272
GEOME 2
Manuscript received: April 29, 2014
Accepted: June 20, 2014

Geologica Macedonica, Vol. **28**, No. 1, pp. 45–53 (2014)
In print: ISSN: 0352 – 1206
On line: ISSN: 1857 –8586
UDC: 551.781:561(497.715)

Original scientific paper

FORAMINIFER FAUNA IN PALEOGENE SEDIMENTS AT RABROVO AND DEDELI SITES IN THE VALANDOVO-GEVGELIA BASIN, REPUBLIC OF MACEDONIA

Violeta Stojanova, Goše Petrov

Faculty of Natural and Technical Sciences, "Goce Delčev" University,
Goce Delčev 89, MK-2000 Štip, Republic of Macedonia
violeta.stojanova@ugd.edu.mk

A b s t r a c t: In this paper the results of micropaleontological research of foraminifer fauna in Paleogene sediments from sections Rabrovo and Dedeli in Valandovo-Gevgelia basin, stratigraphically important for determining Paleogene complex in the basin, are presented. Faunal material were represented by benthic and planktonic foraminiferal fauna and 14 species belonging to 12 genera and 9 families were determined.

Key words: benthos and planktonic foraminifera; Paleogene sediments; Valandovo–Gevgelia basin

INTRODUCTION

Valandovo-Gevgelia Paleogene basin is located at southernmost parts of the territory of the Republic of Macedonia and regarding the geotectonic sense it belongs to the Vardar zone (Fig. 1).

The Paleogene in southern Macedonia, together with Precambrian, Paleozoic and Mesozoic complexes, was subjected to very strong tectonic disturbances. During the Pirinei-Sava compression movements, a continued Paleogene sediment mass between Gevgelia and Valandovo has been mustered, and it was segmented into a number of shells, some raised and eroded, and Lower Miocene exposed to intensive erosion and peneplanization. Currently several scaly towels placed along the tectonic flakes and cover has been preserved from it.

The first evidence for the presence of Paleogene in the Valandovo-Gevgelia basin was provided by Erdmannsdőrfer и Leuchs (1925), who dated these sediments as Oligocene. Based on the study of gastropods, bivalves and other fossil gropus, Kűhn (1951) determined the overal age of the Paleogene rocks in the Valandovo-Gevgelia basin as Late Eocene. When preparing OGK sheet Gevgelia 1:100 000, Ivanovski et al. (1970) the Paleogene in Gevgelia basin is defined as Priabonian.

The first foraminiferal taxonomical investigations of the Paleogene sediments from the Republic of Macedonia was published at the end of the 20th century when Džuranov et al. (1999), and later Stojanova (2008), Stojanova et al. (2011, 2012, 2013) and Valchev et al. (2013) presented foraminifers from Paleogene basins from the Republic of Macedonia.

This study aims to achieve a further understanding of the age of the Paleogene sediments from the Valandovo-Gevgelia basin by means of micropaleontological examination of foraminifer fauna.

METHODS AND MATERIALS

The micropaleontological research of the foraminifer fauna includes sediments of the upper flysch lithozone of two Paleogene cross-sections Rabrovo and Dedeli. 30 samples are fetched and as from the analyses certain positive results are obtained for foraminifer fauna (Fig. 1).

Technical work was carried out by using classical methods for the micropaleontological analysis (chemical break up, washing, drying, selection and determination). Selected foraminaferal specimens were photographed with an electron microscope JMS - 5510 - JEOL.

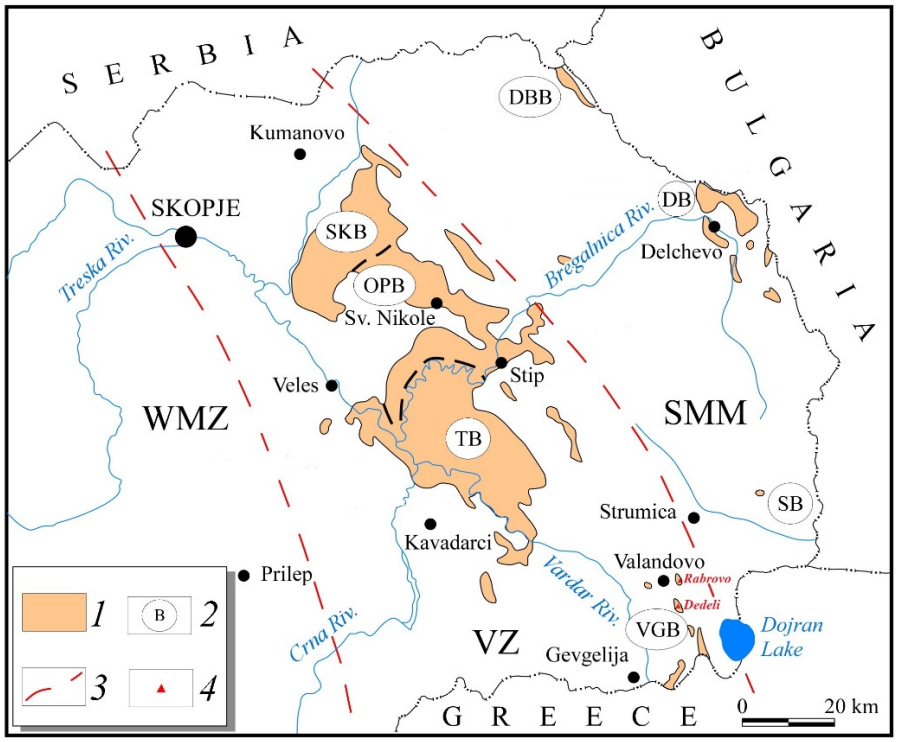

Fig. 1. Sketch of the location of the Palaeogene basins in the Republic of Macedonia
1. Distribution of Paleogene sediments; **2.** Paleogene basins: Tikveš Basin (TB), Ovče Pole Basin (OPB), Skopje-Kumanovo Basin (SKB), Delčevo Basin (DB), Valandovo-Gevgelia Basin (VGB), Strumica Basin (SB), Deve Bair Basin (DBB); **3.** Tectonic boundary; **4.** Studied sections. Other abbreviations used: Serbian–Macedonian Massif (SMM), Vardar Zone (VZ), Western Macedonian Zone (WMZ).

LITHOSTRATIGRAPHY OF PALEOGENE IN VALANDOVO- GEVGELIA BASIN

Valandovo-Gevgelia basin is located between the southwestern parts of Belasica Mountain and the southeastern slopes of Plaush Mountain, and up until the Macedonian-Greek border on the south.

The areas of the broader environment of Valandovo-Gevgelia basin are part of the Vardar zone and are characterized by very heterogeneous lithological structure, with a predominance of tectonic elements in Vardar direction. The heterogeneous lithological structure is represented with different rocky types of Precambrian complex, rocks from Paleozoic complex, Mesozoic rocks, sediments from Upper Eocene and Neogene-Quarter sediments (Fig. 2).

Paleogene sediments are preserved in the form of smaller masses placed along the tectonic peels and covers with general direction NNW–SSE and usually lying transgressively over older crystalline masses of the Vardar zone, and mostly covered by Neogene sedimentary deposits.

According to current knowledge the Paleogene sediments of Valandovo-Gevgelia basin are about 950 m thick. In terms of their lithology, these rocks are developed in flysch facies, that can be subdivided into two units: basal and upper flysch lithozone.

Basal lithozone is represented by conglomerates and sandstone. Characteristic of the lithozone is the indicative gray-red color, which comes from iron-silicic cement, and also the color represented clasts of gneiss, granite, gabbro, diabase, etc. The thickness of the basal lithozone is about 350 m.

The lithological composition above flysch lithozone is presented by flysch sediments such as: sandstone, conglomerates, marls, and colorful clay and limestones. The sandstones are with gray to yellowish-red color, with fine- to middle-sized grained composition, predominantly silicic-iron mass, expressing gradational stratification, wavy lamination, and ripple marks and imprinting, which give a typical flysch character of the lithozone. The clay derivate along with the sandstones are most prevalent members in this lithozone. Their color is greenish-gray to black, and they occur in the form of layers and rarely in a form of layers thickness over 1 m. The marls are frequent members in the

lithozone and they represent the upper parts of the sequence of roughly grained material. The color is gray and appear in community with the marl limestone. Limestone are the rarest members of the lithozone and they occur in the form of thin sub-layers and specks in this unit. They are composed of carbonate material, mixed with clay, iron materials and sand fraction. The thickness of the upper flysch lithozone is about 600 m.

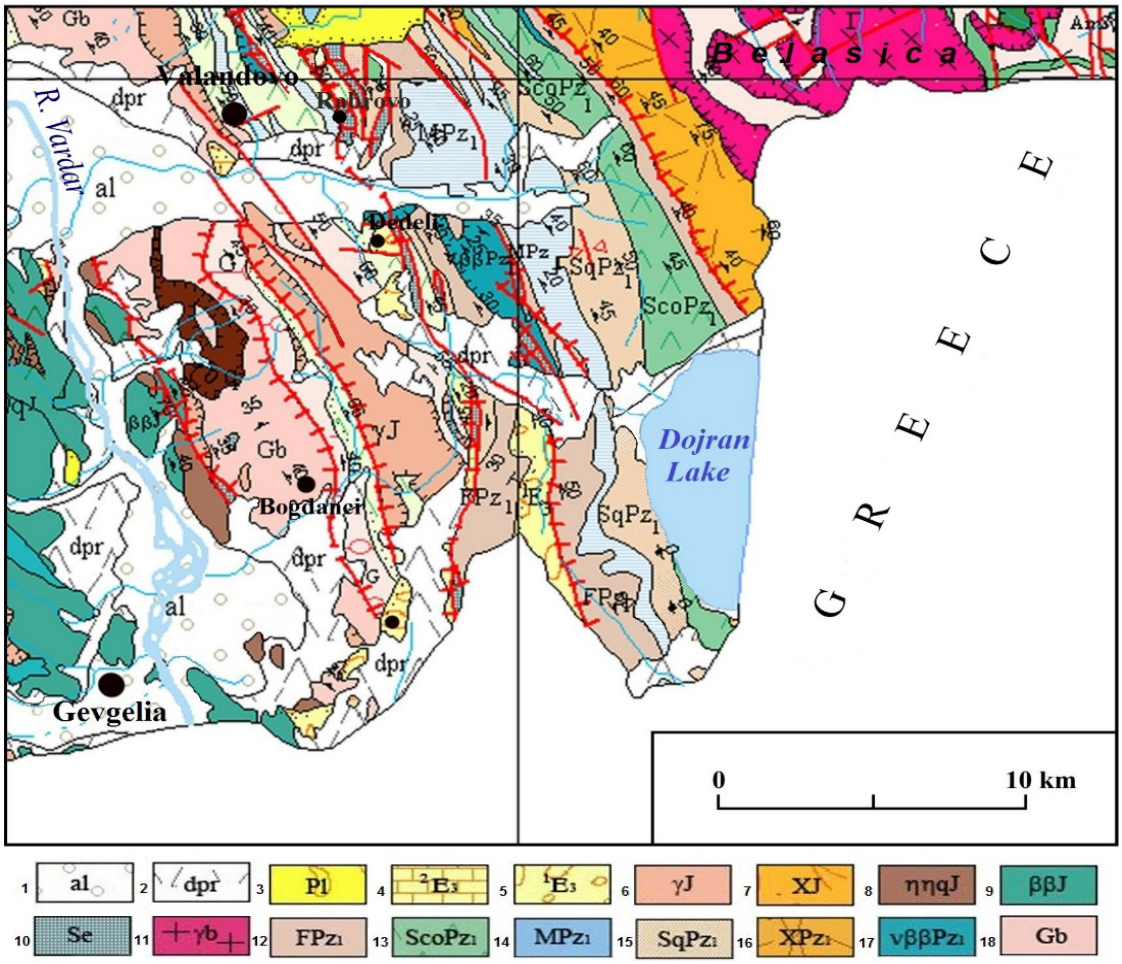

Fig. 2. Geological map of Valandovo-Gevgelia basin
1. Alluvium, **2.** Diluvium–Proluvium, **3.** Sandstones and conglomerates, **4.** Limestones, **5.** Basal series, **6.** Štip – granite, **7.** Rhyolite, **8.** Quartceratophyry, **9.** Diabase, **10.** Serpentinite, **11.** Biotite porphyroides granite, **12.** Phyllites, schists, **13.** Chlorite schists, **14.** Marbles, **15.** Quartz-chlorite schists, **16.** Metaquartzporphyry, **17.** Metagabbros, **18.** Biotite gneisses

DEDELI SECTION

Dedeli section is located approximately 6.5 km southeast of the Valandovo. The section for which samples are taken and micropaleontological examinations of foraminifer fauna performed is located east of the road Valandovo–Doiran over Dedeli village. The investigated section is located in the upper flysch lithozone sediments, with thickness of around 55 meters. The section is constructed from thin layers of dark green Marley-clay sediments, which occasionally change into reddish sandy clays, sandstone, marls and thin-layered limestone.

In this section the sediments are intensely colored, so that the prevailing color is red (Fig. 3).

As for the section 15 samples have been taken, and the testing was made about 1 – 1.5 m between samples in clay–marl layers (samples 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15) and clay-sand layers (samples 3, 8 and 13) (Fig. 4).

The faunal material from benthic and planktonic foraminiferal fauna has been found into the section (Fig. 5).

From micropaleontological analysis positive results were obtained for samples 1,2, 4, 5, 6, 7, 9,

10, 11, 12, 14 and 15, but samples 3, 8 and 13 are negative, for foraminifer fauna.

Benthic foraminifers are represented by the gender representatives: *Spiroplectinella carinata* (d'Orbigny), *Textularia minuta Terquem*, *Quinqueloculina juleana* d'Orbigny, *Triloculina gibba* d'Orbigny, *Nodosaria ewaldi* Reuss, *Eponides minima* Cushman, *Heterolepa dutemplei* (d'Orbigny), *Melonis affine* (Reuss), *Pulenia quinqueloculina* (Reuss), *Bolivina* cf. *cookei* Cushman. Planktonic foraminiferal fauna quantity is poorly represented and represented with only two species: *Globoturborotalia angulioficinalis* (Blow) and *Globoturborotalia ouachitaensis* (Howe and Wallace).

Fig. 3. Section over the Dedeli village

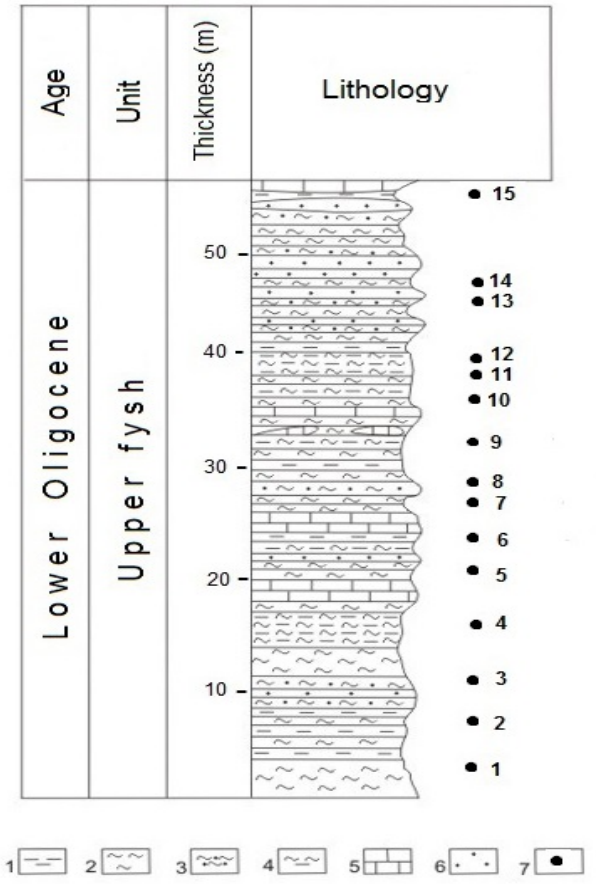

Fig. 4. Geological cross-section – Dedeli
1 – marly, 2 – clayey, 3 – clayey sandstones, 4 – marly-clayey sediments, 5 – limestones, 6 – sandstones, 7 – samples

LOWER OLIGOCENE															GEOLOGICAL AGE
Upper flysch lithozone															Lithostratigraphic unit
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Samples / Foraminifera
				*					*		*				*Textularia minuta* Terquem
			*		*										*Nodosaria ewaldi* Reuss
*	*				*					*					*Triloculina gibba* d'Orbigny
			*												*Eponides minima* Cushman
	*		*		*			*		*	*			*	*Quinqueloculina juleana* d'Orbigny
*	*				*	*			*	*	*				*Heterolepa dutemplei* (d'Orbigny)
					*	*									*Melonis affine* (Reuss)
	*														*Pulenia quinqueloculina* (Reuss)
			*		*						*				*Spiroplectinella carinata* (d'Orbigny)
				*				*			*				*Bolivina cf. cookei* Cushman
								*		*			*	*	*Globoturborotalia angulioficinalis* (Bl..)
											*		*		*Globoturborotalia ouachitaensis* (H. W.)

Fig. 5. Distribution of the foraminifera in the Paleogene cross-section of Dedeli

RABROVO SECTION

Rabrovo section is located approximately 2.5 km northeast of the Valandovo. The section for which samples are taken and micropaleontological examinations of foraminifer fauna performed is located about 1 km north of the Rabrovo village (Fig. 6).

The researched section is located in the upper flysch lithozone sediments with thickness of about 60 meters. The section as a whole is built of thin layers of gray and green marl-clay sediments, which occasionally change into yellow-brown clay sandstone, marls and knotty limestone (Fig. 7).

The faunal material from benthic and planktonic foraminiferal fauna has been found into the section (Fig. 8).

Fig. 6. Section north of Rabrovo village

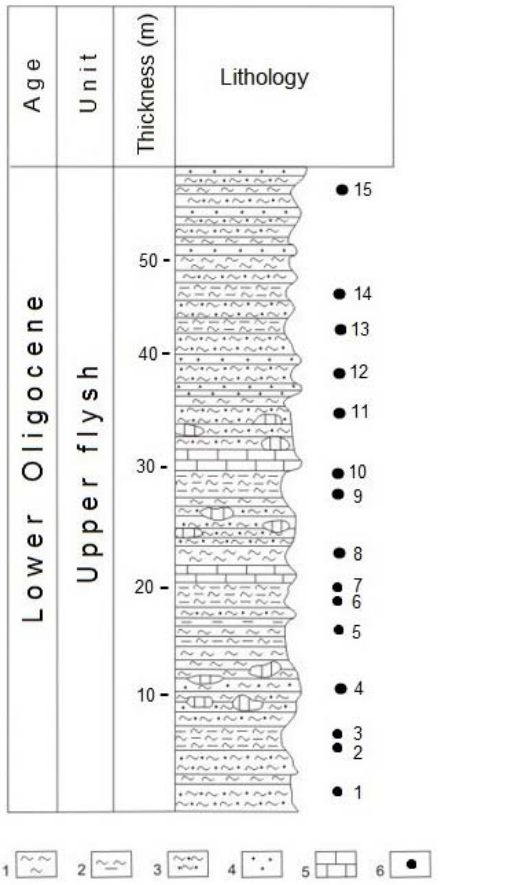

Fig. 7. Geological cross-section – Rabrovo
1 – clayey, 2 – marly-clayey sediments, 3 – clayey sandstones, 4 – sandstones, 5 – limestones, 6 – samples

LOWER OLIGOCENE															GEOLOGICAL AGE
Upper flysch lithozone															Lithostratigraphic unit
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Samples / Foraminifera
	*				*										*Quinqueloculina juleana* d'Orbigny
		*				*									*Textularia minuta* Terquem
		*		*		*	*								*Triloculina gibba* d'Orbigny
					*		*								*Nodosaria ewaldi* Reuss
	*				*										*Eponides minima* Cushman
		*				*	*					*			*Heterolepa dutemplei* (d'Orbigny)
						*						*		*	*Melonis affine* (Reuss)
					*			*					*		*Bolivina cf. cookei* Cushman
							*							*	*Heterolepa perlucida* (Nutall)
						*							*	*	*Globoturborotalia angulioficinalis* (Bl..)
							*					*		*	*Spiroplectinella carinata* (d'Orbigny)
						*	*						*		*Globoturborotalia ouachitaensis* (H. W.)

Fig. 8. Distribution of the foraminifera in the Paleogene cross-section of Rabrovo

Positive results were obtained for samples 2, 3, 5, 6, 7, 8, 9, 14 and 15, but samples 1,4, 10, 11 and 12 are negative for foraminifer fauna.

The discovered foraminifer fauna is characterized by monotony of species and poor number of samples in the analyzed tests, and in some samples the forms are flat and deformed.

RESULTS AND DISCUSSION

After careful examination of the samples collected from the Dedeli section and Rabrovo section, abundant benthic and less common planktonic foraminifers were found: 14 species from 12 genera that belong to 9 families: Spiroplectamminidae Cushman, 1927, Textulariidae Ehrenberg, 1838, Hauerindae Schwager, 1876, Nonionidae Schultze, 1854, Bolivinidae Glaessner, 1937, Nodosariidae Ehrehberg, 1838, Eponididae Hofker, 1951, Heterolepidae Gonzales-Donoso, 1969, Globigerinidae Carpenter, Parker, and Jones, 1862.

The systematic classification of the foraminiferal fauna was done after Löeblich & Tappan (1988) and Pearson et al. (2006).

Thus, 14 species from the studied sections including 2 species of agglutinated foraminifera *Textularia minuta* Terquem, *Spiroplectinella carinata* (d'Orbigny, 1846), 2 porcelaneous *Quinqueloculina juleana* d'Orbigny, *Triloculina gibba* d'Orbigny, 8 hyaline ones *Nodosaria ewaldi Reuss, Bolivina* cf. *cookei* Cushman, *Eponides minima* Cushman, *Mellonis affine* (Reuss), *Heterolepa dutemplei* (d'Orbigny), *Heterolepa perlucida* (Nuttall), *Pullenia quinqueloba* (Reuss), *Nonion graniferum* (Terquem), and 2 species of planktonic foraminifera *Globoturborotalia anguliofficinalis* (Blow) and *Globoturborotalia ouachitaensis* (Howe and Wallace) (Fig. 9)..

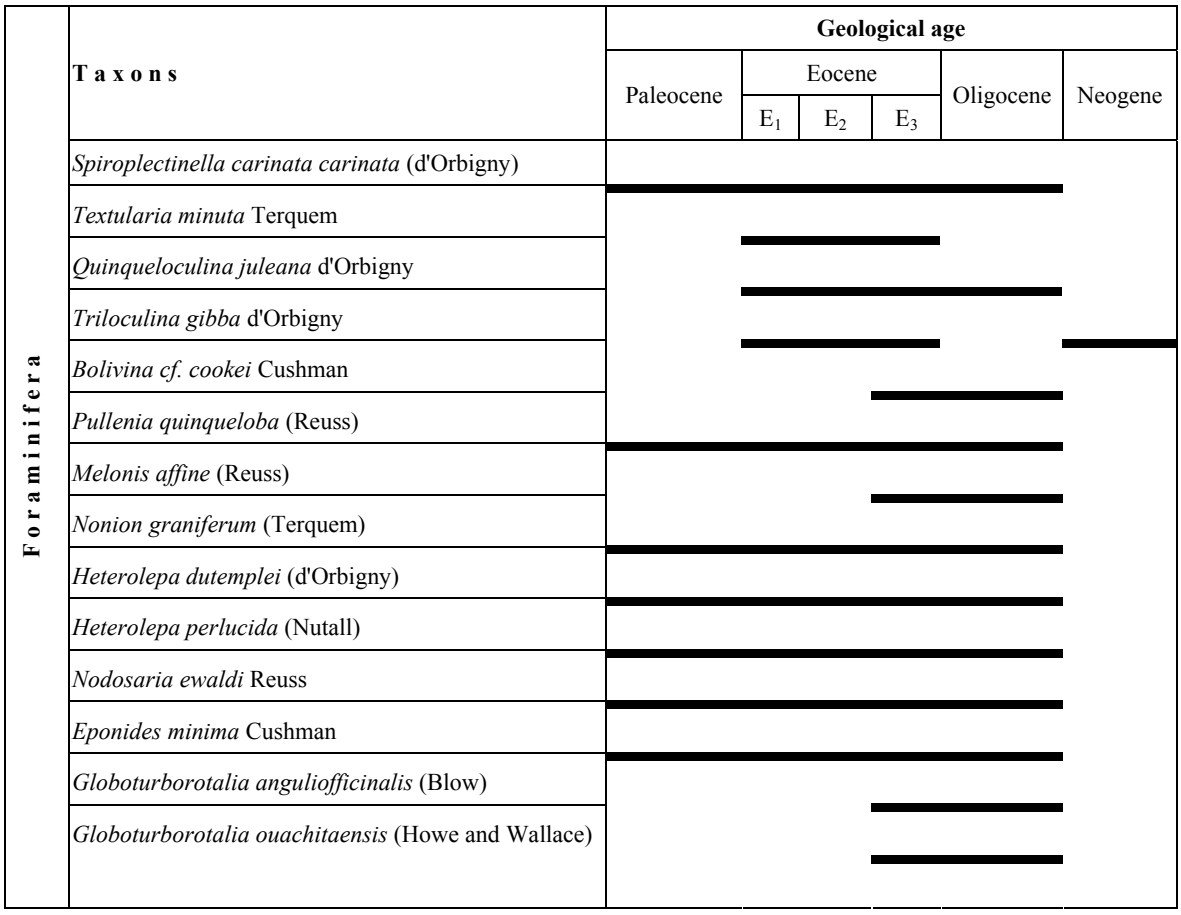

Fig. 9. Stratigraphic distribution of foraminifers from Dedeli and Rabrovo sections

By analyzing the stratigraphic position of certain taxa of the foraminifer fauna at Dedeli and Rabrovo sections it is concluded that:

Benthos hyaline foraminifer of the Rabrovo and Dedeli sections *Nodosaria ewaldi* Reuss, *Bolivina* cf. *cookei* Cushman, *Eponides minima* Cushman, *Mellonis affine* (Reuss), *Heterolepa dutemplei* (d'Orbigny), *Heterolepa perlucida* (Nuttall), *Pullenia quinqueloba* (Reuss), *Nonion graniferum* (Terquem) have broad stratigraphic extension (Upper Cretaceous to Paleocene or Miocene) and cannot determine the exact geological age. Agglutinated and porcelaneous foraminifers do not represent determination of the geological age.

Generally from stratigraphic distribution of planktonic foraminifera *Globoturborotalia angulioffícinalis* (Blow) and *Globoturborotalia ouachitaensis* (Howe and Wallace) occur together from the Upper Eocene (zone P 16) to the end of the Oligocene (zone P 22). The chronostratigraphic framework (Lower Oligocene) of our investigation is based on planktonic foraminiferal data (Stojanova et al., 2013)

Based on the discovered foraminifer association for the Dedeli and Rabrovo sections accurately the geological age in the stratigraphic range from Upper Eocene to Upper Oligocene cannot be determined.

CONCLUSION

Based on the stratigraphic distribution of species within foraminiferal association Dedeli and Rabrovo sections, the geological age of the sediments of the upper flysch lithozone accepted as Lower Oligocene. The geological age of the sediments of the upper flysch lithozone for the Rabrovo and Dedeli sections is accepted as Lower Oligocene, because species *Globoturborotalia angulioffícinalis* (Blow) and *Globoturborotalia ouachitaensis* (Howe and Wallace) for other Paleogene sections in Macedonia are found with typical Oligocene species.

REFERENCES

[1] Džuranov S., Tuneva V., Dumurdžanov N.: *Geol. Macedonica*, **13**, 57–68 (1999).

[2] Erdmannsdörfer O., Leuchs Ch.: *Das Gebiet zwischen Vardar, Strumica und Dojransee*. Berlin (1925).

[3] Ivanovski, T, Rakičevič, T.: *Tolkuvač za Osnovna geološka karta na SFRJ, 1:100 000, list Gevgelia*. Geološki zavod, Skopje, 1–52 (1970).

[4] Ivanovski T.: *Tektonskiot sklop na terenot pomegju r. Vardar, Strumičko Pole i jugoslovensko-grčkata granica, kako prilog kon poznavanje na Vardarskata zona*. Geološki zavod, Skopje, **98** (1971).

[5] Kaasschieter J.: Foraminifera of the Eocene of Belgium. *Mem. Inst. Sci. Nat. Belgique*. **147**, 1–271 (1961).

[6] King C.: Cainozoic micropaleontological biostratigraphy of the North Sea. *Institute of Geological Sciences,* London, **82**, 7, 40 (1983).

[7] Kūhn O.: Novi nalazak gornjeg eocena u Makedoniji. *Glas. Prir. Muz. Srp. Zem.*, **4**, Beograd (1951).

[8] Loeblich A. Jr., Tappan H.: *Foraminiferal Genera and Their Classification*. New York, Van Nostrand Reinhold C., 970 p. (1988),

[9] Odrzywolska-Bienkowa E., Pozaryska K.: *Acta Palaeont. Pol*., **29**, Nos 3–4, 107–156 (1984).

[10] Papp A., Schmidt M. E.: *Abh. Geol. Bundesanst*. **37**, 1–311 (1985).

[11] Pearson P., Olsson B., Huber B., Hemleben C., Bergren W. (eds). 2006: Atlas of Eocene Planktonic Foraminifera. *Cushman Foundation, Sp. Publ.*, 41, 513 (1985).

[12] Stojanova V.: *Evolution and stratigraphy of the Paleogen in the Republic of Macedonia*. PhD. Thesis. Štip, 196 p. (in Macedonian) (2008).

[13] Stojanova, V., Petrov G., Stefanova V.. Small foraminifers from the Paleogene basins in the Republic of Macedonia. *Proc. Nat. Sci. Conf. "Geosciences 2011", Bulg. Geol. Soc., Sofia*, 93–94 (2011).

[14] Stojanova V., Valchev B., Juranov S.: *Compt. Rend. Acad. Bulg. Sci*., **66**, 5, 717–724 (2013).

[15] Valchev B., Stojanova V., Juranov S.: New findings of Paleogene agglutinated and porcelaneous foraminifera from the Republic of Macedonia. *Compt. Rend. Acad. Bulg. Sci*. 66, **7**, 1033–1042 (2013).

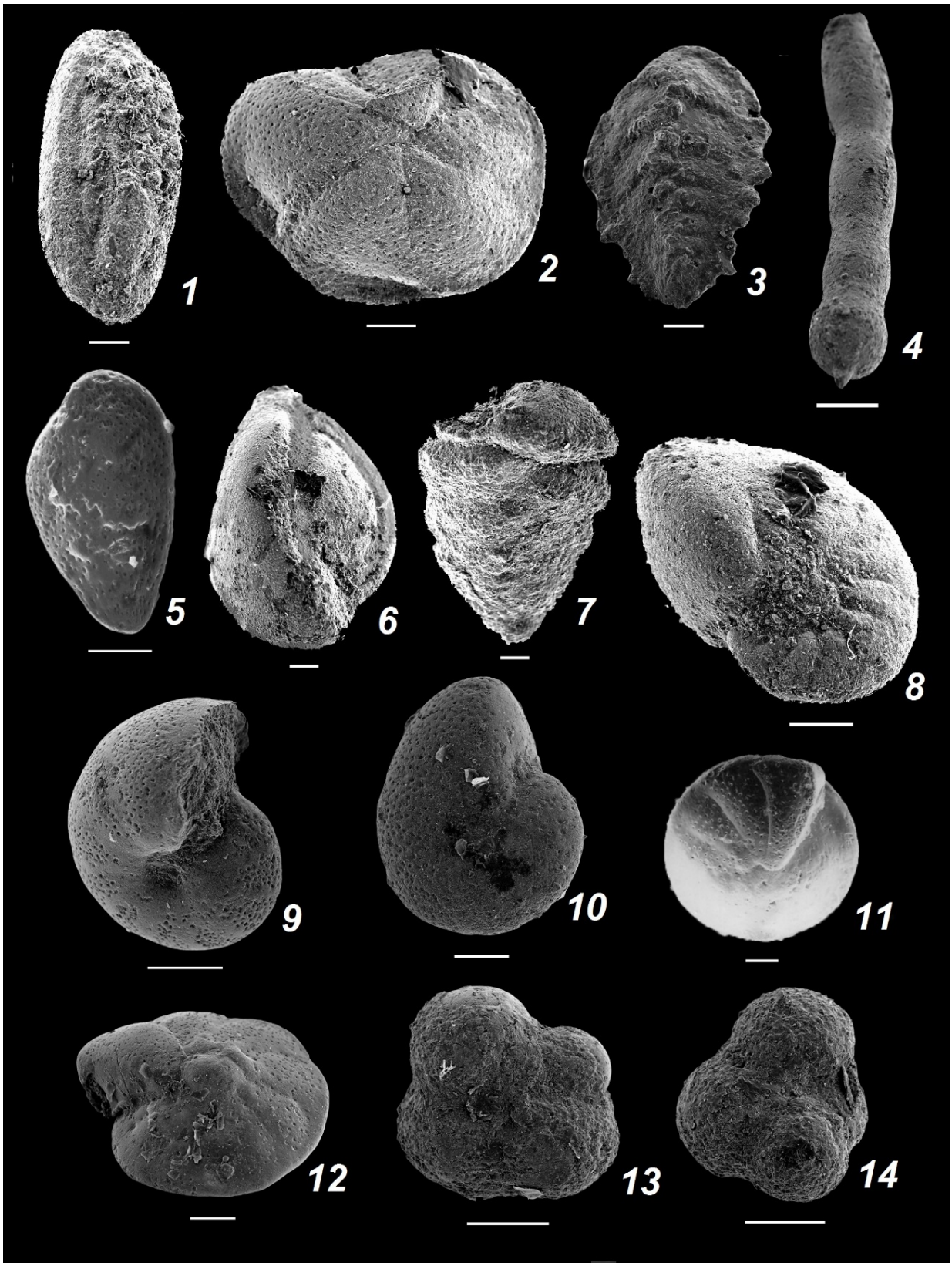

PLATE I. 1. *Quinqueloculina juleana* d'Orbigny**,** SEM×120; **2.** *Eponides minima* Cushman, SEM×170, **3.** *Spiroplectinella carinata* (d'Orbigny); SEM×120; **4.** *Nodosaria ewaldi* Reuss, SEM×65; **5.** *Bolivina cookei* Cushman, SEM×130; **6.** *Triloculina gibba* d'Orbigny, SEM×160; **7.** *Textularia minuta* Terquem, SEM×110; **9.** *Mellonis affine* (Reuss), SEM×230; **10.** *Pullenia quinqueloba* (Reuss), SEM×140; **11.** *Heterolepa dutemplei* (d'Orbigny), umbilical view, SEM×120; **12.** *Heterolepa perlucida* (Nautall), spiral view, SEM×180; **13.** *Globoturborotalia anguliofficinalis* (Blow), umbilical view, SEM×220; **14.** *Globoturborotalia ouachitaensis* (Howe and Wallace), spiral view, SEM×250; Scale bar – 100 μm

Р е з и м е

ФОРАМИНИФЕРНА ФАУНА ВО ПАЛЕОГЕНИТЕ СЕДИМЕНТИ ОД ЛОКАЛИТЕТИТЕ РАБРОВО И ДЕДЕЛИ ВО ВАЛАНДОВСКО-ГЕВГЕЛИСКИОТ БАСЕН, РЕПУБЛИКА МАКЕДОНИЈА

Виолета Стојанова, Гоше Петров

Универзитет "Гоце Делчев", Факултет за природни и технички науки,
Гоце Делчев 89, МК - 2000 Штип, Република Македонија
violeta.stojanova@ugd.edu.mk//gose.petrov@ugd.edu.mk

Клучни зборови: бентосна и планктонска фораминифера; палеогени седименти; валандово-гевгелиски басен

Валандовско-гевгелискиот палеогенски басен се наоѓа во најјужните делови од територијата на Република Македонија и во геотектонска смисла ѝ припаѓа на вардарската зона.

Палеогените седименти во басенот се зачувани во вид на помали маси, сместени по должината на тектонските лушпи и навлаки, со правец на протегање ССЗ–ЈЈИ, и лежат трансгресивно преку постарите кристалести маси од вардарската зона.

Според досегашните истражувања палеогените седименти на валандовско-гевгелискиот басен се со дебелина од околу 950 m и се издвоени две литостратиграфски единици: базална и горна флишна литозона

Во трудот се презентирани резултатите од микропалеонтолошките истражувања на фораминиферната фауна пронајдена во палеогените седименти во профилите Раброво и Дедели. Во профилите е пронајден фаунистички материјал претставен од бентосна и планктонска фораминиферна фауна. Одредени се 14 вида кои припаѓаат на 12 рода и 9 фамилии.

Врз основа на стратиграфската распространетост на видовите во рамките на фораминиферната асоцијација во профилите Дедели и Раброво, геолошката старост на седиментите од горната флишна литозона се прифаќа како долноолигоценска. Староста долен олигоцен е прифатена според стратиграфското распространение на видовите *Globoturborotalia angulioffícinalis* (Blow) и *Globoturborotalia ouachitaensis* (Howe and Wallace) (зона P16 до зона P22), бидејќи во другите палеогенски профили во Македонија тие се среќаваат заедно со типични олигоценски видови.