Thirteenth Romanian Symposium on Paleontology

Iași, 16-17 September 2021

Dedicated to Professor emeritus Leonard Olaru at his 85th anniversary

Abstract Book

Edited by Viorel Ionesi, Crina Miclăuș and Daniel Țabără

Editura Tehnopress Iași, 2021

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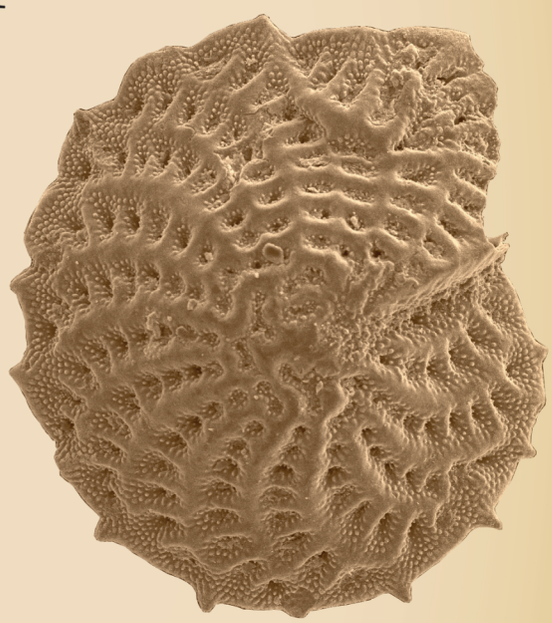

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Thirteenth Romanian Symposium on Paleontology
Programme

All the presentations will be held live online

September 16, 2021

9.00-9.10 – Opening (Welcome and Greetings)

9.10-9.50 – Moment dedicated to Professor emeritus Leonard Olaru at his 85th anniversary (Daniel Țabără)

9.50-10.00 – Pause

10.00 – 12.00 – Oral presentations
Chairperson: Ioan I. BUCUR

10.00-10.20 – Dumitrică, P. & Grădinaru, E. – First finding of Middle Triassic radiolarians in deep-water carbonate-cherty deposits in North Dobrogea
10.20-10.40 – Grădinaru, E. – The Olenekian-Anisian/Early-Middle Triassic boundary and assessment of the potential of conodonts for chronostratigraphic calibration of the Triassic timescale
10.40-11.00 – Bucur, I. I., Enos, P. & Minzoni, M. – New calcareous algae from the Middle Triassic of China
11.00-11.20 – Mircescu, C.V., Bucur, I.I. & Pleș, G. – Understanding the Upper Jurassic-Lower Cretaceous transition in a mixed, pelagic-shallow water depositional setting. A case study from the eastern Getic Carbonate Platform (Postăvaru Massif, Romania)
11.20-11.40 – Crihan, I. M. – The Middle Miocene Bryozoan fauna from Gemini Valley (Banat, Romania)
11.40-12.00 – Pașcalău, P., Bindiu-Haitonic, R., Filipescu, S. & Szekely, F. – The evolution of the paleoenvironments during the early Miocene in the Transylvanian Basin revealed by the foraminifera assemblages from the Racâș section

12.00-13.00 – Pause

13.00 – 15.00 – Oral presentations
Chairperson: Zoltan CSIKI-SAVA

13.00-13.20 – Otriazhyi, P., Obadă, T. & Rățoi, B.G. – Re-examination of the "Phoca" bessarabica holotype

13.20-13.40 – Vasile, Ș., Csiki-Sava, Z., Vremir, M., Norell, M.A., Totoianu, R., Brusatte, S.L., Bălc, R. & Țabără, D. – New data on the Late Cretaceous microvertebrate assemblage from Petrești-Arini (SW Transylvanian Basin, Romania)

13.40-14.00 – Csiki-Sava, Z., Botfalvai, G., Magyar, J., Țabără, D., Albert, G., Makádi, L., Kocsis, L. & Bodor, E.- R. – Of Mice and Men, Maps and Magyarosaurs – rediscovery and significance of Kadić's forgotten dinosaur localities in the western Hațeg Basin

14.00-14.20 – Csiki-Sava, Z., Vasile, Ș., Mremir M., Meng, J., Magyar, J., Botfalvai, G., Brusatte, S.L. & Norell, M.A. – Oldies but goldies – chronostratigraphic and evolutionary implications of the oldest records of kogaionid multituberculates in the uppermost Cretaceous of the Transylvanian area

14.20-14.40 – Păun, E.-I., Rățoi, B. G. & Brânzilă, M. – Additional upper Pleistocene mammals from Zorleni – Bour Hill (Scythian Platform)

14.40-15.00 – Badea, D.-D., Rățoi, B.G. & Brânzilă, M. – Contributions to the study of micromammals from the east Moldavian Platform (Moșna village, Iași county)

15.00-15.20 – Pause

15.20-16.40 – Oral presentations
Chairperson: Mihaela Carmen MELINTE-DOBRINESCU

15.20-15.40 – Țabără, D., Vasile, Ș., Csiki-Sava, Z., Bălc, R., Vremir, M. & Chelariu, M. – Palynological and organic geochemical analyses of the Upper Cretaceous Bozeș Formation at Petrești (southwestern Transylvanian Basin) – palaeoenvironmental implications

15.40-16.00 – Bălc, R., Bindiu-Haitonic, R., Kövecsi, S-A., Vremir, M., Csiki-Sava, Z., Țabără, D. & Vasile, Ș. – Micropaleontological investigation of an Upper Cretaceous section from Petrești locality (Transylvanian Basin, Romania)

16.00-16.20 – Melinte-Dobrinescu M.C. – Calcareous nannofossil extinction, survivorship and speciation during the OAE2 in the Tethys Realm

16.20-16.40 – Grindean, R., Hedi E.M. & Tanțău, I. – Land cover and land-use in the Mureș River middle basin during the Iron Age

16.40-17.00 – Pause

17.00-19.00 – S.P.R. General Assembly

September 17, 2021

9.00 – 10.20 – Oral presentations
Chairperson: Mihaela Carmen MELINTE-DOBRINESCU

9.00-9.20 – Kayğılı, S. – Reticulate *Nummulites* content of the Kırkgeçit Formation, NW Elazığ, Eastern Turkey
9.20-9.40 – Lázár B. & Silye, L. – Quaternary foraminiferal assemblages from the North Atlantic: Effects of the sedimentary processes and oxygenation on the abundance, diversity and preservations
9.40-10.00 – Loghin S., Melinte-Dobrinescu M.C. & Brânzilă M. – Biostratigraphy and palaeoecology of the middle Miocene interval revealed by the Șipote borehole (Moldavian Platform)
10.00-10.20 – Bindiu-Haitonic, R., Bălc, R., Kövecsi, S.A., Pleș, G. & Silye, L. – Calcareous nannoplankton and smaller benthic foraminiferal assemblages from an Eocene nummulitic accumulation (Transylvanian Basin, Romania)

10.20-10.40 – Pause

10.40 – 12.20 – Oral presentations
Chairperson: Crina MICLĂUȘ

10.40-11.00 – Sandy, M. R., Radulović, B. V., & Đaković, M. – Revisiting the Early Jurassic (Sinemurian) brachiopod fauna from Smokovac, Montenegro
11.00-11.20 – Țibuleac P. – Early Jurassic fauna of Prașca Klippe – nautiloids (Rarău Syncline - Eastern Carpathians, Romania)
11.20-11.40 – Lazăr, I., Grădinaru, M., Fernández-López, S. & Grigore, D. – Hardgrounds and condensed horizons in the Middle Jurassic of the Romanian Carpathians: taphonomic analysis and paleoenvironmental significance
11.40-12.00 – Miclăuș C., Seserman A., Ionesi V. & Loghin S. – Mid-Miocene leaves in the offshore-transition heterolithics of Carpathian foredeep
12.00-12.20 – Pricoapsă, D.-D., Mariș, I. & Mare, S. - Sedimentological and petrographical analysis of paleosols from Șard Formation (South Western part of the Transylvanian Basin)
12.20-12.40 – Pleș G., Oprișa A., Silye I., Bucur I.I., Săsăran E. & Mircescu C.V. – Biostratigraphy and paleoenvironmental features of the lowermost Cretaceous carbonates from the Pui-Bănița zone, Southern Carpathians
12.40-13.00 – Juravle D.-T., Florea F.F. & Chira C. – The Miocene deposits of the Outer Moldavides from Suceava Basin (Obcina Mare, Eastern Carpathians)

Abstracts

Contributions to the study of micromammals from the east Moldavian Platform (Moșna village, Iași county)

Badea, D.-D., Rățoi, B.G. & Brânzilă, M.

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Keywords: upper Miocene, Late Vallesian, micromammals, paleoenvironment, biostratigraphy

The last sedimentary megasequence mentioned in the Moldavian Platform (Săndulescu, 1984) represent the late Badenian (middle Miocene) - Maeotian time span (Ionesi, 1994). Deposits belonging to this sedimentary cycle crop out southward of Iași town in Moşna village (48 km from Iaşi). By lithostratigraphic point of view, here is exposed the Balta-Păun Formation. It corresponds with what Ionesi et al. (2005) defined as fresh water biofacies based on the fossil content, consisting of *Planorbis*, *Unio* as well as resedimented *Helix* and *Cepaea*. Balta-Păun Formation also contain mammal fossils (Macarovici & Jeanrenaud, 1958), such as *Hipparion sebastopolitanum*, *Aceratherium incissivum*, *Ichtitherium hipparionum*. The above-mentioned unit is lateral equivalent with the small mactras biofacies (Ionesi et al., 2005), characterized by a fossil assemblage with *Mactra caspia*, *M. bulgarica*, *M. naviculata*.

In the outcrop at Moșna, we found several teeth of fossil micromammals (*Progonomys hispanicus, Ochotona kalfense, Schizogalerix sarmaticum*). Finding micromammals in these sedimentary deposits is an important contribution to the biostratigraphy of the upper Miocene from the Moldavian Platform.

The association of micromammals identified is specific to the Late Vallesian (the beginning of the MN 10 zone, as it is proved based on *Progonomys hispanicus*). Furthermore, this association of micromammals brings important information about the continental paleoenvironment.

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Micropaleontological investigation of an Upper Cretaceous section from Petrești locality (Transylvanian Basin, Romania)

Bălc, R.[1,2], Bindiu-Haitonic, R.[3], Kovecsi, S-A.[3], Vremir, M.[4], Csiki-Sava, Z.[5], Țabără, D.[6] & Vasile, Ș.[5]

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Keywords: Upper Cretaceous, palaeoecology, biostratigraphy, diversity, microfossils

Geological settings

The studied section (450 m in thickness), composed of an alternation of claystone/marlstone with fine sandstone, belongs to the marine Bozeș Formation, overlain by the continental Sebeș Formation. In the upper part of the marine succession, Vremir et al (2014) pointed out a transition through a brackish-estuarine environment. The main purpose of this study was to assess the age of the entire section and to reconstruct the paleoenvironmental conditions based on calcareous nannofossil and foraminifera assemblages.

Methodology

A total of 59 samples were analyzed for their calcareous nannofossil content using a light microscope at 1000x magnification. The calcareous nannofossil zonation of Burnett (1998) and Perch-Nielsen (1985) was used to assess the biozones and the age of the studied sediments. For the analysis of foraminifera, the samples were processed using the standard micropaleontological method (Armstrong & Brasier, 2005). The foraminifera were picked from the >63 µm fraction using an Optika stereomicroscope.

Results

Calcareous nannofossils data. One hundred thirty-eight species of calcareous nannofossils were identified in the studied samples. The calcareous nannofossil assemblages are clearly dominated by *Watznaueria barnesiae* exceeding 50% in three samples; its lowest percentage is 25.70%. In terms of abundance, this species is followed by *Prediscosphaera cretacea*, *Cribrosphaerella ehrenbergii*, *Retecapsa crenulata*, *Eiffelithus eximius*, *Tranolithus orionatus*, and *Micula staurophora.* In the lower part of the studied section a higher abundance of *Russellia* spp. (*R. laswellii* and *R. bukry*) was noticed, decreasing slowly upwards. The absence of Tethyan species (*Uniplanarius trifidus*, *U. sissinghii*) or their low presence (*Ceratolithoides aculeus*) represents an important feature of the calcareous nannofossil assemblages. The abundance pattern of *Watznaueria barnesiae* can be linked to trophic fluctuation and/or low preservation (Erba, 1992; Roth and Bowdler, 1981). On the other hand, this taxon is considered as a warm-water one (Doeven, 1983; Gardin, 2002), increasing under oligotrophic (Erba et al., 1992; Thibault and Gardin, 2007) and low fertility conditions (Roth and Krumbach, 1986; Erba, 1992). Due to the unclear ideas about the abundance of *Watznaueria barnesiae*, it is difficult to decide whether this abundance is a result of a warmer and oligotrophic environment or of dissolution processes. Alves et al. (2018) described the abundance pattern of *Watznaueria barnesiae* as a combination between poor preservation and an oligotrophic depositional environment. Based on the presence of *Ceratolithoides aculeus* (FO at the base of UC15b subzone/CC20 Zone (Perch-Nielsen, 1985) – upper lower Campanian) we can conclude that the studied section is not older than the above mentioned age.

Foraminifera data. Preliminary data based on the analysis of foraminifera distribution along the studied section revealed that these are present in the basal and middle part of the section and have a moderate to poor degree of preservation. The assemblages contain smaller foraminifera individuals, belonging to both benthic and planktonic groups. Among the benthic foraminifera, the agglutinated group is represented by species of *Ammodiscus*, *Reophax*, *Bulbobaculites*, *Haplophragmoides*, *Dorothia* and has been picked only from few samples. The calcareous benthics are present in all the studied samples, being represented by *Stilostomella* spp., *Vaginulina* spp., *Lenticulina* spp, *Cibicides* spp., *Gyroidina* spp. Planktonic forms are poorly preserved, occurring in most of the samples, and are represented by *Heterohelix* spp., *Globigerinelloides* spp., *Globotruncana* spp., *Globotruncanella* spp.. Preliminary biostratigraphic assessment is based on the planktonic taxa *Globotruncana ventricosa* which has its first occurrence at the base of the Campanian and its last occurrence at the top of Maastrichtian (Bolli at al., 1985).

Conclusions

A rich calcareous nannofossil assemblage was identified in Petrești section, with some distinct features, the most important one being the absence of the Tethyan species described in many Tethyan sites. The clear dominance of *Watznaueria barnesiae* can be interpreted as being either a consequence of a low preservation status of the assemblages or as an indicator of a warm and oligotrophic environment. In the basal part of the section, the increased abundance of *Russellia bukryi* and *Russellia laswellii* can indicates shallower waters associated with nearshore or marginal environment. This shallow marine environment is confirmed by the structure of the foraminiferal assemblages too, mostly in the basal and middle part of the sedimentary succession.

Based on both calcareous nannoplankton and foraminifera assemblages, the age of the studied section is considered as starting with the late early Campanian. It is important to mention that bio-events marking the Maastrichtian age were not identified.

Acknowledgments: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P4-ID-PCE-2020-2570, within PNCDI III.

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Calcareous nannoplankton and smaller benthic foraminiferalassemblages from an Eocene nummulitic accumulation (Transylvanian Basin, Romania)

Bindiu-Haitonic, R.[1], Bălc, R.[1,2,3], Kövecsi, S.A.[1], Pleș, G.[1] & Silye, L.[1]

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Keywords: palaeoecology, biostratigraphy, diversity, microfossils

The high-resolution study of the calcareous nannoplankton and smaller benthic foraminifera assemblages from the Eocene (Bartonian) nummulitic accumulation from the Transylvanian Basin proved to be extremely important regarding the biostratigraphic and paleoecological information. The samples were collected from 21 exposures (nine locations in the Gilău area and one location in the Meseș area) of the Căpuș Formation (Popescu, 1978). Except from 3 samples, the microfossil content was recovered from the sandy clayey matrix that loosely binds the *Nummulites* specimens. Data analyses included abundance, infaunal/epifaunal percentages, diversity indices, benthic foraminifera dissolved oxygen index for smaller benthic foraminifera and multivariate data analysis (hierarchical clustering and principal component analysis) for both groups of microfossils.

For the Gilău area, the shallow and oligotrophic environment is suggested by assemblages consisting of *Zygrablithus bijugatus*, *Blackites inflatus*, *Neococcolithes dubius*, *Ericsonia* spp., larger sized reticulofenestrids (calcareous nannoplankton), and *Pararotalia* spp., *Lobatula lobatula*, *Cibicides* spp. (smaller benthic foraminifera). In the Meseș area, high percentages of *Reticolofenestra minuta* (calcareous nannoplankton), agglutinated foraminifera, and *Nonion*, *Protelphidium*, *Reusella* (calcareous benthic foraminifera) indicate more nutrient-rich marine waters and a deeper environment.

Based on micropaleontological content, the deposits can be correlated with the *Reticulofenestra bisecta* Zone and standard NP17/CP14 Zones (Ocada & Bukry, 1980; Perch-Nielsen, 1985), and the smaller benthic foraminiferal *Pararotalia subinermis* Interval Zone (Rusu et al., 2004).

Detailed results were published by Bindiu-Haitonic et al. 2021 (a, b) in Marine Micropaleontology (https://doi.org/10.1016/j.marmicro.2021.101988)
and Data in Brief (https://doi.org/10.1016/j.dib.2021.107154) journals.

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New calcareous algae from the Middle Triassic of China

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Keywords: Triassic, China, Calcareous algae

The Yangtze carbonate platform (Southern China) recorded a long evolution from Proterozoic until the basal Upper Triassic. During Triassic, this platform was dominated by shallow water carbonates. In various sectors of the platform, the Middle Triassic (Anisian-Ladinian) successions contain abundant microfossil assemblages. They consist of benthic foraminifera and calcareous algae. Bucur & Enos (2001) published the first paper about the Middle Triassic dasycladalean algae from the Guizhou region.

In the present study, we describe algae and microproblematic organisms from three sections: Honyan, Longtou and Guanling. Some dasycladalean algae are well known from the Alpine domain: *Oligoporella minutula*, *Oligoporella pilosa*, *Poncetella hexaster*, *Diplopora annulatissima*, *Diplopora annulata*, *Eoteutloporella triasina*, *Pseudodiplopora proba*, *Macroporella dinarica.* However, the dasycladalean association is dominated by species belonging to the genus *Kantia*. Besides *Kantia dolomitica* and *Kantia comelicana*, some new species are present. They are characterized by the presence of intusannulation. This feature is unknown for the *Kantia* species from the Alpine domain. The dasycladalean association contains also new species of the genus *Mizzia* (?*Neomizzia*) and specimens belonging to the organogenus *Acicularia* and/or *Terquemella*. Rare specimens of *„Solenopora*" and *Rivularia* type cyanobacteria are present besides dasycladalean algae. The algal association is accompanied by microproblematic organisms (*Tubiphytes* sp., *Zorniella obscura*, *Plexoramea cerebriformis*, *Ladinella porata*, and *Baccanella floriformis*). Anisian-Ladinian foraminifera complete the micropaleontological association spectrum from the studied region. The most important are *Meandrospira dinarica*, *Endotriadella wirzi*, *Paleolituonella meridionalis*, *Turriglomina mesotriasica*.

The microfossils from the Middle Triassic carbonate platform of southern China belong to the Eastern Tethys province. Some of these species are also present in the Western Tethys (Alpine Domain). On the other hand, the new species presented in this study are absent from the Alpine Domain, and probably represent endemic species for the Eastern Tethys.

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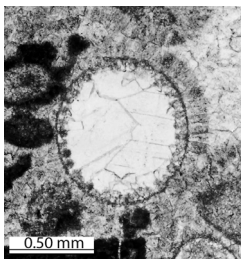
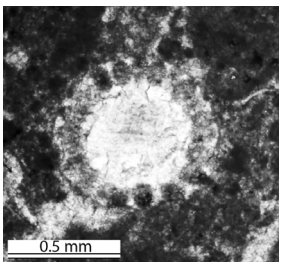
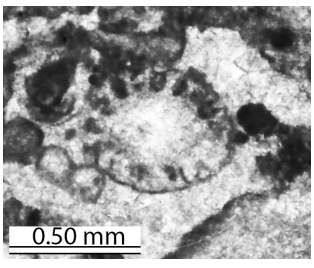


A



B



C

Fig. 1 A-C. *Aciculella*/*Acicularia* div. sp.

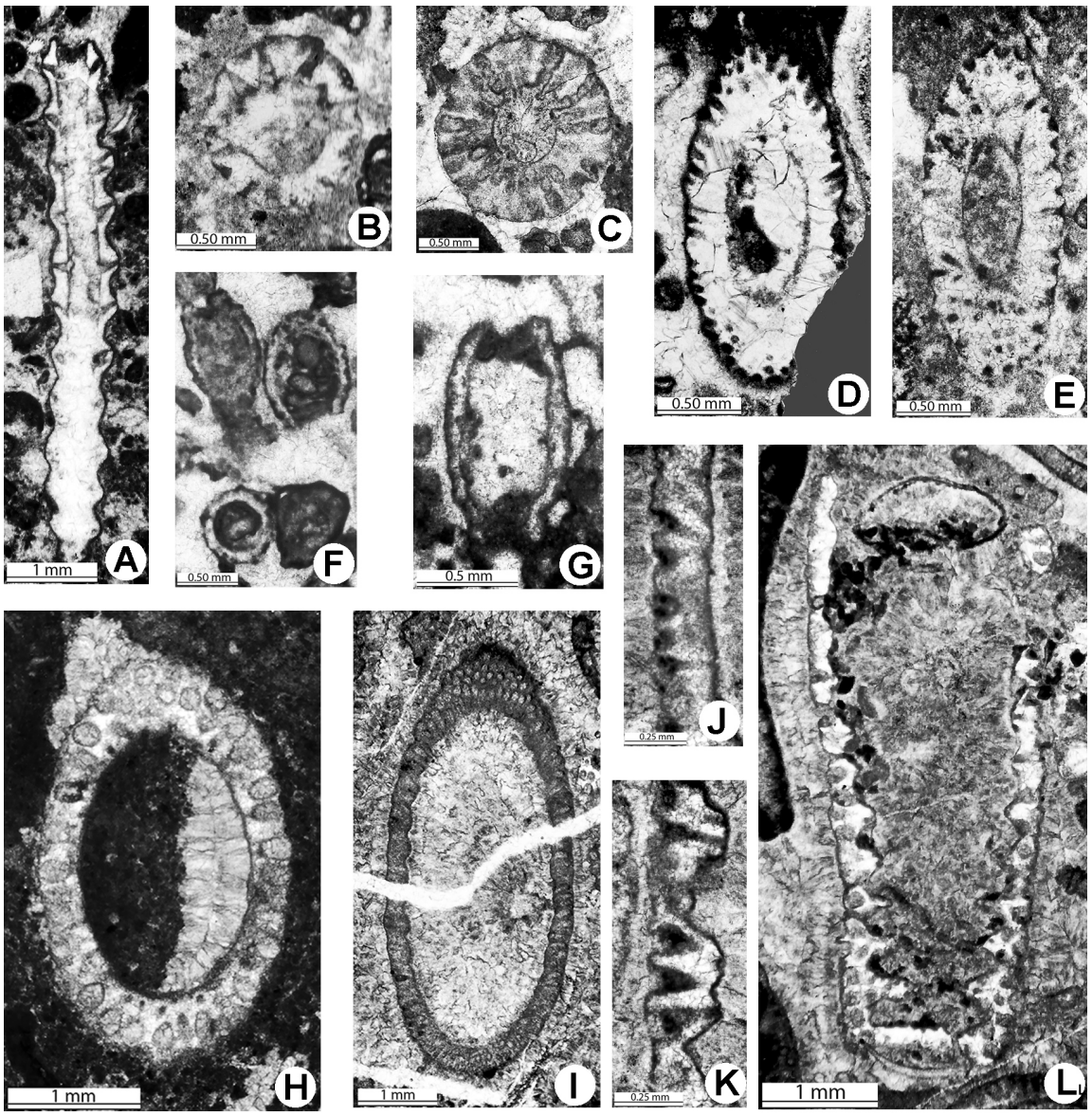


Fig. 2

A - *Oligoporella minutula*; B - *Oligoporella pilosa*; C - *Poncetella hexaster;*

D, E - *Pseudodiplopora proba;* F, G - *Neomizzia*? sp.*;* H-L - *Kantia* div. sp.

The Middle Miocene Bryozoan fauna from Gemini Valley (Banat, Romania)

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Keywords: Faget Basin, Lower Badenian

The studied bryozoan fauna comes from the washing residues of over 30 samples collected in 1975 by Dr. Gheorghe Popescu from the Gemini Valley, East of Nemeșești village, in Banat region. Although the samples were collected mainly for the study of foraminifera microfauna, the residues, especially the coarser ones, also had a rich content in specimens of other groups of microfossils, among which the bryozoans were standing out.

Gemini Valley is a right-side contributor of the Bega Valley, and the middle Miocene deposits here represent the filling of the Făget Basin, a small Neogene sedimentary basin oriented approximatelly east-west, situated between the Southern Apuseni Mts., at north, and the Poiana Ruscă Mts., at south.

The Lower Badenian deposits are very well exposed on the Gemini Valley where they are underlain by Neogene volcanic rocks. They dip soutward and were maped on almost 1 km downstream and about 350 m thickness. The succesion consists mainly of fossiliferous clays, marls, and sandy marls, but begins with 2-3 m of sandstones and microconglomerates. The age of these deposits is given by the extremly rich assemblage of foraminifera. Although the planktonic foraminifera are usually few and with a low diversity, the presence of *Orbulina suturalis* Brőnniman 1951 proves a lower Badenian (upper Langhian) age. The same lower Badenian age is suggested by the extraordinarily rich and diverse assemblages of benthic foraminifera, with numerous specimens of the genera *Amphistegina* and *Heterostegina*.

The bryozoans are present in almost all samples, with, sometimes, very well-preserved assemblages, made of diverse cyclostomes and cheilostomes. For their systematics, we used mostly the online data from the site of the International Bryozoology Association (https://www.bryozoa.net/), as well as the papers of Zagorsek (2010a, 2010b).

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Of Mice and Men, Maps and Magyarosaurs – rediscovery and significance of Kadić's forgotten dinosaur localities in the Hațeg Basin

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Keywords: early Maastrichtian, fossil localities, geoinformatics, palaeoenvironment, wetlands

Introduction

The Hațeg Basin represents the most important location in Romania that yields latest Cretaceous continental vertebrates, including dwarf dinosaurs and endemic mammals, as well as one of the most important localities in Europe. The vertebrate-bearing uppermost Cretaceous continental beds are spread across different parts of the basin, and were included into several roughly synchronous lithostratigraphic units. Of these, the most important ones are the Sînpetru Formation in the central part of the basin, home of the historical vertebrate fossil collection amassed by Nopcsa (Nopcsa, 1905), as well as the Densuș-Ciula Formation, in its northwestern part. The Sînpetru Formation and tentatively correlated successions at Pui or the Râul Mare River, as well as the middle-upper part of the vertebrate-bearing section of the Densuș-Ciula Formation, had been explored intensively during the last century, with remarkable results (see Csiki-Sava et al., 2016). Meanwhile, the lower part of this latter unit, cropping out around Ciula Mică, Vălioara and Boița, has received less attention, mostly due to rather poor outcrops. Despite this, the second historically important vertebrate collection from Hațeg, made by Hungarian Geological Institute field geologist O. Kadić (Kadić, 1916), originate from this area. Unfortunately, precise locality data for this collection, now housed at the Mining and Geological Survey of Hungary, were not given by Kadić in the brief account reporting his excavations at Vălioara. Thus, the origin of these specimens, including potential type material of iconic taxa such as the dwarf titanosaur *Magyarosaurus dacus*, remained unknown.

Methodology

The game-changer in the scientific exploitation of the Kadić collection was represented by the re-discovery, in the archives of the MBFSZ, of the unpublished topographic base map used by Kadić while mapping in the Vălioara area from 1909. On this manuscript map, he marked up precisely the position of his main excavation sites (numbered from I to VII), which allowed to georeference and re-plot these onto the present-day topography. This, in turn, opened up the opportunity to relocate in the field, the sedimentary successions surveyed by Kadić. Furthermore, by using the plotted positions as well as by matching the scarce details given by Kadić in his report concerning the general lithology and colour of the sediments and/or their fossil content and its preservation style, the identification the approximate positions of the excavation sites themselves became possible.

Results

Of Kadić's seven main excavation sites, six (I to VI) were successfully relocated in the field during

our reconnaissance trips in late 2019. More importantly, fossil vertebrate occurrences (sites K1 to K6) were also spotted in the proximity of the re-plotted historical excavation site positions, further strengthening the case for these identifications. Besides the six historical fossiliferous levels, one entirely new vertebrate occurrence (Nvs) was also recorded in the area. A detailed stratigraphical-sedimentological logging along the vertebrate-bearing successions has clarified the stratigraphic position and palaeoenvironmental setting of the fossil localities, showing that most of these (I-V, respectively K1-K5 and Nvs) are stratigraphically lower than other fossil occurrences known to us previously in the Vălioara area. According to the chronostratigraphical tier system developed by Csiki-Sava et al. (2016), our results position the Kadić localities I to V as well as our occurrences K1-K5 and Nvs in the very basal part of the 'middle member' of the Densuș-Ciula Formation, suggesting an early early Maastrichtian age for them. All the taxa reported previously by Nopcsa (1915) from the Kadić collection (*Kallokibotion*, *Allodaposuchus*, *Zalmoxes*, *Telmatosaurus*, *Magyarosaurus*) are also present in our newly collected material, but we have succeeded to add further taxa to the local faunal list – maniraptoran theropods and (most intriguingly) multituberculate mammals. By using geochemical investigations (REE geochemistry profiles), we also compared bones from our recent surveys to those from the historical collection, and were able to further ascertain that the specimens collected by Kadić originate roughly from the same area where we identified the fossil occurrences. In some cases (sites I vs K1, respectively VI vs K6), the fossils we recovered certainly represent other fossiliferous levels than the ones excavated by Kadić a century ago, although these levels must be still closely associated. Sedimentological, taphonomical and palynological studies of the studied vertebrate-bearing successions show that most of these were deposited in dominantly poorly drained, wetland-type environments, unlike the better-drained, calcareous paleosol-bearing fossiliferous successions in other parts of the basin.

Conclusions

Re-identification in the field of the century-old Kadić excavation sites in the neighbourhood of Vălioara, in the western Hațeg Basin, as well as the detailed stratigraphic, sedimentological, paleontological and geochemical study of the local successions that include these sites, revealed them as some of the oldest fossiliferous occurrences in the Hațeg Basin. The known composition of the vertebrate assemblage from these localities was completed now through the discovery of new taxa – maniraptoran theropods and multituberculate mammals. Comparative geochemical (REE spectra) fingerprinting of the historical and the newly collected material, alongside our sedimentological and taphonomical observations, allowed us to re-trace the approximate localities of origin for some of the old Kadić specimens, including that of the potential type material of *Magyarosaurus dacus*, a taxon that finally may have its type locality pinpointed. Most of the Kadić localities and of those identified by us are linked to poorly drained, wetland-type depositional environments, otherwise poorly represented in the uppermost Cretaceous of the Hațeg Basin.

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Oldies but goldies – chronostratigraphic and evolutionary implications of the oldest records of kogaionid multituberculates in the uppermost Cretaceous of the Transylvanian area

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Keywords: Kogaionidae, Campanian, Maastrichtian, body size evolution, character evolution

Introduction

Kogaionids form a peculiar, European endemic radiation of the derived cimolodontan multituberculates, a radiation that populated this continent during the latest Cretaceous-Paleocene. The first members of this clade have been discovered in Paleocene sites of Western Europe, although their true identity was not recognized at that time given the nature of their fossil record (isolated teeth; e.g. Vianey-Liaud, 1979). This came only later, with the discovery of significantly richer and much better preserved kogaionid fossils in the uppermost Cretaceous continental beds of the Transylvanian area, particularly the Hațeg Basin. These include associated sets of teeth, incomplete skulls, and even partial skeletons (e.g. Rădulescu & Samson, 1996, Smith & Codrea, 2015, Csiki-Sava et al., 2018), revealing the kogaionids as one of the very few European vertebrate clades that survived the Cretaceous/Paleogene Boundary extinction. Despite its much-improved fossil record, the phylogenetic relationships, origin and early evolutionary history of the clade remains shrouded in mystery; regardless of the preferred phylogenetic hypothesis, there is both a large morphological gap and an extensive fossil ghost-lineage separating the kogaionids from other cimolodontans.

Methodology

In order to gain new insights into the evolutionary history and morphological transformations of the kogaionids, we have used the integrated chronostratigraphic faunal tier distribution framework developed by Csiki-Sava et al. (2016) for the latest Cretaceous vertebrate-bearing successions and localities, onto which we mapped the approximate distribution of the Transylvanian multituberculate-bearing sites. Although the relative stratigraphic position of these fossil sites across the different sedimentary areas (the Hațeg, Transylvanian and Rusca Montană basins) is still poorly constrained, within-basinal successions can be more reliably reconstructed and these may offer a glimpse into the trends of evolutionary transformations present within the Kogaionidae.

Results

Although the largest part of the Late Cretaceous fossil record of the kogaionids originate from relatively younger deposits (especially faunal tiers 2 and 3 of Csiki-Sava et al., 2016), the recent years have seen the discovery of several early multituberculate occurrences in both the Transylvanian and the Hațeg basins. The stratigraphic position of the southwestern Transylvanian kogaionid fossil localities near Petrești is especially intriguing, as these fossil sites appear to be placed around the Campanian/Maastrichtian boundary, and the earliest of these may even be as old as very latest Campanian (Vremir et al., 2014, 2015), which would make these discoveries the earliest stratigraphically reasonably well constrained kogaionid occurrences in the world. In the Hațeg Basin,

new kogaionid discoveries near Pui (Vasile et al., 2019) and Vălioara (Botfalvai et al., 2021) represent the oldest known occurrences in their respective local successions, and probably the oldest ones in the Hațeg Basin as well, although they appear to be slightly younger (early Maastrichtian in age) than those from Petrești. The discovery of these early kogaionid localities offers a new insight into evolutionary changes that may have taken place during the Cretaceous within the clade. They also may give us hints about the currently hidden pre-latest Campanian evolutionary history of the group.

The study of these early occurrences reveals that they are represented exclusively by small-sized taxa, similar to most of those known from the Paleocene, whereas larger-bodied kogaionid taxa appear only slightly later. Previous comparisons between the more common and best-known larger-sized latest Cretaceous kogaionids and their Paleocene relatives hinted at the presence of certain simple and clear morphological trends in the history of the clade, such as relative shortening of the P3 and p4, simplification of the m1 structure, and elongation of the M1 developing a complete inner cusp row. The morphologies documented in these early kogaionid occurrences from Transylvanian suggest, however, that such clear-cut trends may represent an oversimplification, and that in certain dental features, the oldest, ?latest Campanian-earliest Maastrichtian kogaionids are more reminiscent of the Paleocene members of the clade, than of their largely synchronous and sympatric relatives of larger size. This suggests that significant mosaic evolution of characters may have characterized the kogaionid evolutionary history, as well as that hallmark features such as the highly apomorphic elongated P3 or the short and wide M1 may not represent the plesiomorphic character states within the group, despite being present in most latest Cretaceous kogaionids.

Conclusions

The recent discovery of several kogaionid occurrences that can be placed in faunal tiers 1 or 1/2 (?latest Campanian to early early Maastrichtian) within the Transylvanian uppermost Cretaceous continental beds sheds new light onto the evolution of this group. They represent the earliest known occurrences of kogaionids, thus extending their known stratigraphic range, and also document a more complex character evolution within the group that was previously acknowledged.

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First finding of Middle Triassic radiolarians in deep-water carbonate-cherty deposits in North Dobrogea

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Keywords: radiolarian new taxa, early Illyrian (late Anisian), Grădiștea Island, Tulcea Unit, North Dobrogean Orogen

The first finding of identifiable radiolarians is here reported for the first time from the Middle Triassic deep-water carbonate-cherty deposits that are largely represented in all tectonic units of the North Dobrogean Orogen. The eastern coast of the Grădiștea Island, located at the junction between the Razelm and Babadag lakes, exposes a succession of thin- to medium-bedded carbonate-cherty deposits belonging to the Triassic succession of the Tulcea Unit. Samples from several levels were dissolved with 10% diluted acetic acid, and, after that, the residue was treated with diluted hydrochloric acid. Although radiolarians are present in thin sections in the whole succession, only a single level delivered a very rich assemblage, including more than 30 determinable species, belonging to 13 families and 25 genera. Three genera and 11 species are newly described from this level. Some radiolarians are pyritized, but most of them are limonitized, in which case their determination is difficult or impossible.

The age of the radiolarian fauna from Grădiştea is certainly early late Anisian (early Illyrian). The stratigraphically most important species of this assemblage is *Tiborella tribulata* Marcucci & Bertinelli, 2012 which is very close to *T. florida* (Nakaseko & Nishimura, 2013), the latter being the marker species for the *T. florida* subzone of the *S. transitus* Zone (Kozur, 1995). The absence in this assemblage of representatives of the members of the family Oertlispongidae with bent spines (*Oertlispongus*), which are frequent in the latermost Illyrian and early Ladinian, and whose FAD is recorded in the latermost Anisian, proves that this assemblage is older than the latermost Illyrian. It may be compared with the fauna of the Loibl Formation from Carinthia, Austria (Kozur et al., 1996) and Kamnic-Savinja Alps from Slovenia (Celarc et al., 2013).

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The Olenekian-Anisian/Early-Middle Triassic boundary and assessment of the potential of conodonts for chronostratigraphic calibration of the Triassic timescale

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Keywords: *Chiosella timorensis*, conodont, late Spathian FAD, defunct biotic proxy for base Anisian, Triassic timescale

The conodont *Chiosella timorensis* (Nogami, 1968) has long-time been considered to be a suitable biotic proxy for the Olenekian-Anisian/Early-Middle Triassic boundary, and this is still agreed in the latest version of the Triassic timescale (Ogg et al., 2020). The conodont *Chiosella timorensis* was promoted as a proxy for the nominated boundary in the early 1980s when the ammonoid record around the boundary was not yet well established. On the other side, until the mid 1990s the taxonomic definition and the lineage of the conodont *Chiosella timorensis* were not well stated, and even now there are still controversial interpretations of the taxonomic content of this conodont taxon. The recently acquired ammonoid record around this boundary clearly shows that the FAD of this conodont is located well below the boundary, i.e. in the upper Spathian/upper Olenekian/upper Lower Triassic. The new data achieved from the ammonoid/conodont record around the nominated boundary, especially in the western USA (Goudemand et al., 2012), and also in the Deşli Caira section in Romania (Grădinaru & Gaetani, 2019; Golding, 2021), firmly demonstrate that the conodont *Chiosella timorensis* is a defunct proxy for the Olenekian-Anisian/Early-Middle Triassic boundary. Consequently, the present data on the ammonoid-documented Olenekian-Anisian/Early-Middle Triassic boundary requires the recalibration of all physical events that have been tied to the FAD of the conodont *Chiosella timorensis*. The case of the Albanian Kçira section (Muttoni et al., 2019), for which the chronostratigraphic interpretation of the ammonoid record is proved incorrect, and also the inconsistent data on the ammonoid/conodont biochronology in the recently proposed Chinese GSSP candidates for the Early-Middle Triassic boundary (Chen et al., 2020) definitely make the conodont *Chiosella timorensis* a defunct proxy for the nominated boundary. The history of the controversial usage of the conodont species *Chiosella timorensis* in defining the Olenekian-Anisian boundary justifies a discussion about the usefulness of conodonts in the chronostratigraphic calibration of the standard Triassic timescale. One may conclude that the conodonts are not qualified, and have not a reasonable potential, to be used to define or to redefine the boundaries of chronostratigraphic units in the standard Triassic timescale, which have been defined on ammonoid biochronology.

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Land cover and land-use in the Mureș River middle basin during the Iron Age

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Keywords: palynology, human impact, climate change, vegetation history, Transylvania

Changes in land-use and land cover represent a complex environmental, socio-economic, and technological problem. The effect of land cover change on the supply of ecosystem services derives not only from the reduction of the original cover, but also from the transformation of the landscape structure. The evolution of human communities from the Iron Age had a notable impact on the composition and distribution of different types (classes) of bio-physical coverage of the landscape.
We present a record of changes in land cover and land-use spanning the Iron Age, from Băgău peat bog in the Middle Mureș Valley (Transylvanian Depression). During the early to mid La Tène (ca. 350 - 200/175 BC), the landscape was dominated by dense mixed forests of sessile oak (*Quercus*) and hornbeam (*Carpinus betulus*). The similar proportions of crops and grasslands suggest that agricultural practices were equally distributed between cultivating plants and animal husbandry at the time. The mid to late La Tène (ca. 200/175 BC - 106 AD) land cover was characterized by declining proportions of mixed forests dominated by oak and hazel (*Corylus avellana*) and the expansion of open land. The increasing trend of crops abundance indicates a gradual extension of arable land through deforestation. The land cover during the Roman period (106 - 274 AD) was similar to that of early to mid La Tène, with dense forests of oak and hornbeam and a comparable ratio between crops' and open land herbs' proportions. The latter suggests mixed land-use due to diverse agro-pastoral practices. During the post-Roman period (Migrations period; 274 - 450 AD), the forest composition was more diverse than former periods and was dominated by oak and beech (*Fagus sylvatica*). The decline of crops proportion and increased forest cover, suggest gradual abandonment of settlements and related arable terrain, in favor of semi-nomadic agro-pastoral activities.

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The Miocene deposits of the Outer Moldavides from Suceava drainage basin (Eastern Carpathians)

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Keywords: Paratethys, paleogeography, litostratigraphy, nannoplankton

Paleogeography

In this paper, the correlation of the Miocene litostratigraphic units from Vrancea and Tarcau Nappes, Eastern Carpathians, cropping out in Suceava Basin drainage basin is discussed. The isolation of the Paratethys had major consequences on the distribution of the fossil assemblages with biostratigraphic and paleoenvironmental values. Accordingly, it was developed a different chronostratigraphic chart, whose units have to be correlated with those of global chronostratigraphic chart. The isolation of the Paratethys began in the late Eocene (Priabonian, ca 35 Ma) by drastic reduction of the connections with the Tethys Ocean. Therefore, during the Oligocene, an anoxic paleoenvironment was established (Popov et al., 2004; Van der Boon et al., 2018). Based on the post-Eocene paleogeographical changes, 4 stages in the Paratethys evolution were recognized (Olteanu & Jipa, 2006): Protoparatethys, Eoparatethys, Mesoparatethys, and Neoparatethys (Sarmatian-Holocene). By paleogeographic point of view, in the Paratethys, four different area were defined (Olteanu & Jipa, 2006), namely: the Western Paratethys, covering the Rhodanian Basin, Central Paratethys, covering Pannonic and Dacic Basins, and Eastern Paratethys corresponding the Euxinic, Caspic, and Aral basins. The Carpathian basin is part of the Central Paratethys, being separated by the Eastern Paratethys by the dobrogean-moesian high (Popov et al., 2004). Carpathian Basin is the old foreland basin systems of Grasu et al. (1999). During the lower-middle Miocene, the structogenesis of Eastern Carpathians was defined, the Tarcau and Vrancea Nappes being included in the Carpathian thrust wedge in Old and Young Styrian tectogeneses (Săndulescu, 1984). Consequently, their youngest pre-tectonic deposits are pre-Badenian in age.

Lithostratigraphy and biostratigraphy

The Miocene deposits of Vrancea and Tarcau Nappes, cropping out in Suceava drainage basin show lateral changes from east to west, namely from black shales to calcareous fine sandstones. By lithostratigraphic point of view, from east to west, these deposits belong to: upper dysodilic shales and menilites (UDM), Gura Soimului Formation (GSF); UDM, Arşita Fm. (*sensu* Juravle, 2007), unconformably overlain by conglomerate unit (Micu &Constantin, 1993, in Juravle, 2007); Vinețisu Fm (VF). The former belong to Vrancea Nappe, while the latter to median and western areas of Tarcău Nappe. The Miocene deposits are not preserved on eastern area of Tarcau Nappe.

For the biostratigraphic correlations we have used the biozonations of Martini (1971), Okada & Bukry (1980), Backman et al. (2012), Agnini et al. (2017), as well as the papers Bogatu (1999, in Juravle, 2007), Florea (1999, in Juravle, 2007), Melinte (2005), Popescu (2005), Juravle & Florea (2006), Juravle (2007), Melinte-Dobrinescu & Brustur (2008), Chira et al. (2018), regarding the Miocene deposits of Eastern Carpahian foreland. In the Tocila Member of the upper dysodilic shale formation, cropping out in Sucevița half-window of Vrancea Nappe, Bogatu (1999) describes an association biozone (AZ) with *Triquetrorhabdulus carinatus* Martini (FO, NP25b/NP25a; Melinte; 2005), *Helicosphaera scissura* (FO, NN1), *Dictyococcites bisectus* (LO, NN1/NP25b; Melinte, 2005). As such, the Oligocene-Miocene boundary is contained in the above-mentioned lithostratigraphic unit. This boundary can be traced in the Arşița Formation, the uppermost unit of the sedimentary succession characterizing the VN in Gura Putnei half-window, where Juravle (2007) describes an association biozone with: *Sphaenolithus ciperoensis* (FO, NP24/LO, NP25; Backman et al, 2012; Agnini et al., 2017), *Triquetrorhabdulus carinatus* Martini (FO, NP25b/NP25a; Melinte; 2005), *Dictyococcites bisectus* (LO, NN1/NP25b; Melinte, 2005), *Discoaster druggi* (FO, NP25),

Helicosphaera euphratis (X, NN2; Backman et al, 2012; Agnini et al., 2017). GSF is Burdigalian, this age being supported by a nannoplankton assemblage belonging to NN2-NN3 biozones (Popescu, 2005). In Tarcau Nappe sedimentary succession, the same boundary was traced in the Vineţisu Formation, Along the Dumbravnic brook, a tributary of Sacries River, is exposed a continuous sedimentary succession where VF overlays Kliwa Sandstone Formation. In the lower part of the sedimentary succession, Chira et al. (2018) describes nannoplankton assemblage indicating NP22-NP23 biozones, with: *Reticulofenestra dictyoda, R. bisecta, R. stavensis, R. reticulata; Zygrablithus bijugatus, Lanternithus minutus, Sphenolithus moriformis, S. spiniger, Helicosphaera* cf. *compacta, Discoaster* cf. *deflandrei, Coccolithus pelagicus, C. eopelagicus* In the upper part of the analysed succession, the nannoplankton assemblage, consisting of *Helicosphaera scissura* (FO, NN1; Melinte; 2005), *Zygrablithus bijugatus* (LO, NN1), *Sphenolithus spiniger* and *Helicosphaera* cf. *bramlettei* (LO, NP25), as well as *Coccolithus pelagicus* and *C. eopelagicus*, indicates the NN1-NN5 biozones Similar results yielded the samples analysed from the deposits exposed along Loba-Rașca, Lupoaia, Boului (Paltinu) brooks.

Conclusions

Due to the complex paleogeographic changes of Paratethys in Miocene, where stages of Carpathian Basin isolation by/opening to the Mediterranean domain succeeded, the biostratigraphic correlation of the Miocene lithostratigraphic units poses difficulties when the models used for the latter are used.

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Reticulate *Nummulites* content of the Kırkgeçit Formation, NW Elazığ, Eastern Turkey

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Keywords: Reticulate *Nummulites*, biometry, Upper Bartonian-Priabonian.

The study area is located 15 km northwest of Elazığ, eastern Anatolia, Turkey. Magmatic, metamorphic and sedimentary units ranging from Devonian-Jurassic to Plio-Quaternary in age crop out in this area and its vicinity.

Reticulate *Nummulites* are common in the late middle and upper Eocene shallow marine deposits in Tethys. Because of peculiar features of the test surface, the identification of this group among the nummulids is rather easy, though the species concept is complicated (Papazzoni, 1998; Less and Özcan, 2012; Cotton et al., 2015). Reticulate *Nummulite*s (*Nummulites fabianii* lineage) occur from the late Lutetian to early Chattian in Tethys (Less et al., 2018). Reticulate *Nummulites*, whose evolution is poorly understood, are a distinctive and widespread group of *Nummulites*, commonly used in biostratigraphy (Cotton et al., 2015). The proloculus size of the megalospheric forms of reticulate species has been used in the determination of *Nummulites fabianii–Nummulites fichteli* lineage in the western Tethys. At the same time, the increase of the average length of chambers in the third whorl has secondary importance in recognizing the evolution of the reticulate *Nummulites* because it is affected also by ecological factors (Özcan et al., 2019).

The benthic foraminiferal assemblage of the Kırkgeçit Formation (upper Bartonian-Priabonian) was collected from two measured sections. 289 oriented thin sections from loose samples and 50 thin sections from rock samples were prepared in order to define biozones based on larger benthic foraminifera (LBF). These are determined from both equatorial and axial thin sections. 169 tests of megalospheric form of reticulate *Nummulites*, collected from the two measured sections, were used for biometry. The assemblages of LBF were determined, and correlated with shallow-marine fauna and biota in the deposits of Tethys.

Reticulate *Nummulites* as well as *Nummulites striatus* (Bruguière), *Operculina* ex. gr. *gomezi* Colom & Bauzá, *Sphaerogypsina globulus* (Reuss), *Asterigerina rotula* (Kaufmann), *Gyroidinella magna* (Le Calvez), *Halkyardia minima* (Liebus), *Chapmanina gassinensis* (Silvestri), *Chapmanina elongata* Sirel & Deveciler, *Silvestriella tetraedra* (Gümbel), *Penarchaias glynnjonesi* (Henson), *Nummulites* sp., *Gypsina* sp., *Linderina* sp., *Planorbulina* sp., *Peneroplis* sp., *Spirolina* sp., stomatorbinid form, rotaliids, textulariids, miliolidae, corals, algae, echinoderms, bivalves, gastropods and planktonic foraminifera were determined in this study. The benthic foraminiferal assemblages of the Kırkgeçit Formation are indicative of the SBZ 18 and SBZ 19-20 biozones indicating the latest Bartonian-Priabonian age. In both sections, LBF are dominated by reticulate *Nummulites* (*N. hormoensis* Nuttall & Brighton and *N. fabianii* (Prever in Fabiani)). *N. fabianii* (200 µm-309 µm) shows a clear increase in proloculus diameter in comparison with *N. hormoensis* (168 µm-200 µm). The direct superposition of *N. fabianii* (SBZ 19-20) on *N. hormoensis* (SBZ 18) is detected in this study. The change in embryon size of these reticulate *Nummulites* has been accepted as an important indicator for evolution and biostratigraphy. The depositional environment of the Kırkgeçit Formation in the study area has been interpreted as being the inner and mid parts of a shallow ramp based on the LBF content of it and sedimentological findings (Kayğılı, 2021).

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Quaternary foraminiferal assemblages from the North Atlantic: Effects of the sedimentary processes and oxygenation on the abundance, diversity and preservations

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Keywords: benthic foraminifera, paleoenvironment, taphonomy

Introduction

The late Quaternary sedimentary record of the Madeira Abyssal Plain (MAP) consists of pelagic clays and thick, fine-grained organic-rich, volcanic-rich or calcareous-rich turbidites, deposited by relatively rapid sedimentation. The pelagites and the top of the turbidite sequences have been exposed to extensive oxidation processes due to the presence of progressive oxidation fronts on the bottom of the MAP. The bottom-water oxygen, as long as the diffusive contact with the bottom waters existed, penetrated into the turbidites causing the oxidation of the organic matter and created a sharp oxidation-reduction continuity (de Lange et al., 1987).
Our objective is to determine if the downward moving oxygenation front facilitated the downward colonization of the organic-rich sediments by benthic foraminifera, and as the oxygen-rich waters penetrated into the organic-rich sediment, the CO_2 resulted from the oxidation of the C_{org} caused the corrosion or dissolution of benthic foraminiferal tests.

Methodology

The studied samples were retrieved in 2015, during the MSM48 ADOMIS research cruise (Zonneveld et al., 2016). The samples belong to the MAP megaturbidites E, F, and A, deposited from 110 to ~71 kyrs (Weaver et al., 1992). The studied sedimentary record can be divided in accordance with their stratigraphic position and the oxygen penetration into the sediment. From the bottom to the top, we can identify three lithological zones: F, E and A – turbidites, often with pelagic sediment lying between them. These can be described as the following: F turbidite - the oxidized and +/- bioturbated upper part of the F ($F_{oxid+/-bioturb.}$), the oxidized pelagites (P_{oxid}), E turbidite – lower part of the turbidite, unoxidized (E_{anox}), and A turbidites - consisting of redox zone (A_{red}) and an active oxidation front (A_{ox}) at the top of the core (Zonneveld et al., 2019).
The core sections were sampled at ~ 3 cm intervals with the help of a 10-cc syringe, with 1,5 cm diameter. The resulted samples were freeze-dried and wet-sieved using a 63 μm mesh sieve. Throughout our work, we used the >63 μm fraction size and, when needed, splitted the residue until at least ~300 specimens of benthic foraminiferal test remained in each split. The picked specimens were identified and pictured using an SEM.

Results

Our study shows that the downward penetration (~15cm) of the oxygenation front into the sediments aided the colonization by the benthic foraminifera but had little or no effect on the preservation of the benthic foraminiferal tests. However, there is a clear difference between the species composition and diversity of the foraminiferal assemblages recovered from the E_{anox}, P_{oxid}, $F_{oxid+/-bioturb}$. Furthermore, downward from the bottom part of $F_{oxid+/-bioturb}$ the sediment is barren of foraminiferal tests, suggesting that the colonization by the benthic foraminifera occurred only in the upper 18 cm of the F turbidite. Moreover, we observed a change in the recovered foraminiferal assemblages belonging to the $A_{red,ox}$ turbidites too.

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Hardgrounds and condensed horizons in the Middle Jurassic of the Romanian Carpathians: taphonomic analysis and paleoenvironmental significance

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Keywords: hardground, taphonomy, ammonites, condensed beds, Middle Jurassic

Introduction

Hardgrounds and condensed horizons represent outstanding features of the Middle Jurassic successions of the northern peri-Tethyan basins and consequently these successions were intensively studied, considering their utility in sequence stratigraphy and basin analysis, in evaluation of the paleoenvironmental parameters and also for their fascinating paleoecology and evolution of their characteristic hard substrate communities. The study of the taphonomic features of metazoans assemblages along the hardground discontinuity surfaces is critical for estimation of the paleoenvironmental characteristics, of the degree of colonization and of the degree of sedimentary condensation. Condensation processes form distinctive stratigraphic levels that can be recognized by the presence of hardgrounds, omission surfaces, assemblages of benthic and planktonic fossil, the presence of authigenic minerals (e.g. glaucony, iron oxides and hydroxides) which sometimes form "*crusts*" microbial in origin, intensive bioturbation, the presence of the organic matter and concentrations of rare elements (e.g. iridium). Diverse condensation processes (stratigraphic, sedimentary and taphonomic condensation) have been discussed in detail by Gómez and Fernández-López (1994), Fernández-López et al. (2002) and Fernández-López (2011). In Romania, several studies were concentrated on the genesis of the Middle Jurassic hardgrounds and especially on the ferruginous stromatolites and associated benthic faunas (Grădinaru et al., 2020 and references therein). The aim of this contribution is to present preliminary data concerning the taphonomy of fossil assemblages associated with Middle Jurassic hardgrounds and condensed horizons from the Romanian Carpathians and the interpretation of their paleoenvironmental significance.

Methodology

Hardgrounds and condensed horizons were identified using field and laboratory criteria. Detailed mapping and lithostratigraphic logging were performed for the studied sections. We used a high-resolution stratigraphic approach with facies mapping on kilometric scale outcrops to metric and/or even centimetre scale sampling (for each section) to establish a high resolution spatio-temporal stratigraphic and sedimentologic framework. The samples were prepared for paleontological and taphonomic analyses and for applying optical methods and geochemical, mineralogical and sedimentological analyses. The microfacies and diagenetic features were investigated in thin-sections and polished surfaces under binocular microscope, petrographic microscope, and stereomicroscope.

Results

Ten Middle Jurassic sections from Southern Carpathians (Getic and Danubian units) and from Apuseni Mountains (Bihor unit) have been studied. During the Middle Jurassic, in several areas located in these units were accumulated mixed carbonate-siliciclastic condensed deposits with stratigraphic thicknesses from few centimetres to few tens of meters. These Middle Jurassic sequences are characterized by condensed units with different thicknesses and stratigraphic extensions, as well as by the presence of neptunian dykes, clastic dykes and by submarine syntectonic sedimentary breccias, generated by extensional tectonics. These stratigraphic successions contain condensed horizons bounded by diachronous hardgrounds. Detailed biostratigraphic studies previously accomplished in the studied areas (e.g. Patrulius, 1969, 1996; Grigore et al., 2015) established the heterochronous character of the studied condensed horizons that indicate two time intervals: Bathonian – early Callovian and middle-late Callovian. The condensed horizons, from millimetric to several centimetres thick, contain benthic epifaunal metazoans (sponges, rare solitary corals, bivalves, gastropods, brachiopods, crinoids, echinoids,

serpulids, and agglutinated tube-worms) associated with ammonites and rare belemnites (for Bathonian-lower Callovian condensed horizons) or contain mainly ammonites and belemnites (for middle-upper Callovian condensed horizons). Where they are present, the benthic epifaunal metazoans are very well preserved, with articulated, not broken shells indicating accumulated or resedimented fossils and autochthonous or para-autochthonous assemblages. However, the recorded assemblages of demersal ammonites from the studied condensed horizons are dominated by reworked elements. Accumulated fossils, showing no evidence of removal, are absent. In the Bathonian – lower Callovian condensed horizons, reelaborated internal moulds, exhumed and displaced before their final burial, are dominant. Broken and resedimented shells, displaced on the sea-bottom before their burial, are also common and abundant uncompressed, complete sedimentary internal moulds (especially of the phragmocone) are indicative of low rate of sedimentation. Reworked lithoclasts, shell fragments and concretionary internal moulds show thin encrusting structures such as ferruginous microstromatolites. In the middle-upper Callovian condensed horizons, the specimens are represented by calcareous, concretionary internal moulds, maintaining their original shape and volume, some of them encrusted with thin ferruginous microstromatolitic crusts, are more abundant in the lower part of the Callovian condensed horizons. Reelaborated, concretionary internal moulds are dominant toward the middle part of the Callovian condensed horizons. Broken, disarticulated and resedimented shells, displaced on the sea-bottom before their burial, are also common. These associations could be interpreted as condensed assemblages generated as a result of early cementation and low rate of sedimentation. Within the condensed horizons there are abundant uncompressed, complete sedimentary internal moulds especially of the phragmocones, some of them preserving also the body-chamber, which are indicative of low rate of sedimentation and low rate of accommodation of sediments. Reelaborated internal moulds often show disarticulation surfaces, fracture surfaces with sharp margins and ellipsoidal truncational abrasion facets. Fragmentary internal moulds bearing signs of rounding and/or bioerosion also occur.

Conclusions

The studied condensed horizons show faunal condensation and taphonomic condensation, considering the mixture of non-contemporaneous fossil specimens with very different states of preservation, belonging to successive populations or communities, as well as the occurrence of numerous macro-oncoids that have nuclei represented by ammonites showing diverse preservation states and belonging to several biozones. The microfacies, sedimentological, paleontological, and taphonomic data suggest that these condensed horizons and associated hardgrounds were formed in deep subtidal environments with transition to hemipelagic environments, corresponding to submarine plateaus characterized by absence of light, scarcity of oxygen, low sedimentation rate, affected by intervals of omission/non-deposition, erosion and in situ reworking, produced by temporarily active strong bottom currents and/or by storm events.

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Biostratigraphy and palaeoecology of the middle Miocene interval revealed by the Șipote borehole (Moldavian Platform)

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Keywords: Badenian, Sarmatian, foraminifers, calcareous nannofossils, paleoenvironment

An integrated micropaleontological study, based on foraminifera, ostracoda, and calcareous nannofossils was carried out on 23 samples collected from the recovered cores of the 220 m depth Șipote borehole, located in the Eastern part of the Moldavian Platform. The results of the micropaleontological analysis indicate the presence of Badenian and Sarmatian deposits. Here we present the interval including the Badenian-Sarmatian boundary, enhancing the paleoenvironmental changes across it.

The samples of core in 220-218 m interval contain typical Badenian macrofossils, such as *Chlamys elegans* and *Lithothamnium* sp. (Brânzilă, 1999) as well as a very abundant and well preserved foraminifera assemblage. We determined several foraminifera with biostratigraphic value, as follows: *Globigerina bulloides*, *Bulimina aculeata*, *Bolivina dilatata*, *Uvigerina graciliformis*, *U. semiornata*, *U. brunensis*, *Gyroidina soldanii*, *Heterolepa dutemplei*, and *Melonis pompilioides*. They belong to the foraminiferal Assemblage A (*sensu* Dumitriu et al., 2017), indicating late Badenian (Kosovian) age. Additionally, an equally rich ostracoda assemblage has been identified, containing *Loxocorniculum hastatum*, *L. schmidi*, and *Henryhowella asperrima*, indicating the same age. The foraminifera assemblage from the core sample at 215 m, mainly composed by large keeled elphidiids (e.g. *Elphidium reginum*, *E. aculeatum* and *E. fichtelianum*), *Anomalinoides dividens*, *Cycloforina karreri ovata*, *Quinqueloculina minakove ukrainica*, belongs to *Anomalinoides dividens* Biozone (Filipescu, 2004), indicating early Sarmatian, an age supported also by the ribbed miliolids (Ionesi, 1994).

A rich and diversified calcareous nannofossil assemblage is contained in the sample from 218-217 m interval. The following species have been identified: *Braarudosphaera bigelowii*, *Coccolithus pelagicus*, *C. miopelagicus*, *Coronocyclus nitescens*, *Cyclicargolithus floridanus*, *Discoaster brouweri*, *D. deflandrei*, *D. musicus*, *D. variabilis*, *Helicosphaera carteri*, *H. walbersdorfensis, Pontosphaera enormis, Reticulofenestra pseudoumbilicus,* and *Sphenolithus moriformis.*

The nannofossil assemblage belongs to the NN6 biozone of Martini (1971), which covers the upper Langhian-Seravallian interval (Raffi et al., 2006). In the Paratethyan Domain, the NN6 biozone corresponds with upper Badenian-lower Sarmatian interval (Hartzhauser & Piller, 2007). The boundary between NN5 and NN6 is marked by the LO (last occurrence) of *Sphenolithus heteromorphus*, bioevent that took place at 13.6 Ma (Raffi et al., 2006). Significant biostratigraphic events are recorded in NN6 biozone, such as LCO (last common occurrence) of *Cyclicargolithus floridanus* and *Coronocyclus nitescens* (LO at 12.25), which were calibrated by Raffi et al. (2006).

Fornaciari et al. (1996) defined MNN6a and MNN6b biozones in the Mediteranean area for the upper Langhian-Seravallian interval. The boundary between the biozones MNN6a and MNN6b, marked by the FCO (first common occurrence) of *Reticulofenestra pseudoumbilicus*, corresponds with the boundary between the Badenian and Sarmatian stages in the Central Paratethys, including the intra- and extra-Carpathian areas of Romania (Mărunţeanu, 1992; Melinte-Dobrinescu & Stoica, 2013). In the studied sample, *Reticulofenestra pseudoumbilicus* is very rare; consequently, we assigned the studied sample to the MNN6a biozone, respectively lower part of NN6 indicative for late Badenian age.

For the palaeoenvironmental reconstruction, we applied the calcareous benthic foraminiferal morphogroup analysis of Murray (2006) and Chan et al. (2017). Based on the results, we consider that the Badenian microfaunal assemblages point to an open marine basin, with a normal salinity. The paleodepositional depth, indicated by the most frequently encountered foraminifera species,

belonging to the genera *Bulimina*, *Bolivina*, *Melonis*, *Heterolepa*, and *Gyroidina*, varies from inner shelf to bathyal (Murray, 2006), most probably reflecting a suboxic paleoenvironment (Kaiho, 1994). Similar paleoecological features are indicated by the presence with a significant abundance of the ostracods *Henryhowella asperrima* and *Loxocorniculum hastatum*.

By contrast, the Sarmatian foraminifera (keeled and spined elphidiids) reflect a shallower depositional paleoenvironment, ranging from a normal marine to a brackish regime, well oxygenated (Kitazato, 1988). An oxic paleosetting is also indicated by the Sarmatian ostracod content, comprising species of *Aurila* and *Cyprideis* genera (Whatley, 1995; Gebhardt et al., 2009).

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Calcareous nannofossil extinction, survivorship and speciation during the OAE2 in the Tethys Realm

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Keywords: Cenomanian-Turonian boundary interval, calcareous nannoplankton distribution, mid- to low paleolatitudes

Introduction

Several Earth history intervals, mostly belonging to the Cretaceous Period, are associated with high sea-level fluctuations (Haq, 2014) and a very warm and humid climate; these features were especially described from the Aptian-Turonian interval, producing 'the mid Cretaceous Greenhouse' (Sames et al., 2016). Most of the Oceanic Anoxic Events (OAE) were discovered in the aforementioned interval. An Oceanic Anoxic Event is primary recognised based on the significant shift of ^{13}C isotope, on biotical fluctuation (especially of planktonic organisms) and on its lithological overprint (black shale deposition), being, at the geological time scale, a short event, of a maximum 2 Ma (Arthur & Premoli Silva, 1982; Jarvis et al., 2006). One of the most prominent known OAE, subject of this paper, is OAE2, placed at the Cenomanian-Turonian boundary (Jenkyns, 2010).

Methodology

Three sections located in the Tethyan Realm have been detailed sampled and studied regarding the distribution pattern of nannofossils. These sections, situated in SW Romania (Ohaba-Ponor), N Spain (Arobes) and NE Mexico (Indidura), contain the OAE2, identified on geochemical and biostratigraphical analysis (Melinte-Dobrinescu & Bojar, 2008; Melinte-Dobrinescu et al., 2013; Duque-Botero & Maurrasse, 2005).

Results

In all studied sections, a similar scenario of nannofossil fluctuations was observed, correlated with geochemical data: (1) Pre-excursion phase of OAE2, with low $\delta^{13}C$ values, coeval with nannofossil assemblages dominated by *Watznuaeria barnesiae* and *Eprolithus floralis*; (2) Onset interval (the first build-up phase), containing little fluctuation in nannofossil assemblages comparing with the pre-excursion; (3) Trough Phase that includes peaks in the abundance of the nannofossils *Biscutum constans*, *Cyclagelosphaera margerelli*, *Zeugrhabdotus erectus*, and *Prediscosphaera* spp.; (4) Second build-up phase of $\delta^{13}C$, showing nannofloral peaks of *Zeugrhabdotus erectus*, *Cyclagelosphaera margerelii*, *Prediscosphaera* spp., and *E. floralis*, followed by calcareous dinoflagellate *Thoracosphaera* bloom; (5) Plateau Phase, characterised by minima in nannofloral abundance and diversity, as well as very high percentages of *W. barnesiae* (>80 % of assemblages); (6) Recovery phase, when the diversity and abundance of nannofossils progressively increased. During the OAE2, 3-4 nannofossil species vanished and up to 10 taxa firstly appeared, so the speciation rate is higher than the extinction. Most of the nannofossil taxa that appear in the Cenomanian stratigraphic record continued their distribution in the Turonian, after the OAE2.

Conclusions

The nannofloral turnover, which took place globally across the OAE2, mirrors the new palaeoecological conditions (such as fluctuations in pH, salinity, and dissolved CO_2 and O_2) of surface waters. The calcareous nannofossil record indicates initial oligotrophic conditions, progressively replaced by eutrophic ones during the Trough Phase, while the second build-up phase is characterised at its beginning by eutrophic conditions shifting to mesotrophic ones towards its end. During the Plateau (last stage of OAE2), a significant shift in productivity has been recorded.

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Mid-Miocene leaves in the offshore-transition heterolithics of the Carpathian foredeep

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Keywords: Volhynian, stormy shoreface, hyperpycnites, sequence stratigraphy

Introduction

Occurrence of fossil leaves in sedimentary deposits usually prompts us to think at continental realms (lakes, ponds, floodplains etc). Without a detailed facies analysis, such a dogmatic interpretation calls for a domino of other misinterpretations with consequences in basin analysis. Here we present an example of this kind, where fossil leaves recurrently occur in sedimentary succession, Volhynian (upper middle Miocene) in age, belonging to the north-central part of East Carpathian foredeep (Grasu et al., 2002).

Depositional palaeoenvironment and sequence stratigraphy

The 35 m thick exposure, reaching 100 m wide and facing westward (fig. 1), in Partestii de Jos area (Suceava County), was studied by conventional sedimentary facies analysis.

Four facies associations (FA) were defined and interpreted as offshore-transition, lower shoreface, upper shoreface and (?) coastal plain. Among the facies with diagnostic value, we firstly mention the very fine sands with hummocky and swaley cross stratifications (HCS, SCS), frequently associated with storm deposit (Cheel &Leckie, 1993). The beds with HCS occur either interlayered with mudstone, the association characterising offshore-transition subenvironment, or amalgamated and associated with very fine sands with ripple cross lamination (WRCL), indicating lower shoreface subenvironment. Very fine to medium sands and sandstones with medium scale trough cross stratification (TCS) represent the main facies of the upper shoreface, associated with sands with plan-parallel stratification and WRCL. The fourth FA, coastal plain, occurs only in the uppermost part of the outcrop, consisting mainly of reddish and grey mudstones. Except of it, all the others contain bivalves and gastropods (*Obsoletiforma*, *Tapes*, *Plicatiforma*, *Gibbula*, *Acteocina*) either scattered or concentrated in bioclastic beds (storm lags).

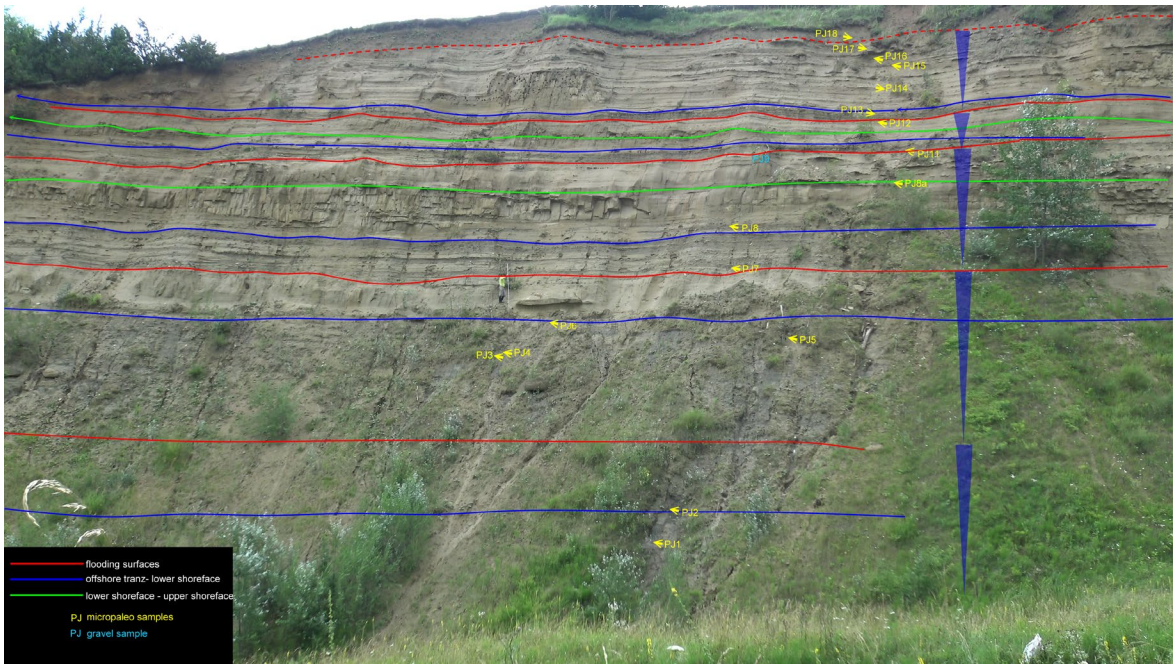

Fig. 1. The Volhynian deposits exposed in Partestii de Jos area (person for scale, 1.6 m). The blue triangles indicate the five parasequences defined. The fossil leaves recurrently occur in the offshore-transition subenvironment (between red and blue lines).

Two to four FAs, parts of the interpreted stormy shoreface environment, are organized in conformable successions: offshore-transition to lower shoreface; offshore-transition to lower shoreface to upper shoreface; offshore-transition to lower shoreface to upper shoreface to coastal plain.

The depositional palaeoenvironment interpretation based on facies analysis is supported by the results of the preliminary microfossil analysis. The PJ2-PJ8 samples (fig. 1) yielded a microfauna assemblage dominated by *Elphidium* (*E. rugosum*, *E. macellum*) and *Porosononion* (*P. subgranosus*) which would indicate the *Elphidium rugosum* Zone and *Porosononion subgranosus* Zone, upper Volhynian in age, of Ionesi (1968) and, also, a shallow (0-50 m) sedimentary environment (Murray, 1991).

The vertical arrangement of the defined FAs, allowed us to divide the sedimentary succession in five parasequences with different thicknesses. Their progradational stacking pattern indicates a decreasing rate of episodic generation of accommodation space for the sediment supply. The way the accommodation was generated also explains the recurrence of transition-offshore deposits in the sedimentary succession. Similar progradational stacking of parasequence sets were recognized in same age sedimentary successions both in wedge-top depozone (Miclăuș et al., 2011) and in other location of foredeep depozone (Miclăuș et al., 2015).

Fossil leaves bearing deposits

The fossil leaves (together with other plant remains) occur in the offshore-transition heterolithics, consisting of mudstone, turbidite-like beds, and discrete beds with HCS. The leaves are associated with turbidite-like bed; the plant remains associated with turbidite-like beds represent a diagnostic criterion for the hyperpycnites, the deposits of hyperpycnal flows associated with fluvial discharges (Zavala et al., 2012). One bed of medium pebbles in top of the third parasequence (Fig. 1) would support this interpretation. It is worthy to mention that some beds with plant remains are interlayered with beds having macro- and microfauna. Others contain macro and microfauna.

Conclusions

The occurrence of fossil leaves or plant remains could be mistakenly interpreted as indicators of continental sedimentation paleoenvironments. Such a situation can be avoided using a detailed facies analysis as it was done for the Volhynian sedimentary succession exposed in Partestii de Jos. We show not only that the depositional environment was the transition-offshore of a stormy shoreface, but also that the plant remains were transported and sedimented by hyperpycnal flows.

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Understanding the Upper Jurassic-Lower Cretaceous transition in a mixed, pelagic-shallow water depositional setting. A case study from the eastern Getic Carbonate Platform (Postăvaru Massif, Romania)

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Keywords: carbonates, microfacies, slope deposits, carbonate platform

Geological framework

The Postăvaru and the Piatra Mare Massifs form the easternmost part of the Getic Carbonate Platform. Their sedimentary succession is part of the "Brașov Series" (Patrulius, 1969) which forms extensive outcrops in the studied area and other adjacent regions (Dâmbovicioara Zone, Piatra Craiului Massif, the northern part of the Bucegi Mountains) (Patrulius, 1969). Four major tectonic compartments (Postăvaru, Cristian, Brașov, and Râșnov) define the geological structure of the Postăvaru Massif (Săndulescu, 1964). They contain a Lower Triassic-Albian sedimentary succession, consisting of silicolitic, carbonate, and siliciclastic rocks. Lower Triassic deposits are present only in the Cristian Compartment. Lower Jurassic Gresten type deposits cover them. The upper Toarcian-basal Middle Jurassic interval is defined by the presence of white quartzitic sandstones equally distributed within the Cristian, Brașov and Postăvaru compartments. The remaining Middle Jurassic succession consists of Bathonian-upper Callovian marls and jaspers. The basal Upper Jurassic (Oxfordian) contains jaspers and radiolarites, crop out in all four tectonic compartments. Štramberk type limestones define the Kimmeridgian-Tithonian succession. Săndulescu (1964) suggested the presence of Berriasian deposits in the Postăvaru Massif. However, the author did not bring any micropaleontological evidence to support this idea. The remaining sedimentary succession contains Valanginian – lower Aptian marls, upper Albian – lower Cenomanian conglomerates and upper Cenomanian – upper "Senonian" marls.

Methodology

Several fieldwork campaigns were deployed and a total number of 800 samples were collected. Field activity involved carbonate bed description and high resolution sampling. Eight hundred thin sections were prepared in order to describe the most important carbonate facies and to determine the micropaleontological associations. Microfacies description follows the classification schemes proposed by Dunham (1962) and Embry and Klovan (1971).

Results

The following sections were studied: Dealul Șprenghiu, Tâmpa, Pietrele lui Solomon, Poiana Mare-Stejeriș, Valea Dracului-Stejeriș, Drumul lui Lexen, Poiana Cristianului, Drumul Roșu, Groapa Dracului, Vanga Mică, Cheile Râșnoavei, Poiana Brașov-Avenul Groapa de Aur, Drumul Albastru, Valea Dragă, Vârful Postăvaru, Sulinar, Dealul Cernit and Poiana Brașov-Râșnov. Microfacies analysis allowed the identification of the following facies associations: bioclastic rudstone with encrusting organisms, coral-microbial boundstone with wackestone or packstone-grainstone type internal sediment, wackestone-floatstone to packstone with encrusting organisms and calpionellids, peloidal grainstone with encrusting organisms, brecciated fenestral wackestone-packstone, wackestone with *Seliporella neocomiensis*, peloidal ooidic grainstone with cyanobacteria nodules, bioclastic intraclastic peloidal grainstone-rudstone, bioclastic intraclastic grainstone with cyanobacteria nodules and black pebbles, bioclastic wackestone, fenestral mudstone-wackestone, peloidal fenestral packstone-grainstone, fenestral wackestone, fine peloidal bioclastic packstone with pelagic bivalves and homogeneous non-fossiliferous mudstone. The micropaleontological association consists of dasycladalean algae [*Salpingoporella annulata* Carozzi, *Salpingoporella pygmaea* (Gümbel), *Seliporella neocomiensis* Radoičić, *Steinmanniporella kapelensis* (Sokač & Nikler), *Griphoporella jurassica* (Dragastan), *Petrascula bursiformis* Etallon, *Neoteutloporella socialis* (Praturlon), *Aloisalthella sulcata* (Alth)], encrusting organisms [*Bacinella* type structures, *Calcistella*

jachenhausenensis Reitner, *Crescentiella morronensis* (Crescenti), *Iberopora bodeuri* Granier & Berthou, *Koskinobulina socialis* Cherchi & Schröder, *Pseudorothpletzella schmidi* Schlagintweit & Gawlick, *Radiomura cautica* Senowbari-Daryan & Schäfer, *Perturbatacrusta leini* Schlagintweit & Gawlick, *Taumathoporella parvovesiculifera* (Raineri)], calcareous sponges (*Neuropora lusitanica* Termier, Termier & Ramalho, *Thalamopora lusitanica* Termier), foraminifera [*Bramkampella arabica* Redmond, *Bulbobaculites felixi* Pleș et al., *Coscinoconus alpinus* (Leupold), *Coscinoconus cherchiae (*Arnaud-Vanneau et al.), *Coscinoconus delphinensis (*Arnaud-Vanneau et al.), *Coscinoconus sagittarius* (Arnaud-Vanneau et al.), *Coscinoconus campanellus (*Arnaud-Vanneau et al.), *Frentzenella involuta* (Mantsurova), *Meandrospira favrei* (Charollais et al.), *Nautiloculina brönimanni* Arnaud-Vanneau & Peybernès, *Protopeneroplis striata* Weynschenk, *Protopeneroplis ultragranulata* Gorbatchik] and pelagic microorganisms (*Calpionella alpina* Lorenz, *Crasicollaria parvula* Remane, *Crasicollaria intermedia* Durand-Delga, *Saccoccoma* sp.).

Discussions

Two main depositional settings can be recognised. The first one corresponds to distal and proximal slope environments, which can be found especially in the central and southern part of the Postăvaru Massif (the Postăvaru and Râșnov compartments, sensu Săndulescu 1964). The second one contains shallow water, platform margin and inner platform depositional areas that cover the northern and northeastern part of the Postăvaru Massif (Brașov and Cristian compartments). The sediment deposition occured simultaneously in both areas at the Upper Jurassic-Lower Cretaceous transition. Shallow water material was supplied to these slope areas from the Postăvaru Compartment, either from the north (Brașov compartment) or from the east and southeast, from adjacent areas (Piatra Craiului Massif, Dâmbovicioara Zone). There is a continuity of sedimentation between the Upper Jurassic (Tithonian) and the Lower Cretaceous (Berriasian). This fact is supported by facies and micropaleontological data. In terms of age, the identified microfossils indicate the Kimmeridgian - Berriasian - ? lower Valanginian interval.

Conclusions

All the facies associations characterize a large variety of depositional settings, ranging from distal slope to platform margin and inner platform areas. The presence of Berriasian deposits is indicated with certitude, for the first time in this area. The Postăvaru Massif represents an intermediate depositional sector located between the shallow water depositional areas of the Dâmbovicioara-Piatra Craiului Zone and the deeper depositional environments corresponding to the Bucegi Mountains.

Acknowledgements

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Re-examination of the "Phoca" bessarabica holotype

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Keywords: Pinniped, Miocene, Paratethys, humerus, taxonomy

Introduction: Evolutionary history of Eastern Paratethyan seals has many mysteries regarding their relationship, ecology and even taxonomy. Nowadays there are known near 10 species of fossil seals, some of them including many findings, while others scarce bones, many of them being separated from each other (Koretsky, 2001, 2013). One species of this kind is the contradictory taxon "*Phoca" bessarabica* described by Simonescu in 1925, whose Holotype is the proximal part of the humerus (see Figure 1).

Methodology: The Holotype was compared with other species of Paratethyan seals. In addition, *"Phoca" bessarabica* femurs were compared with other species, PCA and discriminant analysis being realized. The models were made using a 3D surface scanner.

Results: *"Phoca" bessarabica* has one of the biggest humeri among all Paratethyan seals, only *Pachyphoca chapskii* having a similar size. Unfortunately, only the proximal part of the humerus was preserved. It differs from the closest similar humerus (*Pachyphoca chapskii*) by lower deltoid crest and a more curved body. The head have a round shape and the neck is short, the inner side being curved (in contrast to *Pachyphoca chapskii* and *P. ukrainica* which have straight inner sides). The shape of the deltoid crest resembles with *Praepusa vindobonensis*, but the size of the bone is much bigger.
The femur of *P. bessarabica* has a big head and tubercula, and medial epicondyle larger than lateral epicondyle. The shape of *P. bessarabica* femur is close to *P. ukrainica*, but differs from it by the size of the head and tuberculous, longer neck, and lesser curvature. In comparison with *Phoca novorossica*, *P. bessarabica* is more asymmetric and has a bigger medial epicondyle. Also, *P. bessarabica* femur has a wider body and higher medial epicondyle than *Sarmatonectes sintsovi*, *Praepusa vindobonensis*, and *Cryptophoca maeotica*. *P. bessarabica* femur differs from *Pontophoca sarmatica*, like other species of Paratethyan seals, by a much thinner diaphysis.

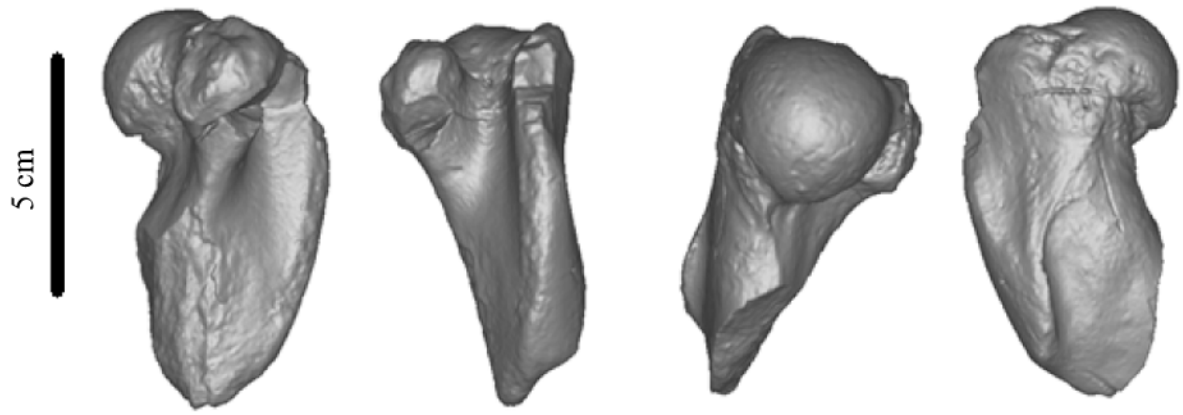

Fig. 1. The 3D model of the holotype of *"Phoca" bessarabica* (№ SF-3) stored in Palaeontological Collection of "Alexandru Ioan Cuza" University from Iași

For PCA and discriminant analysis, was used only one femur of *P. bessarabica*, consequently the results are approximate. PCA analysis grouped *P. bessarabica* nearby *C. maeotica* and *P.*

vindobonensis. On the other hand, discriminant analysis places it near groups that are built by *P. ukrainica* and *Phoca novorossica*.

Conclusions: *Phoca bessarabica* is still one of the most mysterious taxa of Paratethyan seals, ~~and~~ the absence of new findings preventing a better decription of this species. It has a large size and share many characters with other seal species.

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The evolution of the paleoenvironments during the early Miocene in the Transylvanian Basin revealed by the foraminifera assemblages from the Racâș section

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Keywords: foraminifera, palaeoecology, biostratigraphy, early Miocene, Transylvanian Basin

Foraminifera assemblages from 48 samples were used for palaeoenvironmental reconstruction of the marine lower Miocene formations from the Racâș section (Sălaj County, Romania). The foraminifera were collected from terrigenous sediments deposited in neritic and bathial settings. Shelf assemblages with calcareous benthic taxa (mainly species of lagenids, rotaliids, and buliminids) dominate the lower part of the section and were considered as typical assemblages for the Chechiș Formation. Agglutinated species are common starting from the middle part of the section and are associated with the deepening of the environment and the start of turbiditic sedimentation of the Hida Formation. Planktonic foraminifera are present along the whole section, consisting of larger species in the lower part and smaller in the upper part, as a consequence of the eutrophication.

The statistical analysis, namely the proportion of the main foraminifera groups, the diversity indices (Fisher, Shannon), Planktonic/Benthic ratio, the distribution of the infaunal/epifaunal forms, and benthic foraminifera oxygen index (BFOI), indicate frequent fluctuations of environmental parameters and a deepening trend from outer shelf to upper bathyal settings. At the base of the section (Chechiș Formation), well-oxygenated bottom waters (as shown by the BFOI values) and high primary productivity (as suggested by a large number of small-sized planktonic foraminifera) were characteristic. Changes in paleobathymetry and a lower organic input can be observed in the middle and upper part of the section as relatively high proportions of agglutinated taxa (mainly tubular forms) characterize the benthic assemblages.

The biostratigraphic value of foraminifera is limited to the regional scales and is based on the presence of planktonic *Trilobatus trilobus* and agglutinated *Reticulophragmium venezuelanum*, the index species for the early Miocene zones of the Transylvanian Basin (Popescu, 1975).

Compared to the assemblages described by Szekely et al. (2016, 2017), the calcareous benthic foraminifera from Racâș preserve traces of a limited transport from their habitat, probably related to the onset of deeper settings.

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Additional upper Pleistocene mammals from Zorleni – Bour Hill (Scythian Platform)

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Keywords: *Coelodonta*, Equidae, late Pleistocene, mammals, Moldova

The last sedimentary megasequence on the Scythian Platform (Săndulescu 1984) is referred as upper Badenian (middle Miocene) - Pleistocene (Ionesi, 1994).
On the Scythian Platform, along the Bârlad Valley, the Pleistocene deposits are exposed in the river terraces. An expository example is found at the edge of the village of Zorleni (Vaslui District), located north-east several kilometers from Bârlad, in a local open pit (sand quarry) on Dealul Bour (Bour Hill).
Simionescu (1903) was the first author who mentioned fossil remains here, when the fountain of the at-that-time orphanage was dig in the locality: *Hipparion gracille* dentition as well as an antelope skull, which later, in 1904, was attributed to the species *Gazella brevicornis* (Simionescu, 1904) were described. After more than a century, Codrea et al. (2011), mention the presence of *Canis lupus* and *Megaloceros giganteus* in the fluvial deposits, consisting in sands and gravels, of the Bour Hill.
The present study adds to the list of taxa from the Zorleni open pit several fossil remains that have been collected here. They belong to large mammals such as: mammoth (*Mammuthus* sp.), rhinos (*Coelodonta antiquitatis*), and horse (*Equus* sp.). The fossil remains were collected from gravelly fluvial channels that document braided river environment.
The presence of a mammoth, as well as of the other large herbivores, suggest a Weichsel/Würm (upper Pleistocene) assemblage.

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Biostratigraphy and paleoenvironmental features of the lowermost Cretaceous carbonates from the Pui-Bănița zone, Southern Carpathians

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Keywords: peritidal carbonates, benthic foraminifera, multivariate statistical analysis, microfacies, Berriasian–Valanginian

The Pui-Bănița region (Southern Carpathians) holds valuable micropaleontological assemblages that are important for the lowermost Cretaceous biostratigraphy and paleoenvironmental setting of a large carbonate platform system known in the geological literature as the Getic Carbonate Platform (GCP) (*sensu* Patrulius, 1976). However, compared with the other sedimentary zones of the GCP, the lowermost Cretaceous carbonates of this region are still insufficiently documented with respect to their outcropping areas and micropaleontologic assemblages (Dragastan, 2010; Pleș et al., 2019; Oprișa et al., 2021). Field campaigns performed in the southeastern parts of this region (Taia Gorges), led us to discover a new outcrop exposing lowermost Cretaceous shallow-water bioclastic carbonates. We performed on these carbonates sedimentological/paleontological investigations, microfacies and statistical data analyses of the benthic foraminiferal assemblages (diversity indices, cluster and PCA). The obtained results (biostratigraphic, paleoecological and paleoenvironmental data) are of great importance for a better comprehension of the evolution of the central-western part of the GCP during the earliest Cretaceous. The benthic foraminifera represent the most abundant microfossils with individuals belonging to the orders Involutinida, Lituolida, Loftusiida, Miliolida, Textulariida, and Earlandiida (Oprișa et al., 2021). The presence of the orbitolinid foraminifer *Valdanchella miliani* points to a lower Valanginian age of the studied carbonates. Other species, such as *Montsalevia salevensis*, *Haplophragmoides joukowskyi*, *Scythiolina* div. sp., and *Coscinoconus* div. sp., further constrain this age assignment. Since most of these species were previously unknown from this region, an accurate perspective regarding the distribution patterns and paleoecological settings of the lowermost Cretaceous benthic communities of the GCP was achieved. Microfacies analyses revealed the fact that these carbonates were developed under peritidal settings within a shallow-water inner platform depositional environment (bioclastic bars, subtidal–intertidal deposits and intertidal–supratidal ponds). Statistical investigations of the benthic foraminifera assemblages (diversity indices, cluster analyses and Principal Component Analysis) further constrain these environmental interpretations. Moreover, they reveal a strong facies control on the species richness and spatial distribution (Oprișa et al., 2021). Even if the biotic assemblages resulting from cluster analyses and PCA highlight mainly common paleoecological conditions (very shallow depths, well-oxygenated waters, microbial activity and a rich nutrient supply), some foraminifera assemblages reflect opportunistic behavior that can be linked with variations nutrient input. All of these results permit new correlations with all the other synchronous carbonates from the GCP. Therefore, similar settings occupied large areas throughout the GCP and were limited to the central-western, central and eastern parts (e.g., the Buila-Vânturarița Massif and the Piatra Craiului-Dâmbovicioara zone).

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Sedimentological and petrographical analysis of paleosols from Șard Formation (SouthWestern part of the Transylvanian Basin)

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Keywords: Upper Cretaceous, facies analysis, petrographic and geochemical analysis, microfossils

Introduction

A sedimentological and petrographic study has been conducted on the Șard Formation, outcropping along the Ampoi River (Alba County). Previous studies of this formation were made by Codrea et al. (2001), Codrea & Dica (2005), Mariș (2012). The studied area is located on the border between the eastern edge of the South Apuseni Mountains and the southwestern edge of the Transylvanian Basin. The unit is considered Maastrichtian - Priabonian in age and is represented by a braided river system deposits (Codrea & Dica, 2005).

This study has as a primary objective the outcrop from Ampoi River, but samples from Mureș River were also analyzed for correlation purposes and future studies.

For the petrographic study, 6 sandstone thin sections (5 from Ampoi R. and 1 from Mureș R.) and 9 paleosol thin sections (8 from Ampoi R. and 1 from Mureș R.) were analyzed.

Geochemical analyses were made on 6 samples of plaeosols, aiming the major oxides groups for paleoenvironmental interpretation.

Results

The sedimentary facies analysis carried out on the right side of Ampoi River on the Șard Formation, has revealed the following facies defined on their grain-size and sedimentary structures (Miall, 1996): paleosol carbonate - P; heterolithics of sand-silt-mud - Fl, sand with planar cross stratification - Sp, massive sand - Sm, sand with horizontal stratification - Sh, sand with ripple cross-lamination - Sr, gravel with planar cross stratification - Gp, polymictic matrix-supported massive gravel - Gmm, polymictic clast-supported horizontally stratified gravel - Gh, polymictic clast-supported massive gravel - Gmc.

In the field, three types of paleosols horizons have been determined: Type 1 - reddish, brownish, occasionally grey beds with rhizolites and bioturbation, with thickening upward trend (10 to 45 cm), with a low grade of alteration, preserving parental rock structures, such as millimetric laminations (only on the grey layers); Type 2 - reddish beds, with a more advanced alteration than Type 1, having no traces of the original sedimentary structures, but containing carbonatic nodules/mottles, from few mm to 2 cm, with thickening upward trend (20 to 90 cm); Type 3 - reddish to orange carbonate beds, up to 15 cm thickness.

Using Retallak (2001) classification, we consider the paleosols identified in the field to correspond with the following types: Type 1 = A type horizon – early paleosol, retaining some of the parental rock texture and structure; Type 2 = Bk type horizon – immature paleosol horizon with a higher degree of alteration than type A; Type 3 = K type horizon – carbonate crust, horizon with a high content of carbonates, forming massive layers, so-called duricrust.

The petrographic analysis of paleosols has revealed three specific microfacies, classified after Rettalak (2001): Entisol, Inceptisol, and Aridisol.

The matrix (plasma) in 5 of the thin sections (from Ampoi River) is characterized by a low birefringence, common for silaseptic-aseptic microfabric. It still contains parental grains from fine silt to fine arenite size. The mineralogic composition of the grains indicates a sub-lithic sandstone as parental rock. These features are specific to entisol.

In 3 thin sections (2 from Ampoi and 1 from the Mureș Rivers) the matrix bounds the medium silt to fine sand grains but has a low development, specific to agglomeroplasmic-asepic microfabric. The mineralogic composition of the grains indicates the same sub-lithic sandstone, with a higher alteration development. These features are common for inceptisol.

One thin section (from Ampoi River) had few grains scattered in a masive matrix (grain:matrix ratio=10:90), common to a porphyroskelic microfabric. The mineralogic composition of the grains indicates the same sub-lithic fine silt to sandstone. These features are specific to aridisol.
The petrographic analysis made on the unweathered sandstone samples revealed that the ones from Ampoi River have similar mineralogical and diagenetic characteristics with the ones from Mureș River. All thin sections analyzed contain less than 5% feldspars, 10-20% of lithics, and 80-90% quartz, indicating a sublithic sandstone.
The results of geochemical analyses were interpreted using the SiO2/Al2O3+K2O+Na2O diagram proposed by Suttner & Dutta (1986). The paleosols from the Șard Formation were developed in an arid – semi-arid climate, with some close to the humid area, having a medium alteration, fact supported by the petrographic analysis.
The micropaleontological analysis of the paleosols yielded a fossil content, consisting of fragments of egg shell, possible bone fragments, gastropod operculum, that would indicate a humid environment. Vasile et al. (2011) suggested that the sedimentation area of deposits with similar fossil content was an alluvial plain. Marine organisms, such as agglutinated foraminifera, radiolarians were identified, which most likely were reworked from older deposits.

Conclusions

The depositional system of Șard Formation was a braided river system.
From a petrographic point of view, the analyzed paleosols parent rocks were sub-lithic siltstones and sandstones in a semi-arid depositional environment.
Three types of paleosol horizons were defined in field in Șard Formation: Type A - incipient soil, Bk type - immature paleosol, and Type K - carbonatic crust. These types correspond with the petrographic microfacies, as follows: entisol, inceptisol, and aridisol.
In the analyzed samples we also identified a microfossil assemblage, with autochthonous taxa, typical for continental areas, and reworked specimens of marine environment.

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Revisiting the Early Jurassic (Sinemurian) brachiopod fauna from Smokovac, Montenegro

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Key words: Brachiopoda, *Rhynchonellina*, Early Jurassic, Montenegro

The brachiopod fauna from Smokovac, near Risan, was originally described during the nineteenth century and contains species referred to the rhynchonellide genus *Rhynchonellina* Gemmellaro. Smokovac is within the Ledenica anticline, part of the Dinaric Carbonate Platform in the region of the Gulf of Boka Kotorska, Montenegro.

Hauer (1868) was the first to mention the presence of brachiopods in the vicinity of Smokovac and commented on "very peculiar brachiopods" (Hauer 1868, p. 445). This could be a direct reference to the morphology of *Arzonellina stachei* (Bittner) or even smooth-shelled species of *Rhynchonellina* that were perhaps not yet familiar to geologists as the monograph by Gemmellaro (1871), establishing the genus, had not yet been published. Subsequently, brachiopods from Smokovac were described and figured by Eichenbau (1883), Böse (1894), Bittner (1895), Mihajlović (1955), and Bešić (1959).

Specimens that represent two brachiopod species have been prepared from a talus rockfall block collected by MĐ in the vicinity of Smokovac in 2010. The sample was collected from a Quaternary talus field derived from weathered and spalled rock originating from rock outcrops and cliffs at higher elevations. Several attempts to determine the original position of the block in the outcrop have failed so far. Investigation of one of these species has resulted in the discovery that it is a long-looped terebratellidine brachiopod now referred to *Arzonellina stachei* (Bittner) and therefore not a representative of the rhynchonellide genus *Rhynchonellina*, to which Alexander Bittner (1895) had assigned it (Sandy et al. 2018, Sandy et al. in review). With hindsight, the unusual morphology of this species, including a straight hinge line, allows differentiation from species of *Rhynchonellina* with which *Arzonellina* may be considered homoeomorphic. Bittner (1895, p. 564) had also commented on his species *stachei* being "one of the most peculiar and most curious species in the genus".

The original hypothesis when starting to investigate the brachiopods from the talus block was that it probably contained a monospecific assemblage referable to *Rhynchonellina*; this proved to be incorrect when *Arzonellina* was discovered. However, specimens of *Rhynchonellina bilobata* Gemmellaro were also prepared from the block. *Rhynchonellina* belongs to the rhynchonellide Family Dimerellidae within the Superfamily Dimerelloidea (Manceñido et al. 2002) and this was of particular interest. Sandy (1995, 2010; and in Gischler et al. 2003) had considered that representatives of *Rhynchonellina* could be associates of cold-seep faunas or chemosynthetic environments. *Rhynchonellina* is considered to range from the Late Triassic (Norian) to Early Jurassic (Pliensbachian) and occurrences younger than Toarcian require confirmation (Manceñido and Owen in Manceñido et al. 2002). A Late Jurassic (Tithonian) homoeomorph of *Rhynchonellina bilobata* Gemmellaro, "*Rhynchonella*" *schucherti* Stanton is associated with cold-seep environments and has been referred to *Cooperrhynchia* by Sandy and Campbell (1994).

The lithology that the brachiopods were recovered from at Smokovac is a white sparry, crystalline limestone. Stable isotopes of carbon and oxygen were taken from micrite and cements; $\delta^{13}C$ values 2.3 to 2.6‰ and $\delta^{18}O$ values −1.7 to −0.9‰. These results indicate that the carbonate precipitated under "normal seawater conditions" and there is no indication of an association with hydrocarbon seepage on the sea floor.

The paleobiogeographic distribution of the genus *Rhynchonellina* is Tethyan (e.g., Ager 1959; Cicardi and Gaetani 1974); Vörös (1993) commented that *Rhynchonellina* was characteristic of Early Jurassic carbonate platforms. Ager et al. (1972) stated that the highest concentration of described

species of *Rhynchonellina* and *Sulcirostra* (species of which were originally included in *Rhynchonellina*) was in Dalmatia (Croatia and Montenegro) and Sicily. Cicardi and Gaetani (1974) commented on the concentration of *Rhynchonellina* species as western Tethyan (although they note there may be a "monographic burst" of species in this area; however, there appear to be fewer records elsewhere). Therefore, the Apulian Plate can be considered the area of highest diversity for *Rhynchonellina*. This distribution is mirrored by the co-occurring *Arzonellina* at Smokovac that, with only two known species, is restricted to the Apulian Plate. In terms of stratigraphic distribution, Cicardi and Gaetani (1974) consider the early and middle Early Jurassic (Hettangian – Pliensbachian) to be the height of species diversity for the genus *Rhynchonellina* and the subfamily Rhynchonellininae. Smokovac is unique in Montenegro as the only locality with such an Early Jurassic brachiopod assemblage.

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Palynological and organic geochemical analyses of the Upper Cretaceous Bozeș Formation at Petrești (southwestern Transylvanian Basin) - palaeoenvironmental implications

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Keywords: palynology, organic geochemistry, Bozeș Formation, Late Cretaceous

Introduction

The Petrești - Sebeș section analyzed in the present study is located in the southwestern part of the Transylvanian Basin and exposes deep-water turbiditic deposits (about 450 m thick of claystone/marlstone with fine sandstone interbeddings) assigned to the Bozeș Formation. In the top of this unit, a transitional brackish-wetland-lacustrine succession was identified, followed by the characteristic floodplain mudstones and channel fills of the Sebeș Formation (Vremir et al., 2014). Our research focused mainly on the palynostratigraphy of the Bozeș Formation, previously dated either as Turonian – Santonian based on its palynomorph content (Antonescu, 1973) or as upper Campanian (only the upper part of formation cropping out in the Petrești section; Vremir et al., 2014). Moreover, this study also gives some novel palaeoenvironmental interpretations based on palynofacies and organic geochemistry (gas chromatography-mass spectrometry – GC-MS) analyses.

Materials

From the studied section, 18 samples were collected for preliminary assessment, of which 15 come from the Bozeș Formation and 3 from the overlying Sebeș Formation. Some of these samples yielded well preserved palynomorph specimens of a moderate taxonomic diversity.

Results

Palynological data. The palynological assemblage identified in the Bozeș Fm. consists mainly of spores/pollen (terrestrial palynomorphs; ≈99% of the total specimens) and a minor fraction of dinoflagellate cysts (of marine origin). Fern spores and angiosperm pollen are the most abundant. This terrestrial group is dominated by spores, such as *Biretisporites deltoideus, Cicatricosisporites dorogensis, Deltoidospora minor, Polypodiaceoisporites* div. sp., angiosperm pollen derived from Juglandaceae (*Subtriporopollenites constans*), Myricaceae (*Myricipites* div. sp.), and various taxa of Normapolles.

This palynological assemblage contains few taxa that are commonly known to represent biostratigraphical markers in the Upper Cretaceous. One of the most important of them is *Trudopollis cuneolis* (Fig. 1a), known to range from the late early Campanian up to early Maastrichtian (Polette and Batten, 2017). Moreover, *T. cuneolis* is a typical taxon for the *bajtayi – lenneri* biozone (late Campanian), according to the palynozonation of Upper Cretaceous from Hungary (Góczán and Siegl-Farkas, 1990). Two fern spores, namely *Klukisporites pseudoreticulatus* (Fig. 1b) and *Vadaszisporites sacali* (Fig. 1c), have their highest occurrences at the end of the Campanian (Góczán and Siegl-Farkas, 1990; Halamski et al., 2020), therefore the age of the deposits assigned to the Bozeș Formation is no younger than Campanian.

The palynological samples from the Sebeș Formation are palynologically barren, and show a very low amount of kerogen due to the dominantly oxidizing conditions during sedimentation.

Palynofacies analysis and palaeoenvironmental reconstruction. The palynological organic matter content recorded in the studied interval exhibits a low to moderate abundance, with values of Total Organic Carbon (TOC) ranging from 0.66 to 0.84%. Other organic geochemistry data obtained (i.e. pristane/*n*-C_{17} and phytane/*n*-C_{18} ratios; cross-plot of TOC content vs. sulfur content) show that the

lower and middle part of the Bozeș Formation contain a mixed organic matter deposited under suboxic to relatively anoxic conditions of a transitional environment, whereas in the top of the same formation, a small input of organic matter of lacustrine origin was recorded. However, the palynofacies composition identified in the lower and middle part of the Bozeș Fm. indicates that organic matter initially deposited in a transitional environment (proximal facies) was subsequently transported on the slope to an outer neritic - distal area of the Late Cretaceous basin, as indicated by the small-sized and rounded opaque phytoclasts (Figs. 1f, g). In the top of the Bozeș Formation, the palynofacies composition is slightly different. This interval yielded organic matter dominated by a mixture of lath-shaped, often large opaque phytoclasts (Fig. 1h) and large translucent biostructured phytoclasts (woody tissues, cuticles; Fig. 1i), typical for inner – middle neritic environments, with some estuarine / deltaic influences.

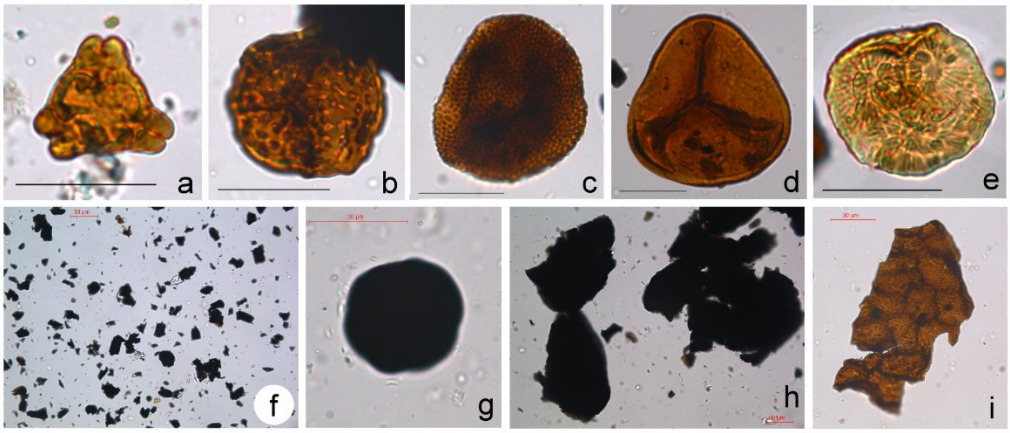

Fig. 1. Representative taxa of the palynological assemblage and typical constituents of the different palynodebris groups from the Bozeș Fm. (scale bar – 30 µm):
a – *Trudopollis cuneolis*; b – *Klukisporites pseudoreticulatus*; c – *Vadaszisporites sacali*; d - *Biretisporites deltoideus*; e - *Asterisporites radiatus*; f, g - equidimensional opaque phytoclasts small in size and rounded shapes (lower part of the studied section); h, i - opaque phytoclasts, large in size and angular forms (h) and cuticles (i) (top of the Bozeș Fm.).

Conclusions

A 450 m thick sedimentary succession assigned to the Bozeș Fm. was analyzed from the Petrești - Sebeș area. The identified palynological assemblage indicates a middle-upper Campanian age for these deposits. Geochemical and palynofacies data reveal an outer neritic - distal environment during the deposition of the lower and middle part of this unit, followed by proximal facies identified at its top. The overlying Sebeș Fm. shows a very low content in kerogen.

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Early Jurassic fauna of Prașca Klippe – nautiloids (Rarău Syncline - Eastern Carpathians, Romania)

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Keywords: Median Dacides, *Cenoceras* species, Sinemurian

Introduction

The nautiloids are merely rare records among the Early Jurassic cephalopods. Nonetheless, their occurrences illustrate a significant cosmopolitan widespread of the survivor stock after the end-Triassic mass extinction.

General geological framework

Rarău Syncline belongs to "Cristalline Mesozoic Zone" or Median Dacides (Dacia Unit), representing an European-derived continental block, which evolved between the East Vardar Ocean Branch (=Main Tethys Ocean) and Ceahlău-Severin Ocean (Săndulescu, 1984, 2014, and references therein; Schmid et al., 2020 and references therein). Two kinds of Alpine nappes have been distinguished within the Median Dacides: the autochthonous Bucovinian nappe system (Infrabucovinian, Subbucovinain, and Bucovinian nappes) and the allochthonous Transylvanian ones.

In the area of the Rarău Syncline, only the Bucovinian Nappe (Turculeț, 1971) and the Transylvanian nappes certainly occur (Săndulescu, 1984). The Bucovinian Nappe is largely built by a metamorphic basement of pre-Alpine nappes, overlain by a folded sedimentary cover of ?upper Paleozoic-Triassic-Cretaceous age. The syncline is filled by the Lower Cretaceous wildflysch regarded commonly as syn-tectonic deposits on top of the Bucovinian Nappe. Post-tectonic deposits have been also mapped in the northern part of the syncline (e.g., Săndulescu, 1984, 2014).

The Transylvanides (Perşani, Olt, and Hăghimaş nappes after Săndulescu, 1984) are preserved only in the wildflysch mass as sedimentary klippen and volcanic blocks of different sizes.

Historical data

Uhlig (1900) has discovered the Prașca Klippe outlining the richness of the Early Jurassic ammonites. It is a big sedimentary Klippe in the Lower Cretaceous wildflysch, located several kilometers southwest of Câmpulung Moldovenesc town. The papers signed by Trauth (1906), Popescu and Patrulius (1964), Popa and Patrulius (1996), and Turculeț (1965-2004) are the subsequent main landmarks in the description of fossil fauna (algae, ammonites, aulacocerids, bivalves, brachiopods, etc.). The nautiloids are very rare, this paper summarizing the data of several previous works.

The Early Jurassic nautiloids are known from two other similar areas of Romanian Eastern Carpathians: Racoș (Alsórákos in original work), Brașov County (Vadász, 1908), and Piatra Singuratică area, Harghita County (Grasu, 1970).

Methodology

The here discussed specimens are internal molds, few of them being affected by erosion or distortion in the host beds. Only two have partially preserved body chambers. They have been prepared with a mechanical tool until the last septum was reach and the siphuncle foramen was exposed. The systematic paleontology follows Kummel (1964). The suture line, the umbilicus opening, the siphuncle position, and the shape of the whorl section have been used as morphological keys for the taxonomical assessment. The following biometrical parameters have been used: Ds – the diameter of the shell/phragmocone; Du – the diameter of the umbilicus; H – the height of the last whorl section; W – the width of the last whorl section; the ratios Du/Ds; W/H, W/Ds.

Nautiloid fauna

The nautiloids of Prașca Klippe are typical for the beginning of Jurassic, belonging to the genus

Cenoceras Hyatt 1883, the only survivor of the end-Triassic mass extinction. They were mainly sampled from the Arnioceras semicostatum and Echioceras raricostatum zones (Sinemurian). *Cenoceras striatus* (J. Sowerby, 1817), *C. intermedius* (J. Sowerby, 1816) emended Tintant, 1984, *C. orbignyi* Prinz 1906 – ?nomen dubium, *C. affinis* (Chapuis and Delwaque, 1854), *C. sturi* (Hauer, 1853), *C. quadrangularis* (Pia, 1914), *C. aratus* (Schlotheim, 1820) emended Quenstedt, 1846-1849, *C. adneticus* (Pia, 1914), and *Cenoceras sp.* (a newly hatched individual) are the main taxa described so far. *Cenoceras aratus* is recorded by two partial conchs that show the main morphological features of the original proposal (Schlotheim, 1820). It also matches with Roemer's description (Roemer, 1836: p. 178) and Quenstedt's works (1846-1849, p. 39, 55-56. tab. 2, figs. 8a, b; 14a, b, fig. 15). *Cenoceras quadrangularis* and *C. adneticus* are also very rare species.

Conclusions

The Prașca Klippe marks an important occurrence of the nautiloids among the Lower Jurassic rocks of Europe.

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New data on the Late Cretaceous microvertebrate assemblage from Petreşti-Arini (SW Transylvanian Basin, Romania)

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Introduction

The Late Cretaceous continental faunal assemblages of modern day Transylvania are some of the best known of their kind in Europe, and have greatly contributed to a better understanding of end-Cretaceous vertebrate evolution and palaeobiogeography on the continent (Csiki-Sava et al., 2015). Most Late Cretaceous faunal assemblages found in present day Romania are of Maastrichtian age (e.g., Csiki-Sava et al., 2015, 2016). The recent discovery of a marine-to-continental transitional sequence, at Petreşti-Arini, in southwestern Transylvania, that includes vertebrate fossil-bearing deposits of Campanian age (Vremir et al., 2014), offers the opportunity of better understanding how the unique Maastrichtian faunas of the area came to be.

Methodology

The gray mudstones from the transitional sequence lying between the uppermost Bozeş Formation that yielded large vertebrate remains (azhdarchoid pterosaurs, the rhabdodontid dinosaur *Zalmoxes* sp., described in Vremir et al., 2014) and the fossiliferous part of the continental Sebeş Formation, was sampled and processed in the attempt of obtaining microvertebrate remains (i.e., skeletal remains of small vertebrates, or small elements – such as isolated teeth – from the skeletons of large vertebrates). Around 500 kg of sediment were screen-washed, using 0.71 mm and 2 mm mesh size sieves.

Results

The search for microvertebrate remains in the probably terminal Campanian lowermost, transitional part of the Sebeş Formation proved successful, leading to the discovery of fairly numerous vertebrate remains belonging to fishes, amphibians, lizards, crocodyliforms, dinosaurs, and mammals.

The fish remains are rare, consisting in isolated rhomboidal scales, very similar to those belonging to lepisosteids. Amphibians are also rare, but some dentognathic remains allow for the identification of anurans similar to the discoglossid *Paralatonia transylvanica* (Venczel & Csiki, 2003), and to an indeterminate albanerpetontid. A small dentary fragment allows for the identification of scincomorph lizards, but a more precise taxonomic assessment of the fragmentary specimen is not possible. Isolated crocodyliform teeth are by far the most abundant remains from the microvertebrate fossil assemblage. At least three different dental morphologies are present, accounting for the presence of *Allodaposuchus* sp., *Sabresucus sympiestodon*, and *Doratodon* sp. (e.g., Martin et al., 2006, 2010; Rabi & Sebők, 2015). Dinosaur tooth fragments were also found, their general morphology supporting the presence of ankylosaurians (possibly *Struthiosaurus* sp.), rhabdodontids (possibly *Zalmoxes* sp.), and indeterminate theropods (possibly three different taxa) (e.g., Weishampel et al.,

2003; Ősi et al., 2014). Mammals are represented by isolated teeth and tooth fragments belonging to a yet undetermined kogaionid.

Conclusions

The Late Cretaceous (Campanian) microvertebrate assemblage from Petreşti-Arini includes at least 11 different taxa belonging to different vertebrate groups (fishes, amphibians, lizards, dinosaurs, mammals). With one exception (*Zalmoxes* sp.), all the other identified taxa are reported for the first time form the uppermost Campanian of the Transylvanian Basin. All belong to families previously reported from the Maastrichtian deposits of Transylvania, but a more precise taxonomic assessment, based on more complete and diagnostic material, is needed in order to fully understand the relation between the Campanian and Maastrichtian faunas of this part of the European archipelago.

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