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Molluscs (Mollusca: Gastropoda, Bivalvia) from The Upper Eocene of Perunika Village (East Rhodopes, Bulgaria) – Preliminary Results

Slaveya Petrova, Elvan Mehmed, Ivelin Mollov, Dilian Georgiev, Iliana Velcheva

Department of Ecology and Environmental Conservation, University of Plovdiv, Tzar Assen Str. 24, 4000 Plovdiv, Bulgaria;
E-mail: sl.petrova@abv.bg

Abstract: During the current study 111 fossil specimens were collected from the region of Perunika Village, Eastern Rhodopes Mountain in Bulgaria. 14 species of gastropods from 11 genera and 3 species of mussels from 3 genera were found there. Most of the species were with Priabonian age and the rest were with more wide vertical distribution among the whole upper Eocene. The gastropods strongly predominated with 100 specimens while the mussels were rare, and were less than 10% from all the molluscs collected. From the snails the specimens from the genus *Globularia* prevailed with 43%, followed by genus *Borsonia* with 15%. The other snail genera had only few specimens registered and were from 2 to 8% from all. The age of the studied sediments can be related to the Priabonian on the base of the determined molluscs fauna. The registered gastropods indicate an ancient warm and shallow sea with oligo- to mezzo saline waters.

Key words: marine mollusks, fossils, paleoecology, Perunika Village, Eastern Rhodopes, Bulgaria

At the beginning of Neozoic era (70 mya) the Rhodopes were one relatively consolidated massif. During Paleogene this massif disintegrated into few smaller ridges. At its eastern part the so called Central, South-eastern and Harmanli blocks were separated (Ivanov 1961, Boyanov 1971). At the end of the Eocene (56-34 mya) on the territory of present Bulgaria there were few separate salt water basins with some large islands within, which were presented by the contemporary massifs of the Sredna Gora, Strandzha, Kraishte, Stara Planina mountains and the central mountain ridge of the Rhodopes. The water of these seas was with normal salinity, and the regional climate was tropical one (Yordanov 1962, Boshev 1966). At the south and south-eastern parts the Rhodopes, the so called Metlichki coral reef was formed. It occupied an area of about 30 km between the Chorbadzhiisko Village, the Elbasan River valley, the region of Krumovgrad town, South of Iran tepe peak and reached the village of Perunika. The reef was more than 6 km wide and is over 90 m deep. It is composed by thick, massive limestone full of fossil foraminifera, corals, seaweed, mussels, gastropods and others (Georgiev 2002).

The knowledge about the geological structure of the Rhodopes Mountain was mainly developed on the basis of the papers of Ivanov (1960, 1961), Goranov (1960), Boyanov *et al.* (1963), and Boyanov, Goranov (2001). So far Eocene sea fossils were registered at the regions of Varna, Tarnovo, Haskovo, Burgas, Pleven, Kardzhali, and were studied most detail at the area of Dolni Voden (Asenovgrad town) by Cholakov, Lyutzkanov (1991) and Temelkov, Cholakov (1996).

The study of large number of fossil localities from a given geological period reveals useful information for the needs of the paleoecological reconstructions. The present work is intended to: (i) represent data on the community of the marine mollusks from a locality of Perunika Village in the Eastern

Rhodopes Mountains which was not studied until now, and (ii) to obtain some information on the local paleoecological environment.

The fossil specimens were collected from the soil surface (down to 20 cm) at area of 4 m^2 in the region of village of Perunika, Eastern Rhodopes Mountains (Fig. 1) during October-December 2011. The fossils were stored in plastic bags and transported to the laboratory of Ecology (Faculty of Biology, Plovdiv University). They were then cleaned, sorted and identified, using the works of Karagyuleva (1964) and a reference collection. Material was stored in the collection of the Department of Ecology and Environmental Conservation, University of Plovdiv. Some diversity indices (Simpson, Shannon, Margalef and Berger-Parker) were calculated for the molluscs community, using the software PAST ver. 2.07 (Hammer *et al.*, 2001).

Taxonomical information. During our research we have collected 111 specimens consisted of minimum 14 species of gastropods from 11 genera, and 3 species of mussels from 3 genera (Table 1). Most of the species were with Priabonian age, and the rest were with more wide vertical distribution among the whole upper Eocene, according to data from the reference sources (Karagyuleva 1964, Harzhauser, Mandic 2001, Harzhauser 2004). The gastropods strongly predominated with 100 specimens while the mussels were rare, and were less than 10% from all the collected molluscs. From the snails the specimens from the genus *Globularia* prevailed with 43%, followed by these from the genus *Borsonia* with 15% (Fig. 2). The other snail genera had only few specimens registered and were from 2 to 8% from all.

Ecological information. The diversity indices, calculated for the gastropod community showed greater values, compared with the mussel community (Table 2). The equitability index (both Simpson and Shannon) showed a value closer to 1, which means the taxa is more or less equally presented in both communities. This statement is conformed by the low values of Berger-Parker index. Based on these results, we used only the predominating species and genera of snails for the paleoecological analysis of Perunika locality.

Paleo-ecological reconstruction. During the Eocene the marine mollusks fauna in Europe was very similar between the different sea basins, as for example the Loire-Paris Basin in France, and the Venetian and Piedmont Basin in Italy. The environmental conditions in the shallow sea areas were similar and the gastropods and mussels which inhabited them are good base for paleo-biogeographic

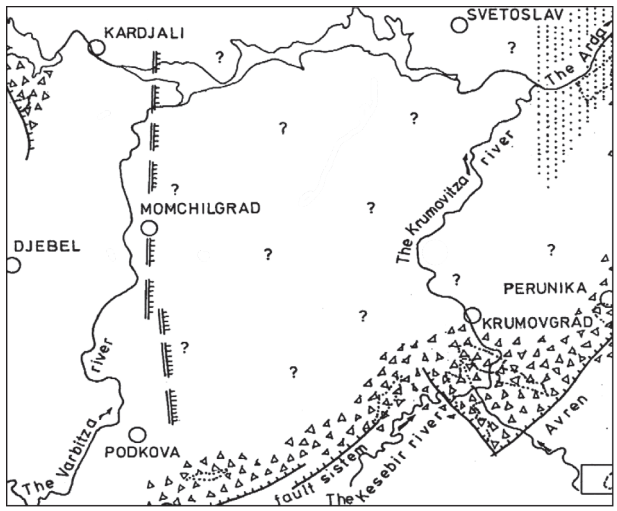

Fig. 1. Location of Perunika Village (Bulgaria).

Table 1. Molluscs (Mollusca: Gastropoda, Bivalvia) from the Upper Eocene collected at Perunika village during present study.

Genus/species	Number	Period
Velates perversus	3	Priabonian
Borsonia cf. *biplicata*	8	-
Cepatia cepacea	1	Priabonian
Globularia patula	1	Priabonian
Globularia vapincana	3	Priabonian
Globularia sigaretina	1	Priabonian
Globularia grossa	1	Upper Eocene
Globularia sp.	16	-
Euspira cf. *achatensis*	2	Priabonian
Batillaria sp.	1	-
Tympanotonus calcaratus	3	Priabonian
Cirsotrema bourdoty	2	upper Eocene
Terebellum sp.	4	-
Hippochrenes ampus	1	-
Sycostoma bulbiforme	4	Priabonian
Undetermined fragments	49	-
Total Gastropoda	100	
Macrosolen sp.	2	-
Crasatella sp.	2	-
Pecten sp.	4	-
Undetermined fragments	3	-
Total Bivalvia	**11**	

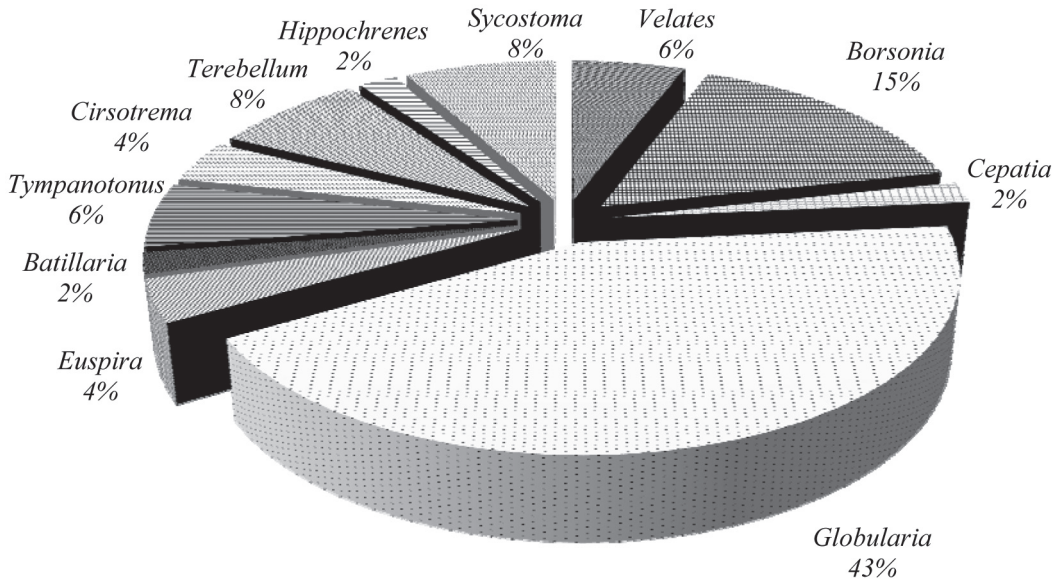

Fig. 2. Percentage of the specimens from different gastropod genera from the Upper Eocene, collected at Perunika village during present study.

Table 2. Diversity indices of the molluscs community from the Upper Eocene at Perunika village.

Diversity indices	Gastropoda	Bivalvia
Shannon (H)	2.314	1.04
Equitability (J)	0.8347	0.9464
Simpson (1-D)	0.8512	0.625
Simpson Evenness (E)	0.6323	0.9428
Margalef	3.815	0.9618
Berger-Parker	0.3137	0.5

co-relations and stratigraphic comparisons (Piccoli 1984, Piccoli *et al*. 1986, Amitrov 1994). The representatives of the genus *Tympanotonus* are facial indicators for rocky conditions and olygo/mezzo halinity (Baldi 1973, Barthelt 1989). The species *Tympanotonus margaritaceus* is widely distributed in the sub littoral of the coastal marshes (Harzhauser 2004), and also was reported for lagoons and brackish waters in riverine-estuary facies (Harzhauser, Mandic 2001). The *Globularia* snails were reported as indicators for typical marine conditions at the area of the East Mediterranean (Mesohellenic Basin, Greece) (Harzhauser 2004). According the same author, such fauna represents increasing of the salinity and gradual transition from the littoral environment to sub littoral one. Mussels association, found in our study, consists mainly of mezzo thermophile forms which allow us to assume that the climate in the region has been moderately warm and humid.

As a synopsis of our study we can make the following conclusions:

On the base of the gastropods identified and associated biota, the age of the studied sediments can be related to Priabonian;

Regardless of anxious tectonic setting which has repeatedly changed the living conditions of the biotope, with a great deal of reliability can be said that the coastal part of the sea has been 100-200 m depth. Waters have been clear and unpolluted, oligo- to mezzo salinity, with temperature between 18 to 22 °C.

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