochemistry

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Key words: *Rhodoliths, tomography, geochemistry, taphonomy, Abrolhos Bank, Brazil.*

Bioturbation at all scales is now recognized as playing a major role in facies interpretation. Macroscopic and microscopic borings can provide an indication of water depth, if they can be attributed to the action of specific borers. Computerized transverse axial scanning (x-ray computed tomography) is a radiographic technique designed to recover precise cross-sectional images (tomograms) of 3-dimensional objects. Tomographic analysis is a new method for assessing bioturbation, for identifying boring taxa, as well as for calculating the volume and porosity in present-day rhodoliths. The tomographic system provides also a quantification of the calcium carbonate produced by bioerosion.

Recent rhodoliths collected at 20 m water depth on the Abrolhos Bank, Brazil, have been multi-scanned analyzed and analyzed in terms of isotope geochemistry. The studied rhodoliths, spheroidal in shape, are constituted mainly by encrusting coralline red algae with a massive inner arrangement in competition with *Acervulina inhaerens*, bryozoans, serpulids and subordinate smaller encrusting foraminifera. The outer rhodolith growth stage shows dominant encrusting growth forms. Coralline taxonomic assemblage is characterized by *Hydrolithon rupestris* (Foslie) Penrose, *Lithophyllum stictaeformis* (Areschoug) Hauck, *Lithothamnion superpositum* Foslie and *Mesophyllum engelhartii* (Foslie) Adey.

The study shows that rhodoliths from this site are characterized by a highly diversified assemblage of boring bivalves associated with the ichnogenera *Gastrochaenolites* and *Entobia*. The fauna from this boring assemblage can remove up to the 10% of the rhodolith volume. The tomographic method can be expected to yield similar results as applied to both modern and fossil rhodoliths from other localities and time frames.

The carbon- and oxygen-isotope analyses were performed on coralline thalli from the inner (near the nucleus) and outer (surface) rhodolith samples. The isotopic data are discussed in terms of: (a) influence of marine cementation, (b) quality and preservation of the rhodoliths collected, (c) difference in sea water temperature between the first and the last rhodolith growth stages. A possible difference in temperature between the inner and the outer parts of the rhodoliths can be estimated as nearly 10°C. If this is confirmed by further analyses, the studied rhodoliths recorded the postglacial oceanographic evolution of the Brazilian platform.

Encrusting organisms and microbial structures in the Upper Jurassic limestones from South Carpathians (Romania)

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Key words: *microbialites, encrusters, Upper Jurassic, Saouth Carpathians, Romania*

Durring the Upper Jurassic-basal Cretaceous, massive reefal limestones evolved in the Stramberk type facies in some areas of the South Carpathinas, such as Piatra Craiului and Buila-Vânturariţa Massifs, which form together with other Mesozoic deposits the sedimentary cover of the Getic Nappe.

A large part of these carbonate deposits is made up of coral-microbial facies associated with a large variety of encrusting organisms and benthic microbial crusts which were important components for the Late Jurassic shallow-water bioconstructions in the Southern Carpathians.

Our study brings new data regarding the occurrence and the importance of these organisms in stabilizing the reefal build-ups of the Upper Jurassic, by showing a comparison between two sections of different areas which have almost the same geological features.

Buila-Vanturarita Massif is a NE-SW orientated carbonate ridge represented by Upper Jurassic reefal limestones, located in the central part of the South Carpathians. Piatra Craiului Massif is located in the eastern part of the Southern Carpathians and it consists mainly of Stramberk type limestones, which crop out in both eastern and the western part of the ridge. The assemblages of calcareous algae and benthic foraminifera identified in samples collected from both areas, revealed a Kimmeridgian-Tithonian (Buila-Vânturariţa) and a Kimmeridgian-Berriasian-?Lower Valanginian (Piatra Craiului) age for these carbonate deposits.

Microbial-coral boundstone and intraclastic-bioclastic rudstone microfacies types are dominant within the Upper Jurassic limestones from both areas.

The rich micropaleontogical associasions identified in the samples collected from Piatra Craiului and Buila Vanturarita Massifs, revealed besides corals, foraminifera, sponges and bryozoans, various types of encrusting organisms and microbial associated structures such as: *Crescentiella morronensis* (Crescenti), *Lithocodium agregattum* Elliott, *Bacinella irregularris* Radoičić, *Radiomura cautica* Senowbari-Daryan & Schaefer, *Petrurbatacrusta leini* Schlagintweit, *Coscinophragma* sp. , *Troglotella incrustans* Wernli & Fookes , *Bulopora* aff. *laevis* (Sollas), *Terebella* sp. , „Macroterebella" sp., etc.

The microfacies analisys together with the identified micropaleontological associations from the studied sections of Buila Vanturarita and Piatra Craiului Massifs, indicates a similar depositional environment for the Late Jurassic carbonates of these areas. Fore-reef, upper slope and reefal sedimentary domains were identified through the entire studied successions.

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Calcareous algae from the Lower Cretaceous carbonates in central Iran (Ardakan area, Herisht Mount)

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Key words: *Dasycladales, Udoteaceae, "Solenoporaceae", Cretaceous, Iran*

Two Cretaceous sections were sampled in Herisht Mount, central Iran (Yazd-Posht-e Badam Block Aghanabati, 2007), 14 km north of the town of Ardakan. The first section, 246 m thick, is located at the southern flank of the Mount Herist. The second one, 640 m thick, is situated about 2 km north-east of the first section.

The base of the first section is covered by alluvial deposits. The thicknesses of the lower part is about 26 m and it is composed of marly limestone with *Balkhania balkhanica* (foraminifera) and girvanelloid cyanobacteria (algae).The upper part of this section is composed of medium to thick bedded gray limestone with many ostreids and orbitolinids.The thickness of this part is about 220 m.

The second section can be divided to three parts. The thickness of the lower part is about 280 m and it is composed mainly of conglomerate and rarely sandstone. The middle part has 64 m in thickness and contains mainly olive shale, yellow marl with intercalation of thin limestone, with abundant orbitolinid foraminifera and with some bivalves imbedded in the shale. The upper part of the section is composed of 296 m thick bedded gray limestone with bivalves (ostreids and rudists), corals, foraminifera and algae. The algae of the upper part of the section were studied and will be described.

Limestones of the both sections contain an assemblage of calcareous algae consisting of: Dasycladales: *Deloffrella quercifolipora*; Granier & Michaud*, Pseudoactinoporella fragilis*; Conrad*, Kopetdagaria sphaerica*; Maslov*, Montiella*? *elitzae* (Bakalova) *Salpingoporella muehlbergii* (Lorenz), *Acroporella* cf. *radoiccae* (Praturlon), *Salpingoporella katzeri* Conrad & Radoicic, *Teruemella* sp., Udoteaceae and Gymnocodiaceae: fragments of *Arabicodium* cf. *aninensis* Bucur, *Arabicodium* sp., *Boueina* sp., *Permocalculus minutus* Bucur, "Solenoporeceans": abundant *Marinella lugeoni* Pfender, Rivulariacean-type and girvanelloid cyanobacteria.

The depositional environment of the green algae is interpreted to be the shelf margin. The girvanelloid algae were observed mainly in micritic sediments and are associated with *Balkhania balkhanika* and *Pseudocylamina* sp. indicating different depositional conditions (platform interior). Further associated fossils are the problematic organisms *Bacinella iregularis* and *Lithocodium agregatum* forming thick carbonate layers in the first section.

Associated foraminifera with the algae in both sections are orbitolinids, chofatellids. psuedocyclaminids. The most probably age of the limestones is Baremian-Lower Aptian.

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Calcareous algae and Problematic microfossils from Permian Dalan formation of Dena Mountain, SW Iran

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Key words: *Calcareous algae, Problematic microfossils, Permian, Dalan Formation, Dena Mountain, Iran*

Dalan Formation is one of the most important formations as a resource of gas in the Zagros basin, which has been researched by geologists in Iran. This Formation is at the base of Zagros zone in south west of Iran, with outcrops in some mountains such as Zard- kuh, Dena, Oshtoran-kuh and Sourmeh. (Motiei 1993) The objective of this reaserch is to study Dalan Formation located 58 km of North-west of Yasouj town, the center of Kohgilouye & Boyerahmad province, and approximately 7 km North-west of Sisakht town, in southern flank of Kuh-e Dena. The Dalan Formation in Dena section is 325.7 m thick and divided into three rock units: the upper carbonate unit, the middle Sandstone unit and the lower carbonate unit. In the Dena Mountain, evaporates of the Nar unit are replaced by thick bed of sandstone (Aghanabati, 2007). This Formation spans from Murgabian to Early Dzhulfian in age. The Dalan Formation is conformably underlain by the Faraghan Formation and disconformably overlain by the thin bedded limestone of the Kangan Formation. The fossil content of the lower carbonate unit of the Dalan Formation include: sponges, corals, gastropods, brachiopods, and different types of foraminifers.

The most important faunas in this section that have taken our attention are problematic organisms and algae. we have considered them with special view in this article. Limestones of this section encompass an assemblage of calcareous algae consisting of Dasycladales: *Mizzia cornuta*; kochansky & Herak, *Mizzia velebitana*; Schubert, *Mizzia longiporosa*; Endo, *Mizzia* sp., *Gyroporella nipponica*; Endo & Hashimoto, *Gyroporella* sp., *Epimastoporella japonica*; (Endo) Roux, *Epimastopora densipora*; Endo, *Epimastopora symetrica*; (Johnson) Roux, *Epimastopora likana*; kochansky & Herak, *Epimastopora* sp., *paraepimastopora kansasensis*; (Johnson) Roux, *Paraepimastopora regularis*; (Johnson) Roux, *Physopporella* sp. Gymnocodiaceae: *Permocalculus tenellus*; (Pia) Elliot, *Permocalculus* cf. *tenellus*; (Pia) Elliot, *Permocalculus fragilis*; (Pia) Elliott, *Permocalculus plumosus*; Elliott, *Permocalculus* cf. *plumosus*; Elliott, *Permocalculus dikenliderensis*; Güvenc, *Permocalculus kanmerai*; (Konishi) Herak & kochansky, *Permocalculus* cf. *solidus*; (Pia) Elliott, *Permocalculus* sp., *Gymnocodium bellrophontis*; (Rothpletz) Pia emend Elliott, *Gymnocodium* sp. and problematic microfossils: *Tubiphytes obscurus*; Maslov, *Pseudovermiporella sodalica*; Elliott, *Vermiporella longipora*; Praturlon, *Vermiporella* sp., *Ungdarella uralica*; Maslov, *Eflüegelia* sp., *Aoujgalia* sp., *Aeolisaccus dunningtoni*; Elliot, *Stacheioides* sp.

Since there are many calcareous algae in the study area, we tried to study this group of microfossils and their importance is in the interpretation of depositional environment in relation to the depth and paleoecology. Some parts of Dalan Formation in Dena Mountain contain calcareous algae and problematic microfossils showing a shallow and relatively energetic environment.

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Carboniferous stromatolites of Timan Ridge (Russia)

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Key words: *stromatolite, Bashkirian stage, paleogeography, ecosystem, Timan Ridge, Russia.*

According to paleogeographic reconstructions the upper Paleozoic sequence of Timan ridge was formed in the eastern part of the North Euramerican province. This province includes the Eurasian northern part (Timan, Kanin and Jugorian peninsulas), Spitsbergen, Greenland, Canadian Arctic Archipelago, Alaska and Yukon. The Carboniferous and lower Permian formations were deposited in the epicontinental shallow sea conditions of the united basin at the northern end of the supercontinent Pangea.

The Upper Paleozoic deposits from the western and eastern slopes of the Timan Ridge were studied. The stratigraphic succession consists of early Carboniferous to early Permian deposits. It can be divided into biostratigraphic Zones based on Foraminifera. Microbial carbonates were recognized in Bashkirian stage deposits in the few sections along Timan Ridge, eithin the basins of Pizhma, Sula and Volonga rivers. These sections show similar facies trends. Bashkirian deposits lies on the eroded surface of Lower Carboniferous dolomites. The lowermost part of Bashkirian stage is represented by limestone and dolomite breccias with clay interlayers. The overlying beds are made up of dolomite and dolomitic limestone with algal detritus and algal interlayers. Bashkirian deposits in the western slope of the Timan ridge (Volonga section) are more complete and their thickness is about 60 m (compared with 2,8-5,3 m in the Pizhma section, and about 28 m in the Sula section). Only small quantities of microfossils debris (Crinoidea, Bryozoa, Foraminifera) were found in the intervals of the carbonate succession containing the stromatolites. The deposits are dated based on typical Bashkirian foraminifera *Pseudostaffella antiqua* (Dutkevich), *P. gorskyi* (Dutkevich), *Profusulinella primitiva* Sosnina, found below and above the beds with stromatolites.

The stromatolite units of 5-7 cm thickness are repeated within the Bashkirian deposits**.** This suggests that few sedimentation breaks occurred during the initial stage of the Timanian sea basin evolution. Erosion discontinuities below stromatolitic carbonates were found.

As a rule the presence of Phanerozoic stromatolites is related to the ecosystem’s destabilization. Usually, intensive development of the cyanobacterial mats associated with a decreasing biodiversity of the normal sea communities. The same happend in Timan Ridge after the sedimentation of the Bashkirian deposits. In the intervals of the carbonate successions containing the stromatolites only small quantities of microfossils were found, including fragments of foraminifers, algal, brachiopods, crinoids. Among foraminifers, the so-called “small foraminifera” dominate, such as *Tolypammina* sp., *Ammovertella* sp., *Globivalvulina* sp. Thus stromatolitic builups in Paleozoic sea basins can be used as markers of the ecological crises. Literature about the Bashkirian stage noted the begining of a colder climate. These circumstances represented probably the reason for the biodiversity decreasing and the subsequent colonization of the empty biotopes by microbial communities.

Early Devonian Algae in the Polar Ural (Russia)

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Key words: *Lanciculoid algae, algal biogerm, Early Devonian, Vojkar Island arc, Polar Ural, Russia.*

The researches of V.P. Maslov (1956) and V.P. Shuisky (1973) attracted the paleontologists' attention to Early Devonian epoch in development of Algae. The composition of the algal assemblages and characteristics of the dominant groups marked a distinctive "Lanciculoid algae flora". According to the main components, this algal association may be considered as a *Lancicula-Litanaia-Paralancicula* community. Lanciculoid algae are most common in this community. They existed from Lochkovian to the Eifelian Stages. Their maximum biodiversity was during Pragian and Emsian. Findings of Lanciculoid algae are recorded in the sections of Ural, Pai-Khoi, Novaja Zemlja, Altaj, Kuzbass, Alaska, Australia and South Europe.

Lanciculoid algae flora is considered as one of the main constituent parts of the Early Devonian organic buildups. V.P. Shuisky (1973) marked the range of such buildups along the full-length of the Ural Mountains. However, he interpreted the paleogeographic distribution of algal buildups according to the geosynclines' paradigm. The paleogeography of the Early Devonian Algal reefs needs to be reinterpreted according to the "tectonic plates" paradigm.

During geological mapping in the eastern slope of the Polar Ural, we have found Early Devonian algal bioherms developed on the volcanic-sedimentary rocks of Vojkar zone (Kevsoim river basin). The bioherms were situated on the ancient volcano's slope and sometimes they ware covered partly by debris materials from above, but subsequently their growth was reactivated. The algal assemblage includes the following species: *Lancicula alta* Maslov, *Lepidolancicula* aff. *crassa* Schirschova, *Praelitanaia* cf. *anirica* (Maslov), *Litanaia* aff. *mira* Maslov, *L. radiosa* Shuysky, *Circella duplicate* Schirschova, *Botrys* sp., *Epimastopora* sp., *Solenopora* sp. According to the general geological situation, this organic algal buildups formed in island arc's geodynamic conditions. Vojkar Island arc existed during long time from Earlier Devonian to the beginning of the Late Devonian, in the eastern part of the Euramerican continent, within the Paleouralian Ocean (Remizov, 2004). The algal biogerms developed both on Uralian, and on South European passive margins. Moreover, these island arches did not hinder the transoceanic currents, allowing similar algal community to extend to the coasts of Australia. Thus, the Early Devonian algal complex can contribute to the paleogeographic and stratigraphic global reconstructions.

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Keynote lecture

Bioinduced and biocontrolled calcification and the geological history of calcified algae and bacteria

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Key words*: algae, bacteria,biomineralization, CO_2-concentrating mechanisms, limestones, precipitation, seawater chemistry*

Micrite, ooids, shells, seafloor crusts and early cements are key components of carbonate sediments. They are produced by precipitation processes ranging from abiotic to bioinduced and biocontrolled. They have commonly involved bacterial and algal carbonates because these cover a wide range of calcification styles and, in addition, abiotic precipitates are locally closely associated with microbial carbonates. The distribution and abundance of these components through time reflect significant changes inmarine carbonate sedimentation and biocalcification that assist understanding of algal and microbial carbonates.

Here I suggest the following as examples of steps and stages in this history:

1. Late Archaean-Early Proterozoic rise of carbonate platforms, reflecting increased abiotic precipitation and possibly also sulphate reduction microbial biocalcification, related to biosphere oxygenation.
2. Mesoproterozoic biogenic ‘whiting’ formation, its impact on stromatolite morphology, and concomitant benthic cyanobacterial calcification that created calcimicrobialthrombolitemacrofabric, related to CO_2-concentrating mechanism (CCM) induction in response to CO_2 decline.
3. Late Neoproterozoic reduction in bioinduced calcification in response to temperature decline.
4. Early Palaeozoic increase in dendrolites, thrombolites and stromatolites (specifically rise in cyanobacterial and microbial sulphate reduction calcification), and also oolites, in response to increased seawater carbonate saturation.
5. Decline in microbial carbonate abundance as biocontrolled calcification rose in the Ordovician.
6. Increase in cyanobacterial sheath calcification and biogenic ‘whitings’ (and mud mounds), and also oolites, in response to CO_2 decline and CCM (affecting cyanobacteria) and to increase in carbonate saturation following Late Devonian extinctions of biocontrolled calcifiers.
7. Short-lived Early Triassic increase in abiotic and microbial carbonates in response to Permian-Triassic extinction of biocontrolled calcifiers.
8. Late Jurassic to Early Cretaceous increase in oolites and microbial carbonates (including biogenic ‘whitings’ and therefore possibly carbonate mud mounds) in response to increased seawater carbonate saturation and decline in CO_2 that induced CCMs in cyanobacteria.
9. Decline in microbial carbonates from the mid-Cretaceous in response to widespread development of planktic biocontrolled calcifiers (e.g., coccolithophores, globigerines). This led to scarcity of sheath-calcified marine cyanobacteria, decline in reefal microbial crusts, and the rise of agglutinating coarse-grained thrombolitic/stromatolitic columns and domes (e.g., Shark Bay, Exuma Sound) that accrete by trapping grains in uncalcified mats that are synsedimentarily early lithified by bacterial sulphate reduction.

10. Marine chlorophytes such as dasycladaleans and halimedaceans are essentially bioindiced calcifiers. Their history should reflect changes in seawater carbonate chemistry. This could account, for example, for Cenozoic decline in calcified dasycladalean abundance. In contrast, calcification in coccolithophores and coralline red algae is significantly more biocontrolled, and these groups appear to show much less overall long-term change in abundance than calcified chlorophytes.

These examples and patterns require further study. They suggest promising areas for research into the long-term development of marine limestones in general, and the history of calcified algae and bacteria in particular.

The origins and evolution of the modern Indo-Pacific reef algal flora: the coralline algae in the context of the THROUGHFLOW Project

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Key words: *coralline algae, reef, paleoenvironmental reconstruction, carbonates, Indo-Pacific, THROUGHFLOW project*

South East (SE) Asia hosts the global centre of maximum diversity for shallow marine ecosystems, mainly associated with thriving coral reefs (Renema *et al.*, 2008). The factors responsible for the origins and maintenance of this diverse biota remain unknown. Previous studies suggest that the formation of the ancestral centre of diversity could be related to the constriction of the Indonesian Throughflow current (ITF) during the Cenozoic, resulting in increased speciation and/or immigration during the Miocene. Unfortunately, the fossil evidence currently available to document this pattern and its geographic context is sparse, and there is a need to collect new data.

The scientific objective of the THROUGHFLOW Project is to reconstruct the biological and environmental history of shallow marine habitats of a selected area of Southeast Asia. Specifically, a multidisciplinary study of key sections in Eastern Kalimantan (Indonesia) will be performed, integrating data from geology, geochemistry, ocean modeling, and paleontology to understand the Neogene history of the region.

In this framework, the projects carried out at Granada University aim to document the timing and patterns of the diversification of Indo-Pacific reef-building coralline algae, the second most important builders in modern Indo-Pacific reefs. The collected data will be integrated with a robust sedimentological framework for detailed reconstructions of the shallow marine carbonate paleoenvironments and their evolution through time.

The first expedition has been already carried out in East Kalimantan (Indonesia) during November-December 2010. A variety of shallow marine ecosystems, including coral reefs and sea grass environments, were found. First results show an exceptional preservation of some fossil algae, especially in places with a high siliciclastic influence (Miocene deposits of the Mahakam Delta). A new expedition is scheduled for summer 2011. We will study a wider temporal (Early to Late Miocene and possibly Late Oligocene) and spatial range of outcrops.

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Late Jurassic *Epiphyton* in Romania

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Key words: *Carpathians, CO_2-concentrating mechanisms, cyanobacteria, Mateiaş Mountain, Paraepiphyton.*

Small calcified dendritic *Epiphyton*-like fossils occur in Late Jurassic shallow-marine limestones at Mateias, 7km NE of Câmpulung in the Carpathian Mountains of south-central Romania. *Epiphyton* Bornemann and similar taxa are common in Cambrian reefs and occur sporadically through the Palaeozoic, including the Late Devonian where they again have a reef-building role. Mesozoic records of these fossils are very scarce. *Epiphyton*-like fossils have always been regarded as photosynthetic algae or bacteria, but it has proved difficult to more precisely establish their affinities. Their sporadic geological distribution raises questions about controls on their calcification. The Mateias specimens are well-preserved in marine cements. They typically form radial clusters of narrow well-defined filaments, generally 20-25 microns in diameter that show dichotomous-branching and consist of dense dark micrite. In places, it is possible to interpret the branches as tubes, similar to the Cambrian epiphytacean *Tubomorphophyton*. In general organization and size they perhaps most closely resemble Devonian *Paraepiphyton*.

These Late Jurassic specimens represent one of the youngest known occurrences of these enigmatic fossils. They emphasize the episodic development of calcified cyanobacteria and similar fossils through the Phanerozoic, especially in the Cambrian-Early Ordovician, Late Devonian-Early Carboniferous, and Late Jurassic-Early Cretaceous. These are all times when seawater carbonate saturation is likely to have been elevated, and the youngest of these episodes (Late Devonian-Early Carboniferous, and Late Jurassic-Early Cretaceous) are also times when it could be suggested that declining levels of atmospheric CO_2 may have triggered CO_2-concentrating mechanisms that promoted cyanobacterial calcification.

Upper Cretaceous foram-algal assemblages of rudist-bearing deposits from Valea Neagră, Borod Area (NW Romania)

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Key words: *foram-algal assemblage, paleoenvironment, Upper Cretaceous, Romania*

The Upper Cretaceous mixed siliciclastic-carbonate sequence exposed in the southeastern part of Borod Basin, close to the Valea Neagra village, consists of conglomerates, microconglomerates and bioclastic sandstones interclated with rudist-bearing limestones. These deposits lay unconformably on the Jurassic deposits following an erosional surface, and are covered by Sarmatian marls. Within the rudist-bearing limestones, two rudist assemblages are distinguished, from bottom to top: the hippuritid lithosome, and the radiolitid lithosome, indicating Santonian-early Campanian and late Campanian–early Maastrichtian age, respectively (Săsăran & Özer, 2011).

Foram-algal assemblages are present in the stratigraphic succession both in the siliciclastic and carbonate deposits. The arenitic matrix of the sandstones and conglomerates contain fragments of rudists, gastropods, ostreids, echinoid plates and spines, red algae and benthic foraminifera. These siliciclastic deposits represent submarine fan deltas situated in the marginal areas of the basin (Săsăran et al., 2009).

Within the hippuritid and radiolitid lithosomes, some levels with peyssonneliacean and sporolithacean encrusting red algae (*Polystrata alba* PFENDER, *Sporolithon* sp., *Lithophyllum* sp.) have been identified, and also benthic foraminifera (miliolids, rotaliids, as well as encrusting and agglutinated foraminifera). The foram-algal assemblages from the rudist-bearing limestones have been found in three type of microfacies: bioclastic-extraclastic grainstone, bioclastic-extraclastic rudstone and bioclastic-extraclastic wakestone/packstone. The carbonate deposits were formed in a normal shallow marine paleoenvironment along a shelf margin, with low sedimentary rates and low to higher hydrodynamics.

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Clypeina helvetica Morellet & Morellet, 1918, revisited. A Priabonian (Late Eocene) dasycladalean alga from the Diablerets-Nappe of the Helvetic Alps, W-Switzerland

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Key words: *Dasycladales, Eocene, Helvetic Zone, Switzerland.*

Clypeina helvetica was described by Morellet & Morellet (1918) from the "Bartonian" of the brackish-influenced "couches à Cerithes" of the karst plateau of Tsanfleuron, Valais region, W-Switzerland, illustrated with six drawings (Fig. 1). According to Deloffre & Génot (1982), *C. helvetica*, which is only known from its type-locality, is "*relatively unknown*"…"*poorly quoted and illustrated*"…and… "*the validity of this species is dubious*". Today, the informal "couches à Cerithes" of the type-area are assigned to the Diablerets Member of the Sanetsch Formation, which is Priabonian in age (Weidmann et al., 1991; Menkveld-Gfeller, 1994) (Fig. 2). Dasycladalean algae, including the dispersed verticil disks of *C. helvetica*, are frequent constituents of the marly, partly sandy limestones of the transgressive Diablerets Member that overlies the karstified palaeorelief of the Lower Cretaceous Schrattenkalk Formation (Fig. 3). The biota present in these wacke- to floatstones are monospecific or show a very poor species diversity suggesting a sheltered and restricted palaeoenvironment.

The comparable large-sized *C. helvetica* is characterized by shallow bowl-shaped verticils bearing numerous short laterals only fused at their proximal parts, and a wide axial cavity. The calcification pattern of *C. helvetica* is similar to the *Clypeina jurassica* group, with radial-fibrous, intracellular calcite enveloping the fertile ampullae. This is the so-far youngest record of this type of calcification. The new findings of Priabonian Dasycladales give further insights into the Middle-Late Eocene crisis with a sharp decrease of species (Barattolo, 2002).

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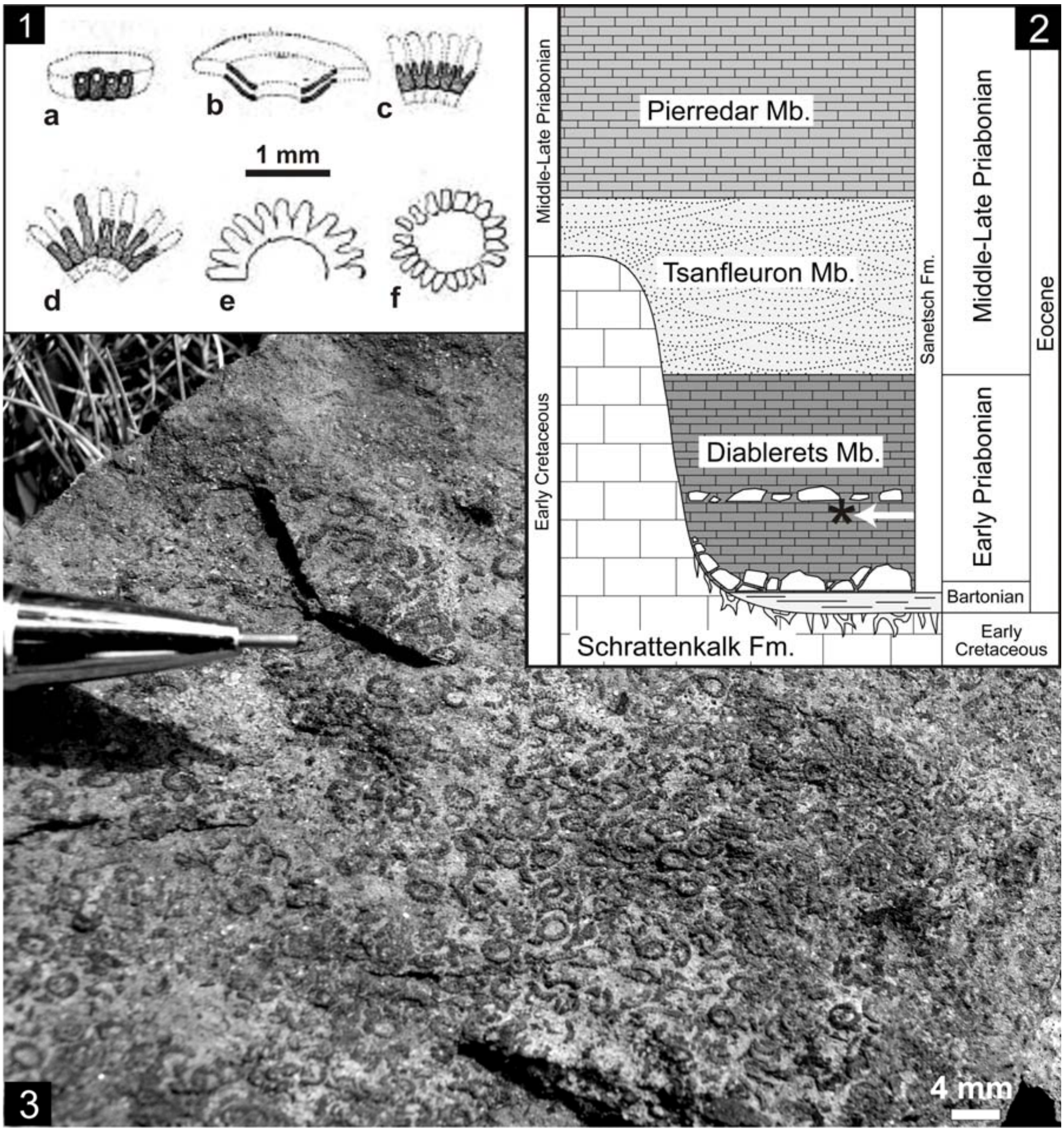

1: Drawings of *Clypeina helvetica* provided in the original description of Morellet & Morellet (1918). Scale bar 2 mm. **2:** Simplified lithostratigraphic chart of the Early Cretaceous and Eocene deposits of the Sanetsch area (western Swiss Alps). The ages of the deposits are based on Weidmann et al. (1991) and Menkveld-Gfeller (1994, with further references therein). The asterisk marks the approximate sample position containing *Clypeina helvetica*. **3:** Rock surface with isolated verticils of *Clypeina helvetica* Morellet & Morellet from the Diablerets Member of the Sanetsch Formation, Lapis de Tsanfleuron, W-Switzerland.

Remarks on the *Pseudovermiporella* Elliott, 1958 and the origin of thaumatoporellacean algae

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Key words: *Microproblematica, Calcareous Algae, Permian, Cretaceous.*

The genus *Pseudovermiporella* (type-species *P. sodalica*) was described by Elliott (1958) as a problematic alga from the Late Permian of Oman. Other authors favour a red algal or foraminiferan origin. Resemblances with the green alga *Thaumatoporella* Pia, 1927 were already remarked by Praturlon (1963), followed by Granier & Deloffre (1994) who tentatively transferred *Pseudovermiporella* to the green algal family Thaumatoporellaceae De Castro. Showing equivalent morphological characteristics (microstructure, daughter-colonies with solid or perforated walls, pore arrangement and dimensions) and habitus variability (irregular tubiform, segmentation, facultative cryptoendolithic way of life), *Pseudovermiporella* is here considered a synonym of *Thaumatoporella* (Fig. 1). The "*small Pseudovermiporella within...larger tubes*" (= daughter-colonies, De Castro, 1991) (Fig. 1e-f) were considered by Elliott (1958) "*to represent post-mortem colonisation*". As the main diagnostic feature for the discrimination between *Pseudovermiporella* and *Vermiporella* Stolley, Elliott indicated a solid dark or grey, lighter inner layer of variable thickness interpreted as "*a secondary deposit formed subsequent to the death*" of the organism. This layer is transjected by dimly recognizable pores that may branch just before reaching the outer dark microcrystalline wall, thus indicating its primary origin (Fig. 1k-l). Remarkably, an unusual "*creeping habit*" was stressed by both Elliott (1958) for *Pseudovermiporella* and Pia (1938, "*kriechender Thallus*") for *Thaumatoporella*.

With a first acme period in the Late Permian, a gap in the Lower Triassic (after the end-Permian extinction), further acme periods in the Lower-Middle Jurassic and Upper Cretaceous, and its persistence until the Paleocene, *Thaumatoporella* can be considered both an opportunistic Lazarus (or survivor) and Methusalemi taxon. Acme periods are characterized by the dominance of special morphotypes, e.g., thin walled thalli in the Liassic, complex segmented thalli in the Middle Jurassic and cylindrical thalli, often with comparably thick walls, in the Upper Cretaceous. It is particularly noticeable that the Late Permian specimens resemble those from the Upper Cretaceous, but derive from different palaeo-environments (external *vs.* internal platform).

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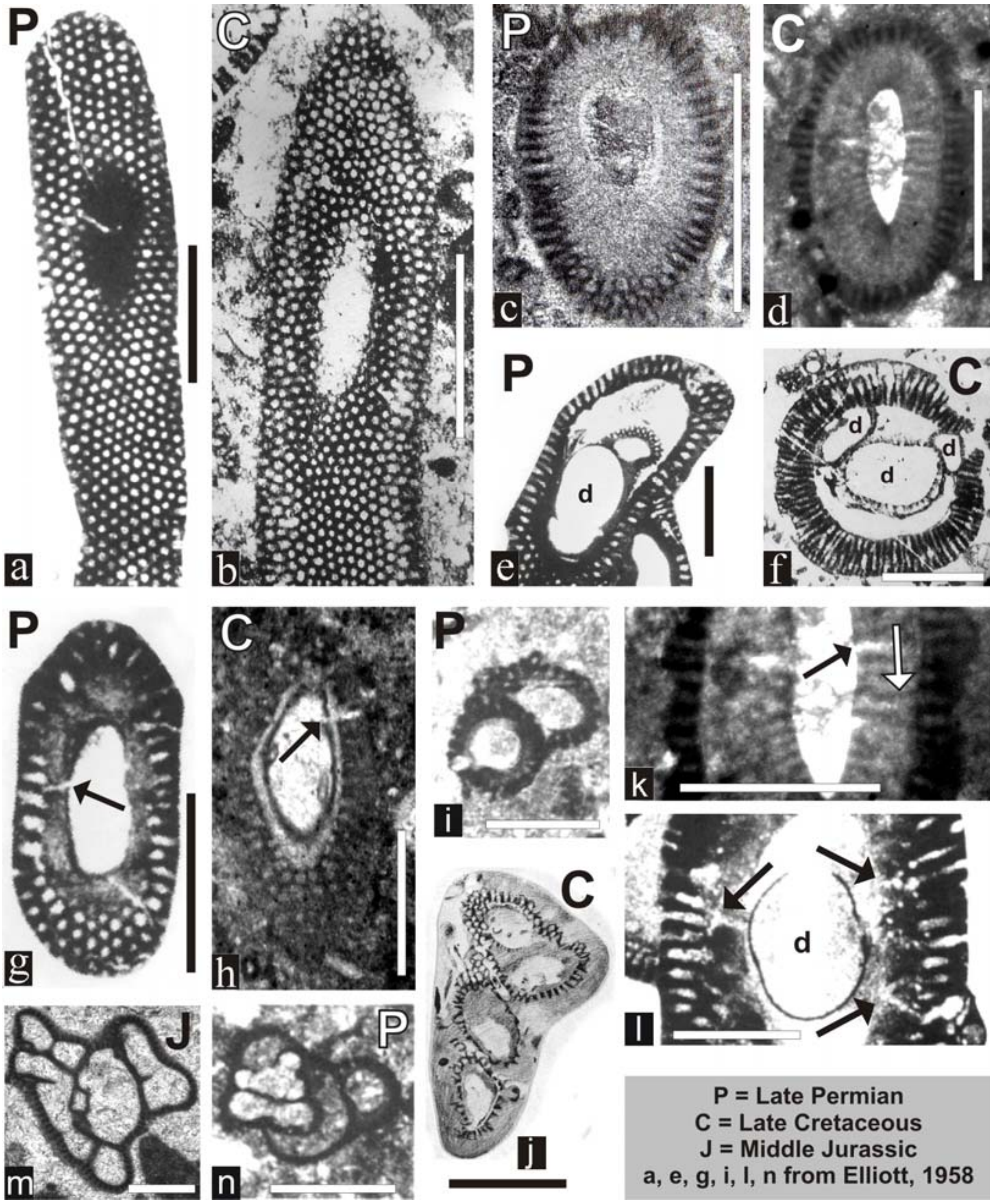

Fig. 1. Comparison between Late Permian *Pseudovermiporella sodalica* Elliott and Mesozoic *Thaumatoporella parvovesiculifera* (Raineri). a, e, g, i, l, n: Late Permian of Oman (from Elliott, 1958). c: Late Permian of China (from Guo & Riding, 1991). b, f: Late Cretaceous of Italy (from De Castro, 1991). d, h, k: Late Cretaceous of Albania. m: Middle Jurassic of Croatia. Scale bars = 0.5 mm except i, k-n = 0.3 mm.

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Interpreting the microencruster incertae sedis *Bacinella ordinata* Pantić, 1972 and *Bacinella bicellularis* Sadati, 1981 as thaumatoporellacean algae

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Key words: *Microproblematica, Calcareous Algae, Triassic, Austria, Croatia*.

Bacinella ordinata was described by Pantić (1972) (Fig. 1/1) as a codiacean alga from the Ladinian of the Dinarids. Later on, it was also reported from the Lower Jurassic of Morocco (Scheibner & Reijmer 1999). Late Triassic Dachstein reefal limestones from the Austrian Salzkammergut contain various microencrusters, e.g., the foraminifer *Alpinophragmium perforatum* Flügel, the incertae sedis *Microtubus communis* Flügel, *Radiomura cautica* Senowbari-Daryan & Schäfer, *Actinotubella gusici* Senowbari-Daryan and *Bacinella ordinata* Pantić (Fig. 1/4). The thin external micritic wall of *Bacinella ordinata* usually appears homogeneous micritic. In some specimens, however, it exhibits a fine perforation (Fig. 1/2-3). The partitions oblique and/or perpendicular to the external wall that form a kind mosaic-like structure are never perforated. On the basis of the alveolar character of the wall, *Bacinella ordinata* is interpreted as a thaumatoporellacean alga sensu De Castro (1991). As alveoli have so far not been reported from "*Bacinella ordinata*", their occurrence is considered an exceptional preservation. Moreover, De Castro (1991) stated that thin-walled specimens (or internal daughter-colonies) often do not show such perforations (alveoli) in the walls. "*Bacinella ordinata*" should neutrally be designated as a thaumatoporellacean alga as it is unclear whether it can be included in the variability of the so far only existing species *Thaumatoporella parvovesiculifera* (Raineri).

Bacinella bicellularis was described by Sadati (1981) (Fig. 1/6) as a possible codiacean alga from Upper Triassic reefal limestones of Austria. The main characteristic is a thallus differentiation with large basal and small distal "cells". An equivalent appearance of irregular constricted tubes is recorded from Middle Jurassic thaumatoporellaceans of Croatia (Fig. 1/7). Besides a mosaic-like pattern of internal homogeneous partitions visible in substrate-parallel sections (Fig. 1/5) equivalent to "*Bacinella ordinata*", a fine alveolar texture of the external wall is also discernible in the figuration of Pl. 1, Fig. 2 in Sadati (1981). Therefore, *Bacinella bicellularis* is here also interpreted as a thaumatoporellacean alga.

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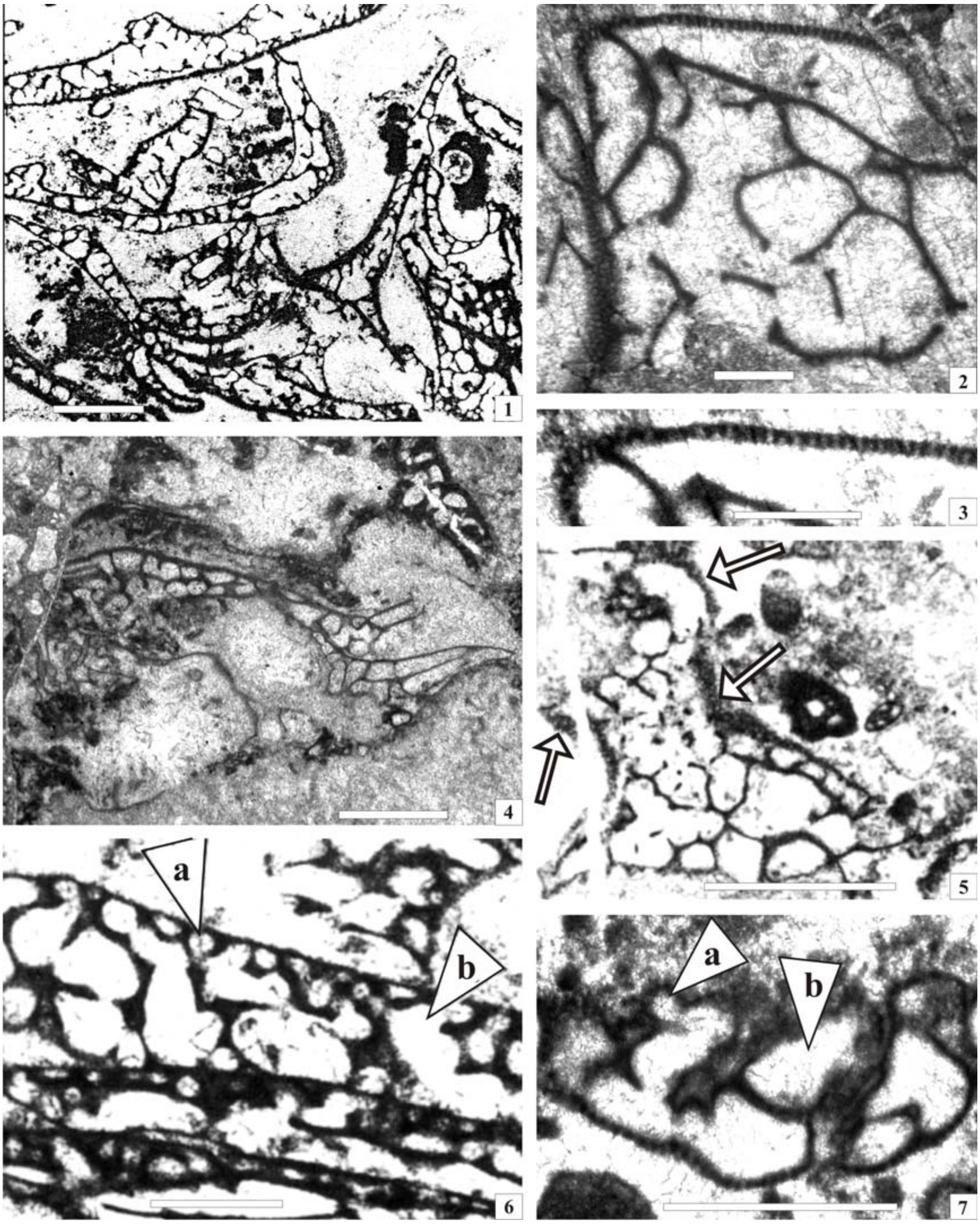

Fig. 1 *Bacinella ordinata* Pantic (**1-4**) and *Bacinella bicellularis* Sadati (**5-7**). **1:** from Pantić, 1972, Pl. 4, Fig. 1), Ladinian of Montenegro. **2-4:** Specimens from the Upper Triassic reefal Dachstein Limestone of Austria (**2**) showing a perforated external wall (**3-4**). **5-6:** from Sadati (1981, Pl. 1, Figs. 2-3), Late Triassic of Austria, showing different sized "cells" (a, b) in **5** (compare **7**). Note the fine perforation of the external wall in **6** (arrows) and the polygonal, mosaic-like central part comparable to *Bacinella ordinata* (**1**). **7:** *Thaumatoporella parvovesiculifera* (Raineri) with irregular constricted tubes like in *Bacinella bicellularis*, Middle Jurassic of Croatia. Scale bars 1, 4-5: 1 mm, 2-3, 6-7: 0.5 mm.

Paleogene Dasycladalean algae from the north-east foot of Biokovo Mt. (Dinarides Mts., Croatia)

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Key words: *Dasycladales, Paleogene, Biokovo, Croatia*.

Previous findings of Paleogene dasycladalean algae in the coastal area of the Karst Dinarides include those from the island of Korčula (Radoičić, 1974, 1995), Pelješac peninsula (Radoičić, 1995) and Konavle area near Dubrovnik (Radoičić, 2004).

On the north-east foot of Biokovo Mt. near Kozica village Paleogene strata lay trasgressively onto the Upper Cretaceous strata. Several samples from the lower part of Paleogene contain numerous specimens of dasycladalean algae. Preliminary investigations indicated fossil association quite similar to one described by Barattolo (1978) and Barattolo & Romano (2002) with addition of some previously unknown forms.

One group of specimens comprises relatively small algae with thin calcareous skeleton and clearly separated whorls of floiophorous branches. Among them species *Clypeina bucuri* BARATTOLO & ROMANO and *Clypeina lucana* BARATTOLO & ROMANO have been determined. New findings of these algae add some new data on their morphology, which ease their mutual discrimination.

Another group of specimens comprise large algae with articulated calcareous skeletons and whorls with differently inclined floiophorous branches. Despite very good preservation of fossil material, it is very difficult to interpret the position of branches as the result of their origin from the same tuft of branches (metaspondylity) or as the result of different inclination of branches from the same whorl (euspondility). Three species can be distinguished in investigated material. One is already known *Praturlonella salernitana* BARATTOLO and other two are new species assigned to the genus *Falsolikanella* GRANIER. Generic determination, due to the mentioned doubt on the position of the branches, should remain uncertain.

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Charophytes from the Upper Cretaceous of the Ager Basin (Central Pyrenees, Spain)

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Key words: *Charales, biostratigraphy, carbonate microfacies, Late Cretaceous, Pyrenees, Spain.*

The Upper Cretaceous of the Ager Basin represents the infilling of a Pyrenean piggy-back basin related to the Serres Marginals thrust-sheet. Campanian to Thanetian sequences range from near-shore bioclastic limestones, deltaic sandstones, lacustrine limestones and fluvial red beds (Colombo & Cuevas, 1993; Galbrun et al., 1993). Lacustine facies were the object of our study and show small-order cycles formed by marls, alternating with charophyte-rich limestones with a characteristic colour banding of light-coloured wackestones and dark packstones.

Marls contain ostracodes, gastropods and charophyte remains. Within the latter, the studied samples provided a charophyte flora composed by two types of thalli: *Charaxis* and *Clavatoraxis,* both with haplostichous cortication, and a number of fructifications: gyrogonites of P*eckichara cancellata*, *P. sertulata, Platychara caudata, P. turbinata*, *Dughiella obtusa*, *Microchara cristata*, *M. parazensis* and *Feistiella malladae*, and utricles of *Clavator brachycerus* (=*Septorella brachycera*).

From a point of view of biostratigraphy, the charophyte assemblage is dominated by *C. brachycerus* and *P. cancellata*. According the biozonation of Feist (in Riveline et al., 1996) this assemblage corresponds to the Peckichara cancellata zone, correlated in the Eastern Pyrenees (Vallcebre Basin) with the C31r magnetochron (close to the Campanian – Maastrichtian boundary).

Freshwater lacustrine limestones show diverse fabrics and skeletal assemblages of freshwater charophytes, cyanobacteria and invertebrates. This allows us to characterise a number of charophyte-rich microfacies and to elucidate the palaeoecology of fossil charophytes and associated fossils.

Light-coloured limestones show three different types of carbonate microfacies:

(1) Wackestone-packstone composed by large portions of haplostichous thalli *Clavatoraxis* sp. type (affine to *Clavatoraxis microcharophorus* Villalba-Breva & Martín-Closas, 2011). Small characean gyrogonites attributed to the genus *Microchara* were found associated but not in anatomical connection with the thalli. There are also tubes of sparry calcite, corresponding to crusts of aquatic plants. Calcified filaments attributed to *Girvanella* sp., are abundant in the muddy sediment and may represent poorly developed cyanobacterial mats. This facies is attributed to deposition within a *Clavatoraxis* charophyte meadow, below the wave motion line.

(2) Laminated packstone of haplostichous *Charaxis* sp. thalli. In the same laminae there are disperse gyrogonites attributed to *Peckichara* sp. and *Microchara* sp. Other intercalated horizons show larger tubes of sparry calcite without internal structures. This facies is related to deposition of parautochthonous remains of a *Charaxis*-dominated meadow.

(3) Mudstones-wackestones of abundant fragmented charophyte remains and other small bioclasts of undetermined affinity. Thalli, usually small portions of isostichous internodes, correspond to the genus *Charaxis*. Most characean gyrogonites are small

in size, fragmented and probably corresponding to the genus *Microchara*. Other types of gyrogonites found were generally broken and are attributed to the genera *Feistiella*, *Platychara* and *Peckichara*. This facies may represent deposition at the shore of freshwater lakes affected by significant wave action.

In contrast, dark-coloured limestones show only one type of carbonate microfacies. This consists of organic-rich packstones of abundant small fragments of *Munieria grambasti* thalli, fragmented ostracodes and undetermined bioclasts. Other, less abundant remains belong to clavatoracean utricles of *Clavator brachycerus*, small portions of internodes of *Charaxis* thalli, characean gyrogonites of *Peckichara* and *Microchara*, vertebrate eggshell fragments, brown wood, fusinite and black pebbles. This facies is attributed to the washed remains of a *Munieria* meadow deposited on the shores of lakes or marshes submitted to significant wave action which resulted in the reworking of desiccated mud-cracks.

The microfacies analysis appears to indicate that during the Late Cretaceous, freshwater lakes showed a variety of different hydrophytic vegetations in the Ager Basin, ranging from the *Munieria*-dominated shallower parts to the deeper parts dominated by *Charaxis* and *Clavatoraxis* meadows. Also, our data indicate that the taxon of problematic affinity *Munieria* was related to clavatoraceans, exactly to *Clavator brachycerus* (=*Septorella brachycera*) in the Upper Cretaceous of the Pyrenees.

The lacustrine facies of the Ager Basin can be compared with other deposits of the same biozone from neighbouring Pyrenean basins, such as the paralic facies of the Vallcebre and Tremp Basins (Eastern and Central Pyrenees respectively). The facies of Ager are distinct from the other coeval localities in showing a higher proportion of *Munieria* and a greater diversity of characeans, but a lower proportion of *Feistiella*. This is significant from the point of view of palaeogeography, since it shows that the Pyrenean Basin displayed a South to North, proximal to distal, facies polarity at the beginning of its Late Cretaceous continentalization, very much in the same way as what happens in Lower Cretaceous Pyrenean basins. However in the Late Cretaceous this polarity was superimposed to the well known East to West polarity, related to the Pyrenan Basin infilling and the anticlockwise rotation of Iberia.

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Cyanobacterial and algal communities in Buzgó tufa depositing stream (Slovak Karst, southern Slovakia)

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Key words: *modern tufa, cyanobacteria, algae, Slovak Karst, Slovakia*.

Studies of the Buzgó tufa depositional stream, coming out from the Krásnohorská Cave (Slovak Karst, southern Slovakia), revealed the presence of cyanobacteria and algae communities in fresh deposits.

Spring field observations shoved that some parts of the stream (mainly cascades) are locally covered by a thin microbial biofilm. Petrographic observation of fresh tufa samples demonstrated that there is a link between presence of microorganisms and tufa internal texture. Microbial-dominated tufa is mainly composed of calcified cyanobacterial filaments covered and local accumulations of diatoms. The individual cyanobacteria filaments reach up to 30-40 µm in length and 4 µm in diameter. They are orientated nearly perpendicularly to the basement. The calcite crystals reach up to 5 µm in length/wide. Microbial-dominated tufa is characterized by very low porosity, which is visible in the form of fine lamination (probably seasonal).

In contrast to the microbial-dominated tufa, a deposit without presence of microbial biofilm is composed mainly of encrusted stems of mosses. Encrustation is composed of the sparry fan-shaped calcite crystals (up to 200 µm in length and 50 µm in wide) orientated perpendicularly to the moss stems. Moss-dominated tufa is characterized by high porosity reaching around 40%.

The above data suggest that presence of microorganisms may significantly affect on tufa texture. Presented results are based only on preliminary studies and will be complemented by detailed seasonal (daily and yearly) observations of aqueous environment and tufa deposits.

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