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ON THE STRATIGRAPHICAL DISTRIBUTION OF SMALL BENTHIC FORAMINIFERA AND THE BIOSTRATIGRAPHY OF THE PALEOCENE OF THE COASTAL PART OF EAST STARA PLANINA

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ABSTRACT. The biostratigraphical subdivision of the Paleocene of the coastal part of East Stara Planina is of great interest for the Paleogene stratigraphy of Bulgaria, because of the fact that the first find of Paleocene sediments in our country was made in the same area. To elucidate the biostratigraphical value of small benthic foraminifera from the studied area we examined the stratigraphical distribution of 229 species and 5 subspecies from 9 borehole and 4 outcrop sections, comprising two types of assemblages - "Byala-type" and "Flysh-type". Planktic foraminiferal and calcareous nannoplankton zonations defined by previous investigators were used for a biostratigraphical framework.
Fife groups benthic foraminifera (Maastrichtian-Paleocene, Paleocene, Paleocene-Eocene, transitional, represented by single specimens) in the "Byala-type" and six groups (Maastrichtian-Paleocene, Paleocene, Early Paleocene, Middle-Late Paleocene, transitional, represented by single specimens) in the "Flysh-type" were established. Both assemblages are dominated by transit and Maastrichtian-Paleocene species, which does not allow us to find criteria (first and last occurrence) for a detailed biostratigraphical subdivision. This fact confirms the local character and the ecological nature of the zones defined by Valchev (2003).
KEY WORDS: Paleocene, benthic foraminifera, biostratigraphy, East Stara Planina.

ОТНОСНО СТРАТИГРАФСКОТО РАЗПРОСТРАНЕНИЕ НА МАЛКИТЕ БЕНТОСНИТЕ ФОРАМИНИФЕРИ И БИОСТРАТИГРАФСКАТА ПОДЯЛБА НА ПАЛЕОЦЕНСКАТА СЕРИЯ В ПРИМОРСКАТА ЧАСТ НА ИЗТОЧНА СТАРА ПЛАНИНА

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РЕЗЮМЕ. Биостратиграфската подялба на Палеоценската серия в приморската част на Източна Стара планина е от особен интерес за стратиграфията на Палеогенската система в България, тъй като тук за първи път е доказано наличието на палеоценски седименти в страната. За изясняване на биостратиграфската стойност на малките бентосни фораминифери от изучавания район е проследено стратиграфското разпространение на 229 вида и 5 подвида в 9 сондажа и 4 разреза в естествени разкрития, участващи в изграждането на два типа асоциации – "беленски" и "флишки". За биостратиграфска рамка са използвани дефинираните от предишни изследователи зони по планктонни фораминифери и варовит нанопланктон.
В "беленския" тип асоциации са отделени 5 групи бентосни фораминифери (маастрихт-палеоценски, палеоценски, палеоцен-еоценски, транзитни, с единични екземпляри), а във "флишкия" – 6 групи (маастрихт-палеоценски, палеоценски, ранно палеоценски, средно-късно палеоценски, палеоцен-еоценски, транзитни, с единични екземпляри). И двата типа асоциации са доминирани от транзитни за Палеоценаската серия видове и такива, идващи от Маастрихтския етаж и изчезващи в най-горните нива на Палеоценската серия, което прави невъзможно намирането на критерии (събития на поява и изчезване) за детайлна биостратиграфска подялба. По този начин се потвърждава локалният характер и еколожката същност на отделените от Valchev (2003) зони.
КЛЮЧОВИ ДУМИ: Палеоценска серия, бентосни фораминифери, биостратиграфия, Източна Стара планина.

Introduction

The biostratigraphical subdivision of the Paleocene of the coastal part of East Stara Planina is of great interest for the Paleogene stratigraphy of Bulgaria, because of the fact that the first find of Paleocene sediments in our country was made in the same area (Трифонова, 1960). Investigating the stratigraphical range of the established species of small benthic foraminifera, the present work aims to find events allowing to define biostratigraphical zones which could be correlated to zones based on planktic organisms.

Material and methods

To elucidate the biostratigraphical value of the small benthic foraminifera from the studied area the stratigraphical distribution of 229 species and 5 subspecies was examined. As a biostratigraphical framework were used the planktic foraminiferal (Juranov, 1983; Джуранов, 1994) and calcareous nannoplankton zonations (Ivanov, Stoykova, 1994; Sinnyovsky, Sultanov, 1994; Sinnyovsky, Stoykova, 1995; Sinnyovsky, 2001) from the same area. The studied foraminiferal remains were obtained from 251 samples (including 74 samples from the geological mapping carried out in 1993) from borehole and outcrop sections (Fig. 1). The samples from boreholes were given to the author by Assoc. Prof. Dr. Sava Juranov (Sofia University "St. Kliment Ohridski")".

Previous investigations

Investigations of the Paleocene foraminiferal assemblages from the coastal part of East Stara Planina started at the end of the 50s and the beginning of the 60s of the 20 century, when Трифонова (1960) first established Paleocene sediments in Bulgaria and published a list of foraminifera. At the same time Станчева (1961) provided taxonomical descriptions of some agglutinated species from the Kozichino Village area. Darakchieva (1999) published microphotographs of some species, but detailed taxonomical studies have been carried out since the end of the 90s, when Valchev (Valchev, 2000, 2001, 2002; Вълчев, 2002) gave descriptions of some groups benthic foraminifera (Family Nodosariidae, diverse agglutinants and hyaline unilocular forms).

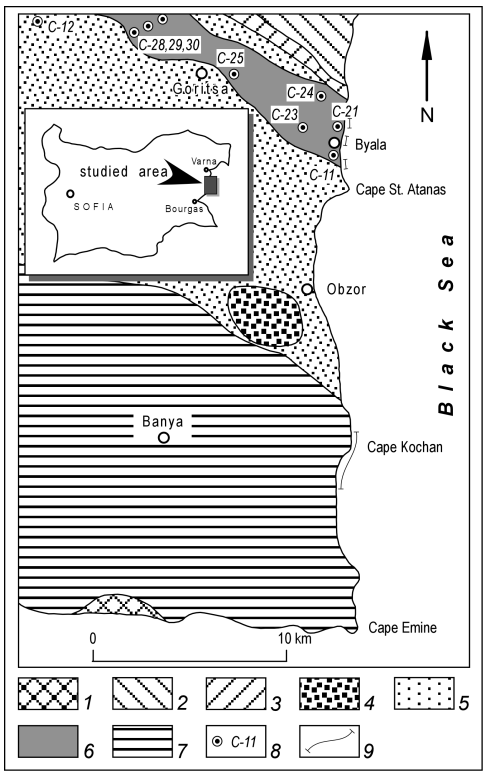


Fig. 1. Simplified geological map of the studied area (emended after Vangelov et al., 1996)
1- Odartsi Fm. (Miocene); 2 – Ruslar Fm. (Oligocene); 3 – Avren Fm. (Upper Eocene); 4 – Obzor Fm. (Middle-Upper Eocene); Dvoynitsa Fm. (Upper Paleocene-Middle Eocene); 6 – Byala Fm. (Upper Campanian-Paleocene);
7 – Emine Fm. (Upper Campanian-Paleocene); 8 – borehole; 9 – outcrop section

The stable taxonomical composition of Paleocene benthic foraminiferal assemblages (small number of first and last occurrence), as well as the cosmopolitan distribution of the most of the species (Berggren, 1984), does not allow a detailed biostratigraphical subdivision. Valchev (2003b) confirmed this fact dividing one zone in the north part and two zones in the south part of the studied area. The author noted that these zones were not based on typical first and last occurrence, and they were of ecological nature. The presence of different paleoecological parameters made the author (Valchev, 2003a; Valchev, 2003c, in press) divide two types of assemblages («Byala-type» and «Flysh-type») characterized by different taxonomical composition and structure.

Results

To elucidate the biostratigraphical value of the small benthic foraminifera I divided the species from both “Byala-type” and “Flysh-type” assemblages into groups according to their stratigraphical range. The stratigraphical distribution of the species in the studied sections is shown on Appendix.

“Byala-type” assemblages
This type was established in the strata of the Byala Formation, and it is characterized by high species diversity (total 228 species). As a whole the assemblage composition is determined by the presence of 34 species (Fig. 2).

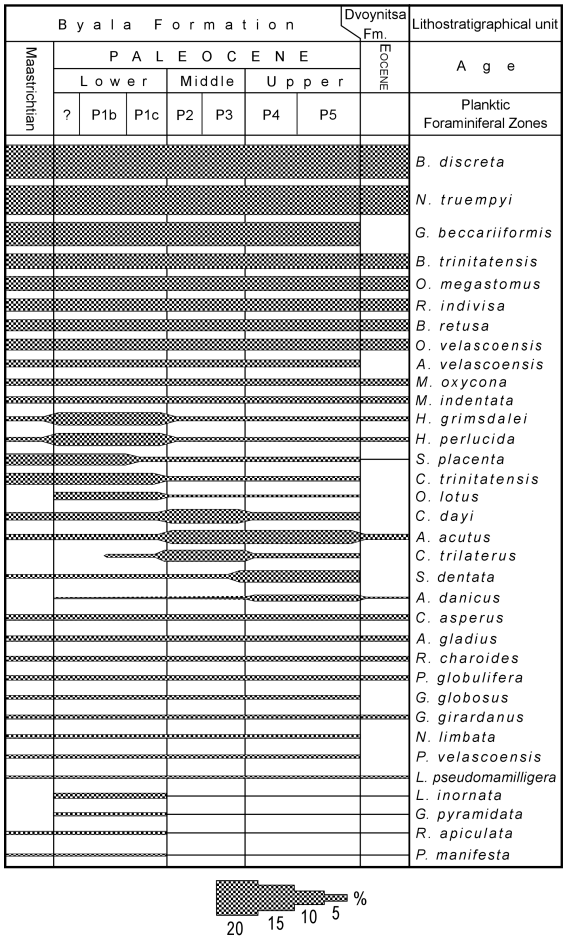


Fig. 2. Taxonomical composition of the “Byala-type” assemblages with the maximum percent abundance of the dominant species (emended after Valchev, 2003a, c)

Fife groups based on the stratigraphical range of the species were divided (Fig. 3A): 1) species continuing from the Maastrichtian and disappearing at the end of the Paleocene (11.4% of the total number of species in the assemblages); 2) species, ranging in the Paleocene only (5.7%); 3) species, first occurring at the beginning of the Paleocene and continuing in the Eocene (5.7%); 4) transitional species (17.1%); 5) species, represented by single specimens in the Paleocene section and because of that with unknown stratigraphical range (60.1%).

The most important groups in the assemblage structure are the transitional [the main contributors *Bathysiphon discreta* (Brady), *Rhizammina indivisa* Brady, *Bulimina trinitatensis* Cushman and Jarvis, *Nuttalides truempyi* (Nuttal),

Osangularia velascoensis (Cushman), *Oridorsalis megastomus* (Grzibowski), *Anomalinoides acutus* (Plummer), *Heterolepa grimsdalei* (Nuttal), *Heterolepa perlucida* (Nuttal), and the secondary *Saccammina placenta* (Grzybowski), *Marssonella indentata* Cushman and Jarvis, *Marssonella oxycona* (Reuss), *Bannerella retusa* (Cushman), *Clavilinoides asperus* (Cushman), *Lenticulina pseudomamilligera* (Plummer), *Astacolus gladius* (Philippi), *Gyroidinoides girardanus* (Reuss)] and Maastrichtian-Paleocene species [the main contributor *Gavelinella beccariiformis* (White) and the secondary *Cibicidoides dayi* (White), *Gyroidinoides globosus* (Hagenow), *Nodosaria limbata* d'Orbigny, *Pyramidulina velascoensis* (Cushman), *Spiroplectinella dentata* (Alth)]. The group of Paleocene species is represented by *Oridorsalis lotus* (Schwager), *Clavilinoides trilaterus* (Cushman), and the Paleocene-Eocene group – by *Gaudryina pyramidata* Cushman, *Anomalinoides danicus* (Plummer), *Lenticulina inornata* (d'Orbigny).

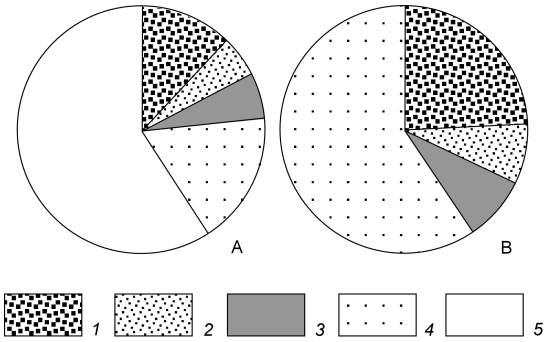


Fig 3. Structure of the "Byala-type" assemblages based on the stratigraphical range of the species
Groups of species: 1 –Maastrichtian-Paleocene' 2 – Paleocene; 3 – Paleocene-Eocene; 4 – transitional; 5 – represented by single specimens

The group of transitional species is the most numerous – 61.7% of total number of dominant species (Fig. 3B), followed by the Maastrichtian-Paleocene group (23.5%), while the other groups are of low importance (total 14.8%).

"Flysh-type" assemblages

This type was established in the strata of the Emine Formation. It is characterized by moderate species diversity (total 125 species). The assemblage composition is determined by the presence of 18 species (Fig. 4).

Six groups based on the stratigraphical range of the species were divided (Fig. 5A): 1) species continuing from the Maastrichtian and disappearing at the end of the Paleocene (3.9% of the total number of species in the assemblages); 2) species, ranging in the Paleocene only (5.9%); 3) species, disappearing at the end of the Lower Paleocene (2.8%); 4) species, established in the Middle and Upper Paleocene (0.8%); 5) transitional species (6.6%); 6) species, represented by single specimens in the Paleocene section section and because of that with unknown stratigraphical range (80.0%).

The Lower Paleocene is dominated by the Paleocene group (the main contributor *Bathysiphon* sp., and the secondary *Psammosphaera* sp. 1 и *Trochammina deformis*). Here the transitional [*Bathysiphon discreta* (Brady), *Rhizammina indivisa* Brady, *Saccammina placenta* (Grzybowski)] and the Maastrichtian-Paleocene group [the main contributor for the Middle Paleocene *Bathysiphon microrhaphidus* Samuel and the secondary *Hormosina velascoensis* (Cushman), *Hyperammina dilatata* Grzybowski, *Recurvoides imperfectus* (Hanzlikova)] are of low percent abundance. The Lower Paleocene is marked by the occurrence of hyaline *Nodosaria limbata* d'Orbigny, *Chilostomelloides* sp., *Oridorsalis megastomus* (Grzibowski), *Astacolus gladius* (Philippi), but they are not of great importance. In the Middle Paleocene an increase of the importance of Maastrichtian-Paleocene group is observed and it dominates the assemblage structure in this level. This fact is influenced by the sharp increase of *Bathysiphon microrhaphidus* Samuel percent abundance. Here secondary contributors are from the transitional and Paleocene groups. The Upper Paleocene is strongly dominated by transitional group (because of the sharp increase of *Saccammina placenta* (Grzybowski) percent abundance), followed by Paleocene and Maastrichtian-Paleocene groups. The Middle-Upper Paleocene species (*Reophax duplex* Grzybowski), is not of importance.

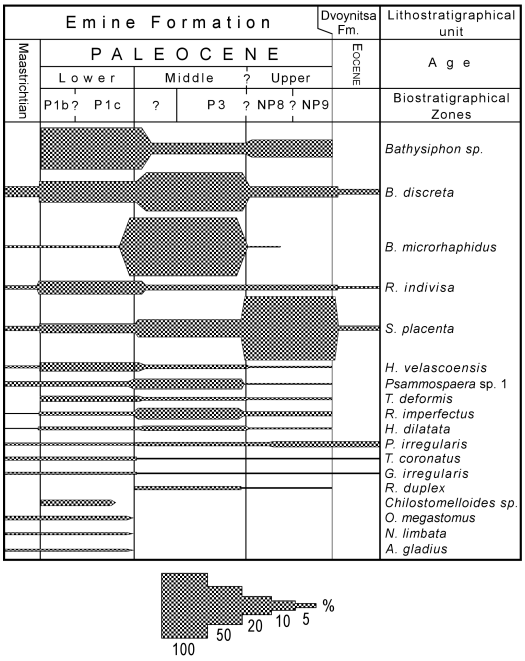


Fig. 4. Taxonomical composition of the "Flysh-type" assemblages with the maximum percent abundance of the dominant species (emended after Valchev, 2003a, c)

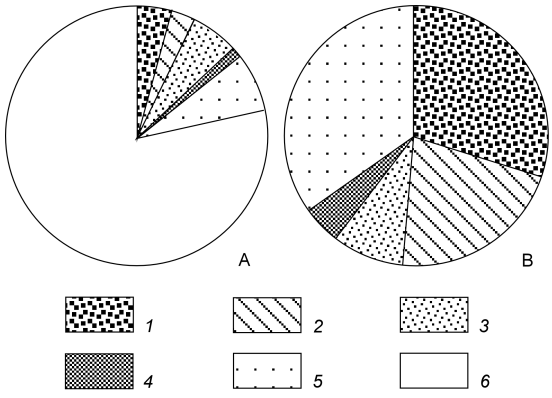


Fig. 5. Structure of the "Flysh-type" assemblages based on the stratigraphical range of the species
Groups of species: 1 –Maastrichtian-Paleocene' 2 –Lower Paleocene; 3 – Paleocene; 4 – Middle-Upper Paleocene; 5 – transitional;

6 – represented by single specimens

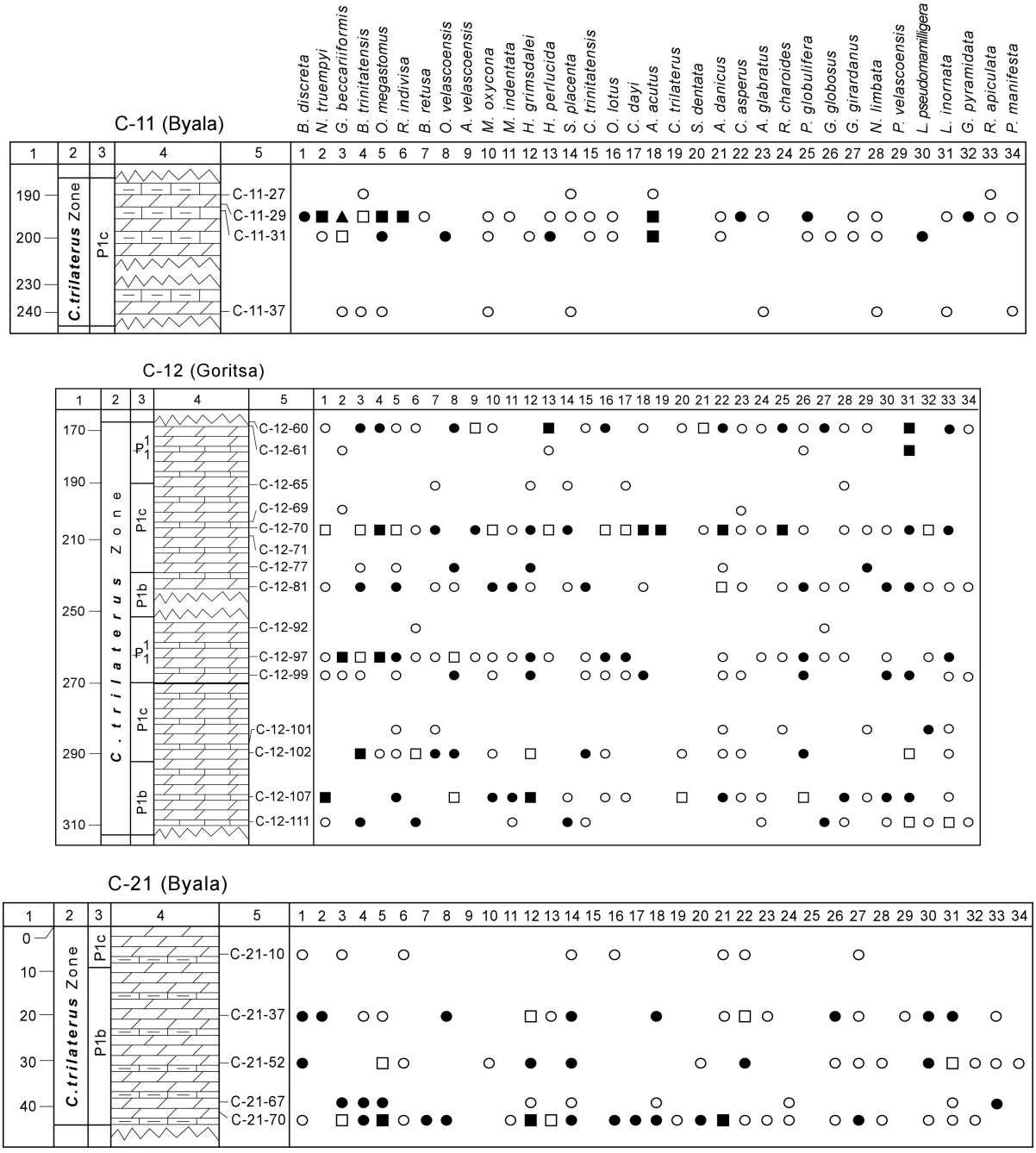
The group of transitional species is again the most numerous – 33.4% of total number of dominant species (Fig. 5B), followed by the Maastrichtian-Paleocene (27.8%), and Lower Paleocene (hyaline) (22.2%) groups. The Paleocene (11.1%) and Middle-Upper Paleocene species (5.5%) are not of great importance. As could be seen there are no groups with a strong domination in the "Flysh-type" assemblages.

Conclusions

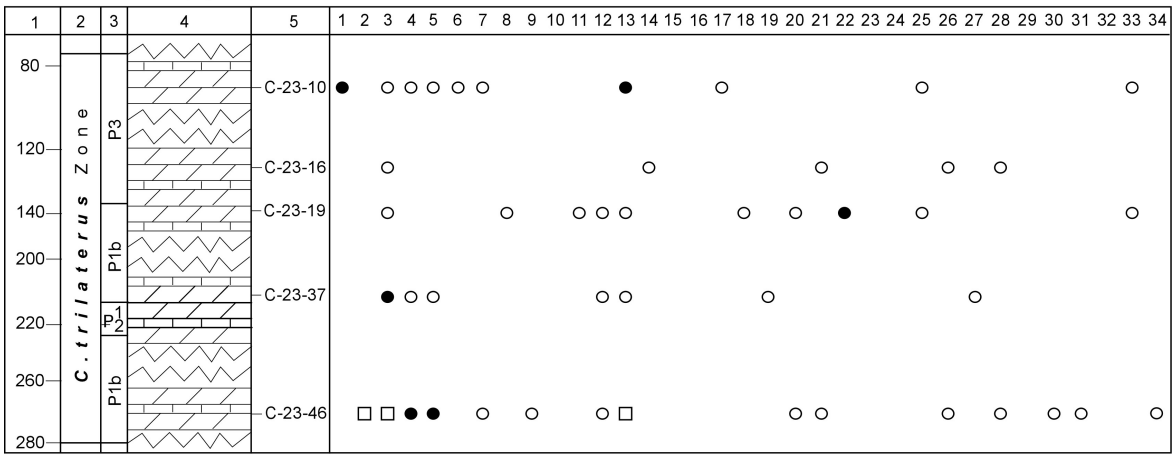
The study of the stratigraphical distribution of the Paleocene small benthic foraminifera from the coastal part of East Stara Planina leads to the following conclusions: 1) Fife groups benthic foraminifera (Maastrichtian-Paleocene, Paleocene, Paleocene-Eocene, transitional, represented by single specimens) in the "Byala-type" and six groups (Maastrichtian-Paleocene, Paleocene, Early Paleocene, Middle-Late Paleocene, transitional, represented by single specimens) in the "Flysh-type" were established; 2) Both assemblages are dominated by transit and Maastrichtian-Paleocene species, which does not allow us to find criteria (first and last occurrence) for a detailed biostratigraphical subdivision; 3) The "Byala-type" assemblages are strongly dominated by the group of transitional species, while in the "Flysh-type" assemblages there are no groups with a strong domination; 4) The actual lack of first and last occurrences in the Paleocene section, as well as the strong dependence of benthic foraminifera on paleoenvironment (appearance and disappearance of some species is influenced by paleoecological reasons), confirms the local character and the ecological nature of the zones defined by Valchev (2003).

Appendix

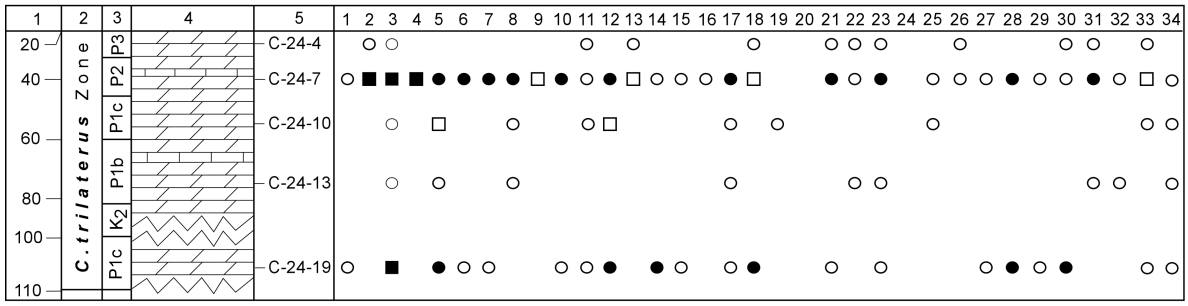
Distribution of the dominant species in the Paleocene of the coastal part of East Stara Planina.



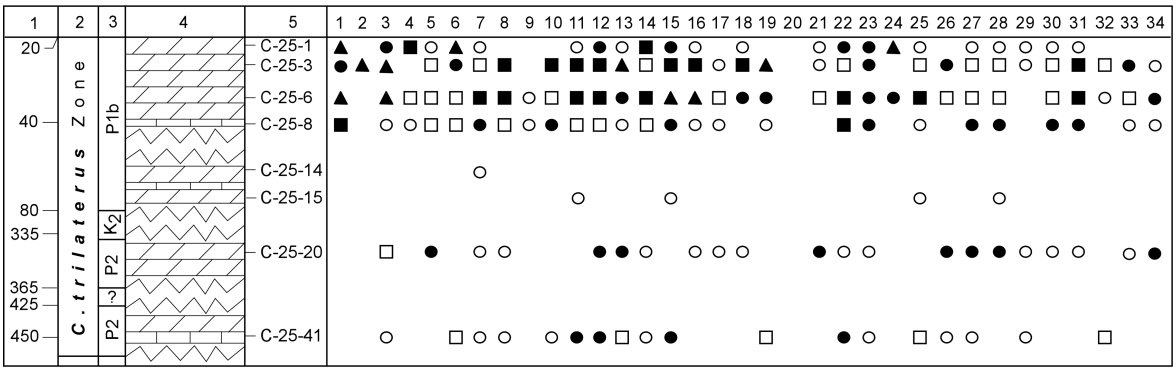
C-23 (Byala)



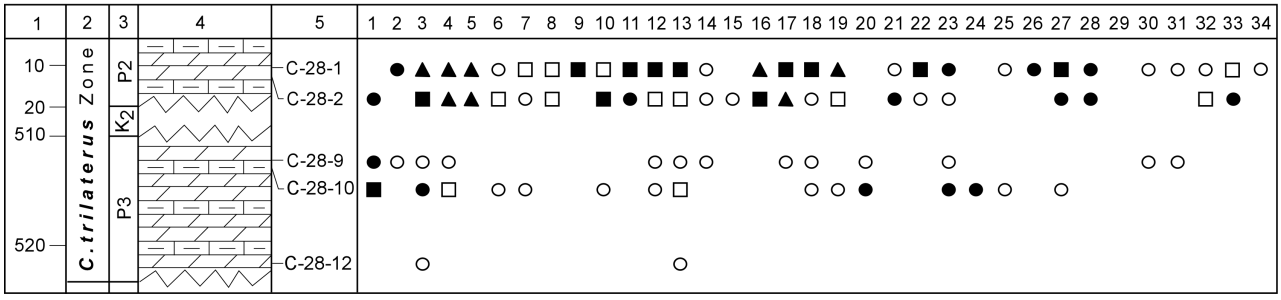
C-24 (Byala)



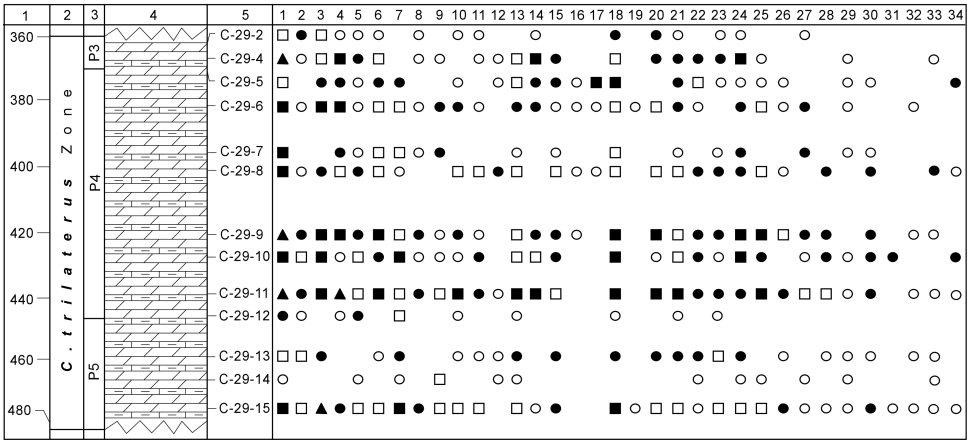
C-25 (Goritsa)



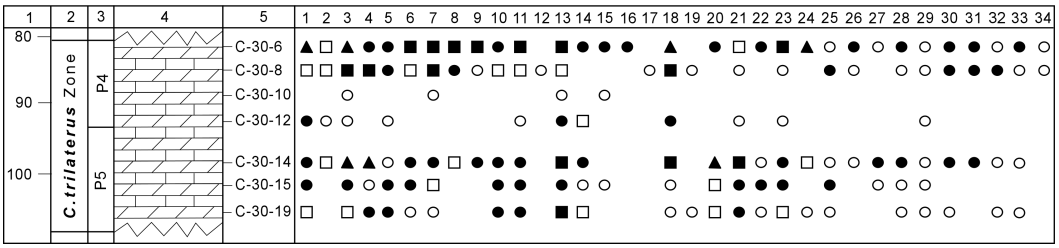
C-28 (Goritsa)



C-29 (Goritsa)



C-30 (Goritsa)



1 - depth (m)

2 - benthic foraminiferal zones

3 - planktic foraminiferal or calcareous nannoplankton zones

4 - lithological column

5 - sample

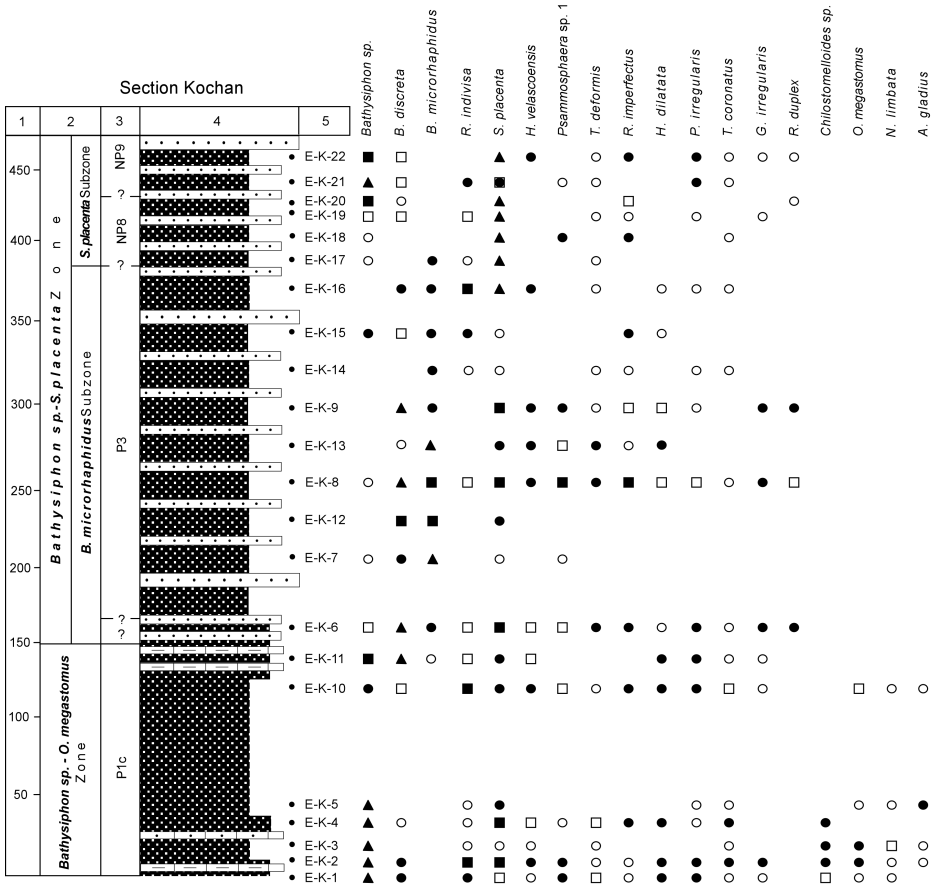
- marls
- limestones
- marly limestones
- sandy limestones
- sandstones
- alternation of siltstones and mudstones
- fault

Number of specimens

○ - 1-2 □ - 6-10 ▲ - >25

● - 3-5 ■ - 11-25

Section Kochan



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