

Integrated biostratigraphy of the Novi Pazar Campanian/Maastrichtian sequence (Vardar Zone)

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Key words: nannoplankton, biostratigraphy, Campanian, Maastrichtian, preflysch, Vardar Zone

Abstract

Hemipelagic and pelagic sediments (=lower and middle part of the preflysch auct) outcropping in Mur section (Novi Pazar, Vardar Zone) have been subject of calcareous nannoplankton analysis. Four calcareous nannofossils zones were recognized in the studied sequence. The obtained data agree with biostratigraphic evidence coming from benthonic and planktonic forams. The consideration that flysch must be post-Maastrichtian in age is supported by calcareous nannoplankton indicating a Middle Eocene age of some samples coming from the flysch of Novi Pazar area.

Introduction

Cretaceous deposits in the Raška region (surroundings of Novi Pazar, Vardar Zone, fig. 1) transgressively overlie Paleozoic rocks. They have been described in the Bajevića Mur area, SW of Novi Pazar, as follows: 1) basal conglomerate and sandstones, 2) rudistid limestone (Santonian), 3) preflysch sediments (Campanian - Maastrichtian) and 4) Maastrichtian flysch (Rampoux, 1964; Petrović & Jankičević, 1988).

Shallow water limestones of the Mur section (fig. 2) bear Santonian-Campanian rudistid assemblages (Pejović, 1978, 1996). Jerotijević (1996), described a rich benthonic foraminiferal association (*Idalina antiqua* association) as Late Santonian-earliest Campanian in age. The rudistid limestones grade into hemipelagic and pelagic sediments (=part of the preflysch sediments according to Petrović & Jankičević, 1988). In about 35 m *elevata* and *ventricosa* zones have been

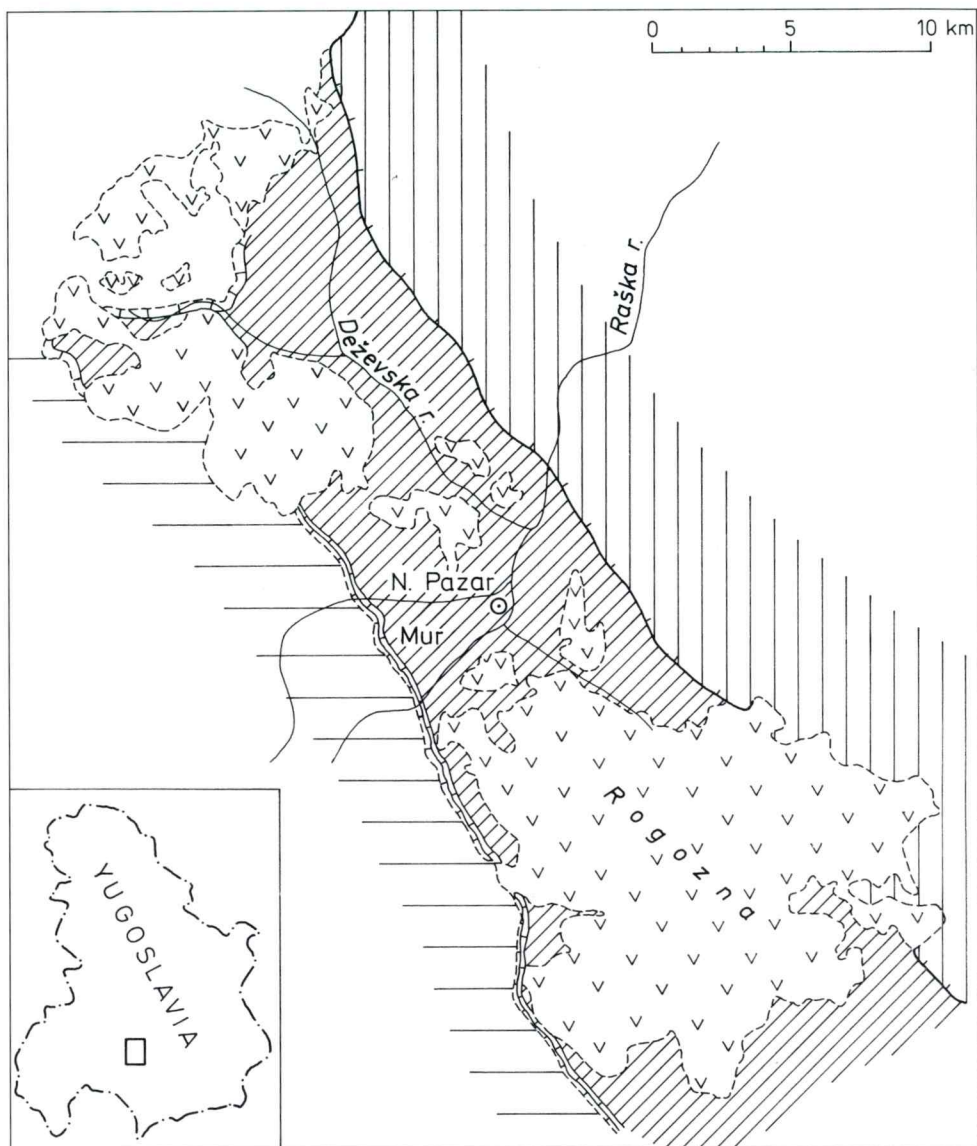


Fig. 1 Geological map of the studied area, according to Milovanović and Čirić, 1968

recognized (Jerotijević, 1996; Jerotijević - Polavder, 1997). The successive planktonic foraminiferal zones have not been documented.

The lithoclastic-bioclastic breccia bed rich in rudist fragments and transported large forams (*Siderolites calcitrapoides*, Orbitoididae) has been dated as Early Maastrichtian. The Campanian/Maastrichtian boundary is hypothetically placed a few meters below the breccia bed.

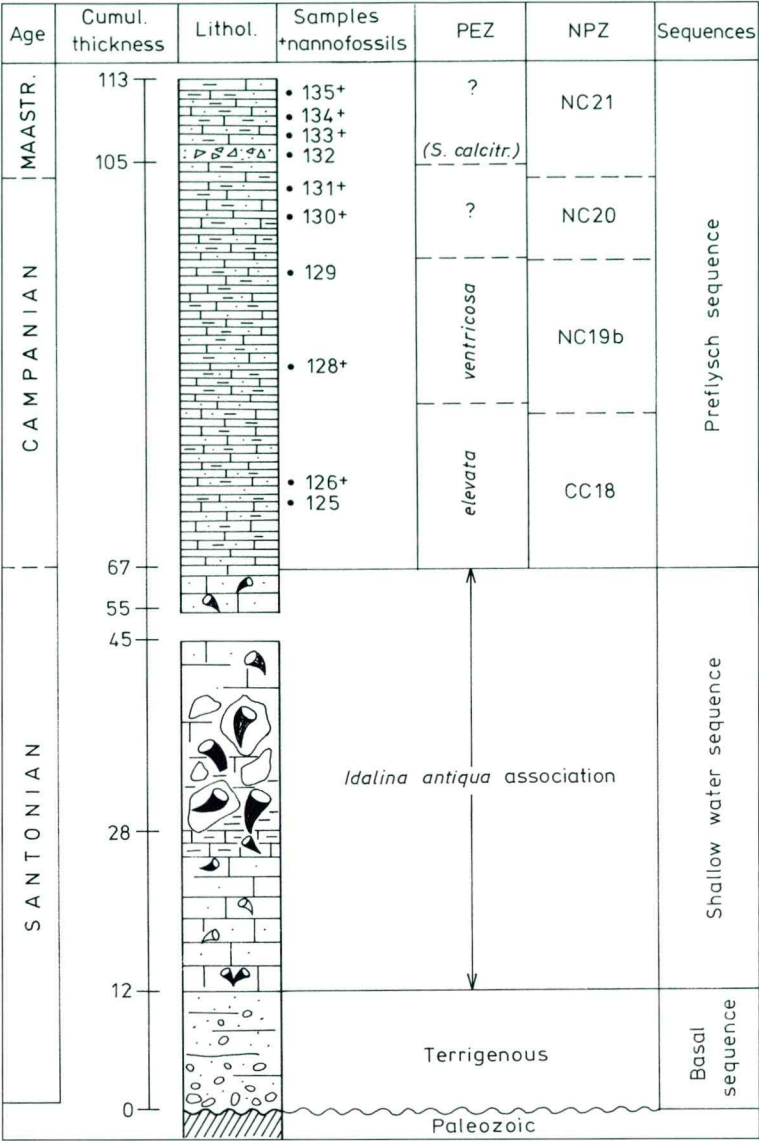


Fig. 2. Stratigraphic column of the Mur succession

To obtain more detailed stratigraphic results, we studied the calcareous nannoplankton associations from the same section.

Calcareous nannoplankton biostratigraphy

Eight samples (S126-S137) have been studied coming from the hemipelagic sediments of the Mur sequence (figs. 1 and 2). The following nannoplankton associations have been recognized.

- Sample S126

Aspidolithus parvus (Stradner) Noël
Braarudosphaera bigelowi (Gran & Braarud) Deflandre
Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre
Eiffellithus sp.
Eprolithus floralis (Stradner)
Lucianorhabdus arcuatus Forchheimer
Micula concava (Stradner) Verbeek
Micula decussata Vekshina
Watznaueria barnesae (Black) Perch-Nielsen
Watznaueria biporta Bukry
Watznaueria communis Bukry
Watznaueria sp.
 Age: Early Campanian
 Biozone: CC18

- Sample S128

Arkhangelskiella cymbiformis Vekshina
Aspidolithus parvus (Stradner) Noël
Calculites obscurus (Deflandre) Prins & Sissingh
Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre
Cyclagelosphaera margerelii Noël
Eiffellithus eximius (Stover) Perch-Nielsen
Lithraphidites carniolensis Deflandre
Lucianorhabdus cayeuxii Deflandre
Manivitella pemmatoidea (Deflandre) Thierstein
Micula concava (Stradner) Verbeek
Micula decussata Vekshina
Prediscosphaera cretacea (Arkhangelsky) Gartner
Quadrum gothicum (Deflandre) Prins & Perch-Nielsen
Quadrum tridum (Stradner) Prins & Perch-Nielsen
Reinhardtites authophorus (Deflandre) Perch-Nielsen
Stradneria crenulata (Bramlette & Martini) Noël
Tranolithus exiguus Stover
Tranolithus phacelosus Stover
Watznaueria barnesae (Black) Perch-Nielsen
Watznaueria biporta Bukry
Watznaueria communis Reinhardt
 Age: Middle Campanian
 Biozone: NC19b *Watznaueria* spp.

- Sample S130

Acuturris scotus (Risatti) Wind & Wise
Calculites obscurus (Deflandre) Prins & Sissingh

Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandrecay*

Lucianorhabdus maleformis Reinhardt

Micula concava (Stradner) Verbeek

Micula decussata Vekshina

Quadrum gothicum (Deflandre) Prins & Perch-Nielsen

Stradneria crenulata (Bramlette & Martini) Noël

Watznaueria barnesae (Black) Perch-Nielsen

Watznaueria spp.

A g e: Late Campanian

B i o z o n e: NC20

- Sample S131

Biscutum constans (Gorka) Black

Calculites obscurus (Deflandre) Prins & Sissingh

Ceratolithoides aculeus (Stradner) Prins & Sissingh <90°

Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre

Cyclagelosphaera margerelii Noël

Eiffellithus turriseiffelii (Deflandre) Reinhardt

Lucianorhabdus cayeuxi Deflandre

Lucianorhabdus maleformis Reinhardt

Micula concava (Stradner) Verbeek

Micula decussata Vekshina

Prediscosphaera spinosa (Bramlette & Martini) Gartner

Quadrum gothicum (Deflandre) Prins & Perch-Nielsen

Reinhardtites levis Prins & Sissingh

Watznaueria barnesae (Black) Perch-Nielsen

Watznaueria biporta Bukry

A g e: Campanian/basal Maastrichtian

B i o z o n e: top NC20

- Sample S133

Arkhangelskiella cymbiformis Vekshina

Arkhangelskiella specillata Vekshina

Biscutum constans (Gorka) Black

Braarudosphaera bigelowi (Gran & Braarud) Deflandre

Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre

Cyclagelosphaera margerelii Noël

Eiffellithus eximius (Stover) Perch-Nielsen

Micula concava (Stradner) Verbeek

Micula decussata Vekshina

Stradneria crenulata (Bramlette & Martini) Noel

Watznaueria barnesae (Black) Perch-Nielsen

Watznaueria biporta Bukry

A g e: Early Maastrichtian

B i o z o n e: NC21

- Sample S134

Arkhangelskiella cymbiformis Vekshina

Arkhangelskiella specillata Vekshina

Aspidolithus parvus constrictus (Hattner et al.) Perch-Nielsen
Braarudosphaera bigelowi (Gran & Braarud) Deflandre
Ceratolithoides aculeus (Stradner) Prins & Sissingh <90°
Calculites obscurus (Deflandre) Prins & Sissingh
Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre
Cyclagelosphaera margerelii Noël
Eiffellithus eximius (Stover) Perch-Nielsen
Lucianorhabdus cayeuxi Deflandre
Lucianorhabdus melaformis Reinhardt
Micula concava (Stradner) Verbeek
Micula decussata Vekshina
Micula praemura (Burkry) Stradner & Steinmetz
Parhabdolithus embergeri (Noël) Stradner
Prediscosphaera cretacea (Arkhangelsky) Gartner
Stradneria crenulata (Bramlette & Martini) Noël
Thoracosphaera spp.
 A g e: Early Maastrichtian
 B i o z o n e: NC21

- Sample S135

Arkhangelskiella cymbiformis Vekshina
Aspidolithus parvus (Stradner) Noël
Ceratolithoides aculeus (Stradner) Prins & Sissingh
Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre
Cyclagelosphaera margerelii Noël
Eiffellithus eximius (Stover) Perch-Nielsen
Eiffellithus turriseiffelii (Deflandre) Reinhardt
Kamptnerius magnificus Deflandre
Lithraphidites camioliensis Deflandre
Lithraphidites praequadratus Roth
Lucianorhabdus cayeuxi Deflandre
Manivitella pemmatoidea (Deflandre) Thierstein
Microrhabdulus decoratus (Deflandre)
Micula concava (Stradner) Verbeek
Micula decussata Vekshina
Parhabdolithus embergeri (Noël) Stradner
Quadruplex trifidum (Stradner) Prins & Perch-Nielsen
Reinhardtites levis Prins & Sissingh
Stradneria crenulata (Bramlette & Martini) Noël
Tranolithus gabalus Stover
Watznaueria barnesae (Black) Perch-Nielsen
Watznaueria biporta Burkry
 A g e: Early Maastrichtian
 B i o z o n e: NC21

- Sample S137

Arkhangelskiella cymbiformis Vekshina
Arkhangelskiella specillata Vekshina
Braarudosphaera bigelowi (Gran & Braarud) Deflandre

Cribrosphaerella ehrenbergii (Arkhangelsky) Deflandre
Cyclagelosphaera margerelii Noël
Eiffellithus turriseiffelii (Deflandre) Reinhardt
Lithraphidites praequadratus Roth
Lucianorhabdus cayeuxii Deflandre
Lucianorhabdus maleformis Reinhardt
Micula concava (Stradner) Verbeek
Micula decussata Vekshina
Micula praemura (Bukry) Stradner & Steinmetz
Prediscosphaera cretacea (Arkhangelsky) Gartner
Watznaueria barnesae (Black) Perch-Nielsen
Watznaueria biporta Bukry
Age: Middle? Maastrichtian
Biozone: NC21

Conclusions

The obtained nannoplankton data agree with biostratigraphic evidence coming from benthonic and planktonic forams. Particularly, calcareous nannofossils confirm the Campanian/Maastrichtian boundary below the breccia level with *Siderolites calcitrapoides*. The upper part of the studied sequence, from sample S131 to S135, has been attributed to Early Maastrichtian. The uppermost studied sample (S137, few tens m up to S135) bears nannofossils of Middle Maastrichtian. Its stratigraphic position, below the upper part of the preflysch sequence, indicates that the flysch of the studied area must be post-Maastrichtian in the age (according to Petrović & Jančićević, 1988, thickness of preflysch sequence is estimated 350-380 m). This consideration is supported by calcareous nannoplankton indicating Middle Eocene age of some samples coming from the flysch of Novi Pazar area (de Capoa & Radoičić, in preparation). The first attempt to apply integral biostratigraphy (PFZ, NPZ) in Campanian-Maastrichtian succession of the Vardar Zone has given the results which encourage a detailed multidisciplinary study (PFZ, NPZ, magnetostratigraphy) of these sedimentary rocks.

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