Alveolinas From the Bunić Section (Lika, Croatia)

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Key words: Alveolina, A. histricha, A. rakoveći, Palaeobiogeography, Biostratigraphic correlation, Cuisian, Adriatic carbonate platform, Bunić, Croatia, Golež, Slovenia, Hrgud, Herzegovina.

Abstract

The Bunić section of Palaeogene carbonates is exposed in a tectonic window through the Dinaric tectonic units in the Kozjak valley in the central part of the Lika region (Croatia). The Lower Eocene limestones in this section yielded Alveolina histricha septentrionalis and A. rakoveći. These two species characterize a particular facies of shallow water deposits during Middle to Late Cuisian times, as observed at Golež and Voz on the north-western margin of the Adriatic and also at Litića and Hrgud in Herzegovina. This is in contrast to Alveolina assemblages of the same age composed of A. levantina, Periloculina dalmatina, Coskelinolina lithurica, which characterize the shallow transgressive deposits of the coastal and insular regions in particular at the Pićan and Benkovac sections.

The Bunić Alveolina assemblage indicates that the limestones in the tectonic window formed part of the sedimentary realm representing the north-eastern margin of the Adriatic platform. This also supports Herak’s tectonic model by distinguishing two tectonically superimposed carbonate platforms, the Dinaricum and the Adriaticum, separated by an interplatform basin called the Epia Adriaticum.

1. INTRODUCTION

In central Lika (Croatia) the Palaeogene strata crop out over a very restricted area (Fig. 1). The largest occurrence of Eocene limestone and flysch is located between Bunić and Čanak villages, 23 km south of the Plitvice Lakes. The rudist limestones of the Upper Cre­taceous are surrounded by tectonic contacts. For a few metres only, the original transgressive contact between the rudist limestones and the overlying Palaeogene carbonates has been observed by M. Šparica (POLŠAK et al., 1978; ŠPARICA, 1978).

These outcrops of Palaeogene strata initiated two hypotheses to explain their origin, either as erosional remnants of a palaeostructural syncline, limited partly by faults (ŠPARICA, 1978, p. 292, Pl. 1) or Eocene windows belonging to the subjacent unit of the Adriatic carbonates (Adriaticum) covered by the Dinaric carbonate platform (Dinaricum) (HERAK, 1986).

The schematic cross-section given in Fig. 1 corresponds to the former interpretation. In between the Adriaticum and Dinaricum platforms, Herak recognizes an interplatform sedimentary belt, named Epia Adriaticum, extending from NW Slovenia to Montenegro (Fig. 3 and HERAK, 1985, 1987, 1989, 1991, 1993).

Until 1985 investigations were carried out within the frame of the project entitled “Palaeogene Foraminifera of Carbonate Development”, organized by INANaftaspilin. Researchers from Zagreb and Ljubljana cooperated with this and the Bunić locality was included in these studies. Among the foraminifera the Alveolina species were studied in more detail than other species. Selected species of the genus Alveolina were used for biostratigraphic correlation of the contemporaneous sections along the Adriatic coast and for comparison with the Bunić fauna (DROBNE, 1977; DROBNE et al., in press).

The aim of this paper is to present the nature and the probable causes of the faunistic similarities in the Alveolina associations from Bunić and the Adriatic platform.

2. THE BUNIĆ SECTION

The Palaeogene strata crop out over a distance of 10 km along the very narrow Kozjan valley. The belt of limestone is not continuous. Flysch sediments are visible for less than 1 km along the road (Fig. 1). The Bunić–Kozjan section (I–9–J) with the collected samples Bu–Ko from 11 to 4 is located on the southwestern slope of the valley, approximately southeast of Čanak village. The samples Bu–Ko 64–67 were taken from the bottom of the valley below, in front of the main section (Fig. 2a).

The base of the logged section is marked by the rudist limestones of Senonian age at an altitude of 965 m. Probably, there is a tectonic contact between the Senonian and Eocene strata. The total length of the outcropping section amounts approximately to 400 m, and the thickness of the alveolina-nummulite limestone to 120

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The logged section ends at sample Bu-Ko 4 (Figs. 2a, 2b) where the section is interrupted by a fault (Fig. 2b). The inclination of strata varies from 30-45°, and their strike is in NNE direction. The beds are in inverse position, and are partially folded.

The limestone is tectonized and cut by calcitic veins. Due to the dense vegetation the succession of layers can not be easily observed. Beds of 30-70 cm thickness prevail, alternating with rare, thicker beds of 1.0-1.5 m.

In the sequence packstones to wackstones are dominant. The foraminifera are poorly preserved, their shells, regenerated during life, were broken by post-diagenetic microtectonic events (Plate I).

3. ALVEOLINA FROM THE BUNIČ SECTION

The study of the Alveolina species is based on 8 samples from the main sequence of the Bunič - Kozjan (1-9-J) section and on 7 samples from isolated localities (Figs. 2a and 2b).

The oriented sections of Alveolina represent 14 species (Tab. 1). This indicates a Middle Cuisian age in the lower and middle part of the section, and Upper Cuisian age in the uppermost beds only (Fig. 2b; Pl. I, II). There are Tethyan species represented by A. cremae CHECCHIA-RISPOLI, A. schwageri CHECCHIA-RISPOLI, A. aff. canavarii CHECCHIA-RISPOLI, A. ruetimayeri HOTTINGER, A. rectiangula DROBNE and others. They have a broad geographical distribution in the Mediterranean, in both carbonate and clastic deposits (CHECCHIA-RISPOLI, 1905; HOTTINGER, 1960; Di SCOTTO, 1966). The appearance of species belonging to the phylogenetic lineage of Alveolina histrica is of particular significance. They were first described in SW Slovenia in the Kozina, Slavec and Golež sections under the specific designation: A. histrica histrica DROBNE and A. h. septentrionalis DROBNE from the Middle Cuisian, as well as A. rakoveci
4. PALAEOGEOGRAPHIC DISTRIBUTION OF SPECIES BELONGING TO THE A. histrica LINEAGE

All occurrences (except Ivartnik, Tab. 1) which yield representatives of the phylum A. histrica are located within a narrow restricted area extending in NW-SE Dinaric direction. This area represents a palaeogeographic domain interpreted as the north-eastern margin of the Adriatic platform. North-Eastwards, this margin is obscured by basinal terrigenous sediments along its extension, in NW Slovenia (PAVŠIČ et al., 1996) as well as in Herzegovina (SLIŠKOVIĆ et al., 1978). The Adriatic platform constituted an isolated shoal zone in the Central Tethys during the Palaeogene (HOTTINGER, 1990). It was drowned at different times in different places according to the latter’s relative position with respect to the platform margin, and subsequently covered by terrigenous sediments. Therefore, is the geographically restricted occurrence of the A. histrica phylum due to true endemism, or to environmental restrictions corresponding to a particular facies belt characterizing the platform margin?

The isolated position of the Palaeogene Adriatic platform in the Tethyan sea may be a good prerequisite for endemism. The occurrence of A. histrica in Ivartnik, outside of the Adriatic domain would suggest otherwise. However, the palaeogeographic position of this latter locality remains clear, as the position of the Palaeogene-Eurasian continental margin in the Alpine realm has not been accurately reconstructed. In particular the position of the Karinthian Krappfeld outcrops...
Table 1  Association of alveolins, specially the species of the phylogenetic lineage Alveolina histrica, marked <O>; for location of sections see Fig. 3.

<table>
<thead>
<tr>
<th>Alveolina</th>
<th>Golež</th>
<th>Voz</th>
<th>BUNIČ</th>
<th>Lištica Dobrinj</th>
<th>Hrgud Stolac</th>
<th>Rosandra Ivartnik</th>
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<td>A. azzarolii</td>
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<td>A. h. septentrionalis</td>
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<td>A. histrica histrica</td>
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<td>A. carantana</td>
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<td>A. rectangula</td>
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(where A. histrica is absent - Van HINTE, 1963), in relation to Ivartnik is unknown.

Alternatively, the Adriatic area corresponding to the distribution of A. histrica exhibits a common sedimentary history. Carbonate sedimentation is continuous from the Lierdian to the Cuisian and the platform was drowned prior to the base of the Lutetian. This characterizes the platform margin in contrast to inner parts of the platform where the marine carbonate sedimentation began late, with the Cuisian transgression, and ended, during the Lutetian (DROBNE, 1977).

Platform margins doubtlessly have habitats other than restricted areas of the internal parts (HOTTINGER, 1980) and may therefore delimit narrow, belt-like areas of distribution for taxa of the larger foraminifera. The present state of knowledge does not permit a definite answer to these questions. However, the linear alignment of the A. histrica occurrences emphasizes the close facies relationship between the Lištica-Hrgud and the Rosandra-Voz areas (Fig. 3) and justifies adding the Bunić A. histrica occurrence into the linear realm. As a consequence, the Bunić occurrence must be interpreted as a tectonic window, where a piece of the Adriatic platform margin is expressed from beneath the overthrust Dinaric tectonic unit.

5. CONCLUSION

The linear extension of the distribution of the Cuisian alveolinitid species belonging to the A. histrica phylum, between NE Slovenia and SE Herzegovina corresponds to the NE margin of the Adriatic platform which constituted an isolated shoal area in the Tethyan sea. The presence of A. histrica in this narrow belt may either reflect particular environmental conditions along the platform margin, or represent an area delimited by endemism, or result from a contribution of both factors. Thus, the facies relations between the Cuisian alveolina limestones are significant enough to justify an interpretation of the Bunić alveolina limestone as an intermediary part of the platform margin, hidden beneath the overthrust Dinaric unit (Fig. 3) and emerging in isolated points from below in a tectonic window.

Acknowledgement

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6. REFERENCES

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**Fig. 3** Geotectonic belts, after HERAK (1986, 1991 - fig. 5) with the positions of the sections composed by alveolina-nummulite limestone. Legend: A) Structural complex of the Adriatic carbonate platform (Adriaticum); B) Deposits of pelagic provenance in connection with the Interplatform belt (Epipalaearticum); C) Structural complex of the Dinaric carbonate platform (Dinaricum); D) The joint area of the Dinarides and Alpides; E) Structural complex of the Inner Dinarides (Supradinaricum) which originated in connection with the ocean belt of the Tethys; black: ultrabasic, basic and associated rocks; P) Pre-Alpine structural complexes (P1 - Pannonian structure, P2 - Serbo-Macedonian Massif); C) Carpatho-Balkanian Belt. A, E) tectonic windows within the Dinaricum; O Occurrence of *A. histrice*, A Coeval alveolina assemblages without *A. histrice*, shown at the Pican (Istria) and Benkovac - Ravni Kotari sections (DROBNE, 1977; DROBNE et al., 1991).


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PLATE I

1 Alveolina-nummulite limestone, A. rectangula DROBNE, A. rakoveci DROBNE, Gimalveolina sp., Orbitolites sp., Nummulites sp., packstone, Bu-Ko 64/5413.

2 Packstone, badly preserved foraminifera, Bu-Ko 4/5258.

All enlarged x10, incident light
PLATE II

1. Alveolina rakoveci DROBNE, f A, axial section, Bu-Ko 64/5417, Upper Cuisian
2. A. rakoveci DROBNE, f A, equatorial section, Bu-Ko 64/5413, Upper Cuisian
3. A. histrica septentrionalis DROBNE, f A, axial section, Bu-Ko 65/5435, Upper Cuisian
4. A. histrica septentrionalis DROBNE, f A, axial section, Bu-Ko 5/5283, Middle Cuisian
5. A. histrica histrica DROBNE, f A, axial section, Bu-Ko 8/5333, Middle Cuisian
6. A. rectangula DROBNE, f B, axial section, Bu-Ko 64/5411, Upper Cuisian
7. A. distefanoi CHECCHIA-RISPOLI, f A, axial section, Bu-Ko 5/5363, Middle Cuisian
8. A. schwageri CHECCHIA-RISPOLI, f A, axial section, Bu-Ko 6/5297, Middle Cuisian
9. A. ruetimeyeri HOTTINGER, f A, axial section, Bu-Ko 6/5297, Middle Cuisian
10. A. aff. canavarii CHECCHIA-RISPOLI, f A, axial section, Bu-Ko 7/5316, Middle Cuisian
11. A. cremae CHECCHIA-RISPOLI, f A, axial section, Bu-Ko 10/5375, Middle Cuisian

All enlarged x10, incident light