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Nummulites and calcareous nannofossils from Lower Eocene beds in the area of Veliko Târnovo (North Bulgaria)

Kina Aladžova-Hrisčeva

Geologičeski institut pri BAN, Ul. Akad. G. Bončev 2, Sofia 1113, Bulgaria

Jernej Pavšič

Katedra za geologijo in paleontologijo, Univerza Edvarda Kardelja v Ljubljani, Aškerčeva 12, 61000 Ljubljana

Abstract

From two sections in the Veliko Târnovo area nummulites and calcareous nannofossils were studied. In the Šemševo section by comparison with nummulites the nannoplankton biozone NP 13, and in the Balvan section biozones NP 9 and NP 11 were separated.

Introduction

Individual beds of the Lower Eocene beds in the area of Veliko Târnovo contain numerous small nummulites. Most of them have been studied and described (Aladžova-Hrisčeva in press). Some of these beds have been sampled for nannofossils. The identified nannoplankton assemblages enabled to subdivide the respective zones.

The nummulite associations in the area of Veliko Târnovo show common features with those of the Mediterranean where a nummulite zonal scheme was developed (Schaub 1981).

The aim of the present paper is to study the joint distribution of nummulites and nannofossils in the Eocene sedimentary rocks in the Veliko Târnovo area (Fig. 1), and to correlate the nummulites and the nannoplankton zones identified.

The stratigraphy of the Lower Eocene beds in the area and the study of the nummulite fauna were performed by K. Aladžova-Hrisčeva. The nannoplankton was studied by J. Pavšič. The samples for this investigation have been presented to him by K. Aladžova-Hrisčeva in 1985.

Note on the stratigraphy

The Lower Eocene sedimentary rocks in the Veliko Târnovo area overlie transgressively and unconformably different levels of the Lovéc Urgonian Group ranging from the Lower to Upper Cretaceous. Due to the wide distribution of talus deposits

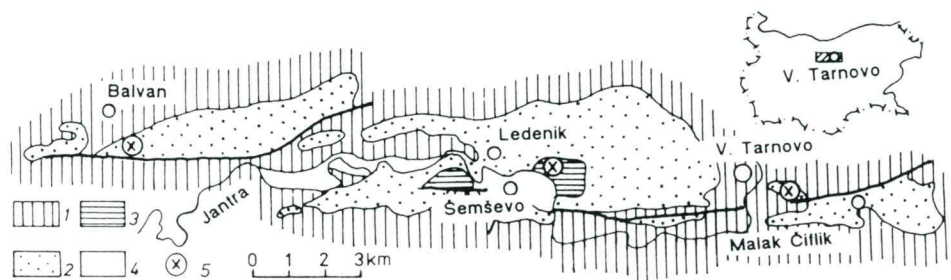


Fig. 1. Distribution of Early Eocene beds in the Veliko Târnovo area
 1 Cretaceous; 2 Šemševo Formation (Early Eocene); 3 Avren Formation (Early Eocene);
 4 Quaternary; 5 Sections of Early Eocene beds

the boundary Cretaceous/Paleogene is masked and the basal Paleogene horizons are usually not exposed on the surface. The sections of the Lower Eocene beds are commonly incomplete due to denudation of their upper parts. Two formations are distinguished in the Lower Eocene: the lower – Šemševo siltstone-sandstone Formation and the upper – Avren Marl Formation (Aladžova-Hrisčeva 1988). The Stokiški limestone member is distinguished in the Šemševo Formation and occurs only in the western part of the area.

The beds of the Šemševo Formation contain nummulites and nannoplankton. These fossils are lacking in the marls of the overlying Avren Formation, but the nannoplankton assemblage is rich and diverse (Fig. 2).

Biostratigraphy

Nummulite zones

The nummulite fauna in the Veliko Târnovo area is poorly preserved and extend of conservation is govered by different composition of the containing sediments (Figs. 2 and 3).

The lowermost levels of Šemševo Formation contain only single specimens of the species: *Nummulites exilis* Douvillé (Pl. 1), *N. spirectypus* Doncieux (Pl. 2), *N. spileccensis* Munier-Chalmas and few rounded small nummulites of the group *N. globulus* whose species determination is very difficult. According to the scheme of Schaub (1981) this association is characteristic of the *Nummulites exilis* zone with stratigraphic range Middle-Upper Ilerdian.

In the higher parts of the Šemševo Formation the nummulite association changes abruptly and is richer both in species composition and amount of specimens. Particularly numerous are the nummulites in the detrital limestones of the Stokiški member. Several tens of specimens of the following species have been found there: *Nummulites praemurchisoni* Nemkov & Barhatova, *N. semiinvolutus* Nemkov (Pl. 2), *N. pernotus* Schaub. Less common are *N. laxis* Schaub, *N. crimensis* Nemkov & Barhatova (Pl. 2). Among the large number of badly preserved nummulites have been identified also *N. cf. soerenbergensis* Schaub, *N. cf. involutus* Schaub. This association defines the *Nummulites involutus* zone whose stratigraphic range is Upper Ilerdian (Fig. 3).

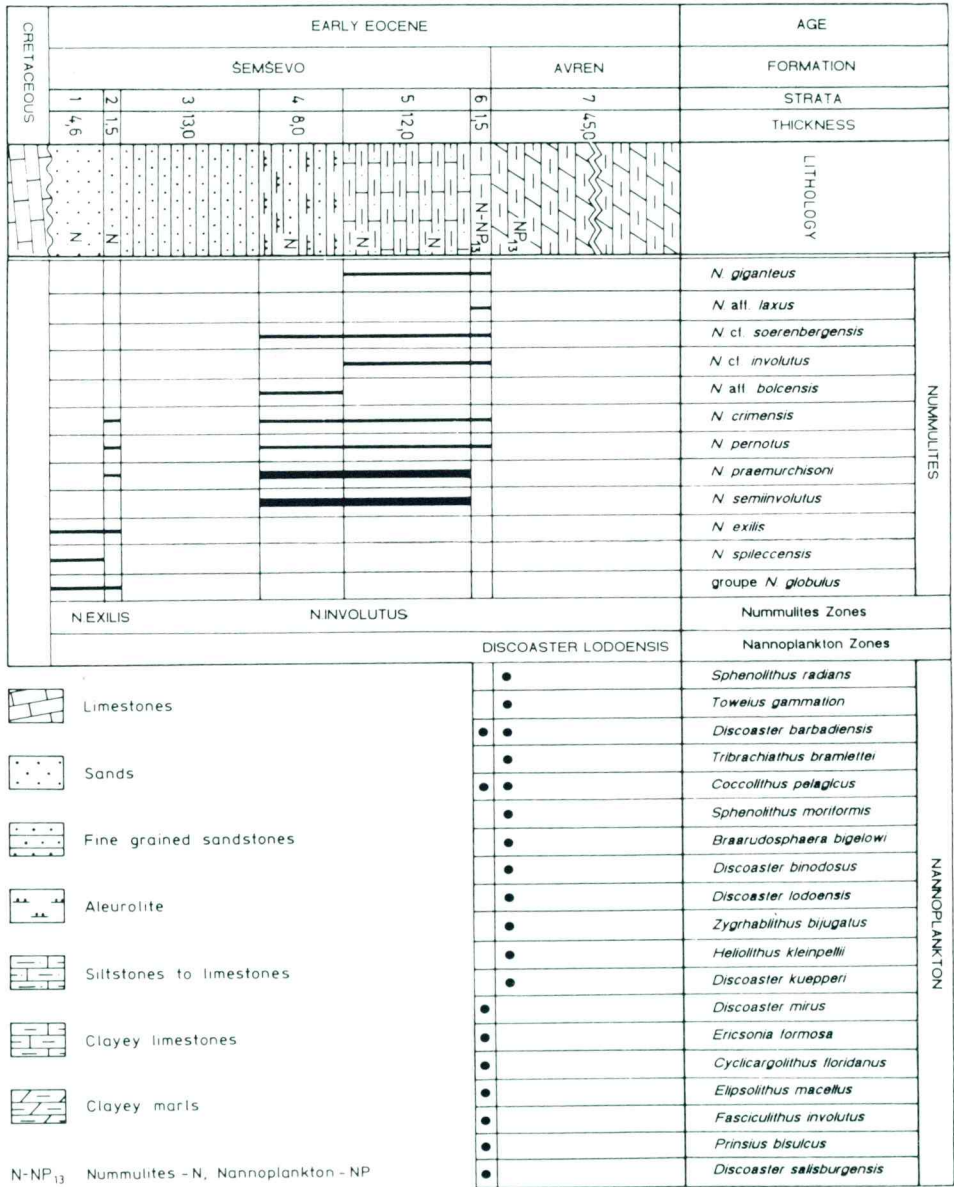


Fig. 2. Section of Lower Eocene beds east of Šemševo

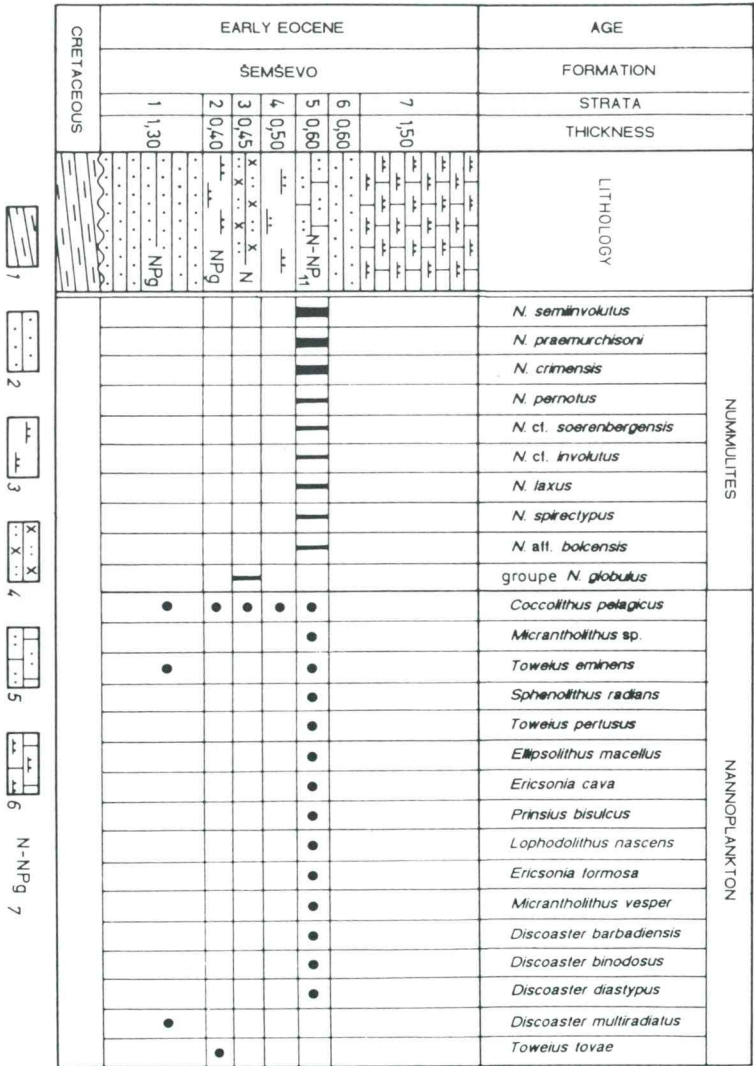


Fig. 3. Section of Lower Eocene beds south of Balvan
1 Clay marl; 2 Fine grained sandstone; 3 Clayey siltstones; 4 Quartzitoid sandstones; 5 Sandy limestones; 6 Aleurolitic limestones; 7 Nummulites
– N, Nannoplankton – NP

The uppermost levels of the Šemševo Formation, directly below the marls of the Avren Formation, contain single specimens of *Nummulites giganteus* Mayer-Eymar, *N. aff. laxus* Schaub, *N. soerenbergensis* Schaub, *N. cf. involutus* Schaub, *N. crimensis* Nemkova & Barhatova, *N. pernotus* Schaub which also fall within *Nummulites involutus* zone.

Nannoplankton

The calcareous nannoplankton we studied from the Balvan and Šemševo sections. In Balvan we found nannofossils in five samples. It is rather good preserved and abundant only in the sample Balvan 5 (Fig. 3). In the first two samples there are autochthonous floras covered with the reworked species mainly from Cretaceous. We determined following reworked species (Pl. 2): *Arkhangelskiella cymbiformis* Vekshina, *Eiffelithus turriseiffeli* (Deflandre), *Watznaueria barnesae* (Black), *Stradneria crenulata* (Bramlette & Martini), *Eiffelithus eximius* (Stover), *Zeugrhabdotus acanthus* Reinhardt, *Chiastozygus litterarius* (Gorka), *Microrhabdulus decoratus* Deflandre, *Cribrosphaerella ehrenbergii* (Arkhangelsky), *Biscutum constans* (Gorka). These samples contain just a few Tertiary species, which correspond to the Lower Eocene (Upper Paleocene) biozone *Discoaster multiradiatus* (NP 9) after Martini (1971).

In biozone *Discoaster binodosus* (NP 11) we put the sample five, where appear with typical nannoflora also characteristic discoasters: *Discoaster binodosus* Martini and *Discoaster barbadiensis* Tan. In Šemševo section (Fig. 2) there are two positive samples. Nannofossils are good preserved. According to typical discoasters; *Discoaster salisburgensis* Stradner, *D. binodosus* Martini and *D. lodoensis* Bramlette & Riedel, we put it in the Lower Eocene biozone *Discoaster lodoensis* (NP 13).

Correlation of nummulites and nannofossils zones

The relationship between the zonal scheme based on nummulites and nannoplankton is shown in Fig. 4. There are some coincidences or incoincidences between the boundaries of some zones, but they are to a certain extent conventional due to the small number of sampled sections.

In the transgressive glauconite sandstones from the base of the paleogene section south of Balvan the nannoplankton species *Discoaster multiradiatus* Bramlette & Riedel has been found. Nummulites are lacking there. In the same glauconite

Age	Nannoplankton Zones	Nummulites Zones
Paleocene Early Eocene	<i>Discoaster lodoensis</i> NP 13	<i>Nummulites</i> are missing
	<i>Tribrachiathus orthostylus</i> NP 12	<i>Nummulites involutus</i>
	<i>Discoaster binodosus</i> NP 11	<i>Nummulites exilis</i>
	<i>Discoaster multiradiatus</i> NP 9	<i>Nummulites</i> are missing

Fig. 4. Correlation between the Nannoplankton and Nummulite zones in the Veliko Târnovo area

sandstones in the easternmost part of the area (near the Malak Čiflik Village), few fossils of the *Nummulites exilis* zone have been found.

In beds rich in nummulite fauna of the *Nummulites involutus* zone (packet no. 5 in the section south Balvan – the Stokiški Member) occur the diverse nannoflora of the *Discoaster binodosus* biozone.

In the silty clayey limestones from the area of Sveta Gora, Veliko Târnovo, which belong to the uppermost parts of the Šemševo Formation, the *Tribrachiatus orthostylus* zone and *Nummulites involutus* zone have been distinguished.

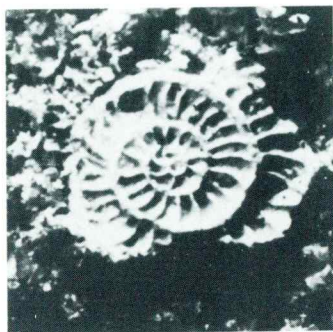
The uppermost parts of the Eocene sections in the area comprise marls which lack nummulites. They contain a rich and diverse nannofossil assemblage defining the *Discoaster lodoensis* zone.

References

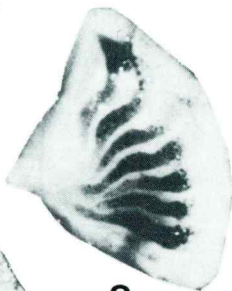
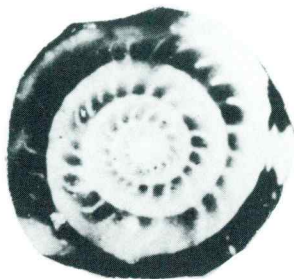
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Plate 1

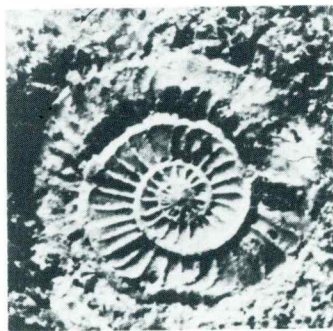
- 1 *Nummulites crimensis* Nemkov et Barhatova (B), × 13
- 2 *Nummulites crimensis* Nemkov et Barhatova, × 15
- 3 *Nummulites exilis* Douvillé (B), × 8
- 4 *Nummulites exilis* Douvillé (B), × 8,5
- 5 *Nummulites exilis* Douvillé (A), × 10
- 6 *Nummulites semiinvolutus* Nemkov et Barhatova (B), × 8
- 7 *Nummulites semiinvolutus* Nemkov et Barhatova (B), × 8
- 8 *Nummulites spirectypus* Doncieux (A?), × 6,5



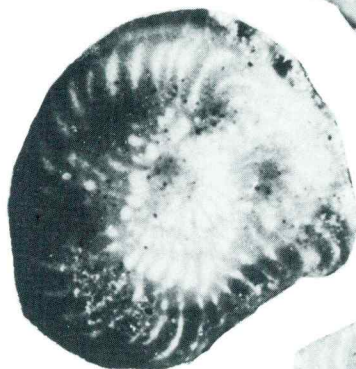
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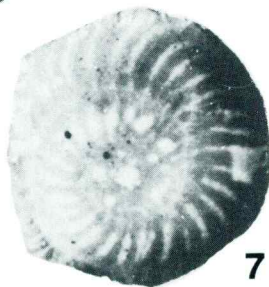
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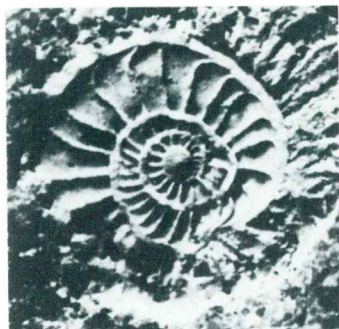
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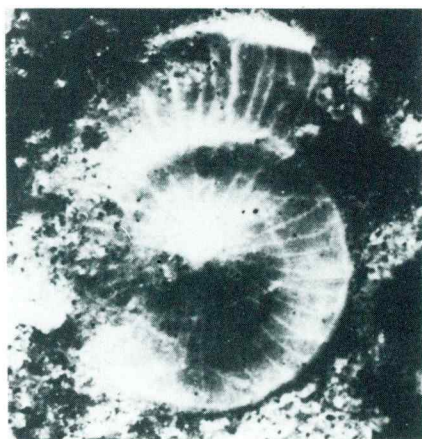
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Plate 2

- 1, 2 *Toweius gammation* (Bramlette et Sullivan), × 1800
 - 3 *Helicosphaera lophota* (Bramlette et Sullivan), × 1800
 - 4 *Toweius pertusus* Sullivan, × 1800
 - 5 *Discoaster multiradiatus* Bramlette et Riedel, × 1500
 - 6 *Discoaster mirus* Deflandre, × 1500
 - 7 *Discoaster diastypus* Bramlette et Sullivan, × 1500
 - 8 *Discoaster lodoensis* Bramlette et Riedel, × 1500
 - 9, 10 *Sphenolithus radians* Deflandre, × 3000
 - 11 *Sphenolithus pseudoradians* Bramlette et Wilcoxon, × 3000
 - 12, 16 *Micrantholithus vesper* Deflandre, × 1500
 - 13 *Zygrhablithus bijugatus* (Deflandre), × 3000
 - 14 *Eiffelithus eximius* (Stover), × 1800
 - 15 *Rhabdosphaera perlonga* (Deflandre), × 3000
- 1, 5-8, 12 under ordinary light, all others between crossed nicols

