FORAMINIFERAL ASSEMBLAGES FROM THE CRETACEOUS–TERTIARY TRANSITION IN THE EMINE FLYSCH FORMATION AT KOCHAN CAPE LOCALITY (EASTERN BALKAN): PRELIMINARY DATA

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ABSTRACT. A 24 m interval in the turbidites of the Emine Flysch Formation (upper Campanian–upper Paleocene), located at 300 m north of Kochan Cape in the Eastern Balkan, was studied in terms of the foraminiferal turnover across the Cretaceous–Tertiary transition. The samples, picked up from the lower 18 m contain planktonic foraminiferal assemblages typical for the uppermost Maastrichtian represented by *Pseudotextularia elegans* (Rhehak), *Laeviheterohelix glabrans* (Cushman), *Heterohelix globulosa* (Ehrenberg), *H. labelosa* Nederbragt, *Rugoglobigerina macrocephalla* Brönnimann, *R. rugosa* (Plummer), *Globotruncana arca* (Cushman). The next 3.5 m are characterised by the presence of *Muricohedbergella monmouthensis* (Olson), *M. holmdelensis* (Olson), *Guembelitria cretacea* Cushman, *Rugoglobigerina macrocephalla* Brönnimann, *Laeviheterohelix glabrans* (Cushman), *Heterohelix globulosa* (Ehrenberg), and *Globotruncana arca* (Cushman). The uppermost 2.5 m of the section reveal typical lowermost Paleocene assemblages, characterised by low taxonomical diversity – only *Eoglobigerina eobulloides* (Morozova) and *E. fringa* (Subbotina). The investigated boundary interval is marked by comparatively uniform benthic foraminiferal assemblages dominated by agglutinated taxa.

Keywords: foraminiferal assemblages, Cretaceous–Tertiary boundary, Emine Fm., Eastern Balkan

ФОРАМИНИФЕРНИ АСОЦИАЦИИ ОТ ГРАНИЧНИЯ ИНТЕРВАЛ КРЕДА-ТЕРЦИЕР В ЕМИНСКАТА ФЛИШКА СВИТА В РАЙОНА НА НОС КОЧАН (ИЗТОЧНА СТАРА ПЛАНИНА): ПРЕДВАРИТЕЛНИ РЕЗУЛТАТИ

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РЕЗЮМЕ. Изследван е 24-метров интервал в турбидитите на Еминската флишка свита (горен Кампан–горен Палеоцен), намираща се на 300 m северно от нос Кочан в Източна Стара планина, с цел установяване на промени във фораминиферните асоциации от граничния интервал Креда–Терциер. Пробите, взети от долните 18 m съдържат типични късномастрихтски видове като by *Pseudotextularia elegans* (Rhehak), *Laeviheterohelix glabrans* (Cushman), *Heterohelix globulosa* (Ehrenberg), *H. labelosa* Nederbragt, *Rugoglobigerina macrocephalla* Brönnimann, *R. rugosa* (Plummer), *Globotruncana arca* (Cushman). Следващите 3,5 m се характеризират с присъствието на *Muricohedbergella monmouthensis* (Olson), *M. holmdelensis* (Olson), *Guembelitria cretacea* Cushman, *Rugoglobigerina macrocephalla* Brönnimann, *Laeviheterohelix glabrans* (Cushman), *Heterohelix globulosa* (Ehrenberg) и *Globotruncana arca* (Cushman). Най-горните 2,5 m от разреза разкриват типични раннопалеоценски асоциации, характеризиращи се с ниско таксономично разнообразие – установени са само видовете *Eoglobigerina eobulloides* (Morozova) и *E. fringa* (Subbotina). Изследваният граничен интервал показва присъствието на сравнително еднообразни асоциации от бентосни фораминифери с преобладаване на аглутинираните форми.

Ключови думи: фораминиферни асоциации, граница Креда-Терциер, Еминска свита, Източна Стара планина

Introduction

The Emine Formation is widely distributed in the East Balkan Unit (*sensu* Dabovski, Zagorchev, 2009 – Figs 1, 2) and comprises a thick turbidite sequence (at least 1670 m – Sinnyovsky, 2004). The rocks were first described as a distinct lithological body by Gočev (1932) who named them as "Emine beds" of Lutetian age. Later on, Botev (1953) referred them to the "Upper Senonian – flysch type", Bonchev (1955) named the unit "Emine formation", and Atanasov and Kanchev (1965) used the term "Emine flysch formation". Bochev et al. (1967) published a detailed investigation concerning the coastal part of the East Balkan, and provided data on the lithology, genesis and age of the unit. They described its lower levels as "Campanian–Maastrichtian – south strip" and the upper levels referred to the "Danian–Paleocene". Karagjuleva and Kostadinov (1977) divided and described an "Emine formation" (corresponding to the "Campanian–Maastrichtian of Bochev et al., 1967) and a "clayey–terrigenous formation" ("Danian-Paleocene" of Bochev et al., 1967). Nachev (1977) gave additional data to the lithology of these bodies. Juranov and Pimpirev (1989) determined the rank of the unit, described the lectotype section and proved the Campanian–middle Paleocene age on the basis of planktonic foraminifera.

Sultanov et al. (1990) provided planktonic foraminiferal and calcareous nannoplankton data determining late Campanian–late Paleocene age. Sinnyovsky and Sultanov (1994) characterised the formation's boundaries and specified the nannofossil data confirming late Campanian – late Paleocene age. Nachev and Dimitrova (1995) also pointed out this chronostratigraphic range.

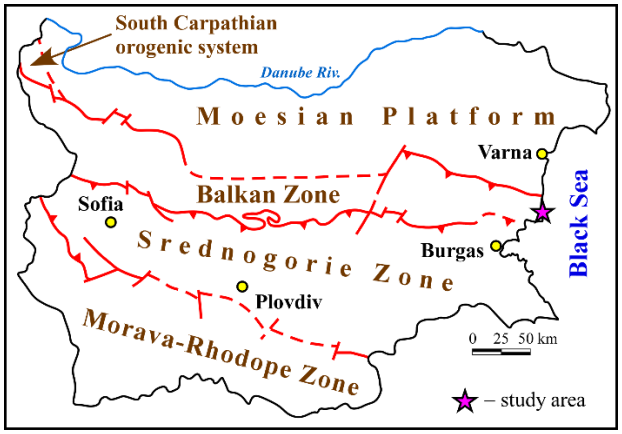

Fig. 1. Tectonic subdivision of the territory of the Republic of Bulgaria (after Dabovski, Zagorchev, 2009) with the location of the studied area

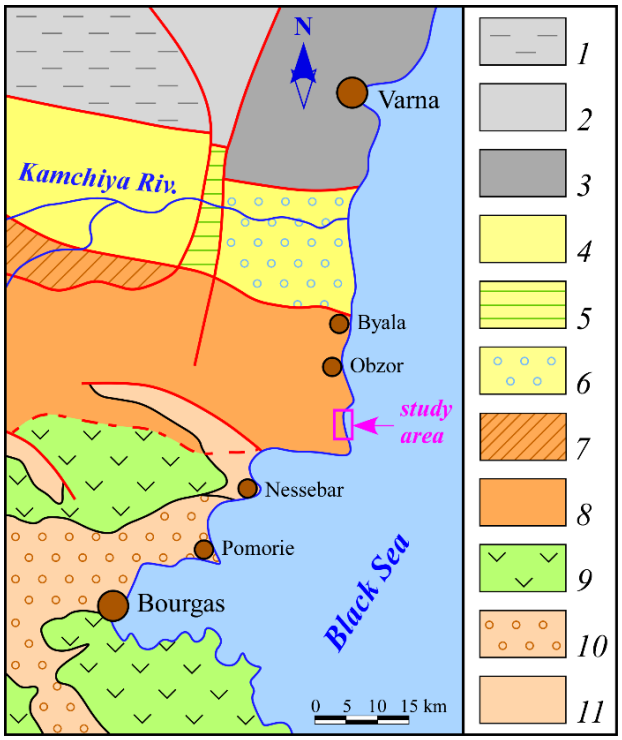

Fig. 2. Location of the studied area amongst the tectonic units in eastern Bulgaria (after Dabovski, Zagorchev, 2009; Bokov et al., 1987, with modifications)
1–2, North Bulgarian Dome (*1*, Hitrino-Kaspichan Block; *2*, Dobrich-Vetrino Block); *3*, East slope of the North Bulgarian Dome; *4*, Provatiya Syncline; *5*, Goren Chiflik Horst; *6*, Dolna Kamchiya Basin; *7*, Fore Balkan Unit; *8*, East Balkan Unit; *9*, East Srednogorie Unit; *10–11*, Intraorogenic basins (*10*, Paleogene–Neogene–Quaternary, *11*, Neogene–Quaternary)

The Cretaceous–Tertiary (K-T) boundary in the Emine Formation was first established by Sinnyovsky and Stoykova (1995) north of the village of Emona by means of calcareous nannofossils. Later on, Sinnyovsky (2003, 2004) proved it near the village of Kozichino and north of Kochan Cape, while Stoykova and Ivanov (2004) established this boundary near the Marash River. Valchev (2006) provided planktonic foraminiferal data from the transition near the village of Kozichino.

The present article aims to represent preliminary data on the taxonomical composition and stratigraphic range of the foraminiferal assemblages (both planktonic and benthic) obtained from the K-T sequence at Kochan Cape locality. Eleven samples from a 24 m thick interval were studied for this purpose.

Geological setting

The area of study is located in the coastal part of the East Balkan Unit (Fig. 2) in the northern limb of the Banya Syncline, which was first established by Radev (1927). Botev (1953) described it as "Banya syncline", and later on it was described by Atanasov and Kanchev (1965), Bochev et al. (1967), Kanchev (1971), Karagjuleva and Kostadinov (1977), Juranov et al. (1994). The fold is entirely formed by the Emine Formation's beds as the limbs are composed of these of late Campanian–Maastrichtian age (Fig. 3).

The K-T transition crops out 300 m north of Kochan. It comprises thin-bedded turbidites dipping 30 to 40° to SSW (Figs 3, 4).

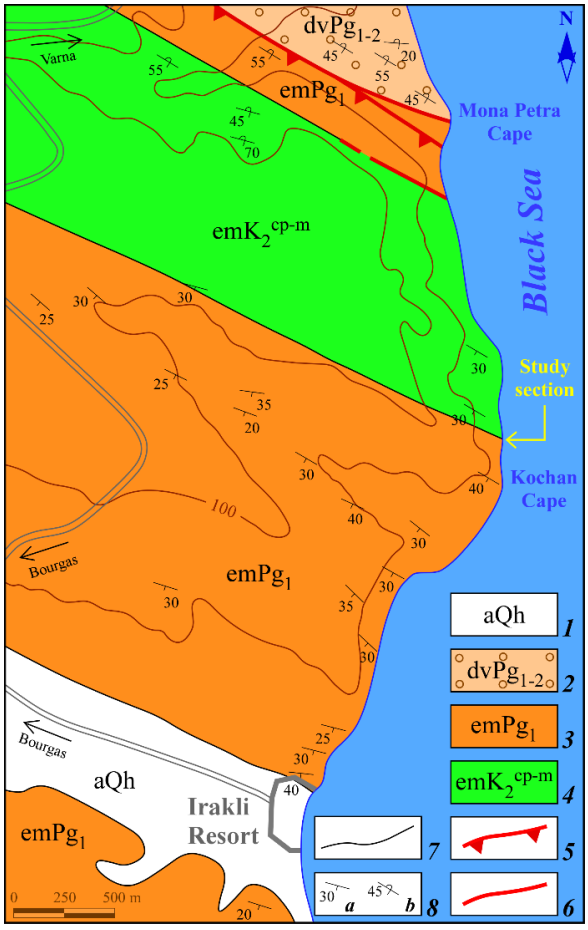

Fig. 3. Geological map of the coastal part of East Balkan (after Juranov et al., 1994, modified) with the location of the K/T transition
1, alluvium (Holocene); *2*, Dvoynitsa Fm. (Paleocene–middle Eocene); *3–4*, Emine Fm. (*3*, upper Campanian–Maastrichtian, *4*, Paleocene); *5*, reverse fault; *6*, normal fault; *7*, stratigraphic boundary; *8*, bedding (*a*, normal, *b*, overturned)

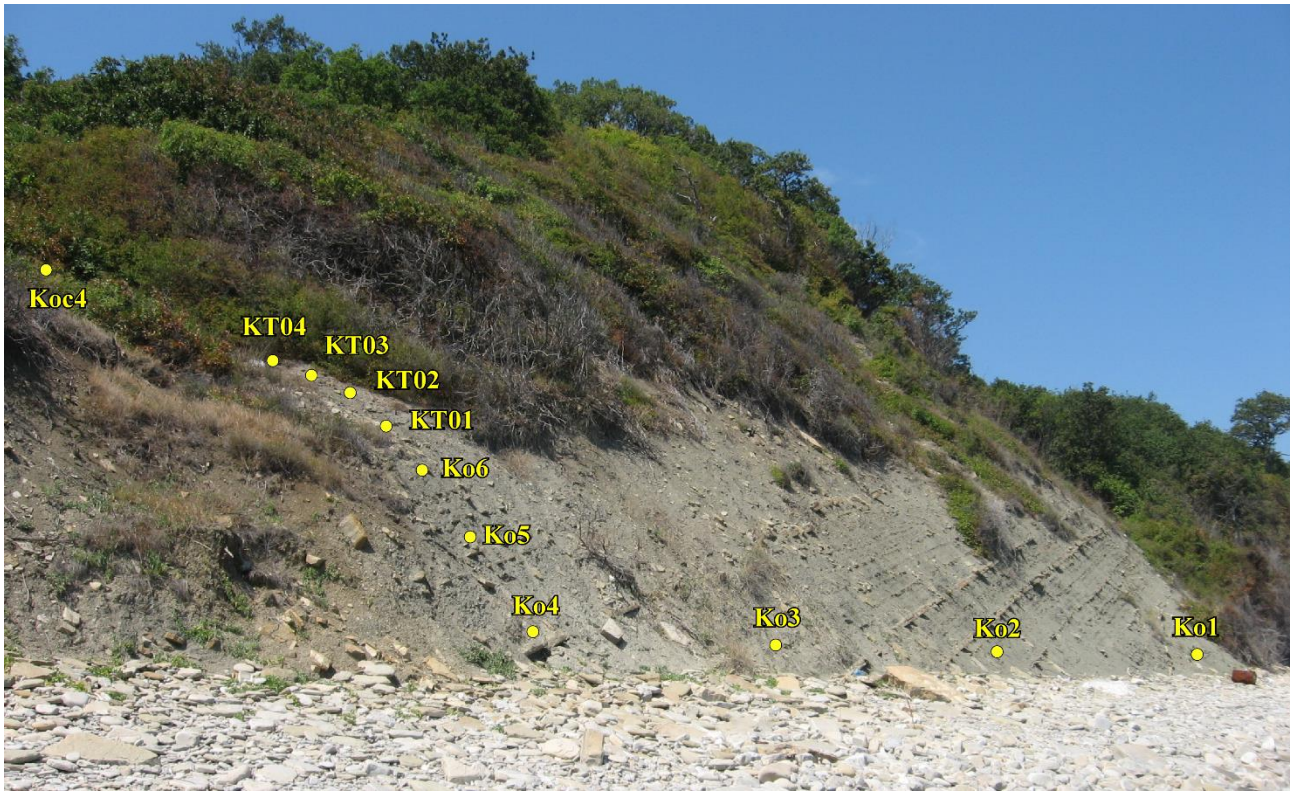

Fig. 4. The K-T transition in the turbidites of the Emine Formation 300 m north of Kochan Cape with the location of the studied samples

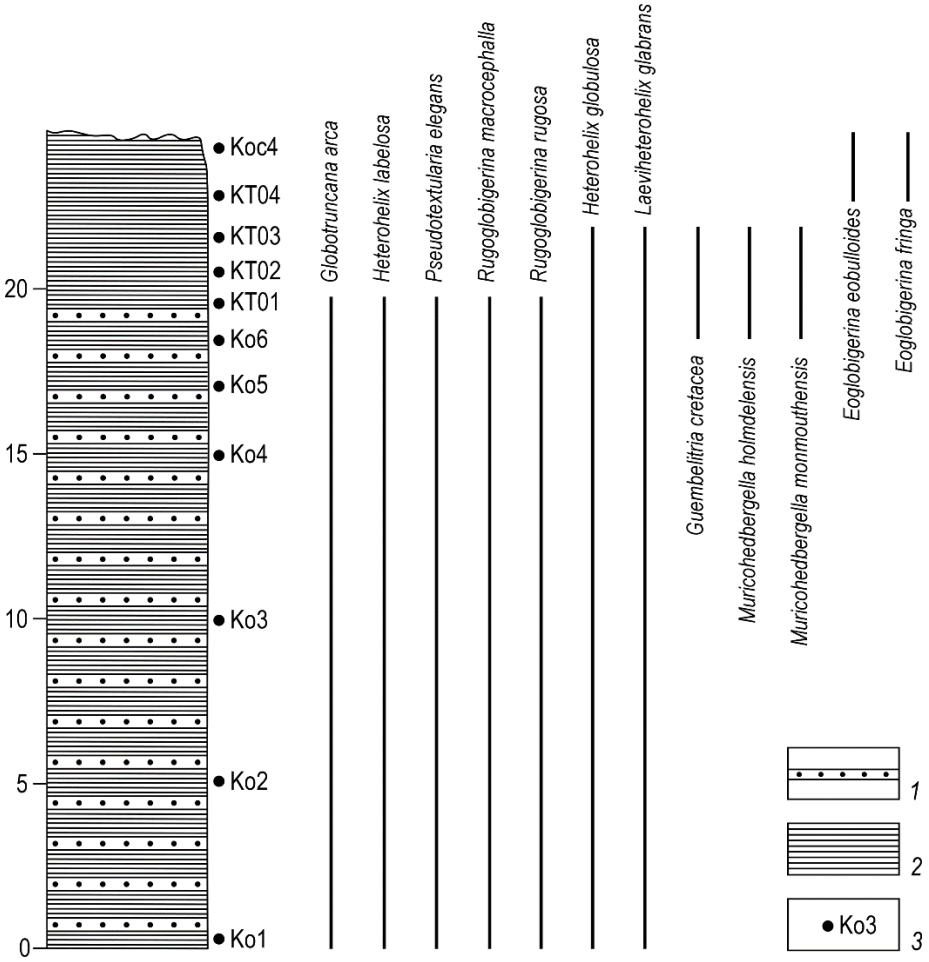

Fig. 5. Column section of the studied K-T transition with the stratigraphic distribution of the established planktonic foraminiferal taxa
1, thin-bedded sandstones; *2*, siltstones, argillites; *3*, sample

Results

Planktonic foraminifera

The lower 18 m of the studied interval (samples Ko1–Ko6 – Fig. 5) contain a poor, but typical lattermost Cretaceous assemblage, represented by rare or single specimens of *Pseudotextularia elegans* (Rhehak), *Laeviheterohelix glabrans* (Cushman), *Heterohelix globulosa* (Ehrenberg), *H. labelosa* Nederbragt, *Rugoglobigerina macrocephalla* Brönnimann, *R. rugosa* (Plummer), *Globotruncana arca* (Cushman). As a whole the recovered specimens are poorly preserved and they were derived predominantly from the 200, 112 and 63 μm residues.

The next 3.5 m (samples KT01–KT03) are characterised by the presence of *Muricohedbergella monmouthensis* (Olson), *M. holmdelensis* (Olson), *Guembelitria cretacea* Cushman, which are referred in the micropaleontological literature to the co-called survivors, as well as typical Late Cretaceous taxa like *Rugoglobigerina macrocephalla* Brönnimann, *Laeviheterohelix glabrans* (Cushman), *Heterohelix globulosa* (Ehrenberg), and *Globotruncana arca* (Cushman). All the species occur as single to rare. *L. glabrans* and *H. globulosa* were established in the lowermost Paleocene near the village of Kozichino (Valchev, 2006).

The uppermost 2.5 m (samples KT04 and Koc4) of the section reveal typical lowermost Paleocene assemblages, characterised by low taxonomical diversity – only *Eoglobigerina eobulloides* (Morozova) and *E. fringa* (Subbotina) were found in the samples. The assemblage, recovered from sample KT04 consists of single specimens, while the one from sample Koc4 reveals is more abundant.

Benthic foraminifera

The investigated boundary interval is characterised by comparatively uniform foraminiferal assemblages dominated by agglutinated taxa. Common species amongst them in all samples are *Dendrophrya excelsa* Grzybowski, *Ammodiscus cretaceous* (Reuss), *A. glabratus* Cushman and Jarvis, *Repmanina charoides* (Jones and Parker), *Paratrochamminoides irregularis* White which occur as rare specimens. Subsidiary elements to the assemblage structure are species like *Rhizammina indivisa* Brady, *Marssonella* spp., *Haplophragmoides* spp. which occur as single specimens.

As a whole the hyaline benthics occur as single specimens. The most common amongst them is *Quadrimorphina allomorphinoides* (Reuss). The other taxa were found at different levels of the section.

Discussion and conclusions

The well exposed turbidite sequence of the Emine Flysh Formation north of Kochan Cape, Bourgas District was investigated from planktic and benthic foraminiferal point of view. It is interesting that the Cretaceous assemblages are less abundant than the Paleocene ones (this fact was noted by Valchev, 2006, concerning the K-T transition near the village of Kozichino). As mentioned above, Cretaceous forms occur with rare or single specimens and this fact makes difficult the biostratigraphical characterisation of the interval. The index species *Abathomphalus mayaroensis* (Bolli) was not established.

The K-T boundary was marked easily in the upper part of the studied section because of the clear planktonic foraminiferal change. 5 species could be considered as survivors. All of them were derived from the 63 μm and 112 μm residue.

The Paleocene assemblages are more abundant, but with low taxonomical diversity. A further detailed sampling would provide a good opportunity for a precise biostratigraphical characterisation of the K-T boundary transition.

Benthic foraminifera show the typical features for the Upper Cretaceous-Paleogene flysch-type assemblages of the Tethys region – uniform taxonomical composition and structure without changes across the K-T boundary and strongly dominated by agglutinated taxa.

Appendix – List of planktonic and benthic foraminiferal species found in the present study

Cretaceous planktonic foraminifera
Globotruncana arca (Cushman)
Heterohelix labelosa Nederbragt
Pseudotextularia elegans (Rhehak)
Rugoglobigerina macrocephalla Brönnimann
R. rugosa (Plummer)

Survivors
Guembelitria cretacea Cushman
Heterohelix globulosa (Ehrenberg)
Laeviheterohelix glabrans (Cushman)
Muricohedbergella holmdelensis (Olson)
Muricohedbergella monmouthensis (Olson)

Paleocene planktonic foraminifera
Eoglobigerina eobulloides (Morozova)
E. fringa (Subbotina)

Cretaceous/Paleogene small benthic foraminifera
Ammodiscus cretaceous (Reuss)
A. glabratus Cushman and Jarvis
A. peruvianus Berry
Aragonia velascoensis (Cushman)
Bathysiphon sp.
Cyclammina sp.
Dendrophrya excelsa Grzybowski
Dentalinoides colei (Cushman and Dusenbery)
Glomospira diffundens (Cushman and Renz)
Gyroidinoides girardanus (Reuss)
Haplophragmoides sp.
Lenticulina sp.
Marssonella oxycona (Reuss)
Nodosaria limbata d'Orbigny
Nodosaria sp.
Osangularia florealis (White)
Paratrochamminoides irregularis (White)
Quadrymorphina allomorphinoides (Reuss)
Reophax duplex Grzybowski
Repmanina charoides (Jones and Parker)
Reussoolina emaciata Reuss
Rhizammina indivisa Brady
Saccammina placenta Grzybowski
Saccammina sp.
Spiroplectammina spectabilis (Grzybowski)
Trochamminoides dubius (Grzybowski)

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