

CAMPANIAN-MAASTRICHTIAN BENTHIC FORAMINIFERAL ASSEMBLAGES FROM THE LYUTIDOL FORMATION IN LYUTI DOL VILLAGE SURROUNDINGS, MEZDRA REGION (WESTERN BULGARIA)

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ABSTRACT. The Lyutidol Formation (Campanian-Maastrichtian) is of great interest from stratigraphical (litho-, bio- and chrono-), sedimentological, paleontological and paleogeographical point of view, because it crops out in a tectonically complicated region (between the Lyuti Dol and Skravena Villages), in the border area between the Western Balkan and the Fore Balkan tectonic zones, building up an allochthonous sheet, which is part of the Balkan Frontal Strip. Its age and stratigraphical position, as well as the fossil content (echinids, inoceramids, calcareous nannoplankton, planktic foraminifera, ammonites), have been discussed in several works. The present article aims to elucidate the taxonomical composition and structure of benthic foraminiferal assemblages from three sections and four single outcrops in the Lyuti Dol Village surroundings. The studied samples contain moderately diverse faunas with comparatively low species abundance. Assemblages are dominated by hyaline or agglutinated taxa (*Gyroidinoides girardanus*, *Osangularia* sp., *Gaudryina. cretacea*, *G. pyramidata*, *Arenobulimina* sp., *Bolivina incrassata*, *Cibicoides* sp., *Marssonella indentata*, *M. oxycona*, *Nodosaria. limbata*, *Quadriformina allomorphinoides*) with broad stratigraphic range, which not allow us to use the data for biostratigraphical analyses. On the other hand, benthic assemblages could be used successfully for paleoecological and paleogeographical reconstructions.

Key words. Campanian, Maastrichtian, benthic foraminifera, Lyutidol Formation, Western Bulgaria.

КАМПАН-МАСТРИХТСКИ БЕНТОСНИ ФОРАМИНИФЕРНИ АСОЦИАЦИИ ОТ ЛЮТИДОЛСКАТА СВИТА В РАЙОНА НА С. ЛЮТИ ДОЛ, МЕЗДРЕНСКО (ЗАПАДНА БЪЛГАРИЯ)

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РЕЗЮМЕ. Лютидолската свита (Кампан-Мастрихт) представлява сериозен интерес от стратиграфска (лито-, био- и хроно-), седиментоложка, палеонтоложка и палеогеографска гледна точка, тъй като тя се разкрива в тектонски сложен район (между селата Люти дол и Скравена) на границата между две тектонски зони – Предбалканската и Старопланинската. Свитата изгражда една алохтонна пластина, част от Старопланинската челна ивица. Нейната възраст, стратиграфска позиция и палеонтоложко съдържание (ехиниди, иноцерамиди, варовит нанопрланктон, планктонни фораминифери, амонити), са били обект на редица публикации. Настоящата статия има за цел да хвърли светлина върху таксономичния състав и структурата на бентосните фораминиферни асоциации от три разреза и четири единични разкрития в околностите на с. Люти дол. Изследваните проби съдържат умерено разнообразна фауна, представена от сравнително малък брой екземпляри. Асоциациите са доминирани от таксони с хиалинна или аглутинирана черупка (*Gyroidinoides girardanus*, *Osangularia* sp., *Gaudryina. cretacea*, *G. pyramidata*, *Arenobulimina* sp., *Bolivina incrassata*, *Cibicoides* sp., *Marssonella indentata*, *M. oxycona*, *Nodosaria. limbata*, *Quadriformina allomorphinoides*) с широк стратиграфски диапазон, което не позволява използването им за биостратиграфски анализ. От друга страна бентосните асоциации могат да бъдат използвани успешно за палеоеколожки и палеогеографски реконструкции.

Ключови думи. Кампан, Мастрихт, бентосни фораминифери, Лютидолска свита, Западна България.

Introduction

The Lyutidol Formation is of great interest from stratigraphical (litho-, bio- and chrono-), sedimentological, paleontological and paleogeographical point of view, because it crops out in a tectonically complicated region (between the Lyuti Dol and Skravena Villages), in the border area between the Western Balkan and the Fore Balkan tectonic zones, building an allochthonous sheet, which is part of the Balkan Frontal Strip (Sinnyovsky, 2009). Its age and stratigraphical position have been discussed in several works (Bonchev, 1932; Stoyanov, Nenov, 1975; Cheshitev, 1971; Batandjiev, 1971; Tzankov, 1989; Aladjova-Hrisheva et al., 1991; Tzankov et al., 1990; Tzankov et al., 1995; Sinnyovsky et al., 1990; Sinnyovsky, Hristova-Sinnyovska, 1993). In paleontological aspect the unit

has been studied by means of calcareous nannoplankton (Sinnyovsky in Sinnyovsky et al., 1990; Sinnyovsky, Hristova-Sinnyovska, 1993; 1996; Sinnyovsky, 2001, 2007; Sinnyovsky in Sinnyovsky et al., 2004), inoceramids (Toula, 1881), echinids (Ilieva, 2000), planktic foraminifera (Dimitrova and Juranov in Sinnyovsky et al., 1990; Valchev, 2010) benthic foraminifera (Dimitrova and Juranov in Sinnyovsky et al., 1990). Rare internal moulds of ammonites have also been found in these rocks (Antonov et al., 2004).

Dimitrova and Juranov (in Sinnyovsky et al., 1990) listed 14 species of planktic and 7 species of benthic foraminifera from the base of the stratotype section of the Lyutidol Formation and adopted Early Maastrichtian age for this level. Later Valchev

(2010) investigated the taxonomical composition and structure of the planktic assemblages from the whole stratotype section, confirmed the Campanian-Maastrichtian age, and concluded that it is not possible to establish biostratigraphical markers (FAD and LAD).

The aim of this article is to reveal the structure and stratigraphical distribution of benthic foraminiferal microfauna in the Lyuti Dol surroundings. Three sections and four single outcrops (Fig. 1) were investigated. Only carbonate intervals of the sections were sampled.

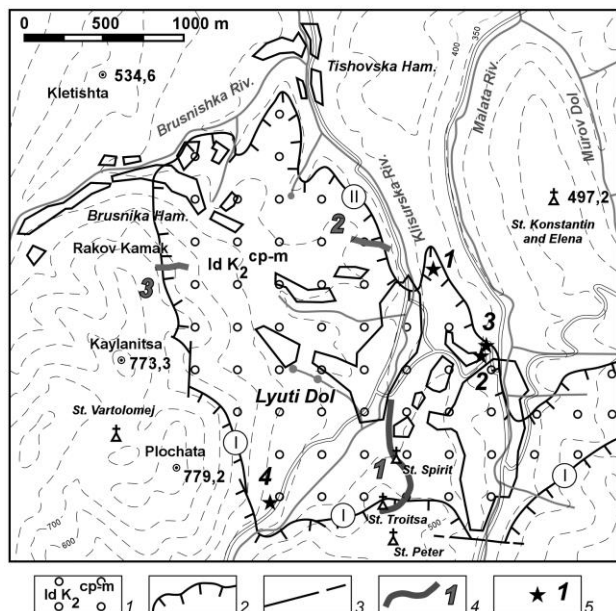


Fig. 1. Simplified geological sketch of the occurrence of the Lyutidol Formation (modified after Sinnyovsky et al., 2004) with the location of the studied sections and outcrops: 1 – Lyutidol Formation (Campanian-Maastrichtian); 2 – thrust: I – Gradishte, II – Lyutidol; 3 - normal fault; 4 – section; 5 – single outcrop

Results

The sections and outcrops, investigated for the purpose of the present article, were conditionally named 1, 2, etc.

Section 1 (stratotype of the Lyutidol Formation)

The lithological column of the section with the location of samples was given by Valchev (2010). Generally six carbonate levels could be observed and they were sampled. The base of the section (samples LD5 and LD5-1) is characterized by assemblage showing low taxonomical diversity and specimen abundance. Totally 19 species were recorded, but only three of them are represented by more than single specimens – *Gyroidinoides girardanus* (Reuss) and *Cibicoides* sp. and *Lenticulina* sp. As a whole assemblage structure is composed mainly of hyaline taxa.

The second carbonate level (sample LD6) shows the same taxonomical diversity (21 species), but there are higher specimen abundance. The assemblage is dominated by *Gaudryina cretacea* (Karrer), *Marssonella oxycona* (Reuss), *Gyroidinoides girardanus* (Reuss), *Osangularia* sp.,

Praebulimina sp., *Ramulina* sp., *Ellipsoglandulina* sp., and *Anomalinoides* sp. With the exception of *G. girardanus*, the other species were not recorded from the base of the section.

The third investigated level (samples LD7 and LD8) contains benthic assemblage with comparatively lower taxonomical diversity (14 species) and specimen abundance. It is dominated by *Clavulinoides* sp., *Arenobulimina* sp., *M. oxycona* (Reuss), *Bathysiphon* sp., *Anomalinoides* sp., and *Ellipsoglandulina* sp. The first two taxa were not observed in the lower levels.

The fourth level of our interest (sample LD10 and LD14) reveals species diversity similar to the first two levels (18 species) with comparatively low specimen abundance. Here the dominating species are *Gaudryina pyramidata* Cushman, *Anomalinoides* sp., and *Osangularia* sp. The first one appears in the second level but as single specimen.

Totally 29 species were recorded from the fifth carbonate level of the section (samples LD15-1, LD15-2, LD21). Characteristic feature of the assemblage is the comparatively high specimen abundance. Four species could be described as common – *Clavulinoides trilaterus* (Cushman), *Gaudryina pyramidata* Cushman, *Arenobulimina* sp. and *Bolivina incrassata* Reuss. Another 8 species appear as more than single specimens – *Gaudryina cretacea* (Karrer), *Marssonella indentata* (Cushman & Jarvis), *M. oxycona* (Reuss), *Gyroidinoides girardanus* (Reuss), *Cibicoides* sp., *Bolivina draco* (Marsson), *Lenticulina* sp., and *Psammosphaera* sp.

The uppermost level of the stratotype section (samples LD11, LD12, and LD13) is the most diverse from taxonomical point of view (34 species) and shows moderate specimen abundance. Dominating taxa are *Arenobulimina* sp., *Cibicoides* sp., *Bolivina incrassata* Reuss, which could be described as common, *Clavulinoides trilaterus* (Cushman), *Bannerella retusa* (Cushman), *Anomalinoides* sp., and *Nodosaria limbata* d'Orbigny, represented by rare specimens.

Section 2 (Lyuti Dol North)

The section is situated on the west riverside of Klisurska River in the north outskirts of Lyuti Dol Village, west of the old road to Botevgrad and the sediments of the Lyutidol Formation are poorly exposed (Plate I, Figs. 1-3). It is about 70 m thick (Fig. 2A) and it is composed mainly by carbonate materials. Five levels were sampled. The base of the section reveals assemblage with low taxonomical diversity (12 species) and specimen abundance. Only *Bolivina incrassata* Reuss appears as rare specimens.

The most diverse and abundant assemblage was obtained from the second investigated level (sample LD25). Totally 23 species were recorded and 7 of them are dominating. They are *Arenobulimina* sp., *Lenticulina* sp. 1, *Lenticulina* sp. 2, *Cibicoides* sp., *Praebulimina* sp., *Nodosaria limbata* d'Orbigny, and *Gyroidinoides girardanus* (Reuss), and all of them could be described as rare.

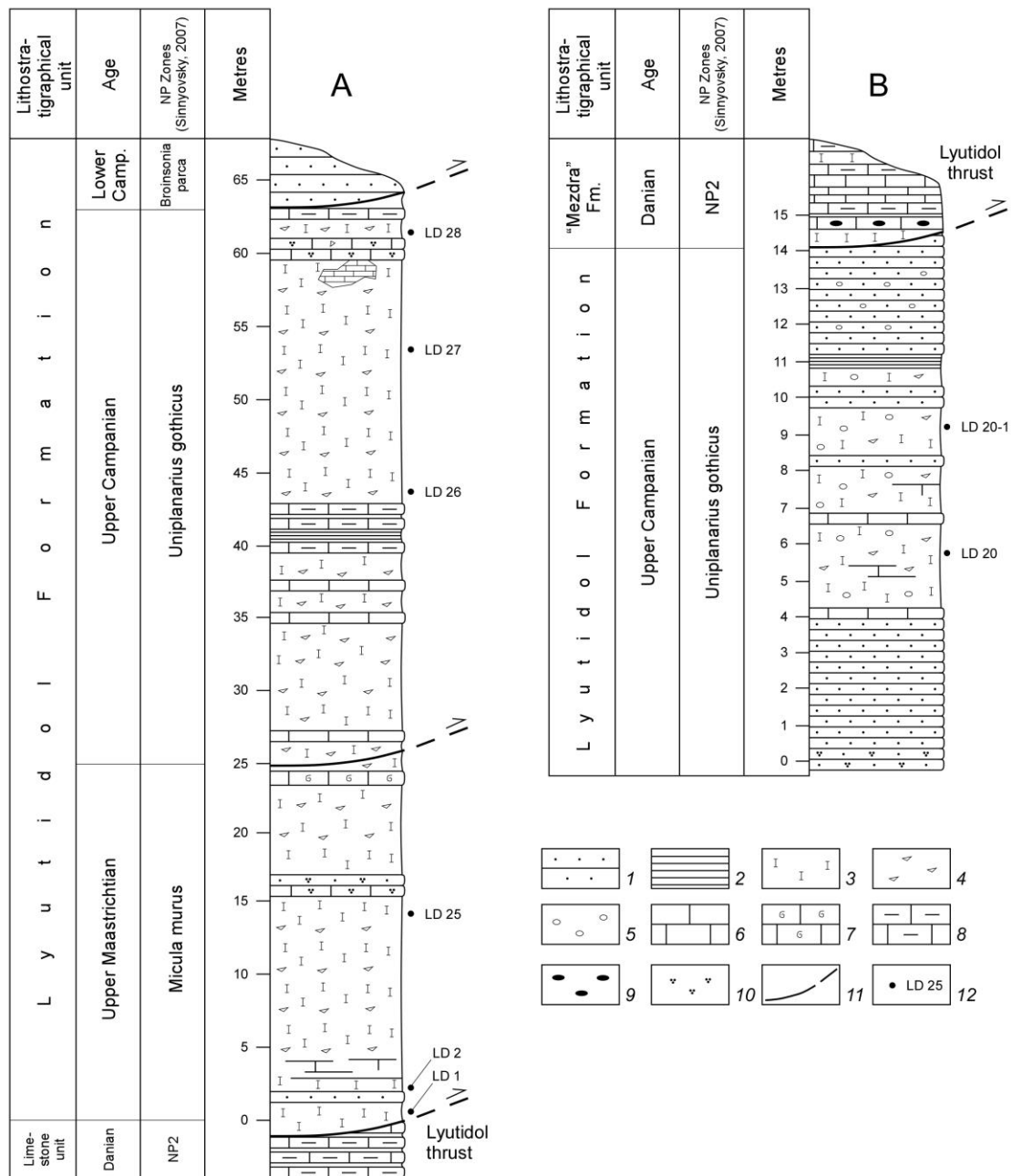


Fig. 2. Lithological columns of two sections of the Lyutidol Formation (modified after Sinnyovsky, 2007): A – Lyuti Dol North, B – Rakov Kamak; 1 – thin-bedded sandstone; 2 – marls; 3 – chalk; 4 – carbonate breccia; 5 – carbonate conglomerate; 6 – limestone; 7 – bioclastic limestone; 8 – marly limestone; 9 – chert; 10 – glauconite; 11 – thrust; 12 – sample

The third sampled level (sample LD26) reveals the lowest species diversity and specimen abundance in this section – 9 benthic species only were found, and all of them appear as single specimens.

The last two levels (samples LD27 and LD28) show similar features – comparatively low taxonomical diversity (15 species in LD27 and 12 species in LD28) and specimen abundance. Dominating for the sample LD27 are *Arenobulimina* sp., *Gaudryina pyramidata* Cushman, and *Cibicidoides* sp, which occur as rare specimens, while the assemblage from the uppermost level is composed mainly by *Gaudryina pyramidata* Cushman, which appears as common species, and *Quadriformina allomorphinoides* (Reuss), occurring as rare taxon.

Section 3 (Rakov Kamak)

This section is situated east of Rakov Kamak and south of Brusnika Hamlet. It is comparatively well exposed, but only 14 m thick (Fig. 2B, Plate I, Figs. 4, 5). The assemblages are characterized by low species diversity (totally 11 species for the whole section) and low specimen abundance – all the species, with exception of *Gaudryina pyramidata* Cushman from sample LD20, appear as single specimens.

Single outcrops

Four single outcrops (Fig. 1, Plate I, Figs. 6-8) were sampled to obtain additional data about the taxonomical composition and structure of the benthic foraminiferal assemblage from the studied area.

Outcrop 1 (sample LD3) is situated in the north outskirts of Lyuti Dol Village on the east riverside of Klisurska River. It reveals carbonate breccia with soft chalky matrix. The benthic foraminiferal assemblage is comparatively diverse (19 species) and it is dominated by *Cibicidoides* sp., appearing as common species, *Gaudryina pyramidata* Cushman and *Osangularia* sp., which are present by rare specimens.

Outcrops 2 and 3 are placed in the northeast outskirts of the village on the west riverside of Malata River. *Outcrop 2* (samples LD4 and LD22). It represents chalky limestones with low taxonomical diversity (10 species) and specimen abundance – all the species appear as single specimens. In the *outcrop 3* (sample LD23) we observed carbonate breccia and conglomerate with soft chalky matrix. The assemblage is moderately diverse (18 species) and it is dominated by *Cibicidoides* sp. and *Osangularia* sp., appearing with rare specimens.

Outcrop 4 is situated in the southwest outskirts of the village on the west riverside of Klisurska River, west of the old road to Botevgrad. Here we sampled weakly cemented glauconitic sandstones (samples LD18 and LD19). Assemblages are with low taxonomical diversity - totally 6 species, all of them appearing as single specimens.

Discussion

Taxonomical diversity

Comparatively large number of species was recorded from the sections and the single outcrops in the Lyuti Dol surroundings - totally 56 benthic foraminiferal taxa. Only 20 of them occur in the all three sections and no one was recorded from a whole section.

Specimen abundance

With exception of the fifth carbonate level of section 1, all the samples are characterized by low specimen abundance. Despite the comparatively large number of species, only few of them are represented by more than single specimens – *G. girardanus*, *Osangularia* sp., *G. cretacea*, *G. pyramidata*, *Arenobulimina* sp., *B. incrassata*, *Cibicidoides* sp., *M. indentata*, *M. oxycona*, *Q. allomorphinoides*, *N. limbata*.

Biostratigraphical markers

All the species, recorded in this study, have broad stratigraphical range (Upper Cretaceous-Paleocene), so it is not possible to define biostratigraphical markers (FAD and LAD) on the base of benthic foraminifera.

Conclusions

The study of the benthic foraminiferal microfauna from the Campanian-Maastrichtian Lyutidol Formation in the Lyuti Dol Village surroundings revealed the following characteristic features:

- Assemblages show comparatively high taxonomical diversity;
- Distribution of the taxa is not uniform in the sections;
- The assemblage structure is dominated by a few species;
- As a whole assemblages are characterized with low specimen abundance – there are not taxa represented by abundant specimens;

Taxonomical composition and structure of Campanian-Maastrichtian benthic foraminiferal assemblages from Lyuti Dol surroundings give us a good opportunity for paleoecological reconstruction and further paleogeographical interpretation of the position of the Lyutidol Formation as a transitional facies between the North European and Mediterranean type Upper Cretaceous in Bulgaria.

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PLATE I

- 1 – The base of section 2 (Lyuti Dol North) – limestone unit is overthrust by Lyutidol Formation (Lyutidol thrust);**
- 2 – Carbonate breccia with soft chalky matrix 55 m above the base of section 2 (sample LD27);**
- 3 – Carbonate breccia with soft chalky matrix at the uppermost part of section 2 (sample LD28);**
- 4 – General view of section 3 (Rakov Kamak);**
- 5 – Carbonate conglomerate and breccia with soft chalky matrix in section 3 (sample LD20);**
- 6 – Chalky limestones in outcrop 2 (sample LD22);**
- 7 – Carbonate breccia and conglomerate with soft chalky matrix in outcrop 3 (sample LD23);**
- 8 – Weakly cemented glauconitic sandstones in outcrop 4 (samples LD18).**

PLATE I

