Paleoecological importance of small foraminifers from Ovče Pole basin in the Republic of Macedonia

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Introduction

The Ovče Pole Paleogene basin is a large Eocene – Oligocene sedimentary mass located in the eastern part of the Vardar zone in the territory of the Republic of Macedonia (Fig.1).
The presence of the fossils in the lithological environment derives many data regarding the paleoecological conditions within those areas. In that sense, the fossils represent a solid source of information regarding the reconstruction of the conditions and the lifestyle of the organisms within one particular living environment. In the recent years the foraminifers represent one of the basic groups of organism that are used for interpretation of the old time sea environments.
The subject of this paper is to present the outcomes from the taxonomical composition and structure of the foraminifer association from Ovče Pole basin that are significant for reconstruction of the living conditions during the period of the Upper Eocene in the basin.

Materials and methods

As for the reconstruction of the living conditions in the Ovče Pole basin applies the method of foraminifer analyzes. This method is consisted of laboratory work and foraminifer analysis. The laboratory processing of the trials is done according the classical methods of micro-paleontological analysis (decomposition, washing, drying, selecting and determining), while the foraminifer analysis is represented with taxonomic analysis to all benthos and plankton samples from fraction 0.1–1 mm. The content of the foraminifers are identified to a visible level, in order to determine the composition and the structure of the foraminifer association. Microphotographs are made of scanned electronic microscope JMS -5510 – JEOL.

Results

In order reconstruct the living conditions that were ongoing for the period of Upper Eocene in the Ovče Pole basin, the following features of the microforaminifer associations were studied:

- Systematic composition of fauna
- Ecological composition of fauna
- Ecological features of the fauna

Whole fauna material that has been collected from the Ovče Pole basin has been represented by representatives from Foraminifera. Foraminifer fauna is identified with 31 genera, where each specie is represented with many species and larger number of samples.
In regard of the ecological composition the fauna in Ovče Pole basin is represented by plankton and benthic foraminifer fauna.
The plankton foraminifer fauna is uniformed and represented with one genus *Globigerina* and 6 species, as an amount quite less in regard to the benthic and they have a limited in prevalence in the basin (northern part of the basin). Apart from that, the benthic foraminifers are dominantry prevalend as an amount, they are more diverse and represented by 30 genera with 57 species, which are quite much more distributed into the basin.
The structure of the foraminifer association has been represented by three types wall textures: aglutinated, porcellaneous and hyaline, that are matching with the following: Textulariina, Miliolina, Lagenina, Rotaliina from the Loeblich & Tappan's (1988) classification.
As environmental characteristics of the fauna are included the following parameters: substrate conditions, the feeding manner, salinity, water temperature, depth, water dynamics etc.

In terms of the substrate conditions of the basin, there are some organisms present from the type of epifauna and infauna. The first one includes *Lenticulina, Heterolepa, Pararotalia, Cancris, Cibicides, Cibicidoides, Gaudrina, Giroidina, Hanzawaia, Nummulites, Quinqueloculina, Spiroloculina, Textularia, Triloculina*, that are appearing as attached for the layer by cementing (immovable benthic organisms). The representatives of the infauna such as *Melonis, Nonion, Noninella, Pulenia, Bolivina, Bulimina, Chilostomella, Fursenkoina, Uvigerina exist* in the sludge layers.The occurrence of infauna – lenticular or elongate compressed forms indicates a soft substrateallowing these forms to "slice"through sediment to obtain nutrients. Silty and muddy substractes are rich in organic debris and therefore attractive to foraminifers. Many of their species are thin-walled, delicate and elongate forms. The hard substracte are characterized with foraminifers from these conditions are thick-walled and heavily ornamented (Brasier, 1980).

In terms of the feeding, the foraminifer fauna that is present is herbivore*: Spiroloculina, Quinqueloculina*, and detritivore *Lenticulina, Heterolepa, Melonis, Nonion.*

The temperature of the water is one of the most essential elements, and is directly influencing to the existence and the spatial distribution of the organisms. To that point, the data gained for the foraminifer species and structure of those in the Ovče Pole basin refer to the fact that the sea was warm during the Upper Eocene. The temperature as a parameter influences the amount of the morphological features of the house (Boltovskoy et al., 1991). Most of the foraminifer representatives in the basin have existed in a moderately warm environment (*Noninella, Pararotalia, Gaudrina, Hanzawaia*), and least of them exist in a cold environment (*Uvigerina, Giroidina, Cibicidoides*).

The salinity represents a one of the main factors of the living organisms in the basins. Most of the foraminifers are adapted to the conditions with a normal degree of salinity – about 35 ‰ (Brasier, 1980). Most of the foraminifer generes such as *Anomalinoides, Pararotalia, Cibicidoides, Fursenkoina, Heterolepa, Lagena, Nonion, Textularia* that are prevailing in the reservoir, are noticed in the normal salty waters (Murray, 1991). As to the foraminifer collection, the exceptions are *Quinqueloculina, Triloculina* as they could survive with salinity up to 65 ‰. The presence of the plankton samples in the trials are also an indication for a normally salted waters (Boltovsky, Wright, 1976, vo Ujetz, 1996).

In terms of depth of the water, it could be concluded that according the foraminifer fauna that is present in the basin, it refers to the shallow water environment (50 - 200 m). Most of the benthic foraminifer fauna that is present in Ovče Pole basin exist in a shelf-batial environment (inner shelf up to 200 m). the exception are the plankton foraminifers found from the genus of Globigerina that exist within a higher degree of depth, that refers to the fact that the northern part of Ovče Pole basin has been further deepened.

Taxonomical diversity of the foraminifer association provides information regarding the depth as well. The agglutinated foraminifers change the morphology along the change of the depth. Within the association the predominated ones are the taxon mostly of a simplified complexion but there are some with a biserial (*Textularia*), multiserial (*Dorothia*), heteromorphous (*Spiroplectammina*), (Berggren, 1984).

The morphological features of the foraminiferal tests are directly depending with the depth. The genera *Pullenia, Bolivina, Bulimina* are typical examples of such dependency. The stings are exposed to changes as they come with the test size and the oramentation. The genus *Bolivina* lose their ornamentation with the increase of the depth, while *Bulimina* genus gets the opposite process. Both species have increased of the test dimensions (Boltovskoy et al., 1991). While with the increase of the depth the representatives of the *Pullenia* get more attributed test (Haynes, 1981), while the genera *Cibicides, Cibicidoides* develop more deepened sutures (Ujetz, 1996).

Studies of modern agglutinated foraminifers shown that the nature of test depends on the dynamics of the environment. The results revealed that in the southern part of Ovče Pole basin, coarsely agglutinated robust form and they indicate highly energy environment.

Conclusion

As of the received data from taxonomic composition and structure of the foraminifer fauna, by the end of the Upper Eocene in Ovče Pole basin, there are two environments that are being determined. The differences could be noticed in the different existing taxonomic composition of foraminifer fauna to some separate spots in the basin. In terms of the depth, the sea environment is shelf. The more southern parts of the basin have been more shallow (inner shelf), while the northern part of the basin has been deeper, for which as a confirmation are the plankton foraminifers. The temperature of the water has been relatively high similar to nowadays tropical seas.

Salinity of the basin has been regular. A higher degree of salinity appears in the shallow part where the porcelain parts are more resolved.

The part of the basin that is more shallow i.e. the southern part, is featured with higher water dynamics. Common taxa (genera, species) that occur in both areas, provided the general characteristics of the Ovče Pole basin.

References

Arsovski M., Dumurdzanov N. Alpine tectonic evolution of the Vardar zone and its place in the Balkan region. Geologica Macedonica, Štip, 1995. 9, 15-22.

Berggren W., A. Cenozoik Deep Water Benthic Foraminifera: a review of major developments since Benthonics´75 – In Oertli, H. J., (ed.), Benthos´83. Second International Symposium on Benthic Foraminifera (Pau, 1983), 1984. 41-43.

Boltovskoy E., et al., Morphological variations of benthonic foraminiferal tests in respons to changes ecological parametars: a review, - J. Paleont. 65, 2, 1991, 175-184.

Brasier M. Microfossils. George Allen & Unwin, 1980. 193 p.

Džuranov S., Tuneva V., Dumurdzanov N. Microforaminifera findings near the village of Čardaklija in the Ovče Pole Paleogene basin, Republic of Macedonia. Geologica Macedonica, Štip, 1999. Vol 13, p. 57-68.

Haynes J. R. Foraminifera. Macimilian Publishers Ltd. London, 1981. 433 p.

Kaasschieter J. Foraminifera of the Eocene of Belgium. - Mem. Inst. Sci. Nat. Belgique, 1961. 147, 1-271.

Löeblich A., Tappan H. Foraminiferal genera and their classification: plates New York, Van Nostrand Reingold, 1988. 900 p.

Murray J. W. A method of determininig proximity of marginal seas to an ocean. Mar. geol., 1976. 22, 103 -119.

Murray J. W. Ecology and Paleoecology of Benthic Foraminifera. Longman Scientific&Technical. 1991. 397p.

Ujetz B. Micropaleontology of Paleogene deep water sediments, Haute-Savoi, France. – Publ. Dep. Geol. paleontol. Univ. Geneva. 1996. 22, 149 p.

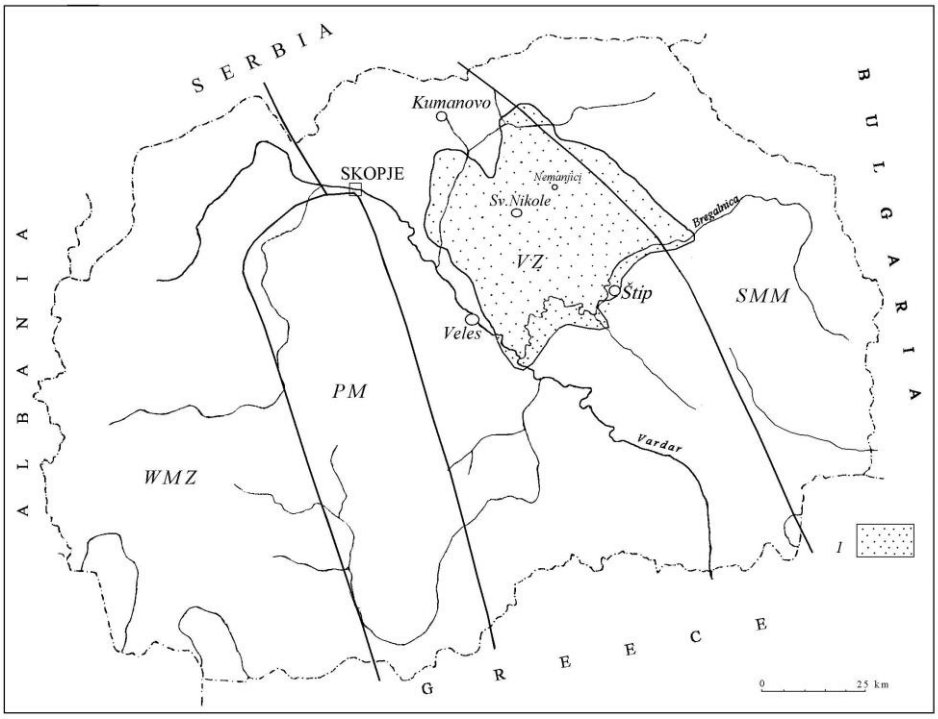

Fig. 1. Map of regional tectonic setting of the R of Macedonia

SMM – Serbian-Macedonian massif, VZ – Vardar zone, PM – Pelagonian massif, WMZ – Western Macedonian , zone, 1 - Ovče Pole Paleogene basin