Geologia Croatica
Journal of the Croatian Geological Survey
and the Croatian Geological Society

2023 | 76/3 | 147–156 | 5 Figs. |

www.geologia-croatica.hr

Middle Aptian Orbitolinid limestones in Belgrade (Serbia): microfacies and depositional environment

Bojana Đorđević [1,*], Hans-Jürgen Gawlick[2], Nevenka Djerić[1], Felix Schlagintweit[3] and Miloš Radonjić[1]

[1] University of Belgrade, Faculty of Mining and Geology, Đušina 7, Beograd, Serbia; (*corresponding author: bojana.dzinic@rgf.bg.ac.rs)
[2] Montanuniversität Leoben, Franz Josef-Straße 18, 8700 Leoben, Austria
[3] Lerchenauerstr. 167, 80935 Munich, Germany

doi: 10.4154/gc.2023.09

Article history:
Manuscript received March 15, 2021
Revised manuscript accepted September 04, 2023
Available online October 16, 2023

Keywords: Orbitolinidae, Microfacies, Early Cretaceous, Dinarides

Abstract

Lower Cretaceous (Aptian) shallow-marine limestones with intercalated polymictic conglomerates were investigated with respect to their biostratigraphic age and their microfacies. They are the younger part of the generally carbonate-siliciclastic Lower Cretaceous deep-water (max. few hundred metres) turbiditic sequences ("Paraflysch") of the so-called East Vardar zone in the Belgrade area. The biostratigraphic age of the limestones was determined by orbitolinid foraminifera: the co-occurrence of *Dictyoconus*? *pachymarginalis* SCHROEDER and *Mesorbitolina texana* (ROEMER) besides various other microfossils suggest a biostratigraphic age of this shallow-marine limestone succession as middle Aptian (Gargasian). Radiolarite components in the conglomerates are Triassic in age and were derived from the obducted Middle Triassic to Middle Jurassic Neo-Tethys ophiolites and/or their ophiolitic mélanges on the wider Adria plate. From both the first precise biostratigraphic age dating as middle Aptian combined with microfacies analysis of these shallow-marine limestones and the component spectrum in the intercalated conglomerates, it can be concluded that the Lower Cretaceous turbiditic "Paraflysch" succession was deposited on the eastern rim of the Dinarides. The results will allow a better comparison of the different Lower Cretaceous sedimentary successions deposited on the eastern margin of the Dinarides.

1. INTRODUCTION

The Lower Cretaceous sedimentary successions in the area around Belgrade are crucial to understanding the late Mesozoic geodynamic history of the Dinarides, because of their position in the proximity of the plate boundary between the Adriatic (Dinarides) and the Moesian plates (Fig. 1a, b). The complex geological setting of the study area is interpreted as a mosaic of continental units (Adriatic or European affinity; SCHMID et al., 2008, 2020 and references therein), which are separated by the so-called Sava suture zone (SCHMID et al., 2020 and references therein), and remnants of domains with oceanic lithosphere (West Vardar and East Vardar ophiolites (*sensu* SCHMID et al., 2008, 2020; Fig. 1a; Neo-Tethys ophiolites *sensu* GAWLICK et al., 2009). Previously, there has been no consensus as to which tectonic unit the Lower Cretaceous sedimentary rocks (Paraflysch sequence sensu DIMITRIJEVIĆ & DIMITRIJEVIĆ (1976) belong: the main Vardar Zone (MVB/Z; KARAMATA, 2006; Fig. 1b), the Sava Zone (SCHMID et al., 2008; Fig. 1b), or the Inner Dinarides (Kopaonik ridge and block unit =KBR/U =; Fig. 1c), or to a sequence with European affinity thrust over the wider Adria plate (TOLJIĆ et al., 2018). This controversy is an ongoing discussion (e.g., TOLJIĆ et al., 2018; BRAGIN et al., 2019; SCHMID et al., 2020). TOLJIĆ et al. (2018) in the latest paper attributed the Paraflysch sequence to be deposited on the outer passive margin of the Moesian plate (Carpatho-Balkanides), and in the oceanic basin between the wider Adria plate to the west (Dinarides) and the Moesian plate (Europe) to the east.

TOLJIĆ et al. (2018) interpreted the entire Cretaceous to Palaeogene sedimentary evolution in the Belgrade area as a fore-arc basin infill, which should have been palaeogeographically situated on the Moesian plate margin (Supragetic nappes according to SCHMID et al., 2008). During the assumed Campanian–Early Palaeogene collision between Moesia and the Dinarides, this fore-arc basin was thrust onto the Adria plate and should mark the suture zone. In the Early Cretaceous "Paraflysch" succession, the shallow-marine Early Cretaceous limestones with conglomerate intercalations locally should evidence a sea-level lowstand (TOLJIĆ et al., 2018). These shallow-marine limestones contain a rich orbitolinid foraminifera fauna that has not previously been studied.

The exact age of these shallow-water limestones is not known, and associated rocks, i.e., intercalated conglomerates with fluvial transported components from a hinterland, are not studied and their hinterland should be according to TOLJIĆ et al. (2018) the Moesian plate. However, due to the occurrence of radiolarite and ophiolite components in these conglomerates associated with the shallow-marine Early Cretaceous orbitolinid-bearing limestones, we disagree with the palaeogeographical interpretation of TOLJIĆ et al. (2018).

Cretaceous sedimentary rocks deposited in the wider Belgrade area are subdivided into the Central and East Belgrade facies, i.e. into different "sub-basins". The Early Cretaceous "Paraflysch" *sensu* DIMITRIJEVIĆ (1997) is an overstep sequence above ophiolites/ophiolitic mélange, mainly preserved in the Central Belgrade facies. In contrast, the East Belgrade facies is incompletely exposed and characterized by late Lower Cretaceous shallow-water limestones which pass into the Urgonian-type reefal sedimentary rocks, both interpreted as deposited in a fore-arc basin on the Moesian margin (TOLJIĆ et al., 2018). However, in the Late Cretaceous, rudist-bearing shallow-marine limestones were formed throughout the Adriatic plate (SLADIĆ-

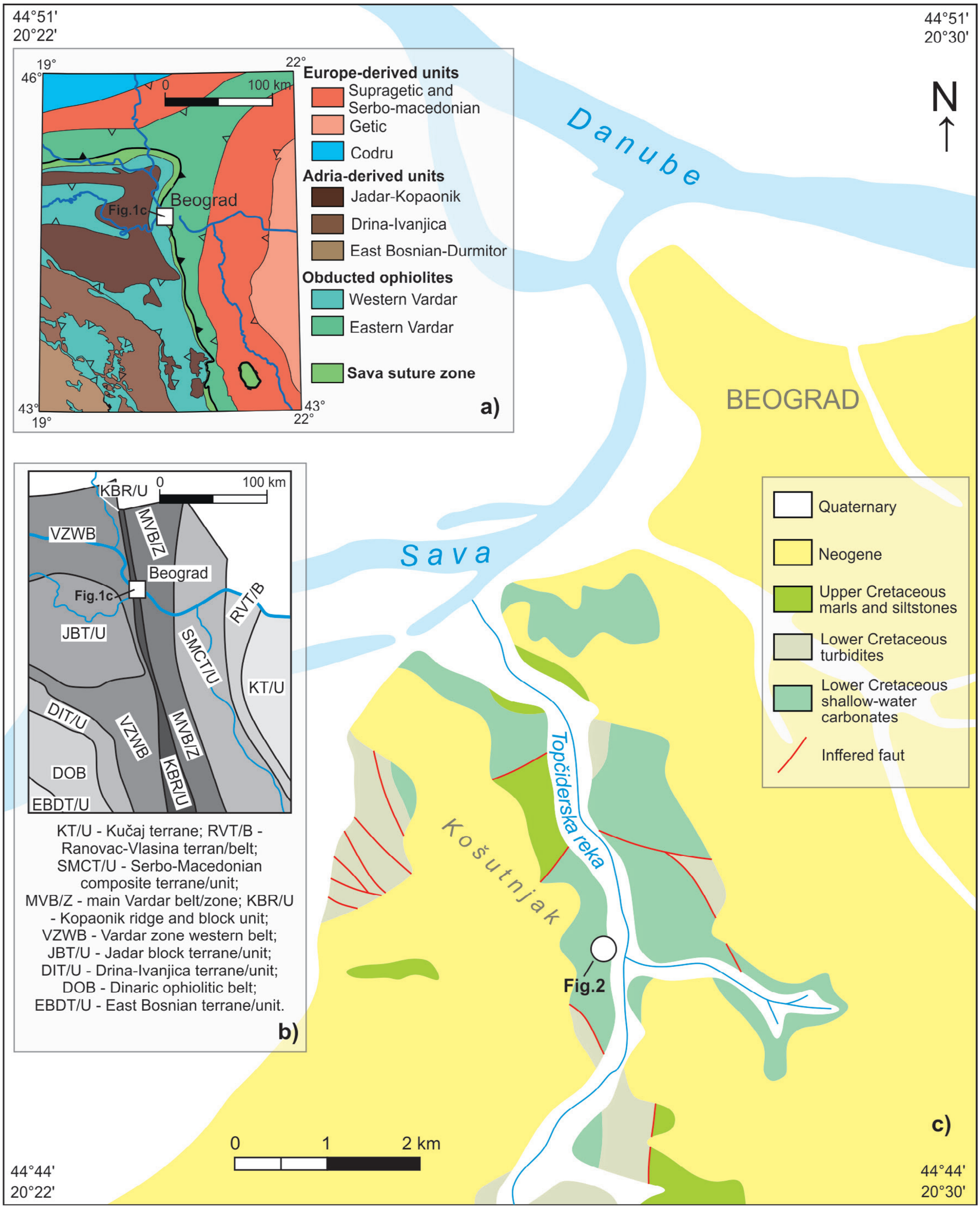

Figure 1. a) The tectonic setting of the Adria – Europe collision zone in central Serbia (modified after SCHMID et al., 2020). b) Overview of the terrains/composite units of central Serbia (modified after KARAMATA, 2006). Note that the geographical position of the map is approximately similar to Fig. 1a. c) Geological sketch map of the central area of Belgrade. The qhite circle marks the position of the studied section at the Košutnjak railway station (see Fig. 2). Modified after MARKOVIĆ et al., 1984.

TRIFUNOVIĆ, 1998), as well as in the wider Belgrade area. They represent the beginning of a new sedimentary cycle, starting in the early Late Cretaceous, after the "Mid-Cretaceous" tectonic motions, which resulted in the eastern Mediterranean area in a new plate configuration (e.g. CSONTOS & VÖRÖS, 2004). After a long period of exposure and continental weathering of huge areas of the Inner Dinarides after the Tithonian uplift and unroofing (GAWLICK et al., 2020 and references therein), including the so-called East- and West-Vardar ophiolites (compare SCHMID et al., 2008, 2020), the whole area was flooded and a widespread shallow-water reefal evolution was established with a very limited palaeogeographic meaning.

In contrast, BRAGIN et al. (2019) used the findings of Late Jurassic radiolarians to suggest that the Central and East Belgrade facies *sensu* TOLJIĆ et al. (2018) have an Adriatic affinity. In fact, the recent controversial discussion clearly evidenced that there is a great need for additional data from the Early Cretaceous sedimentary rocks to answer the still open questions in this area. This issue is crucial geodynamic reconstruction of the Cretaceous and the evolution of the Vardar zone between Moesia and Adria and the Early Cretaceous evolution of the Inner Dinarides, a continental area with erosion during that time span. The Early Cretaceous erosional products of the Inner Dinarides are well studied in the partially underfilled foreland basins to the west (e.g. MIKES et al., 2008), but practically nothing has been studied in their eastern part, i.e. the "Paraflysch" sequences according to DIMITRIJEVIĆ & DIMITRIJEVIĆ (1976).

The sedimentological evolution, i.e. biostratigraphic age dating, microfacies analysis and component analysis of the intercalated turbidites and mass transport deposits of the Early Cretaceous sedimentary rocks in the whole area is only roughly constrained (TOLJIĆ et al., 2018 and references therein). Microfacies analysis of carbonate rocks and component analysis of breccias/conglomerates/turbidites is completely missing. Therefore, there is a need for detailed sedimentological studies and detailed biostratigraphic age dating for an exact correlation of the different Cretaceous successions to unravel the depositional regime and palaeogeographic position of the "Paraflysch" sequence. Only on the basis of a precise age and a provenance analysis of the components in the Early Cretaceous succession can a palaeogeographic reconstruction of their depositional area be possible, i.e. the eastern Dinarides, Europe, or an estimated oceanic domain between Adria and Moesia (Europe).

The aim of this study is to present new biostratigraphic age and microfacies data of these Early Cretaceous (Aptian) shallow-marine limestones and to describe some key components (radiolarites) of the associated fluviatile conglomerates. The presented data will allow a better comparison to be made with similar sedimentary sequences in the wider surroundings, which should result in a better understanding of the geology and evolution of the plate boundary between the Dinarides and Moesia.

2. GEOLOGICAL SETTING

In the Belgrade area, the Lower Cretaceous sedimentary rocks, deposited on top of the Upper Jurassic ophiolitic mélange (TOLJIĆ et al., 2018 and references therein; compare BRAGIN et al., 2019) are represented by two distinct facies: 1) sedimentary rocks composed of sandstones, siltstones, marlstones, sandy limestones, and limestones; 2) shallow-water reef limestones and siliciclastics (ANĐELKOVIĆ, 1973; PAVLOVIĆ et al., 1979; FILIPOVIĆ et al., 1979; MARKOVIĆ et al., 1985) (Fig. 1c). These Valanginian to Aptian sedimentary successions of central Serbia are termed "Paraflysch" by DIMITRIJEVIĆ & DIMITRIJEVIĆ (1976, 1987) with respect to their sedimentological features. Similar deposits of comparable age range but a different geotectonic position related to the vergence of the thrust belts are described from the Alps, Dinarides, Albanides and Hellenides (e.g., the Schrambach and Rossfeld Formations - MISSONI & GAWLICK, 2011a; KRISCHE et al., 2014; Bohinj Formation – KUKOČ et al., 2012; Vranduk Formation - BLANCHET et al., 1970; MIKES et al., 2008; Vermoshi Flysch - MEÇO & ALIAJ, 2000; MARRONI et al., 2009; Firza Formation – GARDIN et al., 1996; Kurbnesh Formation – SCHLAGINTWEIT et al., 2008; Boeotian flysch – NIRTA et al., 2015). In contrast to the "Paraflysch", these sedimentary successions were deposited west of the obducted ophiolites in Early Cretaceous underfilled foreland basins. Only in northern Greece in a similar palaeogeographic setting to the "Paraflysch" was a practically identical earliest Early Cretaceous (Berriasian–Valanginian) sedimentary succession deposited on top of obducted ophiolites/ophiolitic mélange ("East Vardar ophiolites" and equivalents) (KOSTAKI et al., 2013 and references therein). However, from all these Lower Cretaceous (Berriasian to Aptian) successions with reworked material from the wider Adria plate the overlying Upper Barremian, Aptian (and younger) shallow-water deposits with orbitolinid foraminifera are practically not described, because they are mostly eroded. Exceptions are only known from the Northern Calcareous Alps (SCHLAGINTWEIT et al., 2012b and references therein) or the Albanides (ROBERTSON et al., 2012; SCHLAGINTWEIT et al., 2012a and references therein). In Serbia, the occurrence of "*Paleodictyoconus arabicus*" from the Vardar zone in the Kopaonik area was reported by ZELIĆ et al. (2010, fig. 5c) without sedimentological or microfacies studies. To fill this gap in knowledge the orbitolinid-bearing shallow-water limestones from the east Vardar zone are described for the first time.

The shallow-marine Barremian–Aptian limestones in the surroundings of Belgrade are attributed to "Urgonian limestones" (e.g., ANĐELKOVIĆ, 1973; DIMITRIJEVIĆ, 1997). In certain places, these sedimentary rocks overlie older rocks in the sequence or should occur as lenses within the turbiditic sequences (ANĐELKOVIĆ, 1954, 1956, 1973). According to ANĐELKOVIĆ (1973) typical Urgonian carbonates consists of grey reef-type limestones, sandy-marly limestones and siliciclastics rich in a shallow-water fauna (caprinids, orbitolinids, corals, brachiopods, gastropods).

3. METHODS

The studied section (Fig. 2) is located in Belgrade, at the Košutnjak railway station (N44˚45'26.44"; E20˚26'43.77"; Fig. 1c). Nine samples were collected from a six metre thick limestone section overlying mainly fine-grained siliciclastic rocks. From these samples, twenty thin-sections were prepared for microfacies analysis and biostratigraphic age determination. Twenty, mainly rounded to well-rounded radiolarite pebbles from intercalated conglomerates were processed with hydrofluoric acid (3%) but contain only undeterminable radiolarian faunas. During the field work orbitolinids and gastropods were detected.

4. RESULTS

ANĐELKOVIĆ (1973), first studied this section, and subdivided the Košutnjak carbonate succession into three levels with requienids, deposited above the fine- to coarse-grained siliciclastic rocks. Based on palaeontological data (*Requienia ammonia* GOLDFUSS, *Toucasia carinata* MATHERON and *Orbitolina conoidea discoidea* GRAS), ANĐELKOVIĆ (1973) he assigned them an Upper Barremian–Aptian age.

The six-metre thick succession studied in detail consists of decimetre to 0.5 metre thick-bedded greyish orbitolinid-bearing shallow-water limestone (Figs. 2A, 2B). These orbitolinid-bearing beds consist mainly of bioclastic to thick bedded limestones (wackestones to packstones and grainstones). In the lower part of the shallow-water limestone section polymictic carbonate conglomerates with exotic components (volcanic clasts, radiolarites) are intercalated. Besides the orbitolinids, smaller benthic foraminifera, gastropods and bivalves are distributed throughout the succession. Calcareous green algae are rare and appear in some layers.

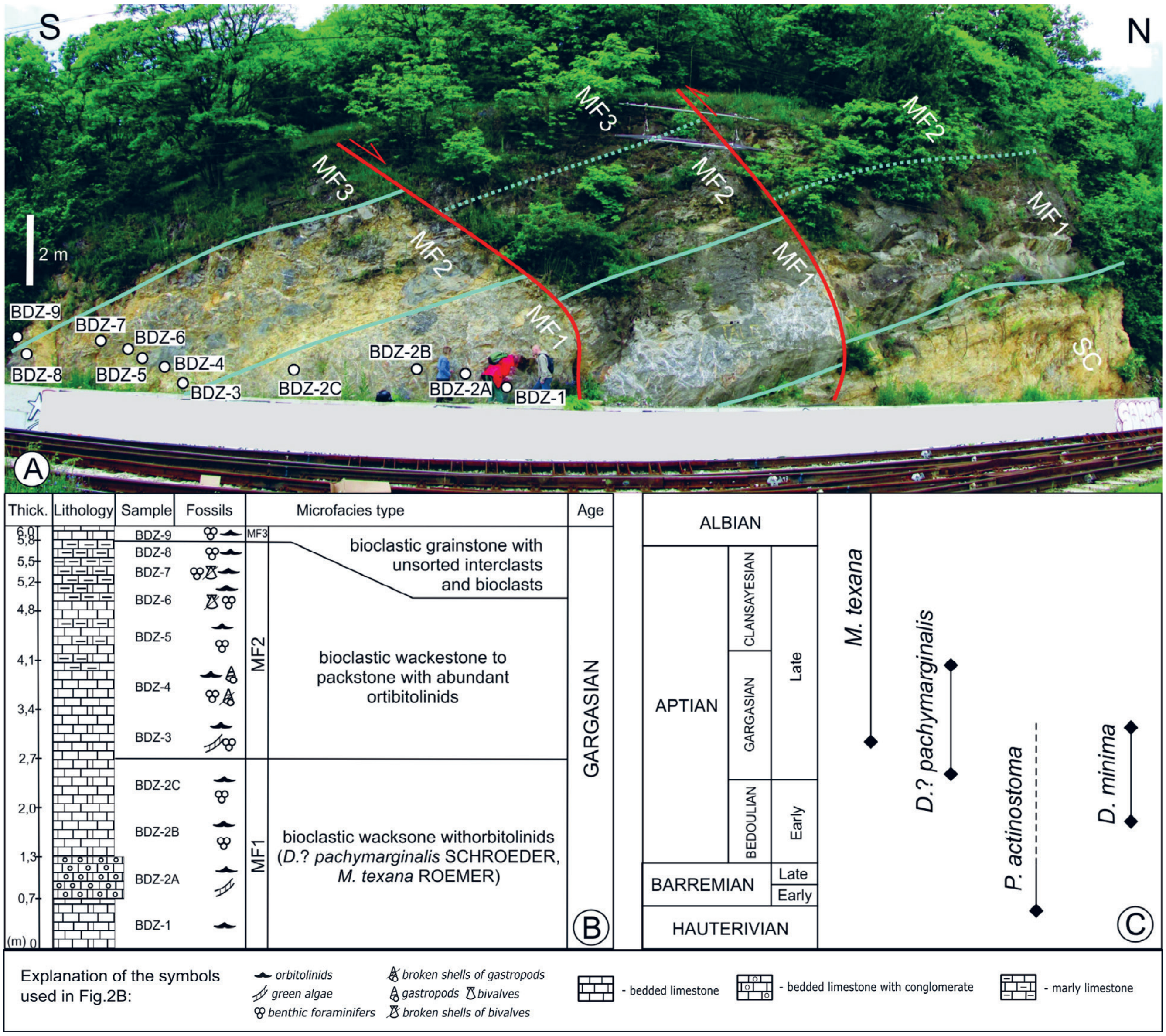

Figure 2. (A). The studied section at the Košutnjak railway station. Blue lines mark the intervals of the interpreted carbonate microfacies (MF1-3, SC – siliciclastic sequence). Red lines mark the fault traces and their relative movement. White circles indicate sample positions (see Fig. 3). Photo taken in May 2019. (B). Geological column and summary of the microfacies types. (C) Biostratigraphic column of the main microfossils from Košutnjak railway station.

4.1. Microfacies analysis

Three main microfacies types (MFT) are distinguished within the shallow-marine limestones of the studied succession (Figs. 2A, 2B).

MFT-1: bioclastic wackestone with orbitolinids (*Dictyoconus*? *pachymarginalis* SCHROEDER, *Mesorbitolina texana* (ROEMER)) (Figs. 3A–C). Besides the age diagnostic orbitolinid foraminifera, other benthic foraminifera are represented by miliolids and textulariids, rare algal remains, gastropods, encrusted stromatoporoids (bacinellid facies – Fig. 3A), and bivalves. Lithoclasts (exotic clasts/radiolarite components) are subangular to well-rounded, vary in size and sorting. According to FLÜGEL (2004) and SUDAR et al. (2008) these kinds of sediments were deposited in a shallow subtidal to intertidal environments. The MFT-1 is the most common in the lower part of the section (Figs. 2A, B).

MFT-2: bioclastic wackestone to packstone with abundant orbitolinids (Figs. 3D–G). The MFT-2 is the most common in the middle and upper part of the succession (MFT-2) (Figs. 2A, B). *Dictyoconus*? *pachymarginalis* SCHROEDER, *Mesorbitolina texana* (ROEMER), *Paleodictyoconus actinostoma* ARNAUD-VANNEAU & SCHROEDER and *Daxia minima* LAUG & PEYBERNÈS are the age diagnostic benthic foraminifera. Besides the orbitolinids, other skeletal grains, small benthic foraminifera such as miliolids and textulariids, gastropods and bivalve's shells occur. In some thin-sections, ooids (Fig. 3E) and subangular peloidal grainstone intraclasts are present. In sample BDZ 7, together with the orbitolinids, indeterminable lituolinid large foraminifera with a complex inner structure appear. Bioclastic wacke- and packstones with abundant larger foraminifera (e.g. orbitolinids) are common microfacies types in inner ramp environments. The presence of imperforate foraminifera such as miliolids and agglutinated orbitolinids indicate relatively low water energy circulation with deposition of abundant carbonate mud in a lagoon (SUDAR et al., 2008; FLÜGEL, 2004). MFT-2 corresponds to the facies of an inner middle lagoon (e.g., Fig. 9L from MOOSAVIZADEH et al. (2020); Fig. 10 (C, D and E) from

RAHIMINEJAD & HASSANI (2015)). The MFT-2 is overlain by wackestones to packstones with a significant amount of fine-grained siliciclastics (Figs. 3F, G).

MFT-3: bioclastic grainstone with large and small unsorted intraclasts, bioclasts (gastropods, bivalves, benthic foraminifera, algae, and other broken skeletal grains) (Fig. 3H) beside aggregate grains, intraclasts, small ooids, and skeletal grains. Aggregate grains have low degrees of roundness. Small intraclasts are subrounded and rounded and show different sphericity values. Large intraclasts have low roundness and low sphericity values. Sediment sorting is poor. The variations in the roundness and sphericity of grains, the wide range of grain size, as well as their

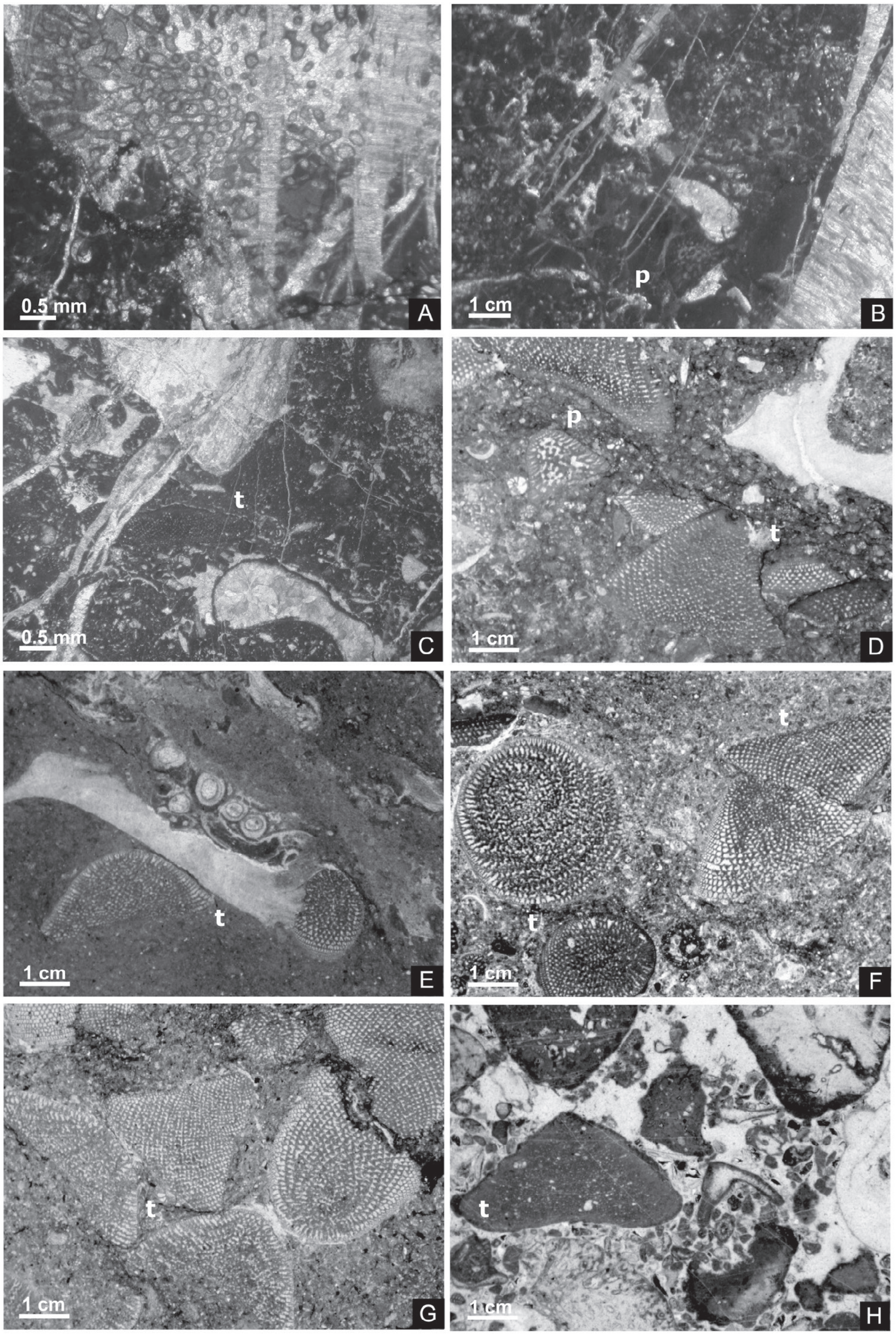

Figure 3. Microfacies of the orbitolinid-bearing sedimentary rocks from the Early Cretaceous (Košutnjak railway station). A: Stromatoporoids encrusted by bacinelid fabrics, the internal sediment is represented by wackestone with *D. pachymarginalis*, miliolids and textulariids. Sample BDZ 1. B: Bioclastic wackestone with *D. pachymarginalis* (p), miliolids and textulariids. Sample BDZ 1. C: Bioclastic wackestone/packstone with orbitolinids. Sample BDZ 2B. D-G: Bioclastic wackestone with *Dictyoconus*? *pachymarginalis* (p), *Mesorbitolina texana* (t) and other benthic foraminifera. Samples BDZ 3, BDZ 4, BDZ 6 and BDZ 8. H: Bioclastic grainstone with coated grains. Sample BDZ 9.

poor sorting indicate mixing and reworking of the grain populations. Large intraclasts with fenestral fabric suggest a low-energy protected intertidal environment. Roundness and sphericity of intraclasts indicate transport within the depositional environment. Poor sorting, mixing of resediments and the deposition of eroded grains together with finer grains point to deposition within tidal channels. The MFT-3 occurs on top of the studied succession (Figs. 2A, B).

In general, all three different microfacies types are characteristic of shallow-marine depositional realms with varying depositional energies and hinterland influences. This is indicated by the different organisms including orbitolinid foraminifera, encrusted stromatoporoids, calcareous algae, ooids beside other organisms and skeletal grains. Open-marine organisms from deeper-water environments are missing. Orbitolinid foraminifera are common in shallow-water limestones (normal salinity and warm water), e.g. in the late Early Cretaceous limestones of the Adriatic Carbonate Platform (VELIĆ, 1988;, 2007 and references therein). The orbitolinid foraminifera are associated with miliolids, which showed spectacular expansion in the Middle Cretaceous, proliferating in mid-latitudes (BOUDAGHER-FADEL, 2008). It is also interesting to note that conical forms of orbitolinids thrive in the shallowest water (SIMMONS et al., 2000). The microfacies changes over small-scales and short time frames together with the change in the association of grain types is according to FLÜGEL (2004) common in platform interiors and in inner to mid-ramp depositional environments, partially influenced by storm-induced currents. These small-scale changes are well developed and commonplace in Jurassic and Cretaceous peritidal limestones of the Adriatic carbonate platform (HUSINEC et al., 2000 and references therein). Coarsening and shallowing-upwards cycles are the result of an increase in water energy which leads to the formation of grainstones composed of mixed and reworked grains. The occurrence of abundant orbitolinid foraminifera is quite common in inner ramp depositional environments.

Conglomerates transported by fluvial systems from the hinterland and intercalated in the shallow-marine orbitolinid limestones contain ophiolite and various radiolarite components (Figs. 4A–D). In these conglomeratic layers, most of the rounded to well-rounded radiolarite components of several millimetres to centimetre-size are too small for the preparation of radiolarian faunas. Still, their microfacies characteristics are well preserved. The microfacies of the radiolarite components resemble the microfacies of ribbon radiolarites as known from the sedimentary cover of the Neo-Tethys Ocean floor or the distal continental slope (GAWLICK et al., 2016a, b; GAWLICK & MISSONI, 2015). However, the conglomerates overlying the orbitolinid-bearing limestones have an identical component spectrum, only differing in the larger size range of the clasts.

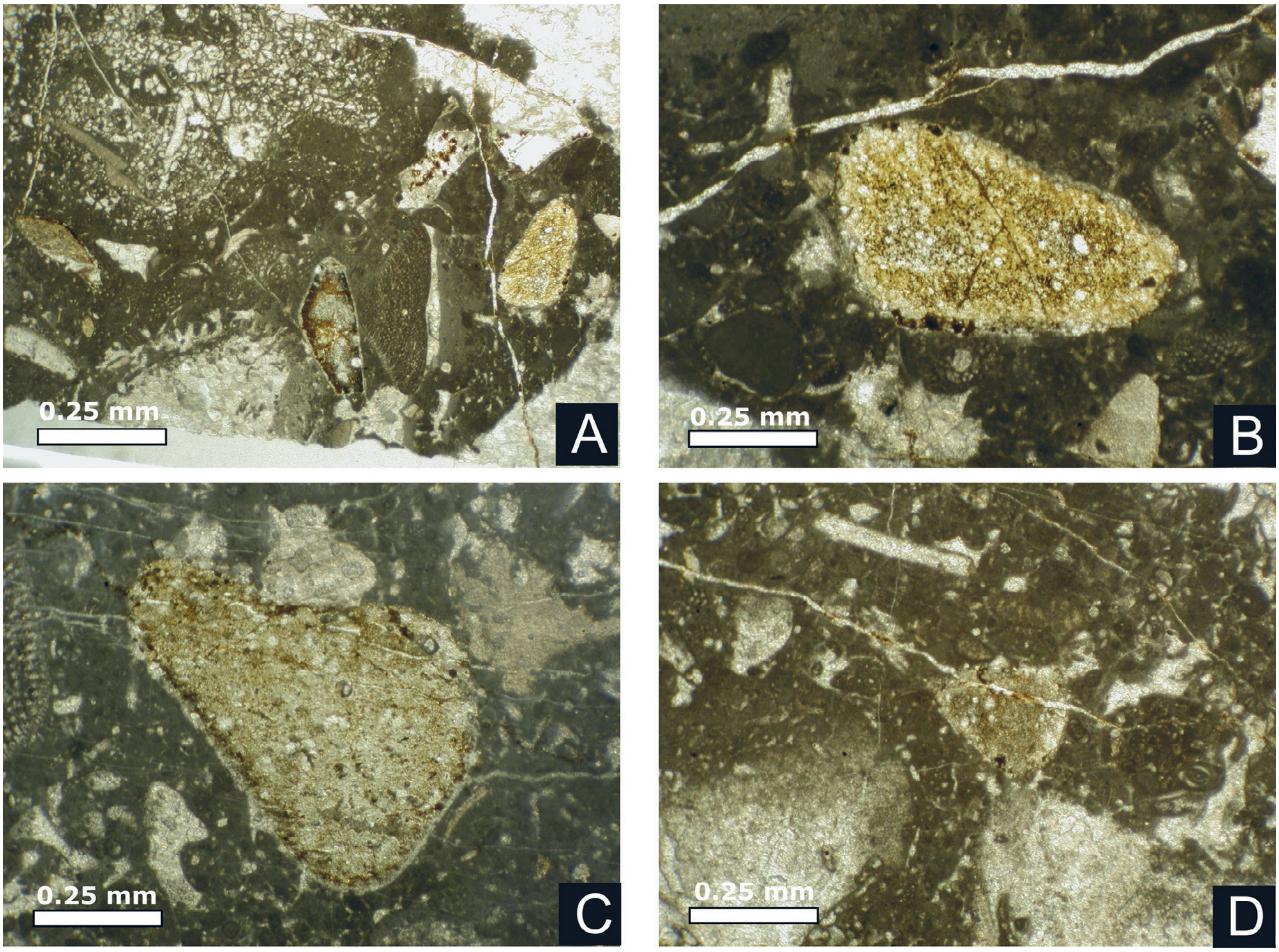

Figure 4. Microfacies of different Triassic radiolarite components associated with the Orbitolina limestones. A: Overview of the reefal limestone with *Mesorbitolina texana* and a radiolarite component. Sample BDZ 2A. B: Rounded Late Anisian to Ladinian radiolarite with recrystallized radiolarians and filaments (compare GAWLICK et al., 2016a). Sample BDZ 2B. C: Rounded Carnian ribbon radiolarite component with remnants of organic material and recrystallized and silicified radiolarians (compare GAWLICK et al., 2016b). Sample BDZ 2A. D: Rounded Norian ribbon radiolarite component. Sample BDZ 2A.

Analysis of the different rounded radiolarite pebbles from these overlying fluviatile conglomerates resulted in identification of very poorly preserved radiolarian faunas due to intense silicification, as typical for oceanic ribbon radiolarites. The radiolarians are strongly recrystallized and cannot be determined, not even to generic level, but they have a clear Triassic (Late Anisian - Ladinian and Late Triassic) radiolarian habitus (compare Fig. 4). However, despite the differences in microfacies of Triassic and Jurassic radiolarites, both are associated with either the Neo-Tethys Ocean floor or the distal parts of the eastern passive wider Adria margin, are well known and documented (GAWLICK et al., 2009; GAWLICK & MISSONI, 2015 and references therein). Therefore, the microfacies of radiolarites can be roughly used to constrain their age, i.e. Middle Triassic (Late Anisian–Ladinian), Carnian-Norian, Rhaetian or Middle Jurassic.

4.2. Biostratigraphy

In the Tethyan realm, the Aptian stage is subdivided into three divisions: Bedoulian (early Aptian), Gargasian (middle Aptian) and Clansayesian (late Aptian) (GRADSTEIN et al., 2020). Some authors (e.g., SCHROEDER et al., 2010) subdivided the Aptian into two divisions (Bedoulian - Early Aptian, Gargasian with Clansayesian - Late Aptian).

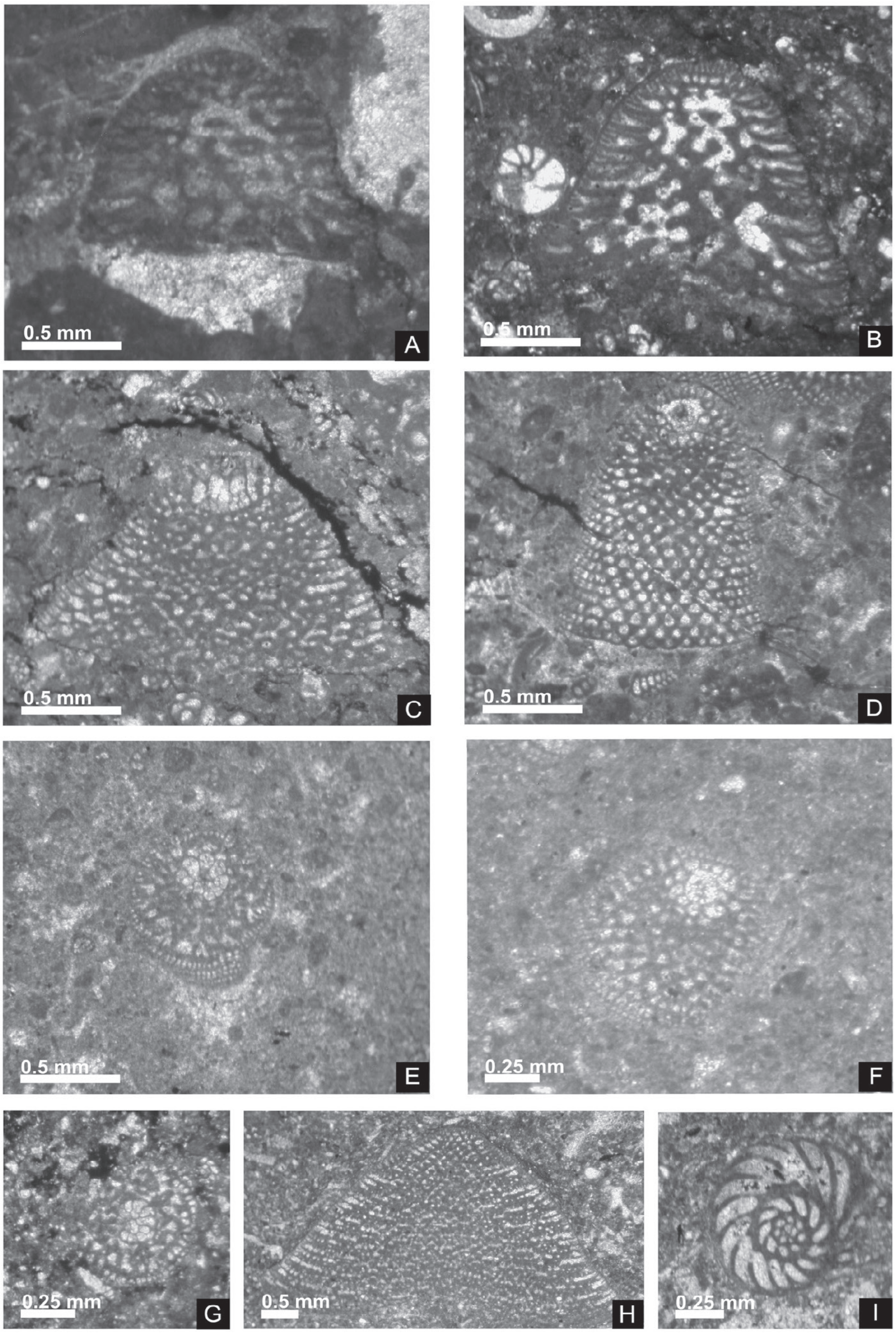

Figure 5. Microfossils from the Košutnjak railway station. A, B: *Dictyoconus? pachymarginalis*. Samples BDZ 1, BDZ 3. Axial section. C – G: *Mesorbitolina texana*. Samples BDZ 3, BDZ 4, BDZ 8. C: axial section, D: tangential section, E–G: transverse section. H: *Paleodictyonus actinostoma*. Sample BDZ 5. Subaxial section. I: *Daxia minima*. Sample BDZ 5.

In the studied section, the Aptian foraminiferal association was analysed in twenty thin-sections yielding *Dictyoconus*? *pachymarginalis* (SCHROEDER), *Mesorbitolina texana* (ROEMER), *Paleodictyoconus actinostoma* ARNAUD-VANNEAU & SCHROEDER, *Daxia minima* LAUG & PEYBERNÈS, and *Nautiloculina broennimanni* ARNAUD-VANNEAU & PEYBERNÈS. Among these, the first two are of biostratigraphic relevance.

Dictyoconus? *pachymarginalis* occurs in samples BDZ 1 and BDZ 3 (Figs. 5A, B). According to SCHROEDER (1964), this species is known from the lower (upper Bedoulian) to the middle Aptian (Gargasian) (Fig. 2C). The species has been reported from many localities of the Neotethyan realm and was originally described from the Alborz Mountains (SCHROEDER, 1964), and was also successively reported from Central Iran (YAZDI-MOGHADAM & AMIRI, 2010; ROOZBAHANI, 2011; SCHLAGINTWEIT et al., 2013; SCHLAGINTWEIT & WILMSEN, 2014), from NW Iran (YAZDI-MOGHADAM et al., 2017), and northeast Iran (TAHERPOUR KHALIL ABAD et al., 2013; BUCUR et al., 2019). It is worth mentioning that the species does not appear on the Arabian Plate (Zagros Zone) (SCHROEDER et al., 2010). In Europe, *D.*? *pachymarginalis* is reported from NE Spain (MASSE et al., 1992), southern Hungary (SCHLAGINTWEIT, 1990), and the southern Apennines of Italy (MANCINELLI & CHIOCCHINI, 2006).

Mesorbitolina texana occurs in all the studied samples except BDZ 1 (Figs. 5C-G). According to SCHROEDER et al. (2010), *M. texana* had its first appearance datum (FAD) at the base of the late Gargasian. Compared with *Dictyoconus*? *pachymarginalis* and *Mesorbitolina texana*, *Paleodictyonus actinostoma* ARNAUD-VANNEAU & SCHROEDER (Fig. 5H) has a much wider range, i.e. from the uppermost Hauterivian to the Aptian (CLAVEL et al., 2014) (Fig. 2C). *M. texana* represents a cosmopolitan species reported from Texas in the West (DOUGLASS, 1960) towards the western Pacific realm, e.g., Japan (IBA et al., 2011). In the Dinaridic realm it has been reported from various localities, e.g., Croatia (HUSINEC et al., 2000). For the wide distribution of mesorbitolinids in the Mediterranean realm see MOULLADE et al. (1985, fig. 2).

The co-occurrence of *Dictyoconus*? *pachymarginalis* (SCHROEDER) and *Mesorbitolina texana* (ROEMER) is known from many localities in the Western Tethyan realm up to the Middle East area (e.g., SCHLAGINTWEIT, 1990; MANCINELLI & CHIOCCHINI, 2006; SCHROEDER et al., 2010; SCHLAGINTWEIT et al., 2013; SCHLAGINTWEIT & WILMSEN, 2014) and indicates an upper Gargasian (Middle Aptian) age for the orbitolinid-bearing beds of the studied section.

5. DISCUSSION

In general, the short-lasting deposition of shallow-water "*Orbitolina*" limestones above marine siliciclastic sedimentary rocks and below a series of fine grained siliciclastic rocks with intercalated polymictic conglomerates is most probably connected with the long-term falling sea-level during the Aptian (OGG et al., 2004). This would imply that the underlying marine siliciclastics were deposited during the lower Aptian. The radiolarite components from the conglomerates intercalated in the *"Orbitolina"* limestones can be attributed by their microfacies characteristics to the Middle and Late Triassic, i.e., the whole ribbon radiolarite sequence of the Neo-Tethys Ocean floor. These Triassic ribbon radiolarites are known from the West-Vardar ophiolites (in the sense of SCHMID et al., 2008; Dinaridic Ophiolite Belt of DIMITRIJEVIĆ, 1997) and the Mirdita ophiolites in Albania (e.g., OBRADOVIĆ & GORIČAN, 1988; DJERIĆ et al., 2007; GAWLICK et al., 2020 and references therein, for Dinarides; DE WEVER et al., 1979; MARCUCCI et al., 1994; CHIARI et al., 1996; GAWLICK et al., 2008; 2016a for Albania; OZSVÁRT et al., 2012, for Greece). Also, the overlying fine-grained siliciclastic rocks, carbonate sandstones and polymictic fluviatile conglomerates consisting of exotic material were shed from the west/southwest and deposited most probably in the late Aptian. These conglomerates consist of volcanic pebbles (most probably ophiolite derived material) and various rounded radiolarite components. Determinable radiolarians from the radiolarite components could not be extracted, and a detailed component analysis especially of the volcanic components is lacking. During the Early Cretaceous, large parts of the Dinarides underwent continental weathering and the erosional products were shed either to the west in the remaining foreland basins (e.g., Vranduk or Bosnian basin) or to the east, i.e. the passive continental margin of the remaining eastern part of the Neo-Tethys Ocean (MISSONI & GAWLICK, 2011b). Triassic to Middle Jurassic ophiolites are only known from the wider Adria plate, i.e. the obducted ophiolites and their ophiolitic mélanges. These ophiolites obducted in Middle to early Late Jurassic times (for discussion see GAWLICK & MISSONI, 2019; SCHMID et al., 2020 and references therein), are missing on the Moesian superunit. The provenance area of the ophiolite and radiolarite components is therefore undoubtedly the wider Adria plate, i.e., the Inner Dinarides. Deposition of this Aptian sedimentary succession on the Moesian margin (TOLJIĆ et al., 2018) can therefore be excluded.

6. CONCLUSIONS

On the basis of the new data from the Košutnjak railway station section in Belgrade, the following conclusions can be drawn:

Deposition of the Early Cretaceous shallow-marine carbonates above the deeper-marine "Paraflsch" succession in the Belgrade area started in the Aptian and not in the Barremian as formerly estimated. The Gargasian age of the "*Orbitolina*"-limestones" in the Belgrade area provides the first most accurate biostratigraphic age data from this carbonate sequence;

Radiolarite components from the conglomerates are Triassic in age and derive from the obducted Middle Triassic to Middle Jurassic Neo-Tethys ophiolites and/or their ophiolitic mélanges on the wider Adria plate;

The first precise biostratigraphic dating as Middle Aptian combined with microfacies analysis of these shallow-marine limestones and the component spectrum in the intercalated conglomerates evidence that the Early Cretaceous turbiditic "Paraflysch" succession was deposited on the western shelf of the remaining Neo-Tethys after Middle to Late Jurassic ophiolite obduction, i.e. on the eastern part of the Jurassic Dinaridic orogen.

ACKNOWLEDGMENT

This manuscript has been written in the framework of the IGCP-project 710 (Western Tethys meets Eastern Tethys). Bojana ĐORĐEVIĆ and Hans-Jürgen GAWLICK gratefully thank the "Central European Exchange Program for University Studies" (CEEPUS) for network mobilities (CEEPUS CIII-RO-0038). Bojana ĐORĐEVIĆ would like to thank Montanuniversität Leoben for providing the facilities for this research. The research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, Contract no. 451-03-68/2022-14/ 200126. We would also like to thank Ioan BU-

CUR (Cluj-Napoca) and anonymous reviewers for their constructive comments and suggestions on the manuscript. The reviewers provided helpful comments that improved this manuscript.

REFERENCES

ANĐELKOVIĆ, M. (1954): L'Urgonien et L'Albien Dans la Zone Crétacée de Topola—Drača (Šumadija — Serbie).– Geološki anali Balkanskoga poluostrva, 22, 27–79. (in Serbian with French Summary).

ANĐELKOVIĆ, M. (1956): La Constitution Geologique et Tectonique des Montagnes: De Gledici (Serbie Centrale - Šumadija).– Geološki anali Balkanskoga poluostrva, 24, 31–184. (in Serbian with French Summary).

ANĐELKOVIĆ, M. (1973): Geology of the Mesozoic in the vicinity of Belgrade.– Geološki anali Balkanskoga poluostrva, 38, 1–142. (in Serbian with English Summary).

BLANCHET, R., CADET, J.P. & CHARVET, J. (1970): Sur l'existence d'unités intermédiaires entre la zone du Haut Karst et l'unité du flysch bosniaque, en Yougoslavie: la sous-zone prékarstique.– Bulletin de la Société Géologique de France, 12/2, 227–236. doi: 10.2113/gssgfbull.S7-XII.2.227

BOUDAGHER-FADEL, M. K. (2008): Evolution and Geological Significance of Larger Benthic Foraminifera.– Developments in Palaeontology and Stratigraphy, Elsevier, 21, 1–544. doi: 10.2307/j.ctvqhsq3

BRAGIN, N., BRAGINA, L., GERZINA, N., DJERIĆ, N. & SCHMID, S.M. (2019): New radiolarian data from the Jurassic ophiolitic mélange of Avala Mountain (Serbia, Belgrade Region).– Swiss Journal of Geosciences, 112, 235–249. doi: 10.1007/s00015-018-0313-8

BUCUR I.I., YARAHMADZAHI, H. & MIRCESCU C.V. (2019): The Lower Cretaceous Tirgan Formation In the Gelian Section (Kopet Dagh, North Iran): Microfacies, Microfossils, And Their Biostratigraphic Significance.– Acta Palaeontologica Romaniae V, 15/1, 13–33. doi: 10.35463/j.apr.2019.01.02

CHIARI, M., MARCUCCI, M., CORTESE, G., ONDREJICKOVA, A. & KODRA, A. (1996): Triassic radiolarian assemblages in the Rubik area, and Cukali zone, Albania.– Ofioliti, 21, 77–84.

CLAVEL, B., CHAROLLAIS, J., BUSNARDO, J., GRANIER, B., CONRAD, M., DESJACQUES, P. & METZGER, J. (2014): La plate-forme carbonatée urgonienne (Hauterivien supérieur – Aptien inférieur) dans le Sud-est de la France et en Suisse: synthèse.– Archives des Sciences, 67, 1–100.

CSONTOS, L. & VÖRÖS, A., (2004): Mesozoic plate tectonic reconstruction of the Carpathian region.– Palaeogeography, Palaeoclimatology, Palaeoecology, 210, 1–56. doi: 10.1016/j.palaeo.2004.02.033

DE WEVER, P., SANFLIPPO, A., RIEDEL, W. R. & GRUBER B. (1979): Triassic Radiolaria from Greece, Sicily and Turkey.– Micropaleontology, 25/1, 75–110.

DIMITRIJEVIĆ, M.D. (1997): Geology of Yugoslavia.– Geological Institute Gemini, Special Publication, Belgrade, 187.

DIMITRIJEVIĆ, M.N. & DIMITRIJEVIĆ, M.D. (1976): Lower Cretaceous complex of the Central Vardar Subzone.– In: 8th Yugoslavian Geological Congres – Ljubljana 1976, 3, 59–72.

DIMITRIJEVIĆ, M.N. & DIMITRIJEVIĆ, M.D. (1987): The Titova Mitrovica Flysch.– In: DIMITRIJEVIĆ, M.N. & DIMITRIJEVIĆ, M.D. (eds.): The Turbiditic Basins of Serbia, Serbian Academy of Sciences and Arts Department of Natural and Mathematical Sciences, 61, 25–64.

DJERIĆ, N., GERZINA, N., & SCHMID, S. (2007): Age of the Jurassic radiolarian chert formation from the Zlatar Mountain (SW Serbia).– Ofioliti, 32, 101–108.

DOUGLASS, R.C. (1960): The foraminiferal genus Orbitolina in North America.– Geological Survey Professional Papers, 333, 1–52.

FILIPOVIĆ, I., RODIN, V., PAVLOVIĆ, Z., MILIĆEVIĆ, M. & ATIN, B. (1979): Osnovna geološka karta SFRJ 1:100000. Tumač za list Obrenovac [*Basic Geological Map of SFRY 1:100.000, Geology of Obrenovac sheet* – in Serbian].– Savezni geološki zavod, Beograd, Federal Geologic Survey, Belgrade.

FLÜGEL, E. (2004): Microfacies of Carbonate Rocks. Analysis, interpretation and application.– Springer, Berlin, 976 p.

GARDIN, S., KICI, V., MARRONI, M., MUSTAFA, F., PANDOLFI, L., PIRDINI, A. & XHOMO, A. (1996): Litho- and biostratigraphy of the Firza Flysch, ophiolite Mirdita Nappe, Albania.– Ofioliti, 21, 47–54.

GAWLICK, H.J. & MISSONI, S. (2015): Middle Triassic radiolarite pebbles in the Middle Jurassic Hallstatt Mélange of the Eastern Alps: implications for Triassic–Jurassic geodynamic and paleogeographic reconstructions of the western Tethyan realm.– Facies, 61, 13–19. doi: 10.1007/s10347-015-0439-3

GAWLICK, H.J. & MISSONI, S. (2019): Middle-Late Jurassic sedimentary mélange formation related to ophiolite obduction in the Alpine-Carpathian-Dinaridic Mountain Range.– Gondwana Research, 74, 144–172. doi: 10.1016/j.gr.2019.03.003

GAWLICK, H.J., FRISCH, W., HOXHA, L., DUMITRICA, P., KRYSTYN, L., LEIN, R., MISSONI, S. & SCHLAGINTWEIT, F. (2008): Mirdita Zone ophiolites and associated sediments in Albania reveal Neotethys Ocean origin.– International Journal Earth Science, 97, 865–881. doi: 10.1007/s00531-007-0193-z

GAWLICK, H.J., GORIČAN, Š., MISSONI, S., DUMITRICA, P., LEIN, R., FRISCHE, W. & HOXHA, L. (2016a): Middle and Upper Triassic radiolarite components from the Kcira-Dushi-Komani ophiolitic mélange and their provenance (Mirdita Zone, Albania).– Revue de Micropaléontologie, 59/4, 359–380. doi: 10.1016/j.revmic.2016.03.002

GAWLICK, H.J., MISSONI, S., SUZUKI, H., & SUDAR, M. (2016b): Triassic radiolarite and carbonate components from a Jurassic ophiolitic mélange (Dinaridic Ophiolite Belt).– Swiss Journal of Geosciences, 9/3, 473–494. doi: 10.1007/s00015-016-0232-5

GAWLICK, H.J., SUDAR, M., MISSONI, S., AUBRECHT, R., SCHLAGINTWEIT, F., JOVANOVIĆ, D., & MIKUŠ, T. (2020): Formation of a Late Jurassic carbonate platform on top of the obducted Dinaridic ophiolites deduced from the analysis of carbonate pebbles and ophiolitic detritus in southwestern Serbia.– International Journal of Earth Sciences, 109, 2023–2048. doi: 10.1007/s00531-020-01886-w

GAWLICK, H.J., SUDAR, M., SUZUKI, H., DJERIĆ, N., MISSONI, S., LEIN, R. & JOVANOVIĆ, D. (2009): Upper Triassic and Middle Jurassic radiolarians from the ophiolitic melange of the Dinaridic Ophiolite Belt, SW Serbia.– Neues Jahrbuch für Geologie und Paläontologie, 253, 293–311. doi: 10.1127/0077-7749/2009/0253-0293

GRADSTEIN, F., OGG, J.G., Schmitz M.D. & OGG, G.M. (2020): A Geological Time Scale 2020.– Elsevier, 1390 p.

HUSINEC, A., VELIĆ, I., FUČEK, L., VLAHOVIĆ, I., MATIČEC, D., OŠTRIĆ, N. & KORBAR, T. (2000): Mid Cretaceous orbitolinid (Foraminiferida) record from the islands of Cres and Lošinj (Croatia) and its regional stratigraphic correlation.– Cretaceous Research, 21, 155–171. doi: 10.1006/cres.2000.0203

IBA, Y., SANO, S., & MIURA, T. (2011): Orbitolinid foraminifers in the Northwest Pacific: Their taxonomy and stratigraphy.– Micropaleontology, 57/2, 163–171. doi: 10.47894/mpal.57.2.04

KARAMATA, S. (2006): The geological development of the Balkan Peninsula related to the approach, collision and compression of Gondwanan and Eurasian units.– In: ROBERTSON, A. H.F. & MOUNTRAKIS, D. (eds.): Tectonic Development of the Eastern Mediterranean Region. Geological Society London Special Publications, 260, 155–178. doi: 10.1144/GSL.SP.2006.260.01.07

KOSTAKI, G., KILIAS, A., GAWLICK, H.-J. & SCHLAGINTWEIT, F. (2013):?Kimmeridgian-Tithonian shallow- water platform clasts from mass flows on top of the Vardar/Axios ophiolites.– Bull. Geol. Soc. Greece, 47/1, 184–193. doi: 10.12681/bgsg.10923

KRISCHE, O., GORICAN, S. & GAWLICK, H.-J. (2014): Erosion of a Jurassic ophiolitic nappe-stack as indicated by exotic components in the Lower Cretaceous Rossfeld Formation of the central Northern Calcareous Alps (Austria).– Geologica Carpathica, 65, 3–24. doi: 10.2478/geoca-2014-0001

KUKOČ, D., GORIČAN, Š. & KOŠIR, A. (2012): Lower Cretaceous carbonate gravity-flow deposits from the Bohinj area (NW Slovenia): evidence of a lost carbonate platform in the Internal Dinarides.– Bulletin de la Société Géologique de France, 183/4, 383–392. doi: 10.2113/gssgfbull.183.4.383

MANCINELLI, A. & CHIOCCHINI, M. (2006): Cretaceous benthic foraminifers and calcareous algae from Monte Cairo (southern Latium, Italy).– Bolletino della Società Paleontologica Italiana, 45/1, 91–113.

MARCUCCI, M., KODRA, A., PIRDENI, A., & GJATA, T. (1994): Radiolarian Assemblages in the Triassic and Jurassic cherts of Albania.– Ofioliti, 19, 105–114.

MARKOVIĆ, B., VESELINOVIĆ, M., ANĐELKOVIĆ, J., STEVANOVIĆ, P., ROGLIĆ, Č. & OBRADINOVIĆ, Z. (1985): Osnovna geološka karta SFRJ 1:10000. Tumač za list Beograd [*Basic geological map of SFRY 1:10000, Geology of Beograd sheet* – in Serbian].– Savezni geološki zavod, Beograd, Federal Geologic Survey, Belgrade.

MARKOVIĆ, B., VESELINOVIĆ, M., OBRADINOVIĆ, Z., ANĐELKOVIĆ, J., ATIN, B. & KOSTADINOV, D. (1984): Osnovna geološka karta SFRJ 1:10000, list Beograd [*Basic Geological Map of SFRY 1:100.000, Beograd sheet* – in Serbian].– Savezni geološki zavod, Beograd, Federal Geologic Survey, Belgrade.

MARRONI, M., PANDOLFI, L., ONUZI, K., PALANDRI, S. & XHOMO, A. (2009): Ophiolite – bearing Vermoschi Flysch (Albanian Alps, Northern Albania): Elements for its correlation in the frame of Dinaric-Hellenic belt.– Ofioliti, 34, 95–108.

MASSE, J.P, ARIAS, C. & VILAS, L. (1992): Stratigraphy and biozonation of a reference Aptian-Albian p.p. Tethyan carbonate platform succession: The Sierra dell Carche series (oriental Prebetic zone – Murcia, Spain).– In: KOLLMANN, H.A. & ZAPFE, H. (eds.): New aspects on Tethyan Cretaceous Fossil Assemblages. Schriftenreihe der Erdwissenschaftlichen Kommissionen der Österreichischen Akademie der Wissenschaften, 9, 201–222. doi: 10.1007/978-3-7091-5644-5_12

MEÇO, S. & ALIAJ, S. (2000): Geology of Albania.– Gebrüder Borntraeger, Berlin, 246 p.

MIKES, T., CHRIST, D., PETRI, R., DUNKL, I., FREI, D., BÁLDI-BEKE, M., REITNER, J., WEMMER, K., HRVATOVIĆ, H. & VON EYNATTEN, H. (2008): Provenance of the Bosnian Flysch.– Swiss Journal of Geosciences, 101/1, 31–54. doi: 10.1007/s00015-008-1291-z

MISSONI, S. & GAWLICK, H.J. (2011a): Jurassic mountain building and Mesozoic-Cenozoic geodynamic evolution of the Northern Calcareous Alps as proven in the

Berchtesgaden Alps (Germany).– Facies, 57, 137–186. doi: 10.1007/s10347-010-0225-1

MISSONI, S. & GAWLICK, H.J. (2011b) Evidence for Jurassic subduction from the Northern Calcareous Alps (Berchtesgaden; Austroalpine, Germany).– International Journal of Earth Sciences, 100, 1605–1631. doi: 10.1007/s00531-010-0552-z

MOULLADE, M., PEYBERNÈS, B., REY, J. & SAINT-MARC, P. (1985): Biostratigraphic interest and paleobiogeographic distribution of early and mid-Cretaceous Mesogean orbitolinids (Foraminiferida).– Journal of Foraminiferal Research, 15/3, 149–158. doi: 10.2113/gsjfr.15.3.149

MOOSAVIZADEH, M.A., ZAND-MOGHADAM, H. & RAHIMINEJAD, A.H. (2020): Palaeoenvironmental reconstruction and sequence stratigraphy of the Lower Cretaceous deposits in the Zagros belt, SW Iran.– Boletin de la Sociedad Geologica Mexicana, 72/2, 1–32. doi: 10.18268/BSGM2020v72n2a060919

NIRTA, G., MORATTI, G., PICCARDI, L., MONTANARI, D., CATANZARITI, R., CARRAS, N. & PAPINI, M. (2015): The Boeotian flysch revisited: new constraints on ophiolite obduction in central Greece.– Ofioliti, 40/2, 107–123.

OBRADOVIĆ, J. & GORIČAN, Š. (1988): Siliceous deposits in Yugoslavia: occurrences, types, and ages.– In: HEIN, J.R. & OBRADOVIĆ J. (eds.): Siliceous Deposits of the Tethys and Pacific Regions, 51–64. doi: 10.1007/978-1-4612-3494-4_4

OGG, J.G., AGTERBERG, F.P. & GRADSTEIN, F.M. (2004): The Cretaceous period.– In: GRADSTEIN, F., OGG, J. & SMITH, A. (eds.): A geologic time scale 2004. Cambridge University Press, 344–383. doi: 10.1017/CBO9780511536045.020

OZSVÁRT, P., DOSZTÁLY, L., MIGIROS, G., TSELEPIDIS, V. & KOVÁCS, S. (2012): New radiolarian biostratigraphic age constraints on Middle Triassic basalts and radiolarites from the Inner Hellenides (Northern Pindos and Othris mountains, northern Greece) and their implications for the geodynamic evolution of the early Mesozoic Neotethys.– International Journal of Earth Sciences, 101, 1487–1501. doi: 10.1007/s00531-010-0628-9

PAVLOVIĆ, Z., MARKOVIĆ, B., ATIN, B., DOLIĆ, D., GAGIĆ, N., MARKOVIĆ, O., DIMITRIJEVIĆ, M. & VUKOVIĆ, M. (1979): Osnovna geološka karta SFRJ 1:10000. Tumač za list Obrenovac [*Basic Geological Map of SFRY 1:10000, Geology of Smederevo sheet* – in Serbian].– Savezni geološki zavod, Beograd, Federal Geologic Survey, Belgrade.

RAHIMINEJAD, A.H. & HASSANI, M.J. (2015): Depositional environment of the Upper Cretaceous orbitolinid-rich microfacies in the Kuh-e Mazar anticline (Kerman Province, Central Iran).– Historical Biology: An International Journal of Paleobiology, 28/5, 597–612. doi: 10.1080/08912963.2014.998667

ROBERTSON, A.H.F., IONESCU, C., HOECK, V., KOLLER, F., ONUZI, K., BUCUR, I.I. & GHEGA, D. (2012): Emplacement of the Jurassic Mirdita ophiolites (southern Albania): evidence from associated clastic and carbonate sediments.– International Journal of Earth Sciences, 101/6, 1535–1558. doi: 10.1007/s00531-010-0603-5

ROOZBAHANI, P.R. (2011): Lithostratigraphy and biostratigraphy of the Lower Cretaceous of the Jalmajird area (northeast of Khomeyn, Central Iran Basin), Iran.– Geo.Alp., 9, 48–58.

SCHLAGINTWEIT, F. & WILMSEN, M. (2014): Orbitolinid Biostratigraphy of the Top Taft Formation (Lower Cretaceous of the Yazd Block, Central Iran).– Cretaceous Research, 49, 125–133. doi: 10.1016/j.cretres.2014.02.016

SCHLAGINTWEIT, F. (1990): Microfaunistic investigations of Hungarian Urgonian limestones (Barremian - Aptian).– Acta Geologica Hungarica, 33/1–4, 3–12.

SCHLAGINTWEIT, F., BUCUR, I.I., RASHIDI, K. & SABERZADEH, B. (2013): Praeorbitolina clavelii n. sp. (benthic foraminifera) from the Lower Aptian (Bedoulian) of Central Iran.– Carnets de Géologie-Notebooks on Geology, 4, 255–272.

SCHLAGINTWEIT, F., GAWLICK, H.-J., MISSONI, S., HOXHA, L., LEIN, R. & FRISCH W. (2008): The eroded Late Jurassic Kurbnesh carbonate platform in the Mirdita Ophiolite Zone of Albania and its bearing on the Jurassic orogeny of the Neotethys realm.– Swiss Journal of Geosciences, 101, 125–138. doi: 10.1007/s00015-008-1254-4

SCHLAGINTWEIT, F., GAWLICK, H-J., LEIN, R., MISSONI, S. & HOXHA, L. (2012a): Onset of an Aptian carbonate platform overlying a Middle-Late Jurassic radiolaritic-ophiolitic mélange in the Mirdita Zone of Albania.– Geologia Croatica, 65/1, 29–44. doi: 10.4154/GC.2012.02

SCHLAGINTWEIT, F., KRISCHE, O. & GAWLICK, H.-J. (2012b): First findings of orbitolinids (larger benthic foraminifera) from the Early Cretaceous Rossfeld Formation (Northern Calcareous Alps, Austria).– Jahrbuch der Geologischen Bundesanstalt, 152, 145–158.

SCHMID, S.M., BERNOULLI, D., FÜGENSCHUH, B., MATENCO, L., SCHEFER, S., SCHUSTER, R., TISCHLER, M. & USTASZEWSKI, K. (2008): The Alpine-Carpathian-Dinaride-orogenic system: correlation and evolution of tectonic units.– Swiss Journal of Geosciences, 101, 139–183.

SCHMID, S.M., FÜGENSCHUH, B., KOUNOV, A., MATENCO, L., NIEVERGELT, P., OBERHÄNSLI, R., PLEUGER, J., SCHEFER, S., SCHUSTER, R., TOMLJENOVIĆ, B., USTASZEWSKI, K. & VAN HINSBERGEN, D.J.J. (2020): Tectonic units of the Alpine collision zone between Eastern Alps and western Turkey.– Gondwana Research, 78, 308–374. doi: 10.1016/j.gr.2019.07.005

SCHROEDER, R. (1964): Orbitoliniden-Biostratigraphie des Urgons nordöstlich von Teruel (Spanien).– Neues Jahrbuch für Geologie und Paläontologie Monatshefte, 462–472.

SCHROEDER, R., BUCHEM, F.S.P., VAN CHERCHI, A., BAGHBANI, D., VINCENT, B., IMMENHAUSER, A. & GRANIER, B. (2010): Revised orbitolinid biostratigraphic zonation for the Barremian-Aptian of the eastern Arabian Plate and implications for regional stratigraphic correlations.– GeoArabia Spec. Pub., 4, 49–96.

SIMMONS, M.D., WHITTAKER, J.E. & JONES, R.W. (2000): Orbitolinids from Cretaceous sediments of the Middle East – A revision of the F.R.S. Henson and Associates Collection.– In HART, M.B., KAMINSKI, M.A. & SMART, C.W. (eds.): Proceedings of the Fifth International Workshop on Agglutinated Foraminifera. Grzybowski Foundation Special Publication, 7, 411–437.

SLADIĆ-TRIFUNOVIĆ, M. (1998): On the Senonian rudist-bearing sediments in Yugoslavia.– GEOBIOS, 22, 371–384.

SUDAR, M, JOVANOVIĆ, D, MARAN, A, & POLAVDER S. (2008): Late Barremian–Early Aptian Urgonian Limestones from the south–eastern Kučaj Mountains (Carpatho–Balkanides, eastern Serbia).– Geološki anali Balkanskoga poluostrva, 69, 13–30. Doi: 10.2298/GABP0869013S

TAHERPOUR KHALIL ABAD, M., SCHLAGINTWEIT, F., VAZIRI, S.H., ARYAEI, A.A. & ASHOURI, A.R. (2013): Balkhania balkhanica MAMONTOVA, 1966 (benthic foraminifera) and Kopetdagaria sphaerica MASLOV, 1960 (dasycladalean alga) from the Lower Cretaceous Tir-gan Formation of the Kopet Dagh mountain range (NE Iran) and their palaeobiogeographic significance.– In: BUCUR, .I.I. & FÜRSICH, F.T. (eds.): Recent advances in fossil algae, Facies, 59/1, 267–285.

TOLJIĆ, M., MAȚENCO, L., STOJADINOVIĆ, U., WILLINGSHOFER, E. & LJUBOVIĆ-OBRADOVIĆ, D. (2018): Understanding fossil fore-arc basins: Inferences from the Cretaceous Adria- Europe convergence in the NE Dinarides.– Global and Planetary Change, 171, 167–184. doi: 10.1016/j.gloplacha.2018.01.018

VELIĆ, I. (1988): Lower Cretaceous benthic foraminiferal biostratigraphy of the shallow-water carbonates of the Dinarides.– Revue de Paleobiologie, Vol. spec. 2, Benthos ‘86, 467–475.

VELIĆ, I. (2007): Stratigraphy and Palaeobiogeography of Mesozoic Benthic Foraminifera of the Karst Dinarides (SE Europe).– Geologia Croatica, 60/1, 1–113.

YAZDI-MOGHADAM, M. & AMIRI, F. (2010): Lower Cretaceous Agglutinated Larger Benthic Foraminifera from the Sarvestan Section, South of Esfahan, Iran.– In: The 1st International Applied Geological Congress – Iran 2010, Department of Geology, Azad University-Mashad Branch, 976–980.

ZELIĆ, M., MARRONI, M., PANDOLFI, L. & TRIVIĆ, B. (2010): Tectonic setting of the Vardar suture zone (Dinaric-Hellenic belt): the example of the Kopaonik area (southern Serbia).– Ofioliti, 35, 49–69.