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Research Paper

Early Cretaceous Benthic Foraminifera from Guri I Pellumbit Section, Klosi Region, Albania

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Abstract: This paper presents the preliminary results of a micropaleontological study performed on Guri e Pellumbit stratigraphic section, in Klos region (Mirdita area). Benthic foraminifera together with "microproblematica", calcareous algae and calpionellids are the main components of Lower Cretaceous reefs and carbonate platforms and have proved to be extremely helpful in the zonation of platform carbonates. The mixture of typical elements of shallow water environments (foraminifera, calcareous algae and microproblemica) with elements of deep environments (calpionellids) and the specific microfacies shortly described in this study are typical for an allodapic limestones (turbidites). Based on the micropaleontological associations with biostratigraphical importance, the age of these deposits is Upper Beriassian-Lower Valanginian.

Keywords*: Early Cretaceous, benthic foraminifera, Mirdita zone, biostratigraphy, Beriassian-Valanginian.*

Introduction

The geological zone of Mirdita has wide spread in Albania, where the ophiolites which are the major components, represent parts of the ocean basin expanded from Middle Triassic to Middle Jurassic between the Adriatic plate and the Korab-Pelagonian continental microblock. The closure of Mirdita ocean basin has occurred throughout Middle Jurassic until the beginning of Late Jurassic. (Xhomo 2002, 2005).

The Middle-Upper Jurassic and Jurassic-Cretaceous deposits covering the ophiolites and the surrounding continental formations have been largely treated by many authors (Shehu et al. 1990, Meço&Aliaj. 2000, Xhomo. 2002, Marku D. 1999, 2000, 2001).

This paper is focused on the micropaleontological and biostratigraphical study from a stratigraphic section within the Jurassic-Cretaceous deposits, Guri i Pellumbit, in Klos (Mirdita area) represented by carbonate deposits interpreted as slope sediments (Figures1 & 2).

Materials and Methods

Our study is based on the investigation of a number of 105 samples collected from a stratigraphic section on the Beriassian-Valanginian carbonate deposits belonging to Mirdita geological zone, followed by a detailed investigation of microfacies types and micropaleontological content under a Zeiss Axioplan 2 imaging microscope.

The geological background of the section

In the studied section are present the ophiolitic formations and their covering deposits (Fig. 1, 2), where the ophiolitic formations are represented by an oceanic crust sequence with gabbros at the bottom and andesites with dacite-rhyolitic dykes on the top, while the deposits covering the ophiolites are represented by:

- limited strips of "blocks in matrix" mélange covering the volcanic rocks. The age of these deposits is given as Upper Callovian - Lower Oxfordian (Xhomo et al. 2002, Aliaj, Kodra 2016).

- "Firza" flysch deposits above the andesites with dacite-rhyolitic dykes where the next horizons have been detailed:

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• Sandy-clayey-marly horizons of Beriassian age

• A thin horizon of Beriassian plately limestones.

• A shallow water carbonate horizon and slope deposits of Guri i Pellumbit section of Upper Beriassian-Lower Valanginian age.

• Conglomerates and clayey-sandy-marly flysch deposits of Valanginian-? Hauterivian age.

Melo 1971 and Meço 1975 by studying the ammonites and calpionellides have assigned the Beriassian age for the horizons below Guri i Pellumbit section. Regarding the above mendioned studies, we think that the andesite with dacite-rhyolitic dykes stretching between the two lower flysch horizons does not represent Beriassian volcanic activity or olistoliths in flysh and we interpret these volcanites as the basement of Beriasian flysch deposits, repeated in the section as consequence of the Beriassian synsedimentary tectonics.

These deposits are in a form of a horizon of several kilometers long and with an average thickness of 50-70 m. In the northeastern part, these deposits are settled above the volcanic and "blocks in matrix" melange, while in the southwestern part are stratigraphically placed above the flysch horizon and the Beriassian plately limestone. In the ceiling of Guri i Pellumbit carbonate deposits, in the northern part, are lying conglomerate deposits, while in the southern part, these conglomerates are facially passing into clayey-sandy-marly flysch deposits.

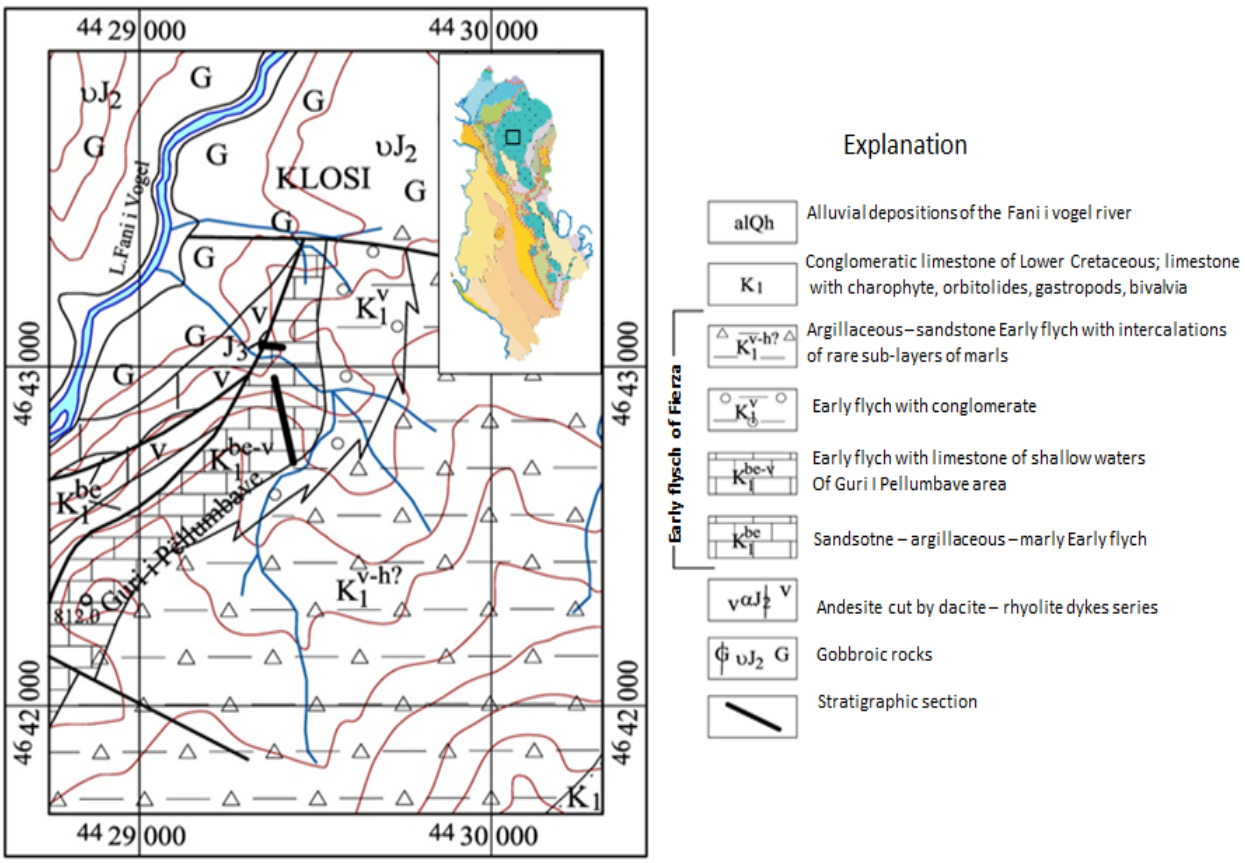

Figure 1.The geology of Guri i Pellumbit section, 1: 25 000 scale

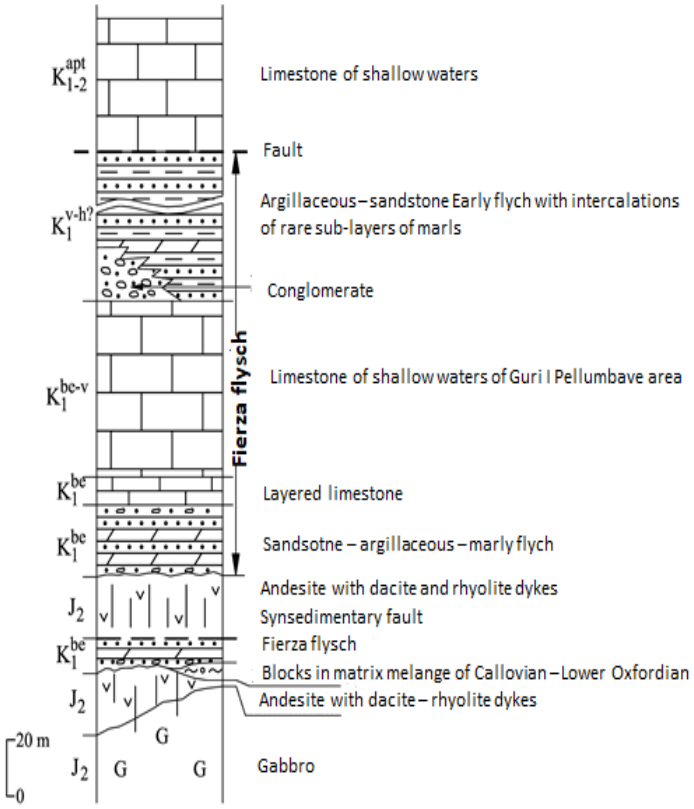

Figure 2. Stratigraphic column of Guri i Pellumbit section

Results

The next dominant microfacies types with their micropaleontological associations each of them pointing to a specific depositional environment were identified in a number of 105 samples systematically collected along the studied section.

Bioclastic peloidal packstone-grainstone

This microfacies is characterized by an abundant presence of bioclasts and peloids as allochems in the micrite dominated matrix, where the larger allochems are represented by corals, sclerospongiaires, echinoderms and bivalves, while the microfauna mainly consists of microbial structures, dasycladacean algae, calpionellids and benthic foraminifera as: ?*Reophax* sp, *Nodophtalmidium* sp, *Ammobaculites* sp, ?*Rectocyclammina* sp, ?*Schythiolina/Histerolina*, *Protopeneroplis cf. banatica*, *Protopeneroplis ultragranulata, Neotrocholina* sp.

Packstone/rudstone

This microfacies contains large fragments of corals, sclerospongiaires, bivales and a microfauna mainly consisting of microbial structures, dasycladacean algae, rare calpionellids and benthic foraminifera as: *Protopeneroplis ultragranulata, Mohlerina basiliensis, Lenticulina* sp, *Neotrocholina* sp, *Ammobaculites, Nodophtalmidium* sp

Bioclastic grainstone

This microfacies is characterized by abundant bioclasts and calcitic cement where the larger allochems are generally represented by corals or sclerospongiaires fragments. The microfauna is represented by microbial structures, dasycladacean algae and benthic foraminifera as: *Protopeneroplis ultragranulata, Coscinophragma* sp, *Scythiolina cf laurentii, Coscinoconus* sp and dasycladacean algae: *Salpingoporella pygmaea*, *Suppiluliumaella polyreme*,? *Suppiluliumaella sp*.

Peloidal bioclastic grainstone
This microfacies is characterized by an abundant presence of peloids as allochems in the micrite dominated matrix where most of these peloids are probably related with microbial activity [microbial peloids as defined in Flügel (2004)]. The microfauna is represented by microbial organisms, dasycladacean algae, calpionellids and benthic foraminifera: *Coscinoconus cf. alpinus, Coscinoconus alpinus, Haplophragmoides jourkovsky, Mohlerina basiliensis*, Protopeneroplis *ultragranulata*, *Coscinoconus cf. alpinus*, *Haplophragmoides jourkovsky*, Neotrocholina sp, *Lenticulina* sp;

Peloidal bioclastic packstone-grainstone
This microfacies consists of abundant peloids, bioclasts and sparry calcitic cement (if the texture is dominantly grainstone) or micritic matrix (if the texture is dominantly packstone) as background material. It consists of microbial structures, dasycladacean algae, calpionellids and benthic foraminifera: *Montsalevia salevensis*, *Haplophragmoides jourkovsky*, *Protopeneroplis ultragranulata*, *Mohlerina basiliensis, Neotrocholina* sp, *Lenticulina* sp, *Coscinoconus* sp. Most of these peloids are probably related with microbial activity [microbial peloids as defined in Flügel (2004)].

Bioclastic rudstone, **packstone rudstone and rudstone/boundstone**
This microfacies contains fragments of corals, sclerospongiaires, bryozoans, bivalves, gastropods and a microfauna represented my microbial structures, dasycladacean algae, calpionellids and benthic foraminifera: *Protopeneroplis ultragranulata*, *Pseudocyclammina lituus, Everticyclammina* sp, *Neotrocholina* sp, *Coscinoconus aff. delphinensis*, *Conscinoconus cherchiae, Coscinoconus* sp, *Gaudryna ectypa*, *Mohlerina basiliensis, Charentia* sp.

Bindstone
This microfacies is rich on *Bacinella irregularis,* bacinelloid and microbial structures, rudists and sponigiaires fragments, algae and benthic foraminifera: *Lithocodium aggregatum*/*Troglotella incrustans, Troglotella incrustans* and *Mohlerina basiliensis, Protopeneroplis ultragranulata*, *Coscinoconus delphinenis* and miliolids.

Boundstones
Corals and sponges play a major role in the construction of the boundstones as well as the microbial organisms that play a secondary role. The cavities and the spaces between the pores are filled with different allochems, with a micrite or sparitic matrix, the calcite being the dominant cement. In most cases the corals are recrystallized. Together with the corals and the sclerospongiaires, the others organisms as *Radiomura cautica, Crescentiella morronensis, Koskinobulina socialis, Terebella lapilloides, Protopeneroplis ultragranulata,* shows that these boundstones are formed in the marginal reefal setting on the platform.

Microbialites
This microfacies fragments of corals, sclerospongiaires, echinoderms and bivalves and a microfauna mainly represented by microbial stuctures, rare sections of calpionellids and benthic foraminifera as *Neotrocholina* sp, *Neotrocholina valdensis, Mohlerina basiliensis* and *Everticyclammina* sp.
The above described microfacies are typical for an allodapic limestone - in fact, the whole sampled section shows a mixture of elements of typical of shallow water and calpionellids, typical elements of deep water - can be interpreted as slope sediments.

Discussions

Based on the above identified micropaleontological assemblages, the studied deposits were assigned to the Upper Berriasian- Lower Valanginian (? Hauterivian) by taking into consideration the next associations with biostratigraphical significance:

Benthic foraminifera as *Pseudocyclammina lituus*, *Protopeneroplis ultragranulata*, *Mohlerina basiliensis*, *Coscinoconus alpinus*, *Coscinoconus elongates* are typical forms for Upper Jurassic but they are also often found in the lower part of the Lower Cretaceous.

Gaudryina ectypa is widely spread within the Lower Cretaceous (Beriasian-Albian) deposits but the most typical species are *Haplophragmoides joukowskyi*, *Montsalevia salevensis*, *Coscinoconus cherchiae*, *Coscinoconus delphinensis*, *Neotrocholina valdensis* and *Protopeneroplis banatica* which are exclusively Beriassian-Valanginian species.

Haplophragmoides joukowskyi was firstly described from the deposits assigned to Valanginian (Charollais et al., 1966), then from Berriasian-Valanginian deposits by Darsac (1983), Bucur et al. (1995), Ivanova (2000) but also from the Hauterivian deposits (more exactely Lower Hauterivian) (Bucur, 1988; Altiner, 1991; Sokač, 1983; Boisseau, 1987; Chiocchini et al., 1988; Velić, 1988; Altiner, 1991; Bucur et al., 1995; Ivanova, 2000; Husinec & Sokač, 2006).

Coscinoconus cherchiae (Arnaud-Vanneau, Boisseau & Darsac, 1988) and *Coscinoconus delphinensis* (Arnaud- Vanneau, Boisseau & Darsac, 1988) are exclusively described from the Beriasian-Valanginian deposits (Boisseau, 1987, Arnaud-Vanneau et al, 1988; Altiner, 1991; Chiocchini et al, 1994; Bucur et al, 1995; Mancinelli & Coccia, 1999); Only *Coscinoconus delphinensis* was described from the Upper Tithonian deposits (Gorbachik & Mohamad 1997).

Montsalevia salevensis was firstly described from the Valangian deposits (Charollais et al., 1966) and then from the Upper Beriassian (Salvini, Bonnard et al, 1984; Zaninetti et al, 1987; Chiocchini et al, 1994) or Hauterivian (Lower Hauterivian (Masse, 1976, Peybernès, 1976; Bucur, 1988), but almost all references of this species are from the Valanginian deposits (Azema et al, 1977;. Vila, 1980, Darsac, 1983; Velić& Sokač, 1983, Boisseau, 1987; Chiocchini et al, 1988; Velić, 1988; Altiner 1991; Bucur et al, 1995; Ivanova 2000, Husinec & Sokač 2006, Schlagintweit & Gawlick, 2006; Granier & Bucur, 2011; Bonin et al, 2012).

-*Neotrocholina valdensis* Reichel, 1955 which is was initially described as typical for the Valanginian deposits (Reichel, 1955) as *type species* for Neotrocholina is very often described as typical species for the deposits **exclusively assigned to Beriassian-Valanginian** (Vila, 1980, Darsac, 1983, Boisseau, 1987, Granier, 1987, Bucur, 1988, Chiocchin et al, 1988, Altiner, 1991, Luperto Sinni & Masse, 1994; Bucur et al., 1995; Neagu, 1995; Clark & Boudagher-Fadel, 2001.

-*Neotrocholina valdensis* Reichel, 1955 was described as Valanginian species (Reichel, 1955) but now is mentioned as exclusively Beriasian-Valanginian species (Vila, 1980, Darsac, 1983, Boisseau, 1987, Granier, 1987, Bucur, 1988, Chiocchin et al, 1988, Altiner, 1991, Luperto Sinni & Masse, 1994; Bucur et al., 1995; Neagu, 1995; Clark & Boudagher-Fadel, 2001.

-*Protopeneroplis banatica* Bucur, 1993. *P. banatica* which was firstly described (si *Protopeneroplis aff. trochronulata*) as hauterivian species (Bucur, 1988); then assigned to Late Valanginian-Early Hauterivian (Bucur, 1991), also identified in southeastern France, (Blanc et al., 1992), in Serbia within the Valanginian deposits (Bucur et al., 1995) and in Slovenia from the Valanginian and Aptian deposits (Bucur, 1997).

A special regard is accorded to *Protopeneroplis ultragranulata* (Gorbachik, 1971) firstly described from the Lower Cretaceous deposits from Crimea (Gorbachik,1971) and considered for a long time as a marker for the Beriassian-Valanginian, but later was also described from the Middle Tithonian (Heinz & Isenschmidt, 1988) or from the Barremian deposits (Bucur, 1993, 1997; Arnaud-Vanneau & Sliter, 1995, nën *Protopeneroplis* sp.) but in the literature is very often described from the Beriassian-Lower Valanginian (Azema et al., 1977; Azema et al., 1979; Salvini-Bonnard et al., 1984; Boisseau, 1987; Granier, 1987; Zaninetti et al., 1988 , Bucur, 1988, Chiocchini et al., 1988; Velić, 1988; Chiocchini et al., 1994; Bucur et al., 1995). Bucur (1993, 1997).

Spiraloconulus suprajurasicus Schlagintweit, 2011 also has a special significance, this foraminifer being described in the Upper Jurassic -? Beriasian deposits from the Northern Calcareous Alps (Schlagintweit, 2011), then mentioned and described from the Tithonian- Upper Beriasian deposits in the Hăghimaş area (Eastern Carpathians, Romania) by Bucur et al. (2011) and Dragastan (2011).

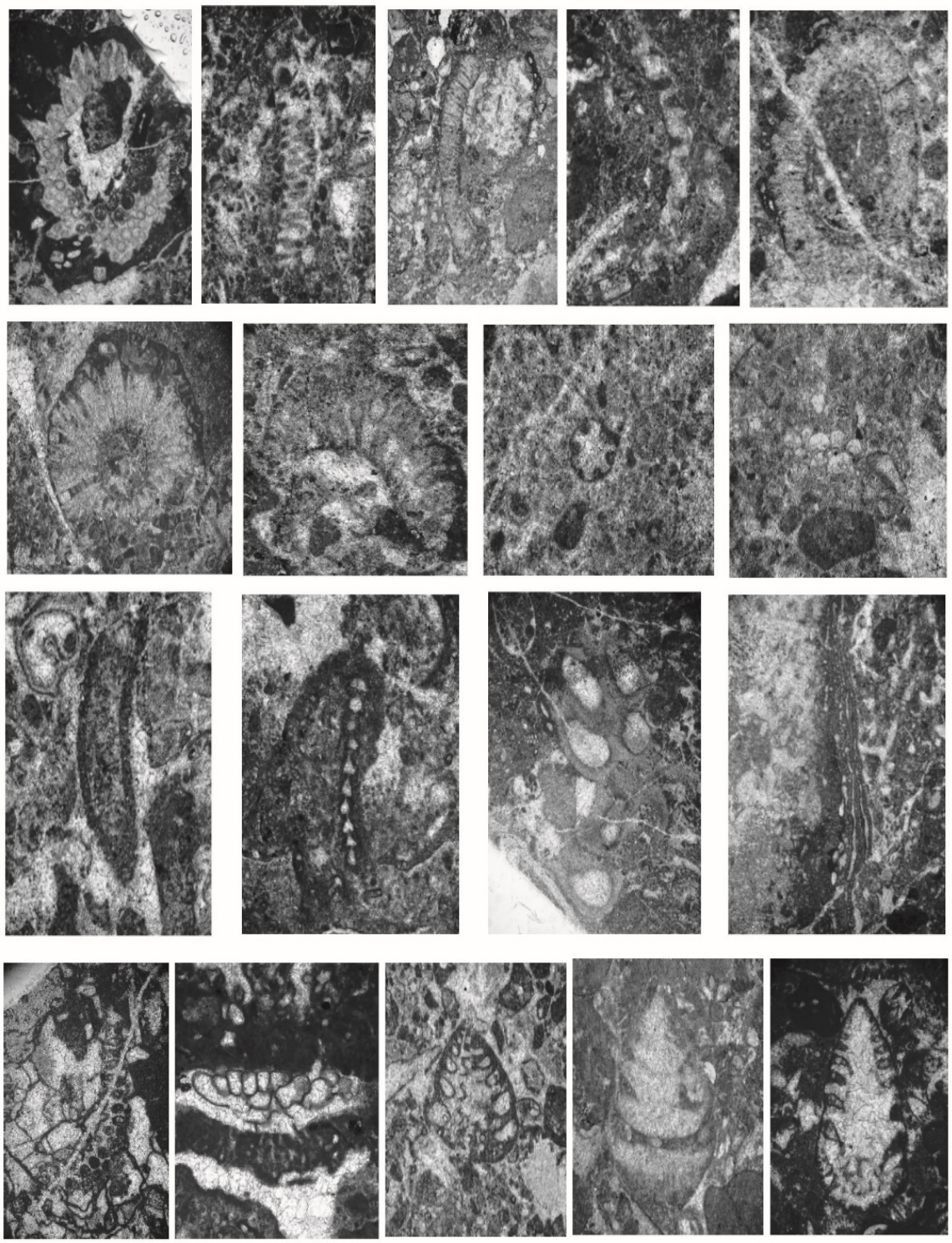

Figure 3. ***1.*** *Zujovicella polonini,* ***2.*** *Neomeris sp.,* ***3***. *Steinmanniporella sp.,* ***4.*** *Griphoporella sp,* ***5.*** *Arabicodium sp.,* ***6.*** *Salpingoporella praturloni,* ***7.*** *Suppiluliumaella polyreme,* ***8.*** *Terquemella sp.,* ***9***. *Koskinobulina socialis?* ***10.*** *Terebella lapilloides sp.,* ***11***. *Crescentiella morronensis,* ***12.*** *Radiomura cautica,* ***13***. *Rodhpletzella sp.,* ***14***. *Bacinella irregularis sp.,* ***15***. *Lithocodium-Troglotella incrustans****16***. *Conscinoconus cherchiae,* ***17.*** *Coscinoconus campanellus,* ***18***. *Coscinoconus alpinus*

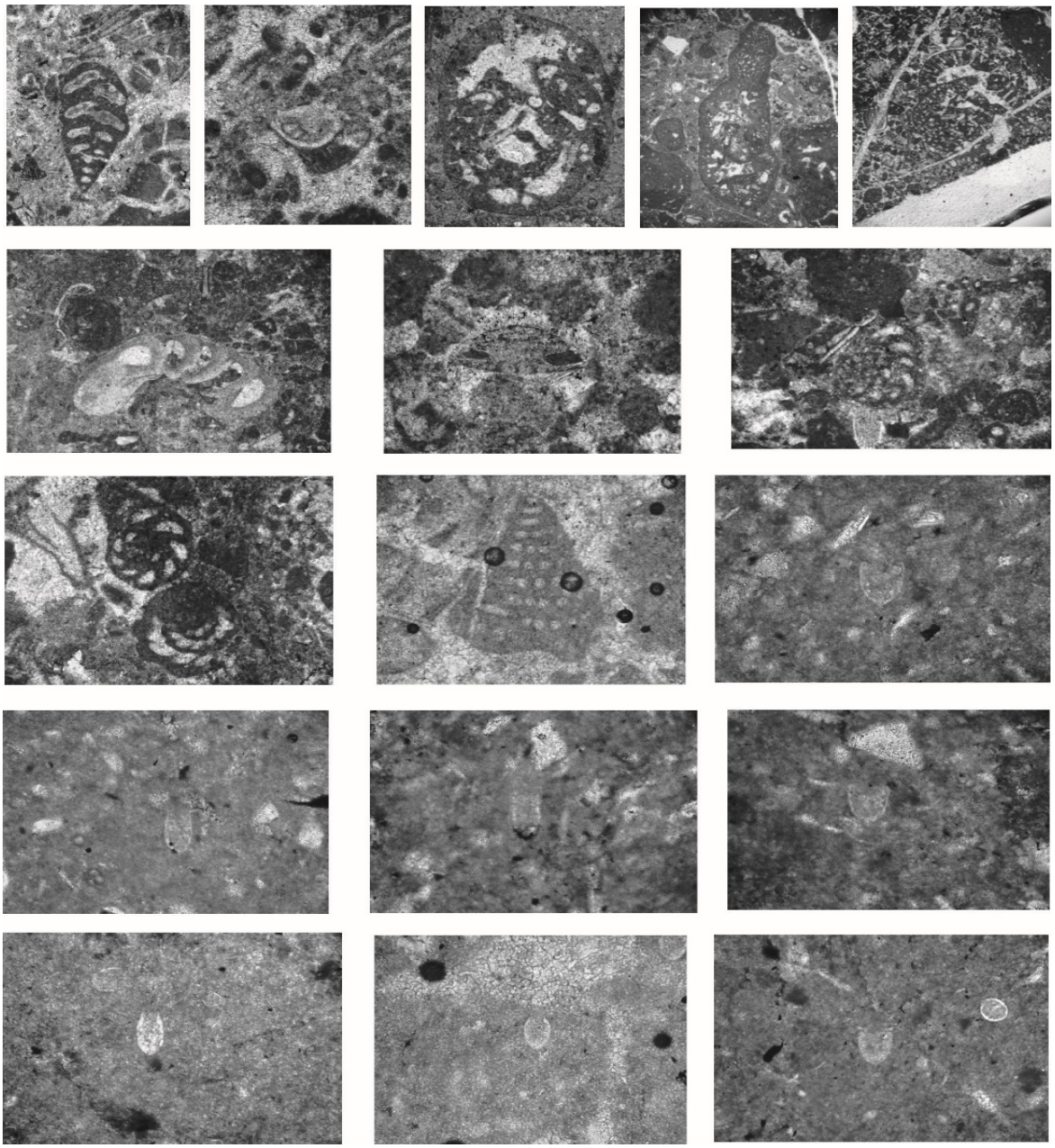

Figure 4. **1**.*Gaudryna ectypa* sp., **2**. *Mohlerina basiliensis*, **3.** *Everticyclammina sps.*, **4**. *Spiraloconus suprajurassicus, **5**. Pseudocyclammina lituus* **6**. *Protopeneroplis ultragranulata* **7.** *Neotrocholina valdensis, **8**. Ammobaculites sp.**, 9**. Charentia* sp., **10**. *Scythiolina cf laurentii,* **11.** *Calpionellites darderi* **12.** *Tintinopsella. carpathica*,. **13.** *Tintinopsella longa,* **14.** *Calpionellopsis,* **15.** *Calpionella elliptica, **16**. Calpionella alpina,* **17.** *Remaniella cadischiana*

Conclusions

Numerous studies throughout the years have proved that in the regional context during Jurassic-Cretaceous time the existence of a deep basin where “Firza" flysch (Xhomo 2002) was deposited.

In the central part of Mirdita zone and rarely in its eastern part, there have been existed sectors that during Beriassian and Valanginian have been occupied by shallow water carbonate deposits (Meço 1975, Peza 1983, Schlagintweit 2006).

As in the Guri i Pellumbit section, also in Kreje Lura region, the calpionelides have been signaled within the shallow water carbonate limestone deposits as Calpionellopsis biozone of Beriassian age and Calpionellites darderi of Lower Valanginian age (Peza et al. 1983).

The next microfacies were identified: peloidal bioclastic packstone-grainstone, packstone-rudstone, bioclastic grainstone, bioclastic peloidal packstone-grainstone, rudstone, packstone-rudstone,

bioclastic rudstone-boundstone, bindstone and microbialites which together with their microfaunistic associations allow us to interpret the whole succession as slope deposits.

Taking into consideration all the microfacies and microfaunistic associations described above along with the geological context, Guri i Pellumbit section can be interpreted as an isolated "haut fond" type platform where bioclasts with shallow water origin have been transported and resettled by turbidic currents and are mixed with typical deep water biota represented by calpionellides.

The age of this section on the basis of foraminifera and calpionellides is Upper Beriassian-Lower Valanginian.

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