Cretaceous Research 56 (2015) 432–446

Contents lists available at ScienceDirect

Cretaceous Research

journal homepage: www.elsevier.com/locate/CretRes

Foraminiferan-calcimicrobial benthic communities from Upper Cretaceous shallow-water carbonates of Albania (Kruja Zone)

Felix Schlagintweit [a, *], Bogusław Kołodziej [b], Ana Qorri [c]

[a] Lerchenauerstr. 167, 80935 München, Germany
[b] Institute of Geological Sciences, Jagiellonian University, ul. Oleandry, 2a, 30-063 Kraków, Poland
[c] Department of Earth Sciences, Faculty of Geology and Mining, Polytechnic University of Tirana, Albania

ARTICLE INFO

Article history:
Received 19 January 2015
Accepted in revised form 20 April 2015
Available online 26 June 2015

Keywords:
Microbialites
Calcimicrobes
Nubeculariids
Thaumatoporella
Decastronema
Campanian
Albania

ABSTRACT

From the Kruja Zone of Albania, shallow-water carbonates assigned to the lower Campanian are described and grouped into six microfacies types of shallow subtidal to intertidal depositional settings. The limestones display internal layering suggestive of microbial fabrics with abundance of nubeculariid foraminifera, incertae sedis *Thaumatoporella* Pia, and subordinate calcimicrobes of possible cyanobacterial origin: *Gahkumella* Zaninetti, *Girvanella* sp., and *Decastronema kotori* (Radoičić). The nubeculariid morphotypes with ornamented tests and microbial coatings reveal some kind of mutualistic relationship comparable to Late Palaeozoic–Mesozoic *Tubiphytes* Maslov and *Crescentiella* Senowbari-Daryan et al. The present study expands our knowledge on the micropalaeontological characteristics of the Late Cretaceous "*Decastronema*–*Thaumatoporella* association" widespread in carbonate platforms of the peri-Mediterranean region. Our findings indicate that nubeculariids may have played an important binding role in Late Cretaceous peritidal laminated limestones.

1. Introduction

Upper Cretaceous shallow-water successions from the eastern Mediterranean region were deposited on Apulian, Apenninic, Adriatic, and other smaller carbonate platforms. They have been described among others from Italy, Slovenia, Croatia, Greece, Turkey (e.g., Gušić and Jelaska, 1990; Carannante et al., 2000; Tišljar et al., 2002; Sari et al., 2009; Diedrich et al., 2011; Jež et al., 2011; Tunis et al., 2011; Brandano and Loche, 2014; Frijia et al., 2015) and Albania (Heba and Prichonnet, 2006: Kruja platform). Biostratigraphy of these limestones is based mainly on larger benthic foraminifera (e.g., Cvetko Tešović et al., 2001; Korbar and Husinec, 2003; Velić, 2007; Checconi et al., 2008; Chiocchini et al., 2008) that only recently were accommodated within a precise chronostratigraphic framework by means of isotope stratigraphy (Frijia et al., 2015).

Laminated limestones, including microbialites, associated with benthic foraminifera and microproblematica, are commonly referred to peritidal depositional settings and commonly make up Upper Cretaceous successions of these platforms. Typical microfacies comprise, for example, wackestones to packstones with benthic foraminifera, and/or the typical association of *Thaumatoporella* and *Decastronema* gr. *kotori-barattoloi* (formerly ascribed to *Aeolisaccus*) with microbialites (Radoičić, 1959; Gušić and Jelaska, 1990; Moro and Jelaska, 1994; Carannante et al., 2000; Buonocunto et al., 2002; Ruberti and Toscano, 2002; Korbar and Husinec, 2003; Golubic et al., 2006; Ćosović et al., 2008; Jež et al., 2011; Ogorolec, 2011; Simone et al., 2012; Spalluto, 2012; Jurkovšek et al., 2013; Brandano and Loche, 2014; Frijia et al., 2015). In spite of the multitude of these literature records, the origin of microbial fabrics associated with different types of nubeculariid foraminifera and microfossils of uncertain or microbial origin are still poorly studied. The aim of this paper is to contribute to a better understanding of this characteristic facies and micropaleontological inventory based on a case study from the Campanian of the Kruja zone in northwestern Albania (Figs. 1–2).

2. Geological setting

Break-up of Adria in the Triassic, followed by the Early Jurassic disintegration of the Southern Tethyan Megaplatform and the formation of the Adriatic Basin resulted in the establishment of the

* Corresponding author.
E-mail addresses: felix.schlagintweit@gmx.de (F. Schlagintweit), boguslaw.kolodziej@uj.edu.pl (B. Kołodziej), ana.qorri@fgjm.edu.al (A. Qorri).

http://dx.doi.org/10.1016/j.cretres.2015.04.009
0195-6671/

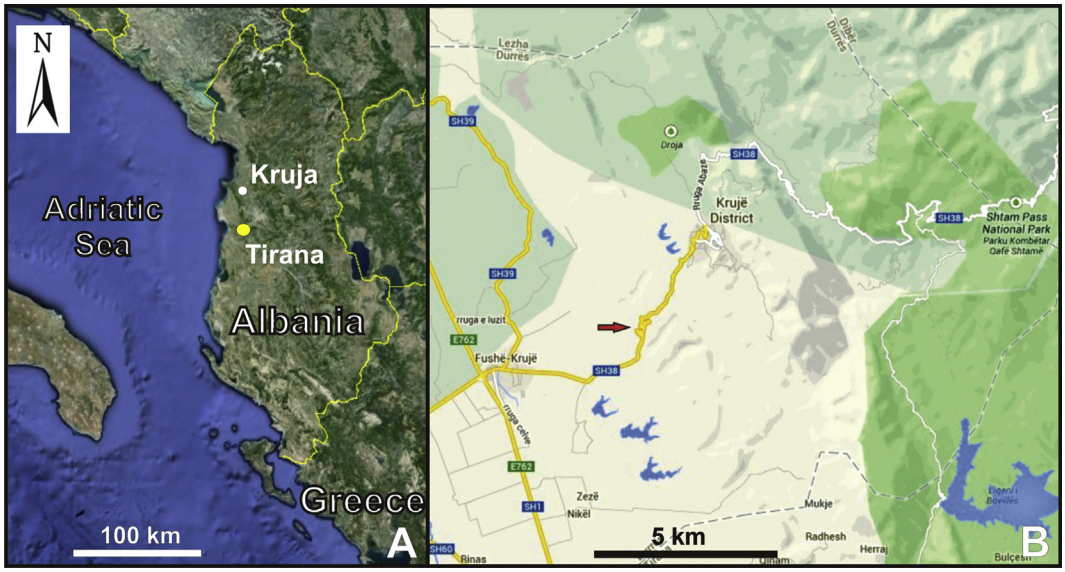

Fig. 1. A, Satellite image of the studied area in the vicinity of Kruja, northwestern Albania, and B, detailed map of the studied section locality (arrow) (from Google Earth and Maps).

Apulian Carbonate Platform, Apenninic Carbonate Platform, and Central Mediterranean Carbonate Platform (Vlahović et al., 2005 and literature therein). The later was a huge carbonate unit that included more or less continuous smaller platforms of the present peri-Mediterranean realm. These are: the Friuli platform (Italy), Dinaric platform (Slovenia), Adriatic or Adriatic–Dinaric platform (Croatia), Adriatic and Dinaric platforms (Serbia, Montenegro), Kruja platform (Albania), Gavrovo and Tripolitza platforms (Greece) and Menderes platform in Turkey. During the Mesozoic these platforms show similar tectonic–sedimentary cycles (Vlahović et al., 2005).

During the Mesozoic and Palaeogene the passive margin of the Apulian Plate was bordered by extensive carbonate platforms, known in Albania as the Kruja zone or Kruja platform. The Kruja zone extends northwards into the Adriatic–Dinaric platform (Montenegro, Croatia) and southwards into the Gavrovo platform (northern Greece). In Albania only upper Mesozoic–Palaeogene deposits are exposed (Robertson and Shallo, 2000; Heba and Prichonnet, 2006; Le Goff et al., 2015).

Data on the Upper Cretaceous carbonate platform of the Kruja zone, a part of the External Albanides (Fig. 2A), come mostly from the studies of Peza (Peza, 1973, 1975, 1977, 1982; Peza et al., 1972) and recent investigations by Heba and Prichonnet (2006, 2009), Heba (2008) and Heba et al. (2009). Studies by Heba and co-authors were performed in two sections: (i) the L'Escalier section in the Kruje-Dajt massif, and (ii) La Route section in the Makareshi massif. In both sections, the Upper Cretaceous carbonates crop out in NNW–SSE trending synclinal structures (Fig. 2A). The upper Santonian–lower Maastrichtian (as dated by larger benthic foraminifera) includes deposits ranging from subtidal to supratidal environments. The lower Campanian deposits cropping out in the studied section were attributed by Heba and Prichonnet (2006) to an intertidal environment (laminated limestones, miliolid limestones, rudist storm limestones, bird's-eyes-bearing dolomites, brecciated dolomites) and shallow subtidal environment (rudist debris-bearing limestones, rudist patch reefs).

In the Borizana section, another section of the Makareshi massif, recently studied by Qorri and Durmishi (2014), the lower Campanian includes deposits of restricted and open platform interior: limestones and dolomitic limestones intercalated by dolomites and siliciclastics. The Upper Cretaceous is marked by a major hiatus spanning the late Maastrichtian and continued to the early Eocene (Gjata et al., 1968). Above this gap, the series continues with the middle Eocene bioclastic limestones, deposited in an open shallow subtidal environment. Above the limestones, the horizon of the upper Eocene "passing marl" marks the transition to the 1500 m thick succession of the Oligocene flysch (Heba and Prichonnet, 2006).

3. Material and methods

Our study focuses on the Campanian succession cropping out ca. 2 km west of Kruja (Fig. 1B), close to the Muslim religious place Gjurma e të Shenjtit Sari Salltik (part of the La Route section of Heba and Prichonnet, 2006). The samples were collected from a 100-m thick roadcut section, starting ca. 70 m below Gjurma e të Shenjtit Sari Salltik. The section consists of bedded wackestones to packstones, commonly laminated, and bindstones subordinate interlayered with rudist floatstones. The study was focused on examination of thin-sections prepared from samples representing predominantly laminated limestones and bindstones (Fig. 3) in order to obtain an overview of the microfacies variability and the associated microfossils. The rock samples and thin sections are housed at the Geological Museum, Institute of Geological Sciences, Jagiellonian University in Kraków (collection ING UJ 232 P, samples and thin sections with prefix Kru).

4. Results

4.1. Microfacies

The following seven microfacies types (MFT) were identified (Figs. 4–5):

MFT-1: Laminated microbial bindstone (Figs. 3C, 4A–B). This microfacies type almost completely lacks benthic foraminifera and other microfossils. In some laminae, however, specimens of irregular globulous specimens of incertae sedis *Thaumatoporella* are present (Fig. 4A). Fine filaments (of porostromate algae or calcimicrobes) occur either in flocculent arrangement or perpendicular to bedding. Individual filaments can only rarely be recognized (Fig. 4B); instead, a clotted-peloidal fabric microstructure prevails.