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Late Triassic to Late Jurassic evolution of the Adriatic Carbonate Platform and Budva Basin, Southern Montenegro

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Abstract

Southeastern Montenegro is the only part of the Adriatic Carbonate Platform (AdCP) that bears record of its evolution from a ramp, through a distally steepened ramp to a platform. In this paper we present the sequence stratigraphy of the Late Triassic to Late Jurassic rocks from this part of Tethys for the first time in the literature. We discovered and described three new facies: hardground and cerebroid oolites of the Livari Supersequence, and black pebble conglomerate of the Tejani Supersequence. The mid-ramp and lower ramp cherty oolite, wackestone and mudstone facies of the Livari Supersequence, as well as Oolite Conglomerate facies of the Stari Bar Supersequence were partially or completely reinterpreted.

The Middle and Late Triassic rifting separated the AdCP from the other South Tethyan carbonate platforms and created the intraplatform Budva Basin. The AdCP evolved through three morphologic stages: a detached ramp (Livari Supersequence; Rhaetian–Early Toarcian), a distally steepened ramp (Tejani Supersequence; Early Toarcian–Middle Callovian) and an accretionary rimmed platform (Stari Bar Supersequence; Oxfordian to Neogene). The Rhaetian regression is marked by a regional unconformity surface that represents a type S sequence boundary at the base of the Livari Supersequence. Lowstand Wedge of the Halobia Limestone was the oldest sediment in the Budva Basin. TST and HST of the Livari Supersequence include: supratidal and intertidal inner ramp sediments, ooid shoals, and cyclic shallowing-up parasequences of the mid-ramp. Sedimentation rates were high in the inner ramp, while Budva Basin received relatively thin accumulation of siliceous plankton. A brief exposure of supratidal flats and ooid bars represents a type P sequence boundary between the Livari and the Tejani Supersequences, which was flooded by the Early Toarcian transgression. TST and HST of the Tejani Supersequence consist of supratidal, lagoon, and shoal sediments in the inner ramp, and deeper water carbonates of the mid- and outer ramp. Highstand shedding of the sediment from the steepened ramp left thick deposits in the Budva Basin. The Bathonian regression is marked by a regional unconformity that represents a type S sequence boundary between the Tejani and Stari Bar Supersequences. Stari Bar Oolite Conglomerate is a Lowstand Wedge of the Stari Bar Supersequence. The Middle Callovian transgression induced aggradation of ooid shoals deep into the platform interior. Oxfordian coral reefs created a rimmed platform and restricted export of the shallow carbonates into the Budva Basin.

Keywords: Adriatic; Platform; Basin; Jurassic; Oolite; Sequences

1. Introduction

Ever since the Budva–Cukali zone was recognized (Bukowski, 1926) the Dinaric Carbonate Platform was considered different from the Adriatic Carbonate Platform. Over several years other names (High Karst, Outer Dinaric belt and Dalmatian–Herzegovinian zone) were used to describe the Dinaric Carbonate Platform. Recently, Vlahović et al. (2002, 2005) proposed that all shallow and deeper water carbonates exposed along the eastern Adriatic coast belong to a single, Adriatic Carbonate Platform (AdCP). In this paper we will use AdCP acronym for the extensive, Bahamian type, south Mediterranean carbonate platform. The Late Triassic events in various Mediterranean platforms (Bosellini, 1984; Čadjenović, 1987; Burchell et al., 1990; Čadjenović and Mirković, 1992; Čadjenović and Vuisić, 1995; Blendinger et al., 2004) indicate a different evolution of the separate platforms. Thus, we propose that the SE part of the AdCP, now exposed in Montenegro, began its

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evolution in the Late Triassic, rather than in late Early Jurassic, as suggested by Vlahović et al. (2005).

The focus of this paper is the southeastern part of the AdCP, which experienced unique evolution with respect to other parts of the AdCP. We recognize three major cycles of sedimentation from the Late Triassic to the Late Jurassic. The cycles are named Supersequences based on their duration (14–29 Ma) as suggested by Sarg et al. (1996). Two older Supersequences, Livari and Tejani, were completely described, and only the basal part, the Transgressive System Tract (TST), of the youngest, Stari Bar Supersequence is analyzed. In this paper we will demonstrate that the AdCP evolved from a detached ramp (Read, 1982; Schlager, 2005) (Early Jurassic) to a distally steepened ramp (Read, 1982) (Middle Jurassic), and only since the Late Jurassic became a carbonate platform (accretionary rimmed shelf of Read, 1982).

The study area is located in southern Montenegro, between the Adriatic Sea to the south, and Lake Skadar (Scutari) to the north (Fig. 1). We measured and described three stratigraphic sections (Fig. 2) that indicate three depositional environments: 1) AdCP interior; 2) the transitional zone of ramp/platform margin; and 3) Budva Basin. The chronostratigraphy (Fig. 3) is based on the fossil assemblages and regional correlation with other Tethys facies and unconformities. Two hundred samples were collected, classified in field (Dunham,1962; Embry and Klovan, 1971) and made into thin sections. Microfacies analyses (Flügel, 2004) were combined with outcrop descriptions to define 23 carbonate facies (Wilson, 1975; Read, 1985), whose arrangement indicates stacking in three Supersequences.

2. Platform foundation

The loferite facies (Bešić, 1975; Radoičić, 1982, 1987; Obradović et al., 1985; Čadjenović and Mirković, 1992) of the Upper Triassic dolomite is the basal unit of the AdCP. The facies

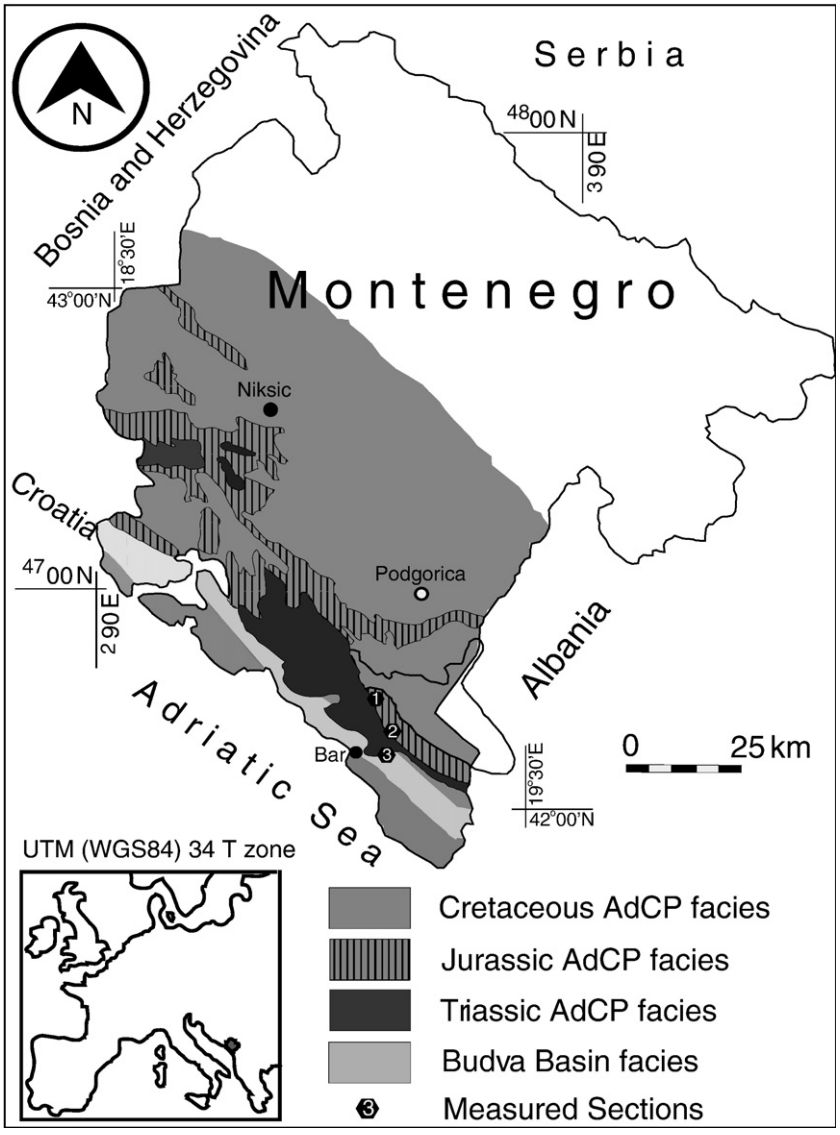

Fig. 1. Adriatic Carbonate Platform in Montenegro with location of three measured sections: 1. Seoca (42° 12′57″ N, 19° 8′12″ E); 2. Livari (42° 7′29″ N, 19° 12′26″ E); 3. Stari Bar (42° 5′5″ N, 19° 10′33″ E).