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Research Paper

Microbial Structures and Microencrusters from Guri I Pellumbit Section, Klosi Region, Albania

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Abstract: Microbial structures, including microencrusters associations, are the main components of the Upper Jurassic-Lower Cretaceous reefal carbonates and play an important role in the paleoenvironmental and paleobathymetric reconstructions. In the Guri i Pellumbave section, a large range of microbial structures and microencrusters was identified and together with other organisms such as foraminifera, calcareous algae, calpionellids and different macro-organisms as corals and stromatoporoids, were important constituents of the studied deposits and abundant almost in the whole section. The mixture of elements typical of shallow water environments and those of deep-water environments represented by calpionellids, allowed us to interpret the carbonate deposits of the studied section as slope sediments.

Keywords: *microbial structures, microencrusters, Mirdita zone, Guri i Pellumbit, Beriassian-Valanginian.*

Introduction

South of the Shkodra-Peje line, the Mirdita zone is characterized by q huge ophiolitic nappe (*Mirdita ophiolite*), up to 13 km thick in the Tropoja massiv (Llangora & Bushati, 1990), which represents the largest European ophiolitic complex.

Within the ophiolites and napes of Krasta Zone there is a very deformed tectonic complex interpreted and named in different ways: as peripheral complex according to Robertson & Shallo (2000) or Hajmeli, Qerret-Miliska and Gjalica according to Kodra *et al.* (1993), Meco and Aliaj (2000). This tectonic complex can be divided into three main structures. The lower structure is characterized by a thick carbonate platform sequence (according to Kodra et al., 1993 was named Hajmeli in the northern part of Mirdita and Gjalica in the eastern part).

The second structure settled on the carbonate platform is is represented by a volcanic, volcano-detric and pelagic (limestones and cherts) sequence confirmed and dated in different countries by microfauna, radiolareans and conodontes (Kodra *et al*., 1993; Meço & Aliaj, 2000). The name of this complex is Rubiku nappe.

The third complex consists of ophiolites of Mirdita Zone which is divided in two belts: the ophiolitic belt of Western Mirdita (OMP) and the ophiolitic belt of Eastern Mirdita (OML) (Shallo et al., 1987; Beccaluva et al., 1994; Tashko, 1996). The contact between these belts is thought to be of tectonic nature. However, Bebien et al. (1998) have shown that there may be a continuity between these two ophiolitic belts.

As is shown by the ages of the metamorphic soles, Mirdita ophiolitic nape has been overthrusted or obducted during Middle Jurassic (Dimo, 1997; Dimo-Lahitte *et al*., 2001), shortly after their magmatic setting. After this process of tectonic setting, the ophiolites have been subjected to erosion.

The post-obduction sediments consist of a chaotic association coming from the internal structures and ophiolites. However, the ophiolitic elements are quite rare, undoubtedly as a result of climatic conditions in which it is developed and carried the erosion of OML. The chaotic sequence is covered by turbidites from Tithonian-Lower Cretaceous (and then by thin carbonate formations of Hauterivian – Barremian and Upper Cretaceous turbidites (Peza, 1985; Shallo, 1990).

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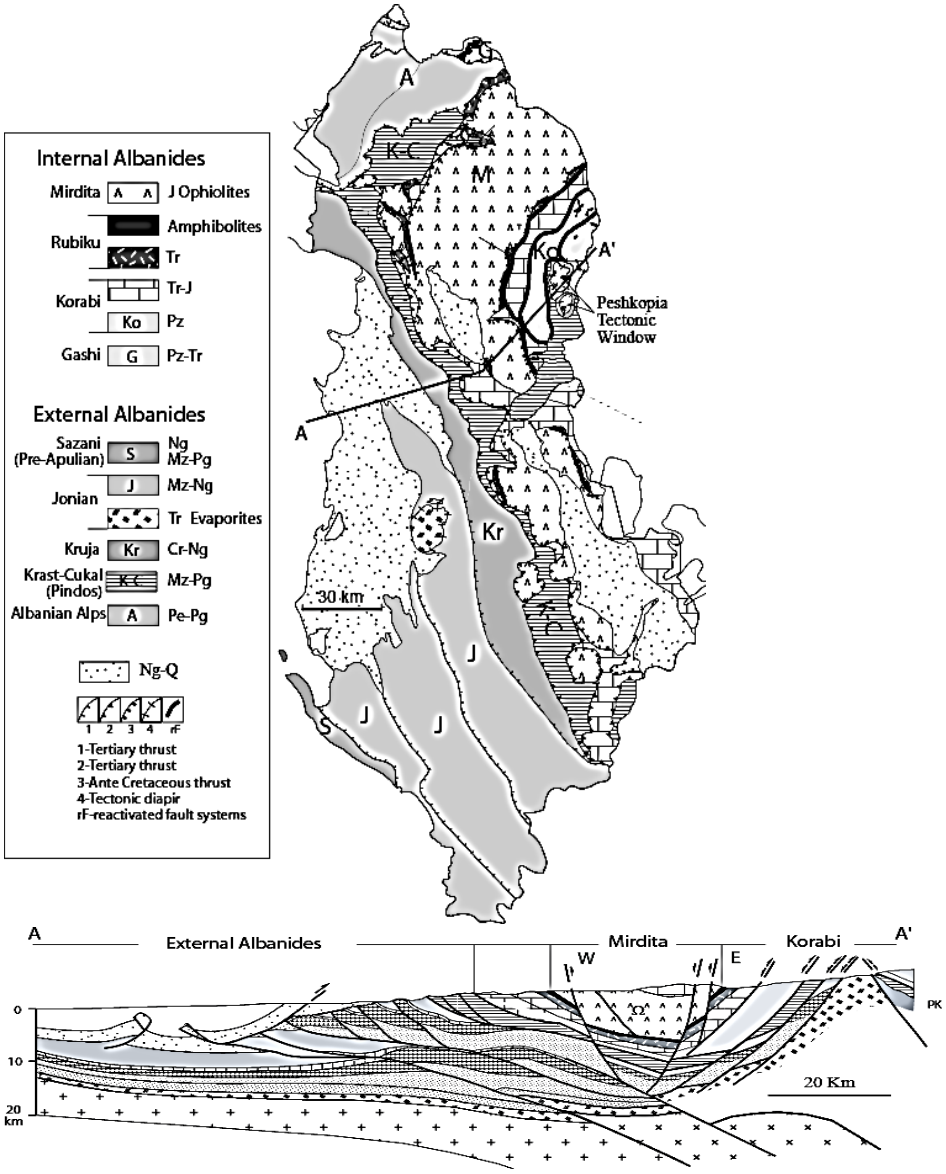


Figure 1. Schematic geological map and cross-section of the Albanides (in Muceku *et al*., 2008)

This work consisted of three different steps used as work method during the study of Lower Cretaceous carbonate deposits of Mirdita geological zone: (1) bibliographic study on the latest existing data on this type of organisms (2) field works, and (3) laboratory works

First, a detailed study of bibliographic sources has been done especially in relation to the morphological features and the affinity of the mentioned microbial structures and microencrusters with the other similar organisms. During the field works step, the studied stratigraphic section was examined and interpreted in relation to its lithology, microfacies and faunistic content with hand-held lenses and a number of 110 samples were collected. The stratigraphic section was carried in Beriasian-Valanginian carbonate deposits. During laboratory studies, detailed micropaleontological analyzes were performed and a number of 109 thin sections was prepared from the collected samples, at the Faculty of Geology and Mining thin section laboratory. Micropaleontological analyzes were performed by investigating the morphology of the specimens and the most concludes species were photographed and determined according to the latest taxonomic hierarchy.

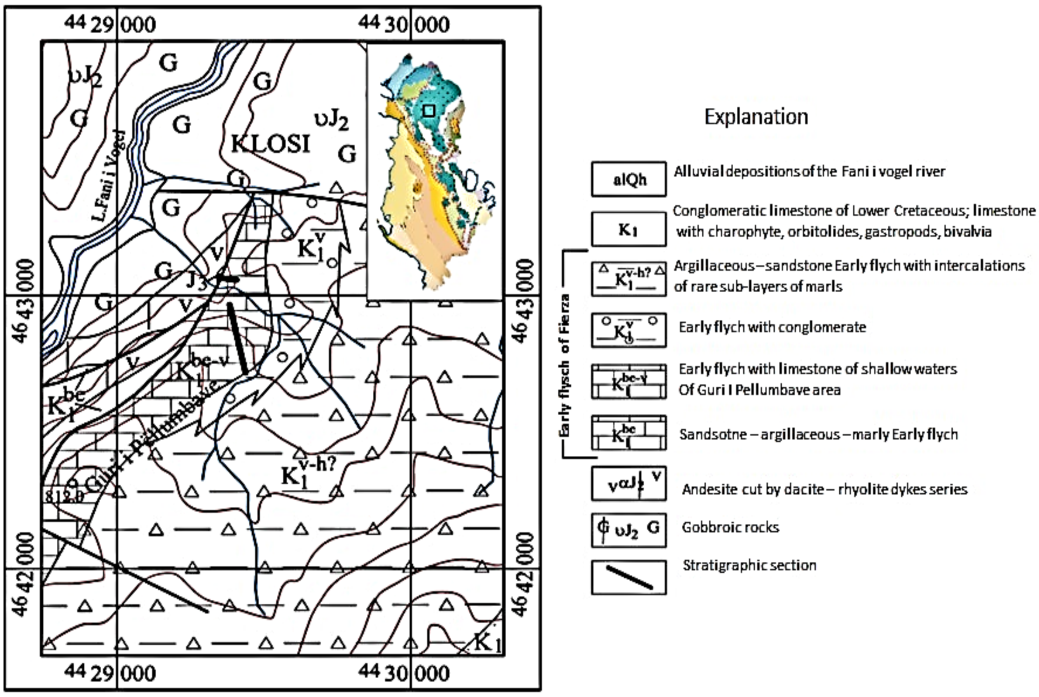


Figure 2. The geology of Guri i Pellumbit section, 1: 25 000 scale

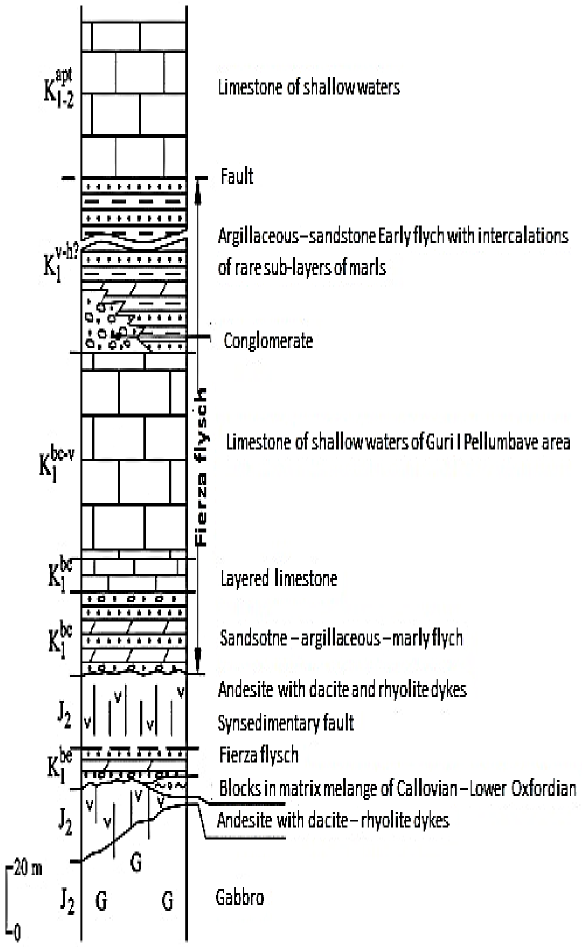


Figure 3. Stratigraphic column of Guri i Pellumbit section

Results

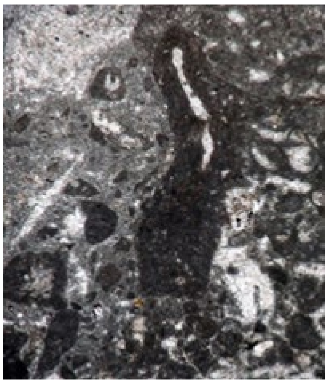
Recent studies performed on the Upper Jurassic-Lower Cretaceous carbonate deposits, especially on reefal limestones, have proven that an important role in their genesis was played by microbial organisms and microencrusters (Leinfelder et al., 1993; Schmid, 1996).

The most important species encountered in Guri i Pellumbave section are: *Crescentiella morroenensis CRESCENTI*, *Bacinella irregularis* RADOICIC, *Lithocodium aggregatum* ELLIOTT, *Troglotella incrustans* WERNLI & FOOKES, *Koskinobullina socialis* CHERCHI &SCHROEDER, *Radiomura cautica* SENOWBARY-DARYAN & SCHAFER, *Iberopora bodeuri* GRANIER & BERTHOU, *Thaumatoporella parvovesiculifera* RAINERI, *Pseudorothpletzella schmidi* SCHLAGINTWEIT & GAWLICK, bacinelloid nodules and peloidal microbial crusts. Most of these structures are related to shallow-water reef environments with variable hydrodynamic regimes.

Crescentiella morronensis CRESCENTI

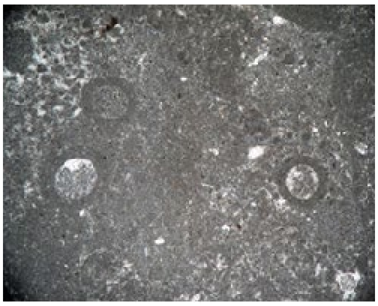
These types of structures were encountered in all the microfacies types identified in the studied area and consists of a "nucleus" represented by a nubeculariid foraminifer where its chambers have central arrangement of the chambers andare they are surrounded by an envelope of micritic origin (Figure 2A, B). In the samples collected from Guri i Pellumbave section, the detailed structure of the micritic envelope with a peloidal texture is probably of microbial origin. The dominant morphological type of *Crescentiella morronensis* in the studied area is ellipsoidal-nubecularioid (Figure 4 A, B). In the studied section, *Crescentiella morronensis* is often associated with *Terebella lapilloides* (Figure 4D-F) and usually this co-habitation shows a bathymetric significance and confirms his occurrence in deep environments (Leinfelder *et al*., 1993a, 1993b, 1996).

A. Crescentiella morronensis, sample D39

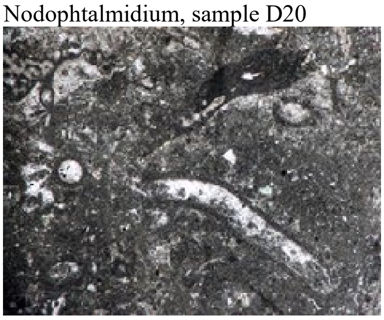


B. Crescentiella morronensis with the microencrusting foraminifera Nodophtalmidium, sample D20

C. The microencrusting foraminifer Nodophtalmidium sp, Sample D6



D. Terebella lapilloides, sample D36



E. Terebella lapilloides and Crescentiella morronensis, sample D101

F. Terebella lapilloides, sample D98

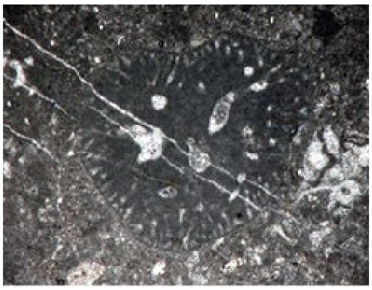
Figure 4. Different microbial structures and microencrusters

Bacinella irregularis RADOIČIĆ

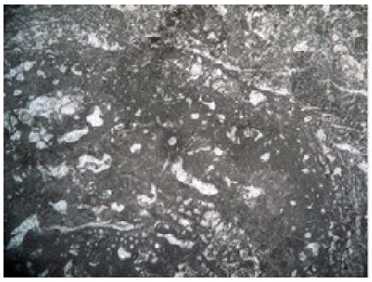
In the studied section, important levels with *Bacinella irregularis* (Figure 4 A-E) are often signaled. This structure is characterized by the presence of crusts or small bubbles consisting of an irregular net, sometimes accompanied by attached structures belonging to another microencruster, *Lithocodium aggregatum* and is considerate as having microbial origin. Other structures that have been described in

Guri i Pellumbave are the so-called "bacinellid" fabrics (Schlagintweit & Bover-Arnal, 2013), "*Bacinella*" type structures and bacinellid structures.

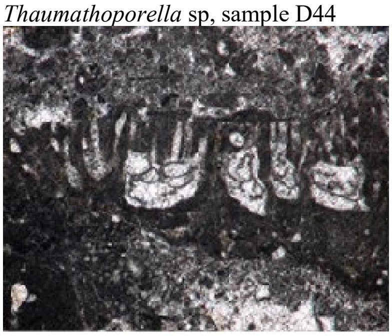
A. *Bacinella irregularis* and *Thaumathoporella* sp, sample D44



B. *Lithocodium aggregatum*, sample D37



C. Bacinella irregullaris, sample D46



D. *Lithocodium aggregatum*, sample D67

E. *Bacinella irregullaris*, sample D73

F. *Lithocodium aggregatum*, sample D89

Figure 5. Different microbial structures and microencrusters

Bacinellid fabrics

In our section species similar to baccinelid fabric (Figure 5 C) have been described in a form of irregular vesicular crusts having a possible microbian origin as shown in Schlagintweit and Boveri-Arnal (2013).

***Lithocodium aggregatum* ELLIOTT**

In our studied samples, *Lithocodium aggregatum* (Figure 5, B, D, F) is in a form of sponge encrusting the internal structure of a microbial crust and is often associated with *Bacinella irregularis* and with other encrusting organisms such as *Troglotella incrustans*.

***Troglotella incrustans* WERNLI & FOOKES**

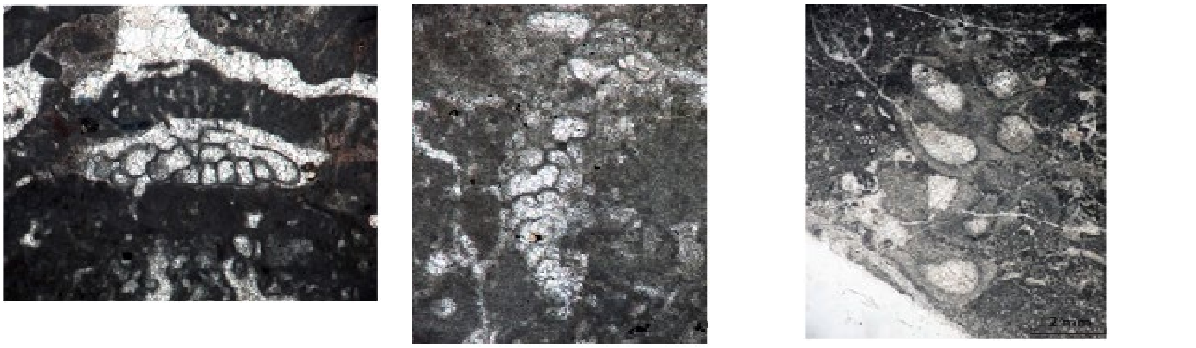
The association of *Troglotella incrustans* with *Lithocodium aggregatum* (Figure 6, A) appears as a symbiotic consortium between two foraminifera, where the chambers of *Lithocodium aggregatum* are inhabited by another foraminifer, *Troglotella* (Figure 6, B).

***Radiomura cautica* SENOWBARY-DARYAN&SCHAFER**

In our section*, Radiomura cautica* (Figure 6, C-D) it is abundant within the microbial crusts reefal nature (Radoičić, 1959) and consists of a structure several hemispherical or spherical typical chambers.

***Koskinobulina socialis* CHERCHI & SCHROEDER**

Koskinobulina socialis (Figure 6, E-F) is another encrusting micro-organism characterized by perforated wall hemispherical chambers which, in our section, is usually accompanied by another microproblematic, *Iberopora bodeuri* Granier et Berthou, consisting of small, bubble-shaped cells.



A. *Troglotella incrustans*, sample D80 (10x)
B. *Troglotella incrustans*, sample D94 (10x)
C. *Radiomura cautica*, sample D14 (2.5x)

D. *Radiomura cautica*, D60 (2.5x)
E. *Thaumathoporella parvovesiculifera*, sample D63 (5 x)
F. *Thaumathoporella parvovesiculifera*, sample D101 (10x)

Figure 6. Different microbial structures and microencrusters

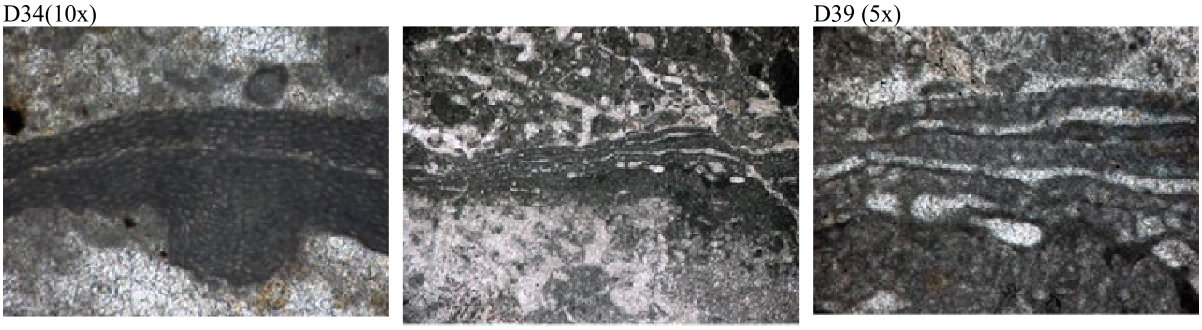
Iberopora bodeuri **GRANIER&BERTHOU**

Iberopora bodeuri (Figure 7, A-B), which in the studied material is present as successive crusts with a cellular structure that envelloped by micrite of possible microbial origin.

Rothpletzella schmidi SCHLAGINTWEIT & GAWLICK*,*

Pseudorothpletzella schmidi (Figure 7, C-D) structures show flat layers of small cells having a domal shape and where the overlapping layers of small tubes are not continuous sideways, ate thin walled and of microcrystalline structure.

A. *Iberopora bodeuri*, sample D34(10x)
B. Iberopora bodeuri, sample D34 (5x)
C. Cores of Rothpletzella type, sample D39 (5x)



D. Cores of type Rothpletzella**,** sample D39 (10x)
E. Microbial crust, sample D17 (5x)
F. Microbial crust, detail, sample D17 (10x)

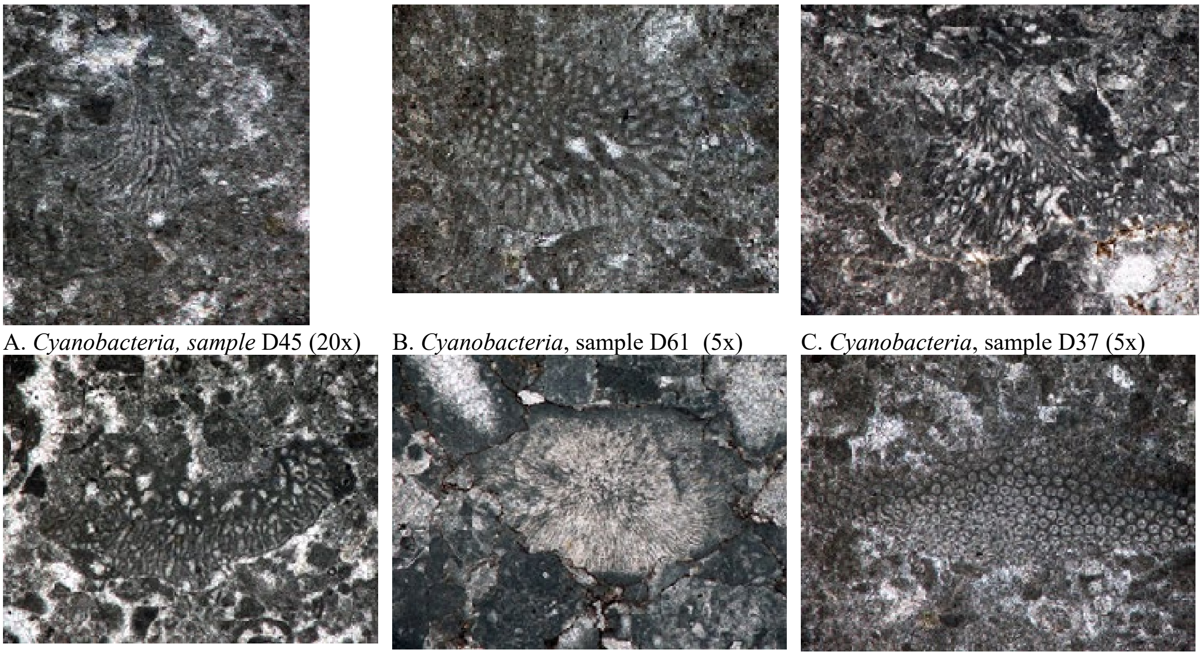
Figure 7. Different microbial structures and microencrusters

***Thaumatoporella parvovesiculifera* RAINERI**

Here *Thaumatoporella parvovesiculifera* (Figure 6, E-F, Figure 6, F) structures are characterized by an irregular cylindrical morphology or in a form of scale-shaped bridges-shaped structures but also forms of *Thaumatoporella parvovesiculifera* similar to single-layer perforated bacinellid forming by a series of cells are also described.

***Koskinobulina socialis* CHERCHI & SCHROEDER**

Koskinobulina socialis (Figure 8, F) is another encrusting micro-organism characterized by perforated wall hemispherical chambers which, in our section, is usually accompanied by another microproblematic, *Iberopora bodeuri* Granier et Berthou, consisting of small, bubble-shaped cells. Other microbial structures identified in the studied section are: microbial crusts (Figure 7. E-F) and different cyanobacteria (Plate 8, Figures. A-E)



A. *Cyanobacteria, sample* D45 (20x) B. *Cyanobacteria*, sample D61 (5x) C. *Cyanobacteria*, sample D37 (5x)

D. *Cyanobacteria*, sample D16 (5x) E. *Diversocalis* sp, sample D100 (5x) F. *Koskinobulina socialis*, sample D37(5x)

Figure 8. Different microbial structures and microencrusters

Discussions

Many of these structures are described for the first time in Albania. They do not have a special biostratigraphic importance but is well known that the above described encrusting organisms are important elements in paleoenvironmental and paleobatimetric reconstructions. A large range of microbial structures and have been signaled in the Lower Cretaceous deposits of Guri i Pellumbave section (*Bacinella irregularis, Crescentiella morronensis, Koskinobulina socialis, Radiomura cautica* or *Iberopora bodeuri, peloidal*, micritic and cyanobacterial structures). In some parts of our section, the many of the coral and stromatoporoids bioconstructions are often encrusted by different microbial, algal and encrusting foraminifera. Most of these structures are typical of shallow environments, mainly reef environments, with variable hydrodynamic regimes (from the intertidal, high-energy environment to protected, low-energy subtidal environment).

In the middle part of the studied section are also described some levels of rudstones with intercalations of microbial boundstones with corals which are ocasionally brecciate. The main identified organisms in these rudstones are: *Crescentiella morronensis, Koskinobullina socialis, Lithocodium aggregatum, Bacinella* type structures, *Radiomura cautica* and *Troglotella incrustans*, these typical deposits being classified as “coral-microbial-microbial-boundstone (Pleș *et al*., 2013).

Lithocodium aggregatum, *Bacinella irregularis* (bacinellide structure) and *Koskinobulina socialis* are usually typical organisms for back-reef facies, but sometimes are signaled in shallow reef marginal facies (Schlagintweit *et al*., 2010). The most present microbial organism in our section, *Crescentiella morronensis,* usually occurs in shallow environments (lagoons, reefs) but is also described from deeper environments (sponges reef, slopes), while *Radiomura cautica* is an organism typical for reef and fore-reef environments.

The "*Lithocodium-Bacinella"* consortium is typical for shelf environments and has been encountered in lagoons and coral reefs (Leinfeder et al., 1993). In our section, Radiomura *cautica* is common among the other microencrusters cementing the above mentioned boundstones, while other organisms also described here, as *Iberopora bodeuri* or *Koskinobulina socialis*, are often described from Early Cretaceous reef environments and from inner platforms or the back-reef environments (eg, Leinfelder et al., 1993; Dupraz and Strasser, 2002).

Conclusions

The Upper Beriassian-Lower Valanginian carbonate deposits from Guri I, Pellumbit stratigraphic section mainly consist of massive reef limestones rich in benthic foraminifera, calcareous algae and callpionellids, along with a wide range of microbial structures and microencrusters as *Crescentiella morronensis*, *Lithocodium aggregatum*, bacinellid structures, *Radiomura cautica*, *Thaumathoporella parvovesiculifera* or *Koskinobulina socialis*). As mentioned above, these organisms do not have a special biostratigraphic importance they are important elements in paleoenvironmental and paleobatimetric reconstructions and together with other organisms with similar living environments, it was possible to carry out zoning of the carbonate platform, thus identifying the platform slope, reef or back reef environments. Most of these structures are related to different shallow-water environments, from intertidal, high-energy environment, to protected low energy subtidal environment.

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