23rd Czech – Slovak – Polish Paleontological Conference
Banská Bystrica, Slovakia

October 15 –17, 2024

ABSTRACT BOOK

23rd Czech - Slovak - Polish paleontological conference
Banská Bystrica | 2024

EARTH SCIENCE INSTITUTE
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Cover photo pictures: Cover photo pictures: Fossils from finding sites of the Central Slovakia. Front side of the cover – radiolaria from Ottnangian sediments of the Pôtor Mb. near Veľký Krtíš; inner page of the cover – Triassic crinoids from the Zámostie limestones of the Choč Unit, Zámostie – Štefánka locality near Nemecká; Jurassic ammonites in the Adnet limestones from the locality Bystrická dolina Valley near Harmanec; Nummulites from the Kršteňany locality near Partizánske (authors: Juraj Šurka, Ján Soták, Peter Ledvák).
Backside cover pictures: inner page photos – institute building and laboratories of the Earth Science Institute of the Slovak Academy of Sciences in Banská Bystrica; outer page picture – outline of the Banská Bystrica Town Castle.

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Edited by:

Ján Soták, Radovan Kyška Pipík & Adam Tomašových

Earth Science Institute,
Slovak Academy of Sciences
Bratislava

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Table of Contents

Preface

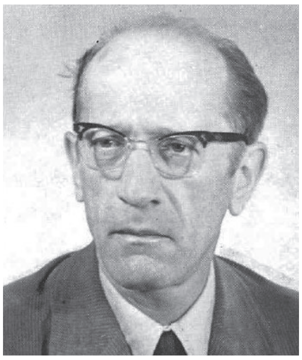
The Czech–Slovak–Polish Paleontological conference is an annual meeting that has already been taking place for 23 years. The conference provides a platform for scientific exchange not only within Czech, Slovak and Polish paleontological communities, but also for paleontologists from other Central European countries. The conference has become renowned scientific event among professional researchers as well as graduate and doctoral students in paleontology.

The 23rd Paleontological conference organized by the Earth Science Institute of the Slovak Academy of Sciences will take place in Banská Bystrica. This city already hosted the 10th Paleontological conference in 2008 and 15th Paleontological conference in 2014. The Earth Science Institute Bratislava (formerly Geological Institute SAS) has a long-lasting tradition of paleontological research, when the foundation of the Department of paleontology and stratigraphy of the Slovak Academy of Sciences was initiated by Acad. Dimitrij Andrusov in 1953. During seventy years of paleontological research, a number of paleontologists from our institute became a world respected, such as following:

Ján Seneš (bivalvia, marine ecosystems, Paratethyan bioprovinces)
Ján Bystrický (dasycladalean algae, Triassic stratigraphy)
Vanda Kollárová Andrusovová (ammonites, bivalvia)
Karol Borza (calpionellids, calcareous cysts)
Eduard Köhler (nummulitids and other large foraminifera)
Jozef Salaj (Triassic foraminifers, Cretaceous and Paleogene planktonic foraminifera)
Otília Jendrejáková (Triassic and Cretaceous benthic foraminifera)
Jarmila Papšová (bivalvia, conodonts)
Róbert Marschalko (sedimentology and stratigraphy)
Jozef Michalík (brachiopods, benthic communities, microplankton, biotic proxies, etc.)
Daniela Reháková (calpionellids, calcareous cysts, microplankton, etc.)
Michal Kováč (bivalvia, paleobiogeography, Paratethyan environments).
Mária Peterčáková (calcareous nannoplankton, radiolaria)
Stanislav Buček (dasycladalean algae, large foraminifera)
Peter Masaryk (biofacies and microfacies)

Historical photo from 1958 with members of the Geological laboratory of the Slovak Academy of Sciences Bratislava.

RNDr. Ján Seneš, DrSc.



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Doc. RNDr. Jozef Michalík, DrSc.

Prof. RNDr. Daniela Reháková, CSc.

Prof. RNDr. Michal Kováč, DrSc.

A gallery of researchers working at the Geological Institute of the Slovak Academy of Sciences (currently Earth Science Institute) who provided a significant contribution to the development of paleontology, biostratigraphy and sedimentology.

This tradition has remained at the Earth Science Institute of the Slovak Academy of Sciences to the present time. Paleontological research has been upgraded thank to EU funding projects providing financial support for developing analytical infrastructure such as isotopic and organic geochemistry, Raman spectroscopy, micro-CT tomography, RTG diffractometry, electron microprobe analysis (EMP) and other laboratory facilities at the working place in Banská Bystrica. The new trends in paleontology research at the Earth Science Institute of the Slovak Academy of Sciences comprise of biochronology, taphonomy, ichnology, biogeochemistry, Micro-CT visualization, paleoclimatology, paleolimnology, molecular paleontology, etc.

Following the tradition and current activity in paleontological research, the Earth Science Institute of the Slovak Academy of Sciences took over a charge for hosting the 23rd Czech–Slovak–Polish Paleontological conference.

Organizing committee decided to place the venue of conference in the iconic building of the Museum of the Slovak National Uprising in Banská Bystrica. The conference scope covers a wide range of fossil studies like micropaleontology, invertebrate and vertebrate paleontology, paleobotany and palynology, paleoecology, paleolimnology, paleobiogeography, biostratigraphy, evolutionary biology, etc. The conference programme comprises 61 scientific contributions, including 31 lectures and 26 posters. Considering a numerous participation of students, the scientific board will award the best master's and the PhD theses in the field of paleontology defending in the last two years, as well as the best oral and poster presentations. Besides of scientific programme, the conference involves a field trip passing through paleontological and attractive geo-touristic sites in the Liptov region. The participants will visit the Mesozoic formations of the Central Western Carpathians in the Veľká Fatra and Nízke Tatry Mts (e.g. Ammonitico Rosso facies, Carnian reefal limestones, „Fleckenmergel" facies), transgressive formations and turbiditic deposits of the Central-Carpathian Paleogene Basin (Nummulite banks), Quaternary travertines and their fissure filling fossils, the exposition of the Slovak Museum of Nature Protection and Speleology, and other paleosites.

We hope that the 23rd Czech–Slovak–Polish Paleontological conference will provide a good opportunity for sharing new ideas in paleontological research, discussing current problems, fostering cooperation of research teams and maintaining community of all friends of paleontology.

On behalf of the Organizing Committee
Ján Soták

Calcareous nannofossils across Eocene–Oligocene transition in the Central Carpathian Paleogene Basin: Biostratigraphic data and paleoenvironmental proxies

SILVIA ANTOLÍKOVÁ[1], JÁN SOTÁK[2]

[1]*Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 840 05, Bratislava, Slovakia; silvia.antolikova@savba.sk*
[2]*Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 974 11 Banská Bystrica, Slovakia; sotak@savbb.sk*

The Paleogene sediments of the Bystré, Istebné and Ružomberok sections were biostratigraphically examined based on calcareous nannofossils and foraminifera. Upper Eocene to Lower Oligocene assemblages of calcareous nannofossils were identified as follows:

Upper Eocene (Bartonian) age was determined in the Bystré and Istebné sections based on the first occurrence of the species *Reticulofenestra hillae* and *Reticulofenestra moorei*, which appear for the first time at the base of the NP 17 Nannoplankton Zone (*sensu* Martini 1971).

Calcareous nannofossils characteristic of the Eocene/Oligocene boundary interval were found in the Istebné and Bystré sections. For the Eocene/Oligocene boundary (Priabonian/Rupelian), which is located in the middle of the NP 21 Zone, the occurrence of biostratigraphic important species like *Isthmolithus recurvus* and *Reticulofenestra lockeri* species are characteristic. A significant decrease in the occurrence of warm-water species such as *Sphenolithus* marks this interval.

Upper Eocene to the lowest Oligocene calcareous nannofossils are characterised by an increase in the size of *Reticulofenestra–Gephyrocapsa–Emiliania* specimens and an increase in their central opening, which is associated with global cooling, Antarctic glaciation, and atmospheric pCO_2 decline during the Eocene/Oligocene transition. The latest studies show that this phenomenon is related to the progressive establishment of global oceanic eutrophication starting in the late Eocene and by the disappearance of a warm oligotrophic surface ocean. The nutritional habits of species had to adapt to these changed conditions, which led to an increase in their body size. (Ma et al. 2024) Large body-size specimens, with large central openings were found in all our examined boreholes.

The Lower Oligocene nannoassemblage belonging to the NP22 Zone was found in the Istebné section based on the occurrence of the species *Helicosphaera bipuncta* and *Helicosphaera recta*, which have their first appearance in this zone.

The youngest calcareous nannofossils were found in the Istebné and Ružomberok sections. Biostratigraphical important species *Reticulofenestra ornata* and *Cyclicargolithus abisectus*, typical for the Rupelian nannofossils of the NP22/23 Zones, were identified in these layers.

In the Istebné section, paleoecological conditions in the sedimentary basin should be determined as eutrophic, temperate water, with normal salinity, and that based on dominant occurrence of the species *C. pelagicus*, *C. floridanus*, *L. minutus* and *Z. bijugatus*.

The species *Sphenolithus moriformis*, which prefers warm-water conditions, was abundant in the Eocene nannoassemblage. With the appearance of the species *Isthmolithus recurvus*, the occurrence of the species *S. moriformis* decreases and the occurrence of *Z. bijugatus* also decrease slightly. Therefore, we can confirm cooler conditions at the Eocene/Oligocene boundary.

In the Bystré section, the calcareous nannofossils and diatoms indicates eutrophic and temperate water conditions. The allochthonous nannofossils like Lower Eocene discoasterids and *Tribrachiathus* species occurred in several intervals of this section. *Thoracosphaera* species are also recorded throughout the section. Currently, *Thoracosphaera heimi* have been observed in water depths between 50 and 100 m and coincide with relatively lower temperatures and relatively higher salinities than respective surface conditions. (Karwath et al. 2000) It is possible to assume similar conditions for the sedimentary basin during the Rupelian period.

In the Ružomberok section, the sedimentary environment can be described as temperate water and eutrophic, based on the occurrence of species *Coccolithus pelagicus*, *Cyclicargolithus floridanus*, *Reticulofenestra daviesii* and *Reticulofenestra lockeri*. The cold-water species were represented by *Chiasmolithus altus*, *Chiasmolithus oamaruensis*, *Reticulofenestra daviesii* and *Reticulofenestra dictyoda*. A slight increase of warm water oligotrophic species was observed in the interval considered as NP 22/23 boundary (Aubry 1992; Dunkley Jones et al. 2008; Fioroni et al. 2015)

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References:

Aubry M.-P. 1992: Late Paleogene calcareous nannoplankton evolution: a tale of climatic deterioration. In: Prothero D.R., Berggren W.A. (Eds.): Eocene-Oligocene Climatic and Biotic Evolution. Princeton University Press, Princeton, 272–309.

Dunkley Jones T. 2008: The response of low-latitude calcareous phytoplankton to global change through the Eocene–Oligocene transition. PhD thesis, University College London.

Fioroni C., Villa G., Persico D., Jovane L. 2015: Middle Eocene-Lower Oligocene calcareous nannofossil biostratigraphy and paleoceanographic implications from Site 711 (equatorial Indian Ocean). Marine Micropaleontology 118, 50–62. https://doi.org/10.1016/j.marmicro.2015.06.001

Ma R., Aubry M.-P., Bord D., Jin X., Liu C. 2024: Inferred nutrient forcing on the late middle Eocene to early Oligocene (~40–31 Ma) evolution of the coccolithophore Reticulofenestra (order Isochrysidales). Paleobiology 50, 29–42. https://doi.org/10.1017/pab.2023.20

Martini E. 1971: Standard Tertiary and Quaternary Calcareous Nannoplankton Zonation. In: Farinacci A. (Ed.): Proceedings of the Second Planktonic Conference, Roma, 1970, 739–785.

Karwath B., Janofske D., Willems H. 2000: Spatial distribution of the calcareous dinoflagellate *Thoracosphaera heimii* in the upper water column of the tropical and equatorial Atlantic. International Journal of Earth Sciences 88, 668–679.

Cretaceous fossil record of Neogastropoda

SOFIA BAKAYEVA[1, 2], ANDRZEJ KAIM[1], KRZYSZTOF HRYNIEWICZ[1]

[1]*Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818 Warsaw, Poland; sofiyabakayeva@gmail.com, kaim@twarda.pan.pl, krzyszth@twarda.pan.pl*
[2]*State Museum of Natural History, National Academy of Sciences of Ukraine, Teatralna st. 18, Lviv 79008, Ukraine*

Neogastropods are marked by their current great diversity, constituting approximately 25 % of all living gastropod species. Their emergence, along with the causes of their rapid radiation, remains not fully understood. In the Cretaceous 20 neogastropod families and 151 genera has been recorded so far. Their stratigraphical and geographical distribution reflects not only the degree of research or exposure of the Cretaceous sediments in different regions but also possible centers of diversification of the neogastropod fauna.

Our research is based on compilation of the published taxonomic data with stratigraphic ranges gathered from the original descriptions as well as revisions and the examination of gastropod collections from various institutions, including the Institute of Paleobiology PAS (Warsaw, Poland), the State Museum of Natural History NASU (Lviv, Ukraine), National Museum of Natural History BAS (Sofia, Bulgaria), and the Geological Survey of India (Kolkata, India).

From the Early Cretaceous 10 neogastropod families and 21 genera have been recorded to date. The generic diversity remained relatively low before the Albian, but increased significantly during that stage and continued to grow until the end of the period. The oldest findings in the Early Cretaceous are extremely rare – only one fragment of juvenile shell has been identified in the Valanginian of Poland (Kaim 2004) and another complete specimen has recently been discovered in the Barremian of Bulgaria (Bakayeva & Kaim 2023). From the Aptian–Albian only one species has been recorded in Mexico (Allison 1955) and from the Albian of England two species are documented (Tracey 2010), whereas from the Albian of Madagascar fifteen species are described (Collignon 1949) being the most abundant Early Cretaceous neogastropod fauna to date. From the transitional Albian–Cenomanian sediments of Austria another four species are known (Kollmann 1976). Totally 10 neogastropod families and 21 genera were documented from the Albian with 19 first appearances of the genera.

In the Late Cretaceous neogastropods occur more frequently with 20 families and 147 genera recorded worldwide. From the Cenomanian 12 families and 30 genera have been documented. Most of these genera continued to thrive from the Albian on, while among 12 genera with first appearances in the Cenomanian 3 became extinct by the end of this stage. 12 families and 45 genera have been recorded from the Turonian (from 19 genera with first appearances 11 became extinct), from the Coniacian – 13 families and 45 genera (11 genera first appeared and 3 became extinct), from the Santonian – 15 families and 50 genera (8 genera first appeared and 3 became extinct), from the Campanian – 18 families and 103 genera (56 genera first appeared and 8 became extinct), and from the Maastrichtian – 19 families and 110 genera (15 genera first appeared and 85 became extinct). The majority of Cretaceous taxa went extinct by the end of the period, however members of 13 families and 25 genera crossed the K/Pg boundary.

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References:

Allison E.C. 1955: Middle Cretaceous Gastropoda From Punta China, Baja California, Mexico. Journal of Paleontology 29, 400–432.

Bakayeva S., Kaim A. 2023: The first record of a turbinellid gastropod from the Barremian of Bulgaria and its importance for the evolution of Neogastropoda. In: Skupien P. (Ed.): 22nd Czech–Slovak–Polish Palaeontological Conference (October 17–19, 2023, Ostrava, Czechia). Abstracts, 15–16.

Collignon M. 1949: Recherches sur les faunes albiennes de Madagascar. V. l'Albien supérieur d'Andranofotsy (Cercle de Manja), avec une notice stratigraphique par P.Hartz. Annales géologiques du Service des mines (Tananarive) 19, 1–40.

Kaim A. 2004: The evolution of conch ontogeny in Mesozoic open sea gastropods. Palaeontologia Polonica 62, 1–183.

Kollmann H.A. 1976: Gastropoden aus den Losensteiner Schichten der Umgebung von Losenstein (Oberösterreich). 1 Teil: Euthyneura und Prosobranchia 1 (Neogastropoda). Annalen Des Naturhistorischen Museums in Wien 80, 163–206.

Tracey S. 2010: Gastropods. In: Young J.R. , Gale A.S., Knight R.I., Smith A.B. (Eds.): Fossils of the Gault Clay. Palaeontological Association Field Guide to Fossils, Number 12. The Palaeontological Association, London, 106–155.

Mesozoic Colombellinidae (Gastropoda): Distribution and taxonomy

SOFIA BAKAYEVA[1, 2], ANDRZEJ KAIM[1], KRZYSZTOF HRYNIEWICZ[1], PETR SKUPIEN[3]

[1]*Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818 Warsaw, Poland; sofiyabakayeva@gmail.com, kaim@twarda.pan.pl, krzyszth@twarda.pan.pl*
[2]*State Museum of Natural History, National Academy of Sciences of Ukraine, Teatralna st. 18, Lviv 79008, Ukraine*
[3]*VSB – Technical University of Ostrava, 17. listopadu 15, 708 00 Ostrava, Czechia; petr.skupien@vsb.cz*

Colombellinidae is an extinct family of gastropods that appeared in the Jurassic and went extinct in the Cretaceous. Members of the family are characterized by a thick oval shell with a narrow, curved aperture, which possesses anterior and posterior canals, a thickened peristome and frequently denticulate outer and inner lips. Initially, it was hypothesized that the family is related to columbellids (Buccinoidea). The relationship between the Jurassic columbellid genus *Zittelia* and the recent *Cypraea* (Cypraeidae) was discussed by Sayn (1932). Taylor et al. (1980) included Colombellinidae in Tonnoidea and postulated its origin during the Jurassic from Stromboidea. Taylor & Morris (1988) considered Colombellinidae as the stem group of Cypraeoidea and Tonnoidea, and as close relatives to Purpurinidae, or the most closely related group to neogastropods. According to the latest classification by Bouchet et al. (2017), the family is placed among taxa of uncertain position within Latrogastropoda. Indeed, the lack of knowledge regarding protoconch morphology makes the systematic position of the family still uncertain.

We have revised all available data about colombellinids and suggest that two genera – *Colombellina* d'Orbigny, 1843 and *Zittelia* Gemmellaro, 1869 – should be retained in the family. The genus *Colombellina* includes 19 species described from various regions, primarily across Europe, with only two species recorded from Japan and one described from India. The genus *Zittelia* is represented by 10 species, which have not yet been discovered outside of Europe. Colombellinid species are typically distributed in carbonate sediments and are represented by single specimens, with the number only extremely rarely exceeding five specimens in the case of *Colombellina*, whereas *Zittelia* species are more numerous, with some species having up to 25 specimens.

Comparison of the most characteristic features of colombellinids (morphology of peristome and aperture) with purpurinids, tonnoids, buccinids, stromboids, and cypraeids has allowed for a new perspective on the phylogenetic relationships among these groups.

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References:

Bouchet P., Rocroi J.-P., Hausdorf B., Kaim A., Kano Y., Nützel A., Parkhaev P., Schrödl M., Strong E. E. 2017: Revised Classification, Nomenclator and Typification of Gastropod and Monoplacophoran Families. Malacologia 61, 1–526.

Sayn G. 1932: Description de la faune de l'Urgonien de Barcelonne (Drôme). Travaux Du Laboratoire de Géologie de La Faculté Des Sciences de Lyon 18, 1–67.

Taylor J.D., Morris N.J., Taylor C.N. 1980: Food specialization and the evolution of predatory prosobranch gastropods. Palaeontology 23, 375–409.

Taylor J.D., Morris N.J. 1988: Relationships of neogastropods. Malacological Review 4, 167–179.

The revision of the baphetids from the Middle Pennsylvanian of the Czech Republic

PAVEL BARTÁK[1], MARTIN IVANOV[1]

[1]*Department of Geological Sciences, Faculty of Science, Masaryk University, Kotlářská 267/2 611 37 Brno, Czech Republic; bartak.pavel@mail.muni.cz, mivanov@sci.muni.cz*

The baphetids represent a clade of the Carboniferous early tetrapods with characteristic crocodile-like skulls and anteriorly extended antorbital vacuities forming key-hole shaped openings on the skull dermal surface. The members of the group were aquatic piscivores frequently found in coal-bearing deposits with abundant fish fauna, and recovered from the lacustrine deposits of the Central and Western Europe, United States and Canada (Clack & Milner 2015). The oldest records of the group are known from the Middle Mississippian (Visean) of Canada, while the most recent findings come from the Middle Pennsylvanian (Moscovian) localities in Czech Republic and Ohio (USA). Several important specimens referred to baphetids have historically been reported from the late Carboniferous (Moscovian: Asturian) of the Nýřany locality near Pilsen in Czech Republic (Fritsch 1885; Steen 1938; Milner et al. 2009), but the aggregated through revision and comparison of this material has never been fully undertaken.

Here we provide a morphological revision of all available baphetid material from the late Carboniferous of the Czech Republic, including one newly described specimen represented by a well-preserved isolated right dentary with teeth. The presumably lost type specimen of *Loxomma bohemicum* was rediscovered and shown to represent a poorly preserved lower jaw fragment of the large temnospondyl amphibian *Capetus palustris*. The all remaining material can be attributed to various ontogenetic stages of *Baphetes orientalis*, which is characterized by the postorbital with a very thin and sharply pointed postfrontal process and a slightly elongate rectangular lateral process of the bone. The most comprehensive phylogenetic analysis of the Baphetoidea to date has been performed, the results of which indicate that the monogeneric subfamily Baphetinae may be polyphyletic. *"Loxomma" lintonensis* from the Moscovian of Linton (Ohio, USA), which was recently found to be a member of Loxommatinae (Milner et al. 2009), has been recovered as more closely related to *Baphetes orientalis* in the present analysis, indicating that its reference to the genus *Loxomma* is doubtful.

References:

Clack J.A., Milner A.R. 2015: Handbook of Paleoherpetology, Part 3A1: Basal Tetrapoda. Dr. Friedrich Pfeil, München.

Fritsch A. 1885: Fauna der Gaskohle und der Kalksteine der Permformation Böhmens, Band 1, Heft 2. Selbstverlag, Prag.

Milner A.C., Milner A.R., Walsh S.A. 2009: A new specimen of Baphetes from Nýřany, Czech Republic and the intrinsic relationships of the Baphetidae. Acta Zoologica 90, 318–334.

Steen M.C. 1938: On the fossil Amphibia from the Gas Coal of Nýřany and other deposits in Czechoslovakia. Proceedings of the Zoological Society of London 108, 205–283.

New data on the Middle Miocene brachiopods of Moravia, Czech Republic

MARIA ALEKSANDRA BITNER[1], ŠÁRKA HLADILOVÁ[2], JAROSLAV ŠAMÁNEK[2], TOMÁŠ TUREK[2, 3]

[1]*Institute of Paleobiology, Polish Academy of Sciences, ul. Twarda 51/55, 00-818 Warszawa, Poland; bitner@twarda.pan.pl*
[2]*Institute of Geological Sciences, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic; sarka@sci.muni.cz, samanek.j@mail.muni.cz, 424007@mail.muni.cz*
[3]*Department of Geology and Paleontology, Moravian Museum, Zelný trh 6, 659 37 Brno, Czech Republic; tturek@mzm.cz*

Brachiopods are common members of the benthic communities of the Middle Miocene (Badenian) deposits of the Central Paratethys. In the Moravian part of the Carpathian Foredeep (Czech Republic), however, they are scarce and of low diversity. Here we describe a brachiopod fauna newly collected from the Lower Badenian calcareous clays at two localities in the Borač area, namely Borač and Borač-Podolí. The assemblage comprises four species, i.e. *Terebratula* cf. *styriaca* Dreger, 1889, *Terebratulina retusa* (Linnaeus, 1758), *Megerlia truncata* (Linnaeus, 1767), and *Megathiris detruncata* (Gmelin, 1791). Among them two species, *T.* cf. *styriaca* and *T. retusa* are recorded for the first time from Moravia. It is worth mentioning that *T. retusa* is very rare in the Miocene of the Central Paratethys, having been so far reported only from Austria (Dreger 1889) and Hungary (Bitner & Dulai 2004). The species *Megerlia truncata* dominates in the studied material, while the fourth species, *Megathiris detruncata* is rare and was found only at the Borač locality. The rarity of the latter species and the absence of other members of the family Megathyrididae, usually a dominant group in the Paratethyan assemblages, may indicate deeper water conditions. Megathyrid brachiopods are shallow-water species preferring cryptic habitats while Recent representatives of *Terebratulina retusa* and *Megerlia truncata* belong to a eurybathic group (Logan 1979).

On the brachiopod shells from the Borač locality two types of trace fossils are observed: drill holes penetrating the shell (ichnogenus *Oichnus* Bromley, 1981) and etching scars produced by a brachiopod pedicle (ichnogenus *Podichnus* Bromley and Surlyk, 1973). The etching scars are restricted to the shells of *Terebratula* cf. *styriaca*, and most probably are of conspecific origin.

References:

Bitner M.A., Dulai A. 2004: Revision of Miocene brachiopods of the Hungarian Natural History Museum, with special regard to the Meznerics collection. Fragmenta Palaeontologica Hungarica 22, 69–82.

Dreger J. 1889: Die tertiären Brachiopoden des Wiener Beckens. Beiträge zur Paläontologie Österreich–Ungarns 7, 179–192.

Logan A. 1979: The Recent Brachiopoda of the Mediterranean Sea. Bulletin de l'Institut Océ anographique Monaco 72, 1–112.

Multivariate assessment of a peculiar elephantimorph (Proboscidea) molar from the Miocene of South Moravia (Czech Republic)

JAKUB BŘEZINA[1], CSABA TÓTH[2], DANIEL MADZIA[3]

[1]*Department of Geology and Paleontology, Moravian Museum, Zelný Trh 6, 659 37 Brno, Czech Republic*
[2]*Earth Science Institute of the Slovak Academy of Sciences, Dúbravská cesta 9, 840 05, Bratislava, Slovakia*
[3]*Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818 Warsaw, Poland*

In 1929, a second right upper trilophodont molar (M2) was found in Lower Miocene deposits at Střelice near Jevišovice (Czech Republic), and identified by Stehlík (1931) as *Mastodon angustidens*. Our reevaluation of the specimen brought up several longstanding issues with the identification of molars of early-diverging elephantimorph proboscideans. Although frequently found isolated, their anatomy is poorly studied, highlighting the need for a deeper understanding of their morphologies. This knowledge could also aid in developing a tool for their identification.

Trilophodont gomphotheres (Gomphotheriidae) are a group of proboscideans that originated in Africa and during the early Oligocene diversified into Choerolophodontinae, Amebelodontinae, and several *Gomphotherium* species (Wang et al. 2017; Sanders 2023). Since the beginning of the Burdigalian (Early Miocene), these elephantimorphs spread across Eurasia (Tassy 1990). Whereas the M2 of choerolophodontines and amebelodontines appear to be comparatively easy to recognize, those of Early Miocene species referred to *Gomphotherium* (often oversimplified as *G. angustidens*) are problematic. The presence of over 8 species of *Gomphotherium* was confirmed in the Lower Miocene of Eurasia. The most common among them are referred to as the "*G. annectens* group", while the "*G. angustidens* group" is represented solely by *G. inopinatum*. Subtapiroid taxa (also called "derived gomphotheres" by Wang et al. 2017), which show a combination of zygodont and bunodont dental characters, hold a special position. Their dental features closely resemble, those of the "robust form" of *Zygolophodon turicensis*, thus making these taxa difficult to tell apart based on their teeth (e.g., Göhlich 2010 vs Tassy 1985).

We performed a multivariate analysis using a preliminary version of a novel character matrix comprising measurements and discrete characters obtained from a wide specter of early-diverging elephantimorphs, including the Střelice specimen. Expectedly, the results show a partly overlapping morphospace occupation of mammutid and gomphothere taxa. Intriguingly, however, there appears to be a shift in the morphospace occupation of early elephantimorph M2, from a "mammutid" to a "gomphothere" morphology. This shift is poorly observable without the use of quantitative methods. Interestingly, the Střelice specimen occupies the "transitional" morphospace, thus illustrating the intermediate traits.

Further exploitation of the available data are expected to result in development of a new tool for more accurately assessing isolated elephantimorph molars.

References:

Göhlich U.B. 2010: The Proboscidea (Mammalia) from the Miocene of Sandelzhausen (southern Germany). Paläontologische Zeitschrift 84, 163–204.

Sanders W.J. 2023: Evolution and Fossil Record of African Proboscidea. CRC Press, Abingdon, 346 p.

Stehlík A. 1931: Nález mastodonní stoličky ve střelicích u Jevišovic. Od Horácka k Podyjí 8, 350–353.

Tassy P. 1985: La place des mastodontes miocènes de l' Ancien Monde dans la phylogénie des Proboscidea (Mammalia): Hypothéses et conjectures. Ms Unpubl. D.Sc. thesis, Université Pierre et Marie Curie, Paris, 861 p.

Wang S.Q., Li Y., Duangkrayom J., Yang X., He W., Chen S.Q. 2017: A new species of *Gomphotherium* (Proboscidea, Mammalia) from China and the evolution of *Gomphotherium* in Eurasia. Journal of Vertebrate Paleontology 37, e1318284.

The lost Jurassic world: New collection of fossils from the lost Jurassic locality Brno–Švédské šance, Bohemian Massif (Czechia)

MIROSLAV BUBÍK[1], PETR HYKŠ[2]

[1]Czech Geological Survey, Leitnerova 22, 602 00 Brno, Czechia; miroslav.bubik@geology.cz
[2]Department of Geological Sciences, Faculty of Science, Masaryk University Brno, Kotlářská 2, 611 37 Brno, Czechia; hyks.petr@mail.muni.cz

Brno–Švédské šance is a classical locality of the Brno Carbonate Platform, formed during the Late Jurassic on the northern margin of the Tethys Ocean. This locality was studied since the end of the 19th century after the opening of several small quarries exposing the uppermost layers of approximately 130 m thick succession of mainly Oxfordian carbonate rocks (Eliáš 1981). About 130 species, including 23 new, were found during the times of active quarrying (Uhlig 1881; Oppenheimer 1907). Since 1949, the quarries were backfilled by industrial waste and rubbish. In 2022, the top of southern-quarry wall was exposed during excavations of foundations for industrial buildings. At this time, we visited the locality to collect as many fossils as possible. We have also localized part of Oppenheimer's (1907) collection, including 11 holotypes of ammonites, at the Geological Institute, University of Vienna. Here we provide the first results of our investigation.

Microfacially, pelbiomicrites and biopelmicrites prevail over biomicrites and pelintrabiomicrites. Packstones are more frequent that wackestones and microbial boundstones. Nests of spiculites and abundant bioclasts (crinoids, foraminifers, echinoids, serpulids, ostracods, bivalves, stromatoporoids, gastropods, *Crescentiella moronensis*) can be seen in thin sections. Bryozoans are quite frequent in the upper part of the quarry.

Foraminifer assemblages from acid residues are dominated by spirillinids – mainly *Spirillina kuebleri* and *S. concava* – due their dissolution resistance (see also Bubík 2010). Thin sections shows higher diversity, with *Falsogaudryinella uvigeriniformis*, *Protomarssonella*, *Paleogaudryina*, *Coscinoconus alpinus*, *Trocholina transversarii*, *Bullopora tuberculata*, miliolids (*Istriloculina*, *Quinqueloculina*, Ophthalmidium, *Vinelloidea*, *Earlandia*, *Cornuspira*), nodosariids (*Lenticulina*, *Astacolus*, *Pyramidulina*), *Rumanolina feifeli*, *Hoeglundina*, etc.

Exposed limestones were relatively poor in macrofossils. The most fossiliferous layers in the past were situated in the northern quarries (Oppenheimer 1907). Nevertheless, the southern quarry yielded tens of terebratulid and rhynchonellid brachiopods including *Somalirhynchia moravica*, various bivalves (*Ctenostreon* cf. *proboscideum*, *Goniomya trapezina*, *Pleuromya* cf. *uniformis*, *Pteria*, ?*Entolium*), gastropods (*Pleurotomaria*, *Pseudomelania*), echinoid spines (*Rhabdocidaris* cf. *orbignyana*), and abundant crinoids (Millericrinida, Isocrinida). Less common were sponges, serpulids, belemnites (*Hibolites* cf. *semihastatus*), and ammonites (one cast of *Microbiplices* sp.).

Biostratigraphically most valuable is the collection of Oppenheimer (1907). The ammonites previously regarded as *Perisphinctes* are in fact representatives of *Microbiplices* (Andrzej Wierzbowski, personal communication). Based on ribbing, they correspond to the early species from the lower Hypselum Zone. Oppenheimer (1907) also figured several specimens of *Epipeltoceras bimammatum*, the index species of the Bimammatum Zone. Therefore, the age of the locality probably corresponds to the Oxfordian–Kimmeridgian transition (Hypselum–Bimammatum zones) which is in accordance with the numerous brachiopods *S. moravica* (Uhlig 1881), which are known from both of these ammonite zones.

References:

Bubík M. 2010: Foraminifer fauna of the Oxfordian limestones of Švédské šance near Brno. Geologické výzkumy na Moravě a ve Slezsku 17, 108–112.

Eliáš M. 1981: Facies and paleogeography of the Jurassic of the Bohemian Massif. Journal of Geological Sciences. Geology 35, 75–145.

Oppenheimer J. 1907: Der malm der Schwedenschanze bei Brünn. Beiträge zur Paläontologie Österreich-Ungarns und des Orients 20, 221–271.

Uhlig V. 1881: Die Jurabildungen in der Umgebung von Brünn. Beiträge zur Paläontologie von Österreich 4, 1–130.

Kimmeridgian ammonite fauna, biostratigraphy and palaeobiogeography of the Mecsek Mountains, Hungary

LÁSZLÓ BUJTOR

Eszterházy Károly Catholic University, Eszterházy tér 1, 3300 Eger, Hungary

New collection (2018–2022) from the abandoned quarries at Zengővárkony (Mecsek Mountains, South Hungary) and revision of old museum material provided some 900 specimens available to this study (Bujtor & Albrecht 2021; Bujtor et al. 2021, Bujtor *in press*). The fauna is pelagic, its lithofacies is mainly ammonitico rosso dominated by ammonites. Beside ammonites, the nautiloids, belemnites, brachiopods, and spirochaete tubeworms are additional elements of the megafauna.

The sequence is a 22 metres thick limestone sequence. Lower part is characterized by thin bedded, laminated dark red coloured limestone, followed by a typical ammonitico rosso lithofacies: spotty, nodular, flesh red coloured, poorly stratified limestone with frequent marly interbedding. Upwards the ammonitico rosso facies disappears, colour changed into greyish white; fine bedding also disappears. Terminal part of the Kimmeridgian is white or greyish white micritic limestone with rich microfossil content (*Saccocoma* and benthic foraminifera).

From the almost complete Kimmeridgian sequence 34 ammonite genera and 45 ammonite species are recorded. 24 species are first records from Hungary. The fauna is dominated by haploceratid and perisphinctid specimens (55 %) with high share of aspidoceratid ammonites (23 %). The fauna is typical Mediterranean Tethyan, although the phyllo- and lytoceratid ratio is lower (22 %) than usual in Mediterranean settings.

There is an indication to the continuous connection with the Submediterranean Province (?*Wegelea* sp., *Orthosphinctes* (*Ardescia*) cf. *schaireri*, *Pseudowaagenia inerme*, and *Gravesia* aff. *gigas*) over the Mecsek terrain which was, geographically, close to the southern margin of stable Europe and it is considered a microplate.

Mediterranean, Kimmeridgian ammonite biozones recognized:

- Hypselum–Bimammatum zones: Zonal subdivision from the Oxfordian Hypselum Zone was not possible. *Trimarginites* cf. *trimarginatus* and *Glochiceras* (*Coryceras*) cf. *microdomum* refer to these zones.
- Planula Zone: not supported by ammonites.
- Silenum Zone: A *Trenerites evolutus* indicates the presence of this zone.
- Strombecki Zone: It is indicated by *Taramelliceras* (*Metahaploceras*) aff. *strombecki*, *Nebrodites hospes* and *Metastreblites* sp.
- Herbichi Zone: It is indicated by *Praesimoceras* cf. *herbichi*, *Nebrodites agrigentinus* and *Idoceras sautieri*.
- Acanthicum Zone: Two *Aspidoceras* species (*A. acanthicum* and *A. longispinum*) refer to the presence of this zone.
- Cavouri Zone: Fragments of *Mesosimoceras cavouri* and *Aspidoceras caletanum* establish the presence of this zone.
- Beckeri Zone: Its is supported by *Hybonoticeras pressulum*, *Pseudowaagenia acanthomphala* and *P. inerme*.

References:

Bujtor L., Albrecht R. 2021: Latest Oxfordian–earliest Kimmeridgian ammonite dominated fauna and microfacies from the ammonitico rosso-type Fonyászó Limestone Formation at Zengővárkony (Mecsek Mountains, Hungary). Volumina Jurassica 19, 61–96.

Bujtor L., Albrecht R., Farkas Cs., Makó B., Maróti D., Miklósy Á. 2021: Kimmeridgian and early Tithonian cephalopods from the Kisújbánya Limestone Formation, Zengővárkony (Mecsek Mountains, southern Hungary), their faunal composition, palaeobiogeographic affinities, and taphonomic character. Carnets de Géologie 21, 265–314.

Bujtor L. (in press): Lower Kimmeridgian ammonite-based biostratigraphy, biogeography, and microfacies of the Mecsek Mountains (South Hungary). Bollettino della Società Paleontologica Italiana

New material of *Discosauriscus* from the lower Permian of the Boskovice Basin reveals a best preserved scaly skin pattern in larval stages of seymouriamorphs

GABRIELA CALÁBKOVÁ[1,2], JAKUB BŘEZINA[1], TOMÁŠ VIKTORÝN[2]

[1]*Department of Geology and Paleontology, Moravian Museum, Zelný Trh 6, 659 37 Brno, Czech Republic*
[2]*Department of Geological Sciences, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic*

Discosauriscus is the most abundant tetrapod from the early Permian of the Boskovice Basin (Czech Republic). The skeletal remains of their immature stages (mostly including larvae) are often articulated in specific layers within several horizons of the Letovice Formation (Calábková et al. 2022, fig. 2). The first material of *Discosauriscus* was described by Makowsky (1876) from the Malá Lhota locality. Since then, these fossils have attracted researchers and collectors for their abundance and completeness. In some cases, their body fossils are associated with soft tissue, such as external gills and eye structures (Špinar 1952; Klembara & Meszároš 1992; Klembara 1995). Here, we present undescribed material from the newly discovered second site near Malá Lhota. Compared to other localities within the Letovice Formation, atypical preservation resulted in the preservation of extremely rare soft tissue with a scaly skin pattern associated with the appendicular skeleton. In addition, well preserved dermal scales were captured in some parts of the bodies. Discosauriscids from Malá Lhota thus provide the most accurate view on the body covering of at least pre-adult representatives of Seymouriamorpha.

References:

Calábková G., Březina J., Madzia D. 2022: Evidence of large terrestrial seymouriamorphs in the lowermost Permian of the Czech Republic. Papers in Palaeontology 8, e1428. https://doi.org/10.1002/spp2.1428

Klembara J. 1995: The external gills and ornamentation of the skull roof bones of the Lower Permian tetrapod *Discosauriscus austriacus* (Makowsky 1876) with remarks to its ontogeny. Paläontologische Zeitschrift 69, 265–281. https://doi.org/10.1007/BF02985990.

Klembara J., Meszároš Š. 1992: New finds of *Discosauriscus austriacus* (Makowsky 1876) from the Lower Permian of the Boskovice Furrow (Czecho-Slovakia). Geologica Carpathica 43, 305–312.

Makowsky A. 1876: Über einen neuen Labyrinthodonten '*Archegosaurus austriacus* nov. spec'. Sitzungsberichte der keiserischen Akademie der Wissenschaft 73, 155–166.

Špinar Z. 1952: Revize některých moravských diskosauriscidů (Labyrinthodontia). Rozpravy Ústředního Ústavu Geologického 15, 1–115.

It's a bird, it's a plane, it's an unexpected chameleon-like tree-climbing anguimorph that lived in the Eocene

ANDREJ ČERŇANSKÝ[1], KRISTER T. SMITH[2,3]

[1]*Department of Ecology, Faculty of Natural Sciences, Comenius University in Bratislava, Slovakia*
[2]*Messel Research and Mammalogy, Senckenberg Research Institute and Natural History Museum Frankfurt, Germany*
[3]*Faculty of Biosciences, Goethe University Frankfurt, Germany*

We here report on a new lizard from the early Middle Eocene of the Messel Pit in Germany based on several specimens. Messel is one of the most important Eocene localities in the world (Schaal & Ziegler 1988; Smith et al. 2018). The basin in which this lake deposit accumulated was created during a phreatomagmatic eruption around 48.2 Ma and the recent age estimates suggest that the fossiliferous horizons of the Middle Messel Formation span the Ypresian-Lutetian boundary (Lenz et al. 2015). Our new lizard represents an unexpected anguimorph specialist with prolonged body, short limbs and prehensile, chameleon-like tail. This indicates its arboreal lifestyle. Arboreality is an interesting biological phenomenon; animals must move through complex three-dimensional and dynamic environments high above the ground. Thus, the risk of fall from tree branches causing injury is high, and animals exhibit various adaptations and different strategies to move with greater surety. In several groups, jumping or gliding is used for habitat navigation, prey capture and escape from predators (Colbert 1967). Another strategy is a prehensile tail – animals can use their tail as a "limb" to wrap around branches. This provides stability and prevents them from falling off the trees. Within lizards, tail prehensility has been documented at least in eight lineages (Bauer 1998) and is most certainly homoplastic. The distribution of animals with prehensile tails has been commonly discussed. Many animals (especially mammals) in modern South America have prehensile tails. Although this cannot be taken as absolute, it has been argued that the rainforest in South America is denser (also having more lianas) than those in Africa or Asia and thus only a few gliding vertebrates are present there (Organ 2008). In contrast, a high number of gliding animals such as colugos, *Gekko* and *Draco* occur in rainforests of Southeast Asia, where an open forest structure might facilitate this type of locomotion. The arboreality in the Messel paratropical forest was not unusual. Our new lizard supports an interpretation of the Eocene Messel ecosystem with the abundance of lianas and palms as denser forest suitable for climbing rather than gliding forms.

References:

Bauer A.M. 1998: Morphology of the adhesive tail tips of carphodactyline geckos (Reptilia: Diplodactylidae). Journal of Morphology 235, 41–58.

Colbert E.H. 1967: Adaptations for gliding in the lizard *Draco*. American Museum Novitates 2283, 1–20.

Lenz O.K., Wilde V., Mertz D.F., Riegel W. 2015: New palynology-based astronomical and revised $^{40}Ar/^{39}Ar$ ages for the Eocene maar lake of Messel (Germany). International Journal of Earth Sciences (Geologische Rundschau) 104, 873–889.

Organ J.M. 2008: The Functional Anatomy of Prehensile and Nonprehensile Tails of the Platyrrhini (Primates) and Procyonidae (Carnivora). Johns Hopkins University. ISBN 9780549312260

Schaal S., Ziegler W. 1988: Messel-Ein Schaufenster in die Geschichte der Erde und des Lebens. Kramer, Frankfurt, Germany.

Smith K.T., Schaal S.F.K., Habersetzer J. (Eds.) 2018: Messel, An Ancient Greenhouse Ecosystem. Senckenberg Gesellschaft für Naturforschung, Frankfurt am Main, 355 p.

Fossil turtles from Czechia and Poland

MILAN CHROUST[1], TOMASZ SZCZYGIELSKI[1]

[1]Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818, Warsaw, Poland

The main object of the research is the revision of fossil turtles (Testudinata) from Czechia and Poland. Much of the historical fossil turtle material from those countries was not revised in decades or centuries and the progress in the understanding of fossil turtle phylogeny and taxonomy is markable. Besides the historical specimens, new material has been recently discovered and is waiting for scientific evaluation. Therefore, the true total diversity of turtles in Central Europe and its changes since the Mesozoic remain unknown. Our main aim is to revise the turtle fauna in a series of papers and, additionally, we propose the creation of a new web database of fossil turtle material. The database is planned to include information about localities, age, brief descriptions of the material with its taxonomic identifications and related references, and lastly, photographs of individual specimens. Therefore, the most important information, most rapidly driving scientific progress, would be accessible on the first click. In the first stage of the project, we revise fossil turtles from Czechia and Poland. The project involves taxonomic reassessment and anatomical redescription of the specimens in the comparative context, considering the current state of knowledge, to update the historic identifications and better understand the distribution of various turtle taxa over time. Besides the traditional methods, we use modern imaging technologies such as photogrammetry and 3D surface scanners to obtain the most complete and accurate digital models, which will be shared with the international scientific community.

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Biostratigraphy of the Seaford Head section (Upper Cretaceous, England), preliminary results

MARKÉTA CHROUSTOVÁ[1], ZOFIA DUBICKA[2], IAN JARVIS[3]

[1]*Institute of Geology and Paleontology, Charles University, Albertov 6, 128 43, Prague, Czech Republic; marketa.chroust@gmail.com*
[2]*Faculty of Geology, University of Warsaw, Al. Żwirki i Wigury 93, 02-089, Warszawa, Poland*
[3]*Geography, Geology and the Environment, Kingston University London, Penrhyn Road, Kingston-upon-Thames KT1 2EE, UK*

Seaford Head (southern England) offers an accessible and complete succession of exposed Turonian to Campanian chalk. It is an important regional reference section for the base of the Santonian (Hampton et al. 2007; Howe et al. 2007) and is an auxiliary GSSP for the Campanian Stage (Jarvis et al. 2023). The foraminiferal and calcareous nannofossil biostratigraphy shows several significant events (Hampton et al. 2007) but the ostracod fauna remains poorly characterised (Slipper 2009). The ostracod and foraminifera assemblages in 94 samples spanning the succession were studied. The ostracod assemblage is low diversity, with 38 species recorded. Despite this, several biostratigraphic events were observed. Many ostracod species display a lowest occurrence (LO) around the Coniacian/Santonian boundary including *Pterygocythereis spinosa* and *Cytherelloidea granulosa,* considered to be biostratigraphically important taxa by Slipper (2009). Higher in the section, the species *Phacorhabdotus semiplicatus* is replaced by *P. lonsdaleianus* close to the Middle/Upper Santonian boundary, and *Pterygocythere laticristata* first appears in the Upper Santonian. Seaford Head has yielded a record of several stratigraphically important benthic foraminiferal lineages of the genera: *Gavelinella*, *Stensioeina*, *Protostensioeina*, *Pyramidina*, *Bolivinoides*. Some bioevents provide important markers for correlation of the English Chalk with the European epicontinental Cretaceous and for placing the bases of stages and substages, e.g.: LO *Gavelinella praeinfrasantonica* (Coniacian), co-occurrence of *Protostesioeina polonica*, *P. bohemica* and *Protostensioeina* sp. E (Santonian), HO *Gavelinella vombensisi* (Middle Santonian), LO *Gavelinella stelligera* (Upper Santonian), LO *Bolivinoides culveresis* (Campanian). Interpretation of the foraminifera and ostracod data from Seaford Head, tied to a uniquely well-constrained lithostratigraphic and macrofossil biostratigraphic framework, is in progress. This holistic approach will improve our understanding of European Upper Cretaceous stratigraphy.

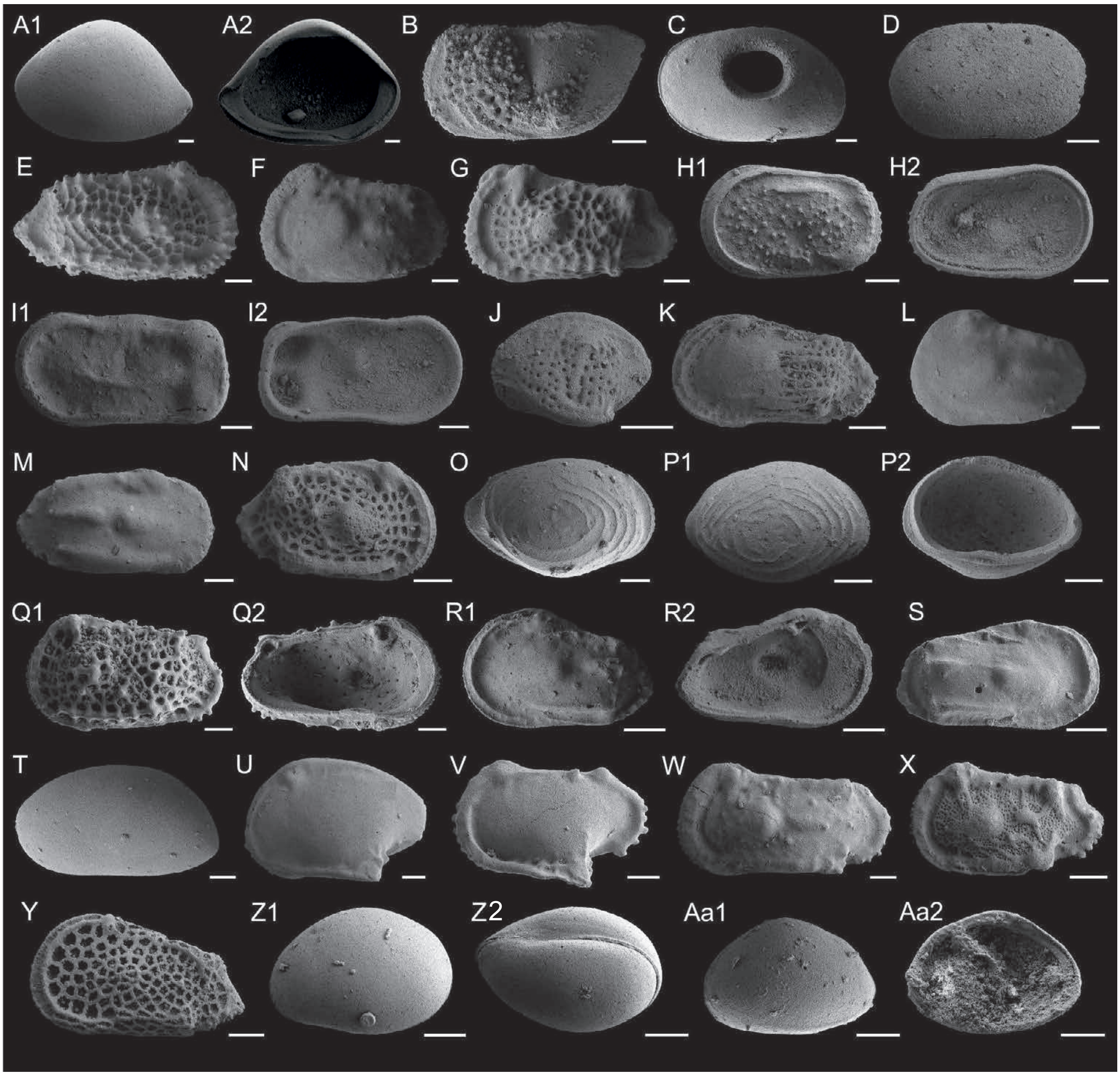
References:

Hampton M.J. et al. 2007: The biostratigraphy of Seaford Head, Sussex, southern England; an international reference section for the basal boundaries for the Santonian and Campanian Stages in chalk facies. Cretaceous Research 28, 46–60.

Howe R.W. et al. 2007: Calcareous nannofossil and planktonic foraminiferal biostratigraphy of proposed stratotypes for the Coniacian/Santonian boundary: Olazagutia, northern Spain; Seaford Head, southern England; and Ten Mile Creek, Texas, USA. Cretaceous Research 28, 61–92.

Jarvis I. et al. 2023: Carbon isotopes, palynology and stratigraphy of the Santonian–Campanian boundary: The GSSP auxiliary sections, Seaford Head (England) and Bocieniec (Poland), and correlation between the Boreal and Tethyan realms. Cretaceous Research 143, 1–45.

Slipper I.J. 2009: Upper Cretaceous. In: Whittaker J.E., Hart M.B. (Eds.): Ostracods in British Stratigraphy. Micropalaeontol. Society, 345–372.



SEM images of selected specimens of Ostracoda. Scale bars equal 100 µm.
A 1–2 *Bairdoppilata* sp., sample 77; **B** *Bythoceratina umbonatoides umbonatoides* (Kaye, 1964), sample 87; **C** *Cytherella ovata* (Roemer, 1841), sample 139; **D** *Cytherella* cf. *contracta* van Veen, 1932, sample 51; **E** *Cythereis longaeva longaeva* Pokorny, 1963, sample 96; **F** *Cythereis paraglabrella* Pokorny, 1965, sample 114.5; **G** *Cythereis triaculeata* Clarke, 1983, sample 96; **H** 1–2 *Cytherelloidea granulosa granulosa* (Jones, 1849), sample 77; **I** 1–2 *Cytherelloidea hindei* Kaye, 1964, sample 84; **J** *Cytheropteron* sp., sample 114.5; **K** *Imhotepia* sp., sample 30; **L** *Karsteneis nodifera tabasca* Slipper, 2021, sample 96; **M** *Karsteneis cf. nodifera nodifera* (Kafka, 1886), sample 121; **N** *Limburgina senonensis* (Damotte, 1964), sample 96; **O** *Neocythere (Physocythere) verbosa* (Damotte, 1962), sample 60; **P** 1–2 *Neocythere (Physocythere) virginea* Jones, 1849, sample 114.5; **Q** 1–2 *Oertliella reticulata* (Kafka, 1886), sample 112; **R** 1–2 *Phacorhabdotus lonsdaleianus* (Jones, 1849), sample 114.5; **S** *Phacorhabdotus semiplicatus* (Reuss, 1846), sample 139; **T** *Pontocyprella* sp., sample 96; **U** *Pterygocythere laticristata* (Bosquet, 1854), sample 148; **V** *Pterygocythereis spinosa* (Reuss, 1846), sample 112; **W** *Rehacythereis* cf. *stellatus* Slipper, 2021; **X** Spinoleberis krejcii Pokorný, 1969, sample 96; **Y** *Trachyleberidea geinitzi* (Reuss, 1874), sample 121; **Z** 1–2 *Xestoleberis ovata* Bonnema, 1941, sample 96; **Aa** 1-2 *Xestoleberis bidentata* Bonnema, 1941, sample 64.5.

Cadosinopsis rehakovii sp. nov. a new Jurassic calcareous dinocyst from the Pieniny Klippen Belt (Western Carpathians)

AGNIESZKA CIUREJ [1], MARTA BĄK[2]

[1]*University of the National Education Commission, Krakow, Institute of Biology and Earth Sciences, Department of Geology and Palaeontology, Kraków, Poland*
[2]*AGH University of Science and Technology, Faculty of Geology, Geophysics, and Environmental Protection, Kraków, Poland*

Calcareous dinocysts (or calcareous dinoflagellate cysts or c-dinocysts) are spherical to ovoid microfossils (10–180 µm), belonging to Thoracosphaeraceae Family of Dinophyceae Class (Elbrächter et al. 2008). They are widely used for biostratigraphy and paleoenvironmental reconstructions (e.g. Reháková 2000; Ciurej et al. 2017).

In this work we present a new species of calcareous dinocyst named *Cadosinopsis rehakovii* sp. nov., which is the third species *of the genus Cadosinopsis* (Ciurej & Bąk 2021). Other species included to this genus are *C. nowaki* Borza, 1984 and *C. andrusovi* Scheibner, 1967. More than two hundred specimens of the newly described species were found within the rich and diverse Lower Tithonian assemblage founded in the Czorsztyn Limestone Formation of the Branisko succession of the Pieniny Klippen Belt (Western Carpathians). The study outcrop is located in the southern part of Poland in the Stare Bystre village, in the Szeligowy Stream which is the right tributary of the Wielki Rogoźnik river; 150 m up from the mouth of the river.

Eighty two specimens of new species have been examined and measured using optical microscope and SEM. A combination of cluster analysis, principal component analysis (PCA) and canonical variates analysis (CVA) were used for statistical analysis.

Cadosinopsis rehakovii sp. nov., has an a spherical to oval cyst shape ranging from 34 to 59 µm in length and 30 to 50 µm in width, with two layered wall. The outer layer is composed of fibrous crystals, vitreous (transparent) in transmitted light. The inner layer is built of coarse – thick, plate-shaped calcite crystals and is white in transmitted light. The aperture is wide, seen only in the inner layer.

The statistical analyses showed that the new species displays a resemblance in cross-section to other two species of *Cadosinopsis*, previously described in literature. However, the two species are easily distinguishable by some features, such difference in cyst size, chamber shape, layers thickness.

Founding the new species *Cadosinopsis rehakovii* can supplement existing research in the context of the biostratigraphy of carbonate sediments.

The holotype and paratypes (located within thin sections in samples Szel 21a and Szel 21b) are stored in the collections of the European Micropaleontological Reference Centre, Address**:** Micropress Europe al. Mickiewicza 30; 30-059 Krakow, Poland, email: info@micropresseurope.eu and housed in Cabinet 7, drawer 11A. Collection reference is EMRC 7/11A.

The new calcareous dinocyst species was named in honor of Prof. Daniela Reháková, for her significant contributions to calcareous dinocysts worldwide study.

References:

Ciurej A., Bąk K., Bąk M. 2017: Late Albian calcareous dinocysts and calcitarchs record linked to environmental changes during the final phase of OAE 1d – a case study from the Tatra Mountains, Central Western Carpathians. Geological Quarterly 61, 95–103.

Ciurej A., Bąk M. 2021: *Cadosinopsis rehakovii* sp. nov., a new calcareous dinocyst from the Jurassic-Cretaceous transitional interval of the Western Tethys. PLOS ONE 16, e0249690. https://doi.org/10.1371/journal.pone.0249690

Elbrächter M., Gottschling M., Hildebrand-Habel T., Keupp H., Kohring R., Lewis J., et al. 2008: Establishing an agenda for calcareous dinoflagellate research (Thoracosphaeraceae, Dinophyceae) including a nomenclatural synopsis of generic names. Taxon 57, 1289–1303.

Reháková D. 2000: Calcareous dinoflagellate and calpionellid bioevents versus sea-level fluctuations recorded in the West-Carpathian (Late Jurassic/Early Cretaceous) pelagic environments. Geologica Carpathica 51, 229–243.

Vegetation and climate oscilations during MCO/MCT in Central and Eastern Paratethys

NELA DOLÁKOVÁ[1], MARIANNA KOVÁČOVÁ[2], TORSTEN UTESCHER[3], MINE SEZGÜL KAYSERI ÖZER[4]

[1]*Department of Geological Sciences, Faculty of Science, Masaryk University, Brno, Czech Republic*
[2]*Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University Bratislava, Bratislava, Slovakia*
[3]*Senckenberg Research Institute and Natural History Museum/Biodiversity and Climate Research Centre, Frankfurt, Germany*
[4]*Dokuz Eylül University, Institute of Marine Science and Technology, Izmir, Turkey*

Originally, we analyzed the Late Burdigalian to Serravalian pollen spectra from the Czech and Slovak regions of the Central Paratethys, as well as the Mura–Zala basin and Transylvanian basin. These were compared with spectra from Eastern Paratethys in Turkey. The climax of the Miocene Climatic Optimum (MCO) revealed oscillations in climatic factors, such as increasing seasonality in temperatures and precipitation. Subsequent cooling and observable precipitation fluctuations were documented as evidence for the Miocene Climate Transition (MCT) (Doláková et al. 2021). The vegetation character in Central Paratethys underwent significant changes due to the Alpine uplift of the western Alps and Carpathians, initiating altitudinal zonality. Differences mainly in quantitative representation of zonal elements between northern localities (Czechia and Slovakia) and southern parts of this area (Slovenia, Romania) indicates increasing of latidudinal zonality. In Eastern Paratethys, palynospectra indicated an earlier trend of gradual cooling and a notable shift towards more arid and continental climate conditions. This trend may be linked to the presence of the vast moderate Eurasian continent (Vernyhorova et al. 2023).

References:

Doláková N., Kováčová M., Utescher T. 2021: Vegetation and climate changes during the Miocene climatic optimum and Miocene climatic transition in the northwestern part of Central Paratethys. Geological Journal 56, 729–743.

Vernyhorova Y.V., Holcová K., Doláková N., Reichenbacher B., Scheiner F., Ackerman L., Rejšek J., De Bortoli L., Trubač J., UtescherT. 2023: The Miocene Climatic Optimum at the interface of epicontinental sea and large continent: A case study from the Middle Miocene of the Eastern Paratethys. Marine Micropaleontology 181, 102231.

A new method for drying paleontological samples containing degradable Fe-sulfides

BORIS EKRT[1], JAN SKLENÁŘ[1], MICHAL NOVÁK[2], TEREZA HORÁKOVÁ[1]

[1]*National Museum, Václavské náměstí 68, 110 00 Prague 1, Czech Republic; boris.ekrt@nm.cz*
[2]*University of Chemistry and Technology, Technická 5, 166 28 Prague 6, Czech Republic*

The presence of unstable Fe-sulphides in palaeontological samples, when their long-term preservation in collections is required, raises a number of problems. Oxidation of Fe-sulphides emits sulfate anions producing sulphuric acid. This reacts with the rock compounds and, as being hygroscopic, absorbs water from the environment. Subsequent multiple hydration, dehydration and crystallization of the sulfates cause destructive volume changes.

This so called "pyrite disease" problem is well known and need of its solution is broadly understood. Nevertheless, as already stated by Sklenář et al. (2015), the site conditions and the collecting procedure are crucial, although they had not been addressed. Degradation process usually starts as early as at the site due to surface weathering. Even if the samples are taken directly from a non-weathered rock environment, the electrochemical process of the degradation is usually initiated during desiccation of the natural rock moisture. Anyway, if the wet sample already contains dissolved degradation intermediates, the rock surface with the fossils is often damaged by subsequent crystallization as a result of normal desiccation procedures. It does not matter much whether the material itself contains sulphides or not.

Drying of samples under common room conditions creates a hazardous environment in the capillary system of the rock. Unstable Fe-sulphides, or the initial products of their degradation, are present together with water in the capillaries and with atmospheric oxygen, which gradually penetrates them.

Here presented desiccation method prevents both the initiation of the oxidation process and the surface crystallization of the products. It uses a well-known drying process of ice sublimation in vacuum – the so-called lyophilization. The low partial pressure of oxygen in the evacuated chamber, the temperature of the deep-frozen samples (around −60 °C) and the omission of the aqueous phase due to sublimation drying combine to create conditions under which neither oxidation nor hydration processes occur, nor the growth of large crystals from solution.

Testing of various petrological and paleontological samples has shown that, as with biological materials, there is no damage due to rapid freezing and vacuum.

Depending on the nature and possible previous damage of the specimen, it is advisable to apply one of the methods of remedial preservation after the drying process (Novák et al. 2015; Ekrt et al. 2023), mechanically stabilize the consolidants and choose suitable storage conditions (Sklenář et al. 2015).

References:

Ekrt B., Sklenář J., Novák M., Horáková T. 2023: Sanační konzervace a stabilizace sbírkových předmětů s obsahem degradujících Fe-sulfidů metodou vysokotlaké aplikace suchého amoniaku. Památkový postup, Praha, 2023.

Novák M., Kotlík P., Ekrt B., Sklenář J. 2015: Neutralizace korozních produktů a stabilizace pyritizovaných paleontologických a mineralogických nálezů pomocí uhličitanu amonného. Památkový postup, Praha, 2015.

Sklenář J., Ekrt B., Sejkora J., Kolesar P., Gazdová Z., Malíková R., Nohejlová M., Kotlík P., Novák M., Ďurovič M., Říhová Ambrožová J. 2015: Metodika preventivní a sanační konzervace sbírkových předmětů z oblasti paleontologie a mineralogie ohrožených produkty degradace sulfidů. Národní muzeum, Praha, 172 pp.

Fossils of the Semtín Breccia (Ordovician, Czech Republic)

OLDŘICH FATKA[1], PETR BUDIL[2], MARIKA POLECHOVÁ[2], HOLGER GEBHARDT[3], DANIELA FESTI[3], MATĚJ ŠILINGER[1], VOJTĚCH KOVÁŘ[1, 2], JAKUB VODIČKA[4], MARTIN VALENT[5], ZUZANA TASÁRYOVÁ[2]

[1]*Charles University, Institute of Geology and Palaeontology, Albertov 6, 128 43, Prague 2, Czech Republic*
[2]*Czech Geological Survey, Klárov 3, 118 21, Prague 1, Czech Republic*
[3]*Geosphere Austria in Vienna, Paleontology and Collections, Neulinggasse 38, 1030 Wien, Austria*
[4]*Museum of Bohemian Karst, Husovo náměstí 87, 266 01 Beroun, Czech Republic*
[5]*National Museum, Palaeontological Department, Cirkusová 1740, 193 00, Prague 9, Czech Republic*

Early Paleozoic rocks are widely represented in the Bohemian Massif. In comparison, the distribution of paleontologically dated unmetamorphosed to slightly metamorphosed Ordovician rocks is much more restricted, being known from the Saxothuringian Zone, Teplá–Barrandian Unit (Barrandian area), Železné hory hills area, and bedrock of the Bohemian Cretaceous Basin. The distribution of the Paleozoic rocks underlying the Bohemian Cretaceous Basin is comparatively well studied, but information on contained fossils is rather poor (Malkovský et al. 1974). Jaroslav Jiljí Jahn, mapping geologist of the Kaiserlich–Königliche Geologische Reichsanstalt Vienna, documented a common occurrence of Precambrian and Lower Paleozoic rocks in the Semtín Breccia near Pardubice. The Semtín Breccia presents a unique phenomenon – a chimney breccia of neovulcanite (nephelinitic basalt) containing xenoliths of Proterozoic and Early Paleozoic bedrock. The breccia cuts through the Mesozoic sediments of the Bohemian Cretaceous Basin.

Jahn (1896) published a detailed assessment of plumulitid machaeridians, hyolithids, orthid brachiopods, bivalves, gastropods as well as trinucleid and dalmanitid trilobites. After the publication of Jahn´s study, only several samples of the Semtín Breccia were donated to the Naturhistorisches Museum Vienna and to the University of Vienna. A few samples were sent also to the National Museum Prague and later also to the Czech Geological Survey. However, the destiny of more than ninety five percent of the original material was unknown.

In 2020, a virtually complete collection of Jahn's palaeontological material and lithological samples of sediments and volcanites from the Semtín Breccia was re-discovered in collections of the Geologische Bundesanstalt (Geosphere Austria in Vienna). The extensive "detective work" resulted in finding of rare material from the Semtín Breccia in collections of other two Austrian and three Czech institutions, namely in Naturhistorisches museum, Vienna, Department of Palaeontology of the University of Vienna, Czech Geological Survey Prague, National Museum, Prague and Museum of Eastern Bohemia, Hradec Králové. Recently, the all up to date known material originating from the Semtín Breccia deposited in Austrian and Czech institutions was revised. Where possible, museological relationships and back stories were reconstructed. This material allowed a comprehensive revision and a new evaluation of contained fossils, including the newly studied acritarchs and chitinozoans, as well as a refinement of the age of the rocks.

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References:

Jahn J.J. 1896: Basalttuff-Brecie mit silurischen Fossilien in Ostböhmen. Verhandlungen der k. k. geologischen Reichsanstalt 16, 441–459.

Malkovský M., Benešová Z., Čadek J., Holub V., Chaloupský J., Jetel J., Müller V., Mašín J., Tásler R. 1974: Geologie české křídové pánve a jejího podloží. Nakladatelství Československé akademie věd, Praha.

Period/Era	Series	Semtín Breccia (Jahn, 1896)		Barrandian area	Železné hory area
Devonian		Hercyn (Etage *F*).	9. Weisser Kalk mit (Crinoiddenreste, Brachiopoden und Korallen.	(?) Kotýs + (?) Koněprusy limestones	Podol Limestones
Silurian		Obersilur (Etage *E*).	8. Schwarzer Kalk mit Crinoidenresten und Orthoceren	(?) Lochkov + (?) Požáry formations	Prachovice Formation
Ordovician	Upper	Untersilur (Etage *D*).	7. Grauer Quarzit d_5 (Kosover Schichten).	Kosov Formation	Míčov „Beds"
			6. Schwarzer Thonschiefer und grauer Grauwackenschiefer mit zahlreichen Fossilien d_3 + d_4 (Trubiner und Zahořaner Schichten).	Bohdalec & Králův Dvůr Fms.	
				Zahořany Formation	
				Vinice Formation	
			5. Grauer Quarzit mit Scolithosröhrchen d_2 (Drabover Schichten).	Letná Formation	
				Libeň Formation	
				Dobrotivá Formation	Skalka Quartzites
	Middle		4. Schwarzer Thonschiefer d_1 (Rokycaner Schichten).	Šárka Formation	Šárka „Beds"
	Lower			Klabava Formation	
				Milína Formation	
				Třenice Formation	Lipoltice Formation
Cambrian	middle	Mittelcambrium (Skrejer und Jinecer Schiefer, Etage *C*).	3. Bläulicher und grünlicher Thonschiefer mit Grauwacken-Sandsteineinlagerungen.	Buchava and Jince formations	Senice „Beds"
	lower	Untercambrium (Třemošná-Conglomerat, Etage *C*).	2. Quarzconglomerat, quarzitischer Sandstein etc.	Žitec-Hluboš + Sádek + Holšiny-Hořice + Klouček-Čenkov + Chumava-Baština + formations	NOT ESTABLISHED
Neoproterozoic		Praecambrium (Etage *B*).	1. Thonschiefer mit Kieselschiefer (Lydit) und Quarzit.	Kralupy-Zbraslav + Štěchovice groups	NOT ESTABLISHED

Correlation of stratigraphy of the Semtín Breccia used by Jahn (1896) with the current lithostratigraphy in the Barrandian area and in the Železné hory area.

Lithostratigraphy and microfacies of the Pieniny Klippen Belt in the western part of the Oravská Magura Mts.

KAMIL FEKETE[1], ONDREJ PELECH[1], MÁRIO OLŠAVSKÝ[2], FRANTIŠEK TEŤÁK[1], KATARÍNA KORÁBOVÁ[1], JOZEF MADZIN[3], LENKA ŠAMAJOVÁ[1]

[1]*State Geological Institute of Dionýz Štúr, Mlynská dolina 1, 817 04 Bratislava, Slovakia*
[2]*State Geological Institute of Dionýz Štúr, regional center, Zelená 5, 974 04 Banská Bystrica, Slovakia*
[3]*Earth Science Institute SAS, Ďumbierska 1, 847 11 Banská Bystrica, Slovakia*

Oravská Magura Mts. is located in the central part of the Orava region (northern part of Slovakia). The geological structure of this region is from North to South composed of the Flysch Belt, Pieniny Klippen Belt (PKB) and Inner Carpathian Paleogene Basin rocks. PKB marks the boundary between the External and Internal Western Carpathians (Hók et al. 2019). The "klippen" are composed of Jurassic and Early Cretaceous limestones that are more resistant to erosion than the surrounding Upper Cretaceous and Paleogene sandstones, marlstones and clayey sediments.

More or less complete Jurassic to Early Cretaceous sequences of the PKB in the studied area, could be divided into several shallow and deep-water successions (Fig. 1). They consist of a wide range of clastic and carbonate sedimentary rocks from sandstones of Gresten beds, spotted limestones of Allgäu Fm, Posidonia beds, through crinoidal limestones (Krupianka and Smolegowa Fms), radiolarites of the Czajakowa Fm, Czorstyn red nodular limestones and biancone facies limestones forming isolated klippens. The Upper Cretaceous variegated marls of the Púchov Fm, polymict conglomerates to sandstones of the Snežnica Fm and claystones form the "klippen cover". The incorporation of some Jurassic lithostratigraphic units is currently being a matter of debate. Likewise, the inclusion of the Upper Cretaceous to Paleogene sediments of "klippen cover" in individual successions. Aforementioned research is part of the ongoing project *Geological map of the Oravská Magura Mts. at scale 1:50,000* comprising complex geological research (geological mapping, petrography, microfacies and biostratigraphic analysis, structural geology, etc.).

Acknowledgements: This research was supported by the project of the Ministry of Environment of Slovak Republic, *Geological map of the Oravská Magura at scale 1:50,000.*

References:

Gross P. (ed.), Filo I., Halouzka R., Haško J., Havrila M., Kováč P., Maglay J., Mello J., Nagy A. 1994: Geologická mapa južnej a východnej Oravy 1:50 000. MŽP SR – GÚDŠ, Bratislava.

Hók J., Pelech O., Teťák F., Németh Z., Nagy A. 2019: Outline of the geology of Slovakia (W. Carpathians). Mineralia Slovaca 51, 31–60.

Plašienka D., Aubrecht R., Bezák V., Bielik M., Broska I., Bučová J., Fekete K., Gaži P., Gedl P., Golej M., Halásová E., Hók J., Hrdlička M., Jamrich M., Józsa Š., Klanica R., Konečný P., Kubiš M., Madarás J., Majcin D., Marko F., Molčan Matejová M., Potočný T., Schlögl J., Soták J., Suan G., Šamajová L., Šimonová V., Teťák F., Vozár J., 2021: Structure, composition and tectonic evolution of the Pieniny Klippen Belt – Central Western Carpathian contiguous zone (Kysuce and Orava regions, NW Slovakia). Comenius University Bratislava, 148 p.

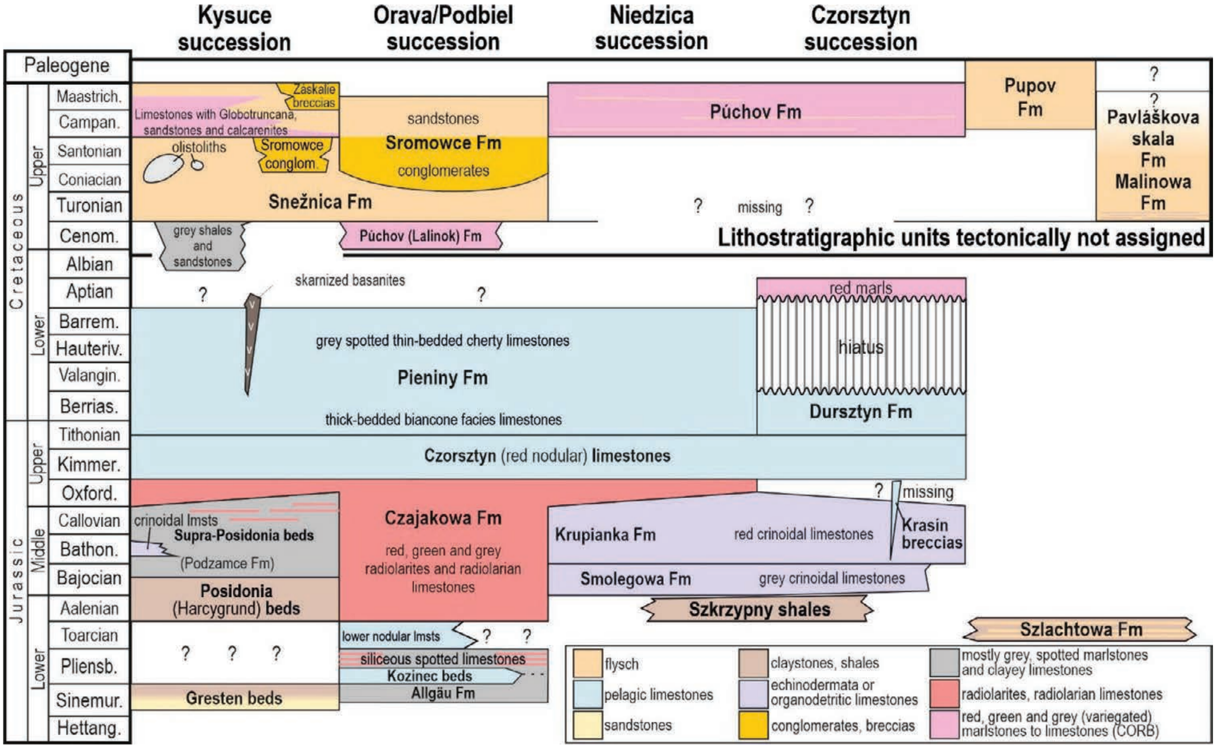

Fig. 1. Lithostratigraphic table of the PKB of the western part of the Oravská Magura Mts. (based on e.g. Gross et al. 1994; Plašienka et al. 2021, etc., and own original data).

Ichthyofauna of the upper Oligocene (Chattian) Trbovlje Formation from Slovenia

ROK GAŠPARIČ[1,2], TOMAŽ HITIJ[1,3], JURE ŽALOHAR[1,4], TOMÁŠ KOČÍ[1,5], MARTINA KOČOVÁ VESELSKÁ[1,6], OLEKSANDR KOVALCHUK[7]

[1] Institute for Palaeobiology and Evolution, Novi trg 59, 1240 Kamnik, Slovenia; rok.gasparic@gmail.com
[2] The Oertijd Museum, Bosscheweg 80, 5283WB Boxtel, The Netherlands
[3] University of Ljubljana, Faculty of Medicine, Vrazov trg 2, 1000 Ljubljana, Slovenia
[4] Biotehnični center Naklo, Strahinj 99, 4202 Naklo, Slovenia
[5] Paleontological Department of Natural History Museum, National Museum at Prague, Cirkusová 1740, 193 00 Prague 9 Horní Počernice, Czech Republic
[6] Institute of Geology of the Czech Academy of Sciences, Department of Paleobiology, Rozvojová 269, 165 00 Praha 6 Lysolaje, Czech Republic
[7] Department of Palaeontology, National Museum of Natural History, National Academy of Sciences of Ukraine, Bohdana Khmelnytskoho 15, Kyiv 01054, Ukraine.

Hundreds of fish specimens were collected from the locality "Neža" situated between towns of Hrastnik and Trbovlje. Fossil-bearing Oligocene beds crop out in an abandoned coal mining pit, that has been intensively mined for lignite over the last two centuries (Bechtel et al. 2004).

The marls above the coal layer are fossiliferous, yielding a diverse fish fauna (Križnar & Lorencon 2021), crustaceans (Buckeridge et al. 2020; Kovalchuk et al. 2023; Gašparič et al. 2024), molluscs, as well as abundant plant remains. A smaller area was excavated and bed-by-bed sampling was conducted. Fossil remains of fish and flora occur throughout the section with varying frequency. Additionally, four mass accumulations of fish remains were identified at different levels within the section. Preliminary investigation of ichtyofauna shows diverse association of fishes, represented by the families Clupeidae, Carangidae, Caproidae, Triglidae, Paralepididae, Centriscidae, Syngnathidae and one specimen of the order Anguilliformes.

Similar finely laminated "fish beds" of lower Miocene or Oligocene age are reported from several locations across Paratethys (e.g. Bieńkowska-Wasiluk 2010) and were likely deposited within the anoxic basins.

References:

Bechtel A., Markic M., Sachsenhofer R.F., Jelen B., Gratzer R., Lücke A., Püttmann W. 2004: Paleoenvironment of the upper Oligocene Trbovlje coal seam (Slovenia). International Journal of Coal Geology 57, 23–48.

Bieńkowska-Wasiluk M. 2010: Taphonomy of Oligocene teleost fishes from the Outer Carpathians of Poland. AGP 60, 479–533.

Buckeridge J.S., Kočí T., Gašparič R., Kočová V.M. 2020: *Actinobalanus? Sloveniensis* (Thoracica, Balanoidea), a new species of cirripede from the Oligocene and Miocene of Slovenia that grew attached to wood substrates. NJGP, Abhandlungen 296, 51–65.

Gašparič R., Hyžný M., Hitij T., Šoster A. 2024: Late Oligocene decapod crustaceans from the Trbovlje Formation of Slovenia, with a description of two new species of hymenosomatid crabs. Palaeontologia Electronica 27.1.a4, 1–16.

Kovalchuk O., Hyžný M., Świdnicka E., Barkaszi Z., Berezovsky A., Dumitriu S., Grădianu I., Gašparič R., Přikryl T., Stefaniak K. 2023: Taphonomy and palaeoecology of decapod crustaceans from Oligocene and Early Miocene fish beds of the Central and Eastern Paratethys. Historical Biology 35, 2253–2270.

Križnar M., Lorencon R. 2021: Zgornjeoligocenske morske britvice (Centriscidae, Gasterosteiformes) iz Trbovelj (Zasavje, Slovenija): preliminarna raziskava. Geološki zbornik 26, 58–61.

Calcareous nannoplankton and foraminifera from the Cerová locality

EVA HALÁSOVÁ[1], MICHAL JAMRICH[1], ANDREJ RUMAN[1], NATÁLIA HUDÁČKOVÁ[1]

[1]*Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University Bratislava, Mlynská Dolina, Ilkovičova 6, 842 15 Bratislava, Slovak Republic; natalia.hudackova@uniba.sk*

The profile outcrops near the Cerová-Lieskové at the foothills of the Malé Karpaty Mountains (N–E Vienna Basin). During the Karpatian (uppermost Burdigalian), massive, locally laminated calcareous clay and clayey silt deposits with thin tempestites (up to 5 mm thick) of the Lakšárska Nová Ves Formation appear here. In the uppermost part of the section, clayey silts with abundant plant remnants occur.

Samples (45) were collected from the section with a sampling spacing of ~40 cm for calcareous nannoplankton, and foraminifera analyses. The profile found associated microfossils, including radiolarians, ostracods, fish otoliths, statoliths, bathyal shark teeth, diatoms, and silicoflagellates. Macrofossils include vertebrates (fishes) and invertebrates (small-sized bivalves and gastropods, scaphopods, nautilids, coleoids, regular and irregular echinoids, brittle stars, siliceous sponges, and crustaceans. Plant debris, wood fragments, well-preserved leaves, and even spikes are present too.

Abundant but less diverse calcareous nannofossils of NN4 Zone assemblage are documented. The late Karpatian age of the deposits is assigned to the NN4 (NN4b) Zone based on the co-occurrence of *H. ampliaperta* and *S. heteromorphus* in the entire profile. Foraminiferal taxa *Uvigerina graciliformis* and *Trilobatus bisphericus* support Karpatian age; the absence of *Praeorbulina* species does not allow inclusion in the Lower Badenian (Langhian).

Calcareous nannofossils assemblages dominate *Coccolithus pelagicus*, followed by small retitulofenestrids (*R. minuta* and *R. haqii*), *Cyclicargolithus floridanus* and *Syracosphaera pulchra*. The accompanying assemblages *Calcidiscus* spp., *Coccolithu*s *miopelagicus*, *Coronocyclus nitescens*, helicoliths (*Helicosphaera ampliaperta*, *H. carteri*, *H. mediterranea, H. scissura, H. walbersdorfensis*), as well as biostratigraphical important *Sphenolithus heteromorphus* appear in low numbers. The high dominance of *C. pelagicus* indicates cooler eutrophic conditions; small reticulofenestrids tolerate salinity oscillation, and nutrients and reflect surface water stress conditions. Helicoliths document shallow, near-continental environments, and upwelling regimes during the sedimentation. A low number of discoasters, typical in warm and oligotrophic waters, suggest a eutrophic sedimentation environment near the coast.

The planktic foraminiferal association is composed mainly of temperate shallow dwellers, globigerinids – *Globigerinella obesa* and *Globigerina bulloides* accompanied by tenuitellinids, locally with mass abundances of *Casigerinella boudecensis* and supports cooler eutrophic conditions. Warm to temperate water taxa such as *T. bisphericus* and *T. trilobus* are rare.

Benthic foraminiferal assemblages are dominated by infauna (*Bolivina fastigia, B. hebes, Bulimina striata, Uvigerina* spp.) representing dysoxic–suboxic environment. Rare oxiphylic genera *Cibicides* and *Cibicidoides* occur only in the upper part of the profile. The BFOI index in the upper part corresponds to dissolved oxygen ranging from 1.2 to 2 ml/l, commonly seen as dysoxic or low oxic conditions of pore water. Paleodepth analyses allow us to estimate water depths of 240–330 m, and diversity indices support the typical diversity of the shelf and deep-sea foraminiferal assemblages.

In the lower part of the profile, specimens of *Bathysiphon filiformis* are very abundant and reach big dimensions. This assemblage represents recolonization after slips of shallower siliciclastic material from the onshore sedimentary facies.

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Revision of the genus Walbeckia, a Late Cretaceous fagalean lineage

ZUZANA HEŘMANOVÁ[1], MARIA VON BALTHAZAR[2], JIŘÍ KVAČEK[1], JÜRG SCHÖNENBERGER[2]

[1]*National Museum, Prague, 110 00 Václavské náměstí 68, Prague 1, Czech Republic; zuzana.hermanova@nm.cz*
[2]*Department of Botany and Biodiversity Research, University of Vienna, Rennweg 14, A-1030 Vienna, Austria*

Our study shows that the genus *Walbeckia* Knobloch et Mai forms a rather heterogenous group that is in need of revisions. Originally, the genus contained ten species. Based on the new morphological analyses in the present study, two of these species, namely *Walbeckia aquisgranensis* and *W. fricii*, are reinterpreted and removed from the genus. *W. aquisgranensis* is transferred here to a newly established genus *Felianthus* gen. nov. The genus includes two species: *Felianthus aquisgranensis* (Knobloch et Mai) sp. nov. and *Felianthus aacheniensis* sp. nov. Flowers of *Felianthus* gen. nov. are structurally bisexual and epigynous. The perianth consists of two small tepals and the androecium consists of two stamens (only filament bases preserved). Pollen grains are triangular-oblate, triaperturate. The gynoecium is syncarpous, two-locular at the very base and unilocular above. The ovary surface is characterized by longitudinal ribs that run from the ovary base to the tepals. The fruits are one-seeded and the seeds are attached basally. Based on the triangular-oblate and triaperturate pollen grains of the Normapolles type, the genus *Felianthus* gen. nov. is here treated as part of the Normapolles complex.

In addition, specimens previously described as *Walbeckia fricii* Knobloch et Mai are here reinterpreted as *Zlivifructus fricii* (Knobloch et Mai) comb. n. based on the presence of a tetramerous perianth and tetramerous androecium, which is characteristic for the Normapolles genus *Zlivifructus* Heřmanová, Dašková, Ekrt et J. Kvaček.

Our study also shows that the remaining species and specimens of the genus *Walbeckia* Knobloch et Mai still form a rather heterogenous group in need of further revisions, which will have to await the discovery of additional and hopefully better-preserved specimens from the Late Cretaceous of Central Europe.

A selachian fauna from the middle Miocene Laško Formation near Viševca, Slovenia

TOMAŽ HITIJ[1,2], JURE ŽALOHAR[1,3], ALEŠ ŠOSTER[4], ROK GAŠPARIČ[1,5], TOMÁŠ KOČÍ[1,6], MARTINA KOČOVÁ VESELSKÁ[1,7]

[1]*Institute for Palaeobiology and Evolution, Novi trg 59, 1240 Kamnik, Slovenia; rok.gasparic@gmail.com*
[2]*University of Ljubljana, Faculty of Medicine, Vrazov trg 2, 1000 Ljubljana, Slovenia; tomazhitij@gmail.com*
[3]*Biotehnični center Naklo, Strahinj 99, 4202 Naklo, Slovenia; jure.zalohar@guest.arnes.si*
[4]*University of Ljubljana, Faculty of Natural Sciences and Engineering, Aškerčeva c. 12, SI-1000, Ljubljana, Slovenia; ales.soster@ntf.uni-lj.si*
[5]*The Oertijd Museum, Bosscheweg 80, 5283WB Boxtel, The Netherlands*
[6]*Paleontological Department of Natural History Museum, National Museum at Prague, Cirkusová 1740, 193 00 Prague 9 Horní Počernice, Czech Republic; protula@seznam.cz*
[7]*Institute of Geology of the Czech Academy of Sciences, Department of Paleobiology, Rozvojová 269, 165 00 Praha 6 Lysolaje, Czech Republic; veselskamartina@gmail.com*

In 1988, a sedimentary succession rich in shark teeth, composed primarily of alternating beds of conglomerate, sandstone, and sand with rare thin silt beds and a single 2 cm layer of volcanic ash, was discovered in the basal part of the Laško Formation (Early Badenian age, Early middle Miocene) near the Viševca Village (Tunjice Hills, Slovenia).

A rich assemblage of shark teeth was discovered from the upper part of the exposed section. Specimens were recovered from a 20–30 cm thick bed of grey sandstone and grey unconsolidated sand. Palaeontological research in decades following the discovery resulted in the collection of thousands of specimens, which were not described until now. The unconsolidated sands in the lower part of this bed allowed for the collected material to be wet-sieved and carefully examined. We preliminary identified the following genera *Galeocerdo* (Müller & Henle, 1837), *Carcharias* (Rafinesque, 1810), *Carcharhinus* (Blainville, 1816), *Hemipristis* (Agassiz, 1843), *Isistius* (Gill, 1865), *Hexanchus* (Rafinesque, 1810), *Cosmopolitodus* (*Isurus*) (Glikman, 1964), and *Pristiophorus* (Bleeker, 1859). The majority of teeth are small, ranging from 3 to 10 mm in size. Additionally, to the numerous sharks remains, teeth of actinopterygians *Diplodus* (Rafinesque, 1810) and *Pagrus* (Cuvier, 1816) were also recovered. Other fossil remains include abundant echinoid spines and plates, and very rare fragmented remains of decapod crustaceans.

Below the fossiliferous sandstones and unconsolidated sands lies a 60 cm thick bed of yellow-brown sandy conglomerate, containing larger (up to 45 mm), but less common shark teeth belonging to the genus *Cosmopolitodus* (*Isurus*) (Glikman, 1964). Associated fauna of this layer includes remains of molluscs *Pecten* (O. F. Müller, 1776), *Conus* (Linnaeus, 1758), *Pyrula* (Lamarck, 1799), *Trochus* (Linnaeus, 1758), *Xenophora* (Fischer von Waldheim, 1807), *Terebratula* (Müller, 1776), as well as fragments of echinoids and rare annelids (Žalohar & Zevnik 1996, 2006).

The abundance of selachian taxa from Viševca provides new information about their diversity and the palaeoenvironmental settings in middle Miocene deposits of the southwestern part of Central Paratethys.

References:

Žalohar J., Zevnik J. 1996: Terciarne Plasti V Tunjiškem Gričevju : Geologija, Stratigrafija in Paleontologija. Gimnazija Kranj 1996.

Žalohar J., Zevnik J. 2006. The Miocene beds in the Tunjice Hills. Kamniški zbornik 18, 289–301.

The Upper Badenian seagrass meadows from the NE part of the Vienna Basins – multiproxy evidence

NATÁLIA HUDÁČKOVÁ[1], KATARÍNA HOLCOVÁ[2], MARTINA HAVELCOVÁ[3], ŠÁRKA HLADILOVÁ[4], KATARÍNA ŠARINOVÁ[1], MICHAL JAMRICH[1], ANDREJ RUMAN[1], MARIANNA KOVÁČOVÁ[1]

[1]*Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University Bratislava, Mlynská Dolina, Ilkovičova 6, 842 15 Bratislava, Slovak Republic; natalia.hudackova@uniba.sk*
[2]*Institute of Geology and Paleontology, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic*
[3]*Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, V Holešovičkách 41, 182 09 Praha 8, Czech Republic*
[4]*Institute of Geological Sciences, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic*

Seagrass/seaweed meadows represent "islands" of life in marine "deserts" formed of muddy, sandy, stony, or rocky substrates. The primary precondition for evaluating the contribution of fossil seagrass/seaweed meadows to shelf biodiversity is their successful identification in the rocks. The direct signal represented by seaweed/seagrass body fossils is rare. Indirect evidence is based on the presence of protists and animals associated with seagrass/seaweed meadows or organic geochemistry and a biomarker study.

We selected four localities with indicative seagrass foraminifera from the Malé Karpaty Mts (Slovakia) foothills. All samples (Sandberg (S) 1–4; Fuchs Quarry (FQ) 1–4; Devínska Nová Ves – BAZ (DNV-BAZ) 1–2; Stupava Vrchná Hora (S-VH) 1–5) were studied by an integrated approach. This comprehensive methodology included paleontology (foraminifera, calcareous nannoplankton, mollusks, palynology), organic geochemistry (*n*-alkanes, Pr/Ph-ratio), and elemental analysis.

The presence of *Calcidiscus premacintyrei, Coronocyclus nitescens Pontosphaera japonica*, *Reticulofenestra pseudoumbilicus, Sphenolithus abies,* and *Orbulina universa* allows the samples to be correlated with the NN6 Zone assemblage. Palynomorphs are nearly absent, which is probably a consequence of their oxygenation.

Based on the analysis of Foraminifera assemblages, three associations are documented, each depending on phytal and sediment substrate: (a) *Posidonia-Sargassum* leaf's association with a predominance of epiphytic A+B group (DNV-BAZ and S), where small-size gastropods, phytophagous, are typical for seagrasses. The presence of *Microloripes* and infaunal foraminifera supports low oxic sediment. Coccolith crusts document low terrigenous input in DNV-BAZ 1 locality; (b) arborescent algae *Pseudolithophyllum, Ectocarpus, Cutleria* association with a predominance of epiphytic C group Foraminifera species (S-VH 1-3 localities); (c) foraminiferal association typical for the rhizomes of *Posidonia* and arborescent algae stolon's, with nutrient-rich sediment supported by shallow substrate dwellers of epiphyte of D group and shallow infauna group and mollusks typical for stenohaline, oxyphilic, warm-water, photic zone (FQ 1 locality).

Though studied localities differ by lithologies and paleontological content, the organic-geochemistry record is uniform. The clear evidence of submerged/floating macrophytes (=sea grasses) is represented by the presence of C_{21}, C_{23}, and C_{25} n-alkanes. The abundant n-alkanes C_{16}–C_{19} indicate the occurrence of organic matter from algae (both micro- and macroalgae) and bacteria. Macroalgae can also be expected from body fossils of Corallinales found in all localities. The markers of terrestrial plants indicate strong dominance of marine organic matter over the terrestrial one.

Though the lithological character of studied rocks, as well as the composition of epifaunal foraminifera, indicate an oxyphilic environment at the seafloor, the Pr/Ph (pristane/phytane) ratio suggests anaerobic condition inside sediment between seagrass roots. The occurrence of *Guttulina*, *Globulina*, *Bulimina*, and other eutrophic and hypoxic foraminifera can confirm it.

The multiproxy study enabled reliable interpretation of uniform seagrass/seaweed meadows in the foothills of the Malé Karpaty Mts. The low ratio of terrestrial plants in the total budget of organic matter might be caused by restricted terrestrial input to the basin due to decreased rainfall, the extensive sea flooding of the territory, and the great distance of the studied localities from the coast.

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Hind limb locomotion of the genus *Devinophoca* (Phocidae, Pinnipedia)

RICHARD HUPKA[1], MARTIN SABOL[1]

[1]*Department of Geology and Palaeontology, Faculty of Natural Sciences, Comenius University, Ilkovičova 6, 841 04 Bratislava, Slovakia; hupka8@uniba.sk, martin.sabol@uniba.sk*

Pinnipedia is a monophyletic group of semi-aquatic carnivores with unique adaptations for movement on land and in water. Representatives of the Phocidae (seals) family, unlike the species of the remaining two families – Otariidae (sea lions) and Odobenidae (walruses), are not able to use their hind limbs for terrestrial locomotion. Morphometric Analysis (MMA) together with Principal Components Analysis (PCA) of tarsal bones (*astragalus* and *calcaneus*) of the basal genus *Devinophoca* (Figs. 1 and 2) from the Miocene sites of Devínska Nová Ves – Bonanza and Devínska Nová Ves – Waitov lom Quarry demonstrate similarities with the corresponding skeletal elements of Recent phocids. Based on obtained data, a hypothesis about the hind limb locomotion abilities of the genus *Devinophoca* is presented. The relation to locomotory adaptations in modern seals support the early evolution of this character in this group of pinnipeds.

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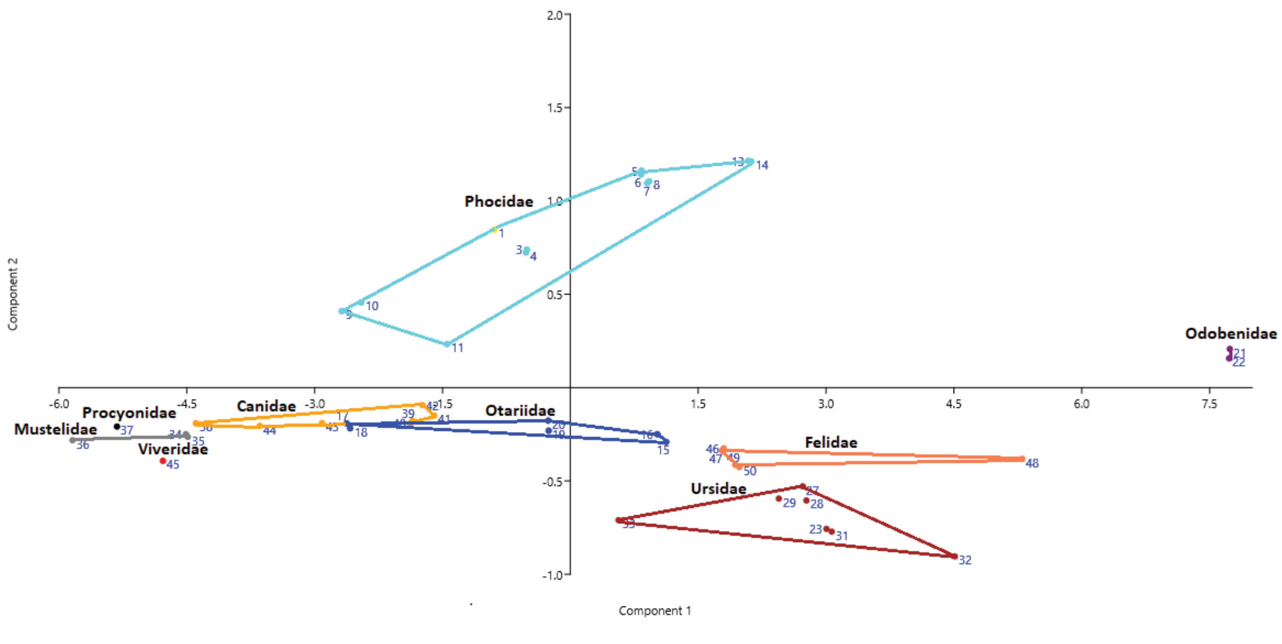

Fig. 1. PCA-Correlation plot of *Devinophoca* astragalus (1) in comparison with the same one element of various carnivoran groups.

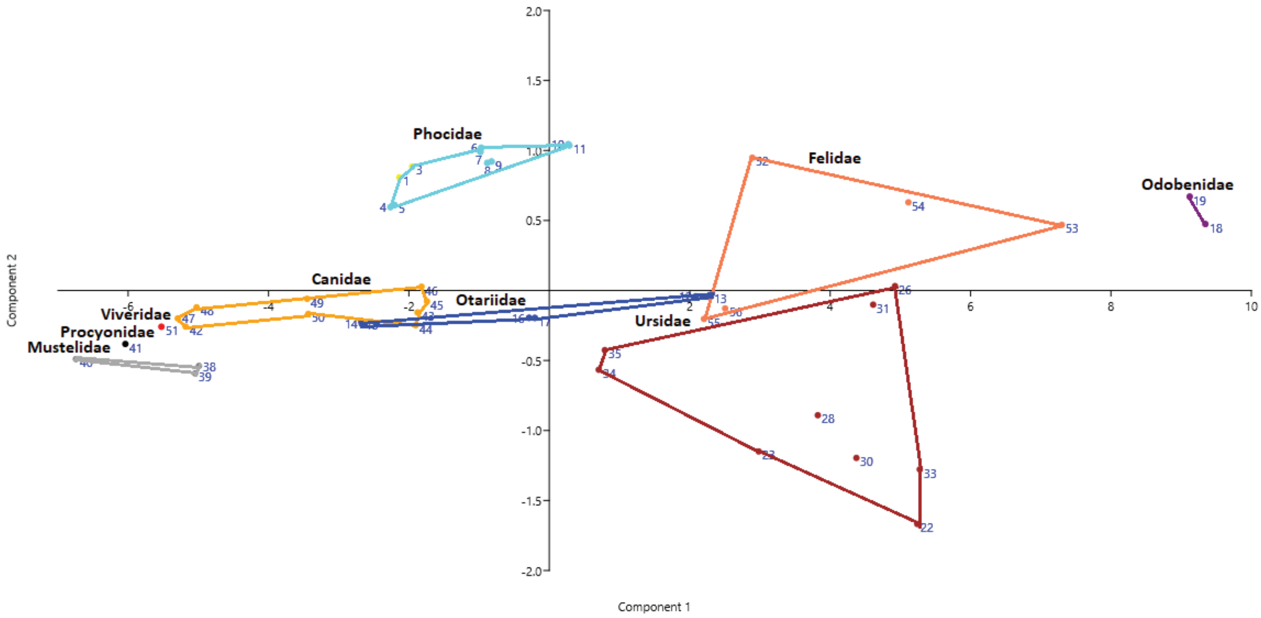

Fig. 2. PCA-Correlation plot of *Devinophoca* calcaneal bones (1, 3) in comparison with the same bone element of various carnivoran groups.

A 300-year history of a mountain lake in the Low Tatra Mts., as reconstructed from subfossil Chironomidae

MARTINA JAMBROVIĆ[1], LADISLAV HAMERLÍK[2,3], KATARZYNA SZARŁOWICZ[4], DUBRAVKA ČERBA[5], FILIP JĘDRZEJEK[4], RASTISLAV MILOVSKÝ[1], TOMÁŠ HRDÝ[2], RADOVAN PIPÍK[1], PETER BITUŠÍK[2]

[1]*Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 974 11 Banská Bystrica, Slovakia; jambrovic@savbb.sk, pipik@savbb.sk, milovsky@savbb.sk*
[2]*Faculty of Natural Sciences, Matej Bel University, Tajovského 40, 974 01 Banská Bystrica, Slovakia; ladislav.hamerlik@umb.sk, peter.bitusik@umb.sk, tomas.hrdy@student.umb.sk*
[3]*Institute of Zoology, Slovak Academy of Sciences, Dúbravská cesta 9, 840 05, Bratislava, Slovakia*
[4]*Faculty of Energy and Fuels, AGH University of Krakow, al. A. Mickiewicza 30, 30-059 Krakow, Poland; szarlowi@agh.edu.pl, jedrzejek@agh.edu.pl*
[5]*Water Research Institute, National Water Reference Laboratory of Slovakia, Department of Assessment and Aquatic Ecosystems Research, Nábrežie armádneho generála Ludvíka Svobodu 5, 812 49 Bratislava, Slovakia; dubravka.cerba@vuvh.sk*

Paleoecological investigation was carried out on a short sediment core from Vrbické pleso, a lake of glacial origin in the Low Tatra Mountains, central Slovakia. The study aimed to reconstruct past environmental changes and assess the impact of climatic oscillations and of the well-documented human activities in the surrounding area. An analysis of subfossil chironomid remains was applied, supported by loss-on-ignition and a land cover reconstruction based on historical maps and satellite imagery. The age-depth model was done by combining the results of ^{14}C and ^{210}Pb dating, with the oldest sediment sample dated to 1718 CE. Two main phases of lake development were revealed: one preceding major anthropogenic pressure, specifically the opening of the first hotel in the lake vicinity in the 1950s, and the second, subsequent phase, characterised by massive infrastructure and tourism expansion.

The oldest part of the core dates back to the Maunder Minimum, the coldest period of the Little Ice Age, and its chironomid assemblages were dominated by taxa indicative of very cold and oligotrophic conditions. Warming which followed the Maunder Minimum caused a gradual shift in the taxonomic composition, with the previously dominant taxa decreasing in abundance or even disappearing. Generally though, the chironomid assemblages during this time were still reflective of relatively cold temperatures and low productivity, and their composition remained mostly stable until the middle of the 20th century. The deforestation in the lake catchment due to construction of accommodation and recreation facilities, as well as access roads and trails, the increasing number of year-round tourists, and the damming of the lake in 1960, which raised the water level to improve conditions for boating and angling, all had a significant impact. The resulting increase of nutrient input into the lake and decrease in oxygen content are evident from the rising abundances of several taxa tolerant of higher trophy. Legislative safeguards were put in place in 1978, with the establishment of the Low Tatra National Park, yet lake Vrbické pleso and the surrounding valley remained under severe anthropogenically-induced stress. The increasing proportions of thermally plastic taxa in the 21st century are suggestive of warming due to recent climate change. This will likely only compound the already considerable negative human influence, thereby making the restoration of the lake to its original state improbable.

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Biostratigraphy and paleoecology of the upper Badenian nearshore facies in the northern part of the Vienna Basin (Slovakia)

MICHAL JAMRICH[1], ANDREJ RUMAN[1], SAMUEL RYBÁR[1,2], MARIANNA KOVÁČOVÁ[1], NATÁLIA HUDÁČKOVÁ[1]

[1]Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University Bratislava, Mlynská Dolina, Ilkovičova 6, 842 15 Bratislava, Slovakia; michal.jamrich@uniba.sk
[2]Department of Geodesy and Mine Surveying, Faculty of Mining and Geology, Technical University of Ostrava, 17. Listopadu 2172/15, Poruba, 708 00 Ostrava, Czech Republic

In the CP, the late Badenian substage is characterized by the Badenian Salinity Crisis, and these chemical sediments rapidly pass into and alternate with algal limestones, as observed in the Carpathian Foredeep. In the Vienna and Pannonian basins, evaporites are less pronounced and are intermixed with muddy and sandy facies; however, algal limestones are well-developed. This study provides a comprehensive examination of algal bioherm structures, including reefs and carpets that contain nannoplankton and foraminifera, originating from the upper Badenian (Middle Miocene) strata of the Vienna Basin in the Central Paratethys (localities from the southern slopes of the Devínska Kobyla hill – Devín, Sandberg, Devínska Nová Ves, Stupava, Jabloňové, Kuchyňa, Rohožník). These lithofacies primarily consist of the carbonate red algal genus *Lithothamnion*. Through an integrated approach that combines calcareous nannoplankton, foraminifera, sedimentology, and palynology, the study explores the Serravallian (upper Badenian) sediments from the Vienna Basin. Biostratigraphic dating was conducted based on the presence of *Orthorhabdus rugosus*, a common occurrence of *Helicosphaera walbersdorfensis,* and the absence of *Sphenolithus heteromorphus*. *Orbulina universa* presence supports these results and aligns with the NN6/CPN9 zones. The small area around Devín shows various paleoenvironments and reveals (1) shallow normal marine water with reduced oxygen content on the seafloor, (2) well-oxygenated, euryhaline shallow normal marine water conditions, (3) eutrophic normal marine deeper waters (Fig. 1).

A strongly stratified water column in the system of narrow channels and protected lagoons can be the reason for the emergence of dysoxic communities, confirmed by the palynomorphs preservation. A shallow water shelf environment with increased temperatures and, thus, salinity increase allowed CO_3^{2-} supersaturaturation and carbonate precipitation, forming algal reefs. Sandy seabed covered by seagrass is documented by the prevalence of epiphytic taxa such as *Biasterigerina*, *Amphistegina*, and keeled elphidia. The coastal environment of riparian forests and swamps with extrazonal mountain vegetation supports paratropical to warm-temperate humid climates. Sedimentation during the Serravallian in the outer to inner shelf paleoenvironment was characterized by nearshore deposits dominated by sandy mudstones, conglomerates, and laminated fine sandstones with fine-grained clastics. The obtained results are tied to geography (Fig. 1) further along the Devínska Kobyla Hill from Devín to Rohožník. The paleoenvironment of the Devín area is interpreted as a bay-lagoon system towards to the northeast along shallow water shelf with various environments. Carbonate precipitation is supported by the dominance of *Amphistegina* sp., which is associated with the formation of algal limestones. Well-aerated oligotrophic shallow water with seagrass or rigid substrate suitable for algal patch reef growing is observed in upper Badenian strata today exposed on the Malé Karpaty Mts. slopes. This research highlights the importance of focusing on taphonomic processes and paleoecological proxies in small-scale characterization and detecting short-term shifts within paleoenvironmental conditions.

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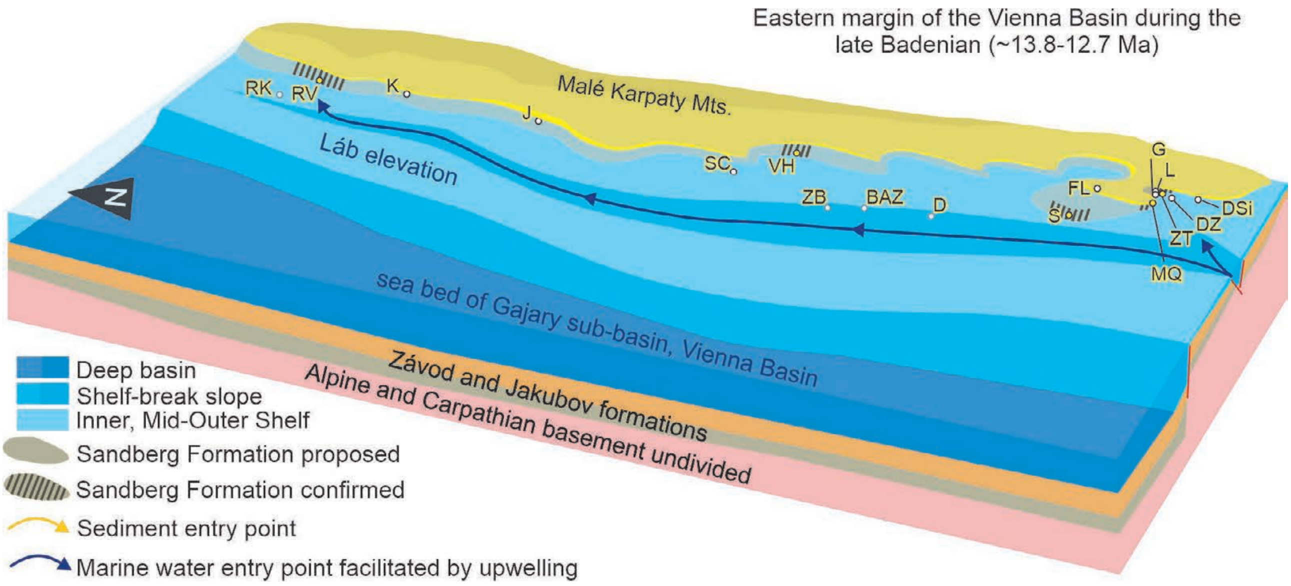

Fig. 1. The late Badenian paleogeographic block diagram of the Vienna Basin's eastern margin suggests the original distribution of the Sandberg Fm. limestones (Jamrich et al. 2024).

How I rescued the D.G. Jenkins Collection of Microfossils

MICHAEL A. KAMINSKI

King Fahd University of Petroleum & Minerals, Dhahran, 31261, Saudi Arabia

The collection of microscope slides relating to the study of Jenkins (1960) "Planktonic Foraminifera from the Lakes Entrance Oil Shaft, Victoria, Australia" has now been archived in the collections of the European Micropalaeontological Reference Centre (EMRC), Micropress Europe, in Kraków. The study, published in *Micropaleontology* volume 6, documents the fauna from an oil shaft excavated between 1941 and 1945 about a mile north of the town of Lakes Entrance, Australia. The samples from the oil shaft were brought to the University of Aberystwyth where the slides were prepared, and at a later time the collection found its way to the National Museum of Wales in Cardiff. The Lakes Entrance Oil Shaft is the type locality for the eight species and subspecies: *Globigerina euapertura* Jenkins, 1960, *Globigerina woodi* Jenkins, 1960, *Globigerinoides apertasuturalis* Jenkins, 1960, *Globorotalia conica* Jenkins, 1960, *Globorotalia extans* Jenkins, 1960, and *Globorotalia testarugosa* Jenkins, 1960, and the subspecies *Globorotalia menardii miotumida* Jenkins, 1960, and *Globorotalia menardii panda* Jenkins, 1960. The benthic foraminifera from the Lakes Entrance Oil Shaft were studied by Li & McGowran (1997), who recognized over 250 species. The collection occupies 13 drawers (each holding 66 slides) and consists mostly of picked and sorted assemblages of foraminifera, with some loose residues in single-hole slides. There are no "type slides" holding named specimens of foraminifera, and Jenkins (1960) did not mention where the type specimens of his new species were deposited. The Lakes Entrance Oil Shaft collection is currently housed in Cabinet 19 at the EMRC.

David Graham Jenkins was born in Wales and studied at the University of Aberystwyth. The subject of Graham's Ph.D. thesis was the Tertiary planktonic foraminiferal faunas of the Southern Hemisphere, supervised by Prof. Alan Wood. He later worked for British Petroleum, the New Zealand Geological Survey, and then the University of Canterbury, Christchurch, were he served as Head of Department. In 1990, Graham had retired to Wales, taking up an honorary position at the National Museum of Wales in Cardiff. He passed away suddenly in the summer of 1995. A couple years later a former student of mine who was working at the Cardiff Museum phoned me at my office at UCL, and in an urgent voice informed me that the cleaners have just cleared out Jenkin's office at the museum. He asked me to *"come immediately"*, because the contents of his office had been dumped into boxes and were awaiting the next trash pick-up. I arrived at the museum the next morning to find journals, reprints, personal files, and microscope slides in boxes piled up next to the museum's basement loading door, together with the trash. I parked my VW Golf next to the loading door at the rear of the museum, and loaded up my car. I was horrified to see that the microscope slides had simply been dumped into boxes for disposal and were mostly upside down.

Having filled the car and unable to see out of my rear window, I drove back to London, and placed some of the items in my garden shed, and other items such as reprints and journals in my office at UCL. In 2010, I shipped these items to Kraków, where they spent some time in my basement before being curated in the collections of the European Micropalaeontological Reference Centre at Micropress Europe. The Jenkins Collection of reprints on the subject of planktonic foraminifer is also now housed at the EMRC. Finally, 64 years after the publication of the Jenkins (1960) paper, the Jenkins microfossil collection is safely archived and available for viewing.

References:

Jenkins D.G. 1960: Planktonic Foraminifera from the Lakes Entrance Oil Shaft, Victoria, Australia. Micropaleontology 6, 345–371.

Li Q., McGowran B. 1997: Miocene climatic oscillation recorded in the Lakes Entrance oil shaft, southern Australia: benthic foraminiferal response on a mid-latitude margin. Micropaleontology 42, 149–164.

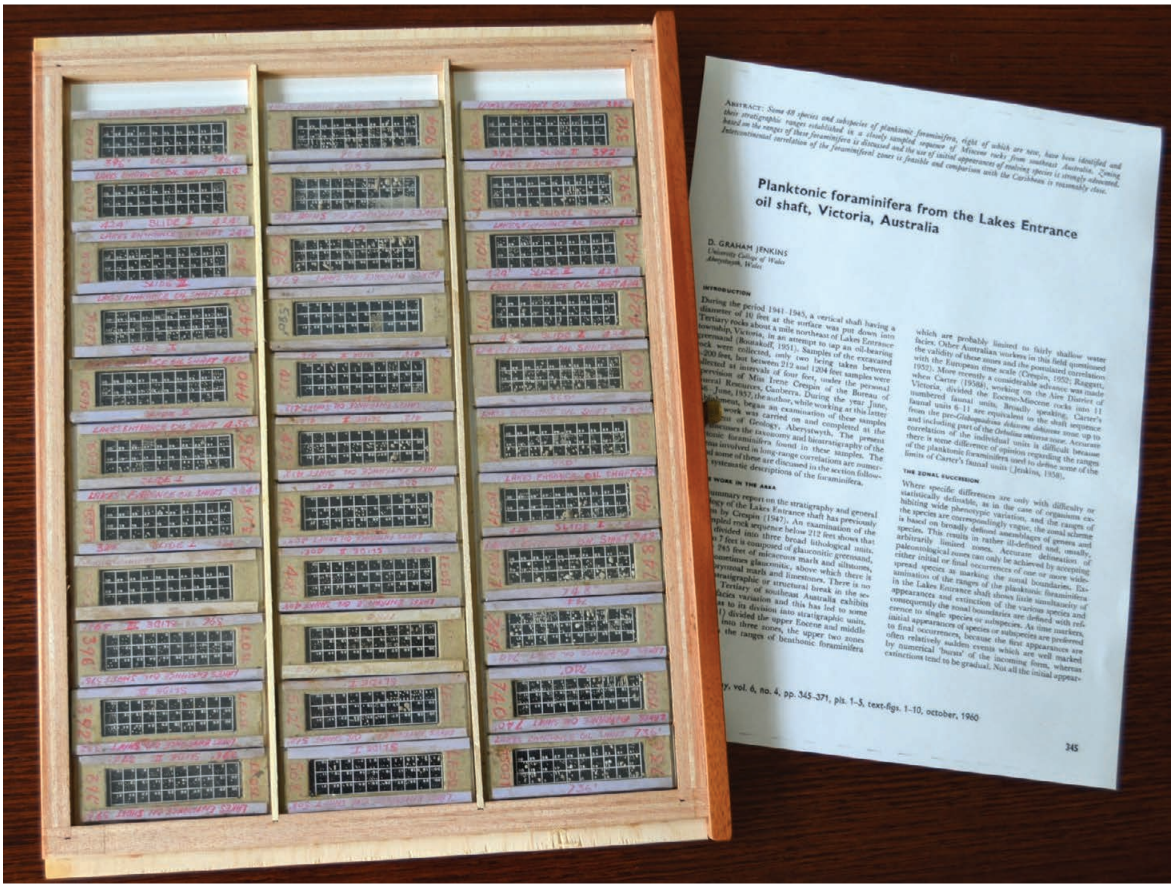

Fig. 1. One of the trays of microslides from the Lakes Entrance Oil Shaft collection.

Tube polychaetes worms (Sabellida, Sabellidae, Serpulidae) from shallow water nearshore facies locality at Turkaňk

TOMÁŠ KOČÍ[1,2,3], ROK GAŠPARIČ[1,5], MARTINA KOČOVÁ VESELSKÁ[1,4], TOMAŽ HITIJ[1,6], JAKUB HARSA[7], LENKA VÁCHOVÁ[3]

[1]*Institute for Palaeobiology and Evolution, Novi trg 59, 1240 Kamnik, Slovenia*
[2]*Ivančická 581, Praha 9, Letňany, 199 00, Czech Republic; protula@seznam.cz*
[3]*Paleontological Department of Natural History Museum, National Museum at Prague, Cirkusová 1740, 193 00 Prague 9, Horní Počernice, Czech Republic*
[4]*Institute of Geology of the Czech Academy of Sciences, Department of Paleobiology and Paleoecology, Rozvojová 269, 165 00 Prague 6, Czech Republic*
[5]*The Oertijd Museum, Bosscheweg 80, 5283WB Boxtel, Netherlands*
[6]*University of Ljubljana, Faculty of Medicine, Vrazov trg 2, 1000 Ljubljana, Slovenia*
[7]*Lesy České republiky, s.p. Správa toků oblast povodí Vltavy, Tyršova 1902, 256 01 Benešov, Czech Republic*

The rich assemblage of more than 5000 tube-dwelling polychaetes including sabellid and serpulid worms was collected in the last ten years (2014–2024) in the ?upper Cenomanian–lower Turonian nearshore/shallow-water outcrop at Turkaňk (Kolín area, Bohemian Cretaceous Basin, Czech Republic). Preliminary revision has documented 11 polychaete species, belonging to two families in the order Sabellida, namely Sabellidae (with a single species, *Glomerula serpentina*) and Serpulidae (serpulids), which comprises 10 species in 7 genera: *Filogranula* (*F. cincta*), *Neovermilia* (*N.* cf. *ampullacea*), *Laqueoserpula* (*L. reussi*), *Dorsoserpula* (*D. bipartita*), *Placostegus* (*P. velimensis*, *P. zbyslavus*), *Pyrgopolon* (*P.* cf. *tricostata*, *P. ziegleri*), and *Neomicrorbis* (*N. c. subrugosus* and *N. c. crenatostriatus*). All collected material was wet-washed over a sieve and examined under a binocular microscope. Our research builds upon the detailed taxonomic and palaeoecological studies of the late Cretaceous polychaetes by Ippolitov et al. (2014), Jäger (1983), Jäger & Kočí (2007), Kočí (2012) and Ziegler (1984). Most serpulids are encrusters on different substrates; e.g. *Neomicrorbis c. subrugosus* encrusted oyster shells and tubes of *Pyrgopolon* cf. *tricostata* provided a hard substrate for cheilostome bryozoans. Few tubes exhibit *Entobia* isp. bioerosion by clionid sponges and other types of microborings need further study.

References:

Ippolitov A.P., Vinn O., Kupriyanova E.K., Jäger M. 2014: Written in stone: history of serpulid polychaetes through time. *Memoirs of Museum Victoria* 71, 123159.

Jäger M. 1983: Serpulidae (Polychaeta, Sedentaria) aus der nordeutschen höheren Schreibkreide Systematik, Stratigraphie, Ökologie. Geologishes Jahrbuch, Reihe A 68, 3–219.

Jäger M., Kočí T. 2007: A new serpulid, *Placostegus velimensis* sp. nov., from the Lower Turonian of the Bohemian Cretaceous Basin. *AGP* 57, 8996. .

Kočí T. 2012: Revision and new finds of *Sabellidae* and *Serpulidae* (*Polychaeta*, *Canalipalpata*) from nearshore locality Kaňk – Na Vrších near Kutná Hora (Upper Cenomanian–Lower Turonian, Kolín area, Bohemian Cretaceous Basin – the Czech Republic). Sborník Národního Muzea v Praze, řada B – přírodní vědy 68, 7–14.

Ziegler V. 1984: Family Serpulidae (Polychaeta, Sedentaria) from Bohemian Cretaceous Basin. ČNM 39 B, 213–254.

First find of pedunculate cirripedes from Slovenia and palaeogeographical remarks of *Scalpellum burdigalense* Des Moulins, 1875

MARTINA KOČOVÁ VESELSKÁ[1,2], ROK GAŠPARIČ[1,3], TOMÁŠ KOČÍ[1,4], TOMAŽ HITIJ[1,5], JURE ŽALOHAR[6]

[1]Institute for Palaeobiology and Evolution, Novi trg 59, 1240 Kamnik, Slovenia; rok.gasparic@gmail.com
[2]Institute of Geology of the Czech Academy of Sciences, Department of Paleobiology and Paleoecology, Rozvojová 269, 165 00 Prague 6, Czech Republic; veselskamartina@gmail.com
[3]The Oertijd Museum, Bosscheweg 80, 5283WB Boxtel, Netherlands
[4]Paleontological Department of Natural History Museum, National Museum in Prague, Cirkusová 1740,193 00 Prague 9 Horní Počernice, Czech Republic; protula@seznam.cz
[5]University of Ljubljana, Faculty of Medicine, Vrazov trg 2, 1000 Ljubljana, Slovenia; tomazhitij@gmail.com
[6]Biotehnični center Naklo, Strahinj 99, 4202 Naklo, Slovenia

Herein we report on the first occurrence of pedunculate scalpellid cirripede, *Scalpellum burdigalense* Des Moulins, 1875, from the Badenian deposit (middle Miocene) of Šentilj in the Central Paratethys of Slovenia. The species, which is represented by a single scutum, inhabited a shallow sublittoral environment up to 200 m. To date, only acorn barnacles were described from this area (Buckeridge et al. 2020, Kočí et al. 2023). During the Oligocene and Miocene, Slovenia was part of a larger epicontinental Paratethys Sea. Paratethys was separated into larger geotectonic units, namely the Western, Central and Eastern Paratethys, which underwent different environmental histories controlled by differently timed geotectonic events and global sea-level fluctuations. In the early–middle Miocene, the Central Paratethys was episodically connected with the Western Tethys (proto-Mediterrain) through the Pre-Alpine and Slovenian strait (Sant et al. 2019). The fossil record of *S. burdigalense* has already been known from the proto-Mediterrain of France, Italy, and Sardinia (Withers 1953) as well as from the Badenian of western Ukraine (Wysocka et al. 2012). The new occurrence of *S. burdigalense* in Slovenia thus fills in a gap in the palaeogeographical distribution of the species and shows the importance of the Slovenian marine corridor in the faunal exchange between the Central Paratethys and the proto-Mediterranean area during the early–middle Miocene.

References:

Buckeridge J.S., Kočí T., Gašparič R., Kočová Veselská M. 2020: *Actinobalanus*? *sloveniensis* (Thoracica, Balanoidea), a new species of cirripede from the Oligocene and Miocene of Slovenia that grew attached to wood substrates. NJGP–Abhandlungen 296, 51–65.

Kočí T., Gašparič R., Buckeridge J., Kočová Veselská M., Šoster A. 2023: The first record of a Konservat-Lagerstätten in which early post-settlement stages of fossil archaeobalanids (Cirripedia: Balanomorpha) are preserved. Integrative Zoology 19, 200–223.

Sant K., Palcu D.V., Turco E., Di Stefano E.A., Baldassini N., Kouwenhoven T., Kuiper K.F., Krijgsman W. 2019: The mid-Langhian flooding in the eastern Central Paratethys: integrated stratigraphic data from the Transylvanian Basin and SE Carpathian Foredeep. International Journal of Earth Sciences 108, 2209–2232.

Withers T.H. 1953: Catalogue of fossil Cirripedia in the Department of Geology, Vol. 3. Tertiary. London.

Wysocka A., Radwański A., Górka M. 2012: Mykolaiv Sands in Opole Minor and beyond: sedimentary features and biotic content of Middle Miocene (Badenian) sand shoals of Western Ukraine. Geological Quarterly 56, 475–492.

Novelties in the fossil wood record of the Paleogene of České středohoří and Doupovské hory Mts.: From Banská Bystrica 2014 to Banská Bystrica 2024

VÍT KOUTECKÝ[1], JAKUB SAKALA[2]

[1]*Jan Evangelista Purkyně University in Ústí nad Labem, Faculty of the Environment, Pasteurova 15, Ústí nad Labem, Czech Republic*
[2]*Institute of Geology and Palaeontology, Faculty of Science, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic*

In 15th Czech–Polish–Slovak Paleontological Conference in Banská Bystrica, Koutecký & Sakala (2014) presented the results of the Master Thesis of the first author (VK). Here, 10 years later, we present the results of the PhD Thesis by VK, supervised by JS on the systematics of the fossil woods from the Paleogene volcanic areas of the České středohoří and Doupovské hory Mts. (Bohemian Massif, Czech Republic). Overall, 3 conifers from two families (Cupressaceae s.l. and Pinaceae) and 17 angiosperms from 9 families (Lauraceae, Platanaceae, Ulmaceae, Fagaceae, Juglandaceae, Betulaceae, Malvaceae s.l., Ebenaceae and Oleaceae) including two indeterminable samples designated as “Xylotype Nechranice 1” and “Xylotype Ludvíkovice 1” were identified and successively published (Koutecký & Sakala 2015; Koutecký et al. 2019, 2023, 2024; Mysliveček et al. 2021, 2023).

Among others, two anatomical forms, the stem and root wood, were identified as *Taxodioxylon gypsaceum* (Cupressaceae s.l.), as well as a new genus and species *Paradiospyroxylon kvacekii* (Ebenaceae), where the stem wood represents holotype and root wood represents paratype of the taxon. In one case, the botanical reconstruction sensu Whole-plant approach was proposed, combining the wood of *Eucaryoxylon crystallophorum* and the fruit of *Carya quadrangula* (both Juglandaceae). Finally, the youngest palaeobotanical record of the České středohoří Mts. was described from the upper Oligocene Dobrná Fm. of the Milá stratovolcano as well. Overall, all studied samples highlight the importance of discussing the individual/intraspecific variability in systematic palaeobotany and the general application of the Whole-plant approach.

References:

Koutecký V., Sakala J. 2014: Paleogene woods from the Doupovské hory and České středohoří Mts. (Bohemian Massif, Czech Republic): overview and new results. Abstract book of the 15th Czech–Polish–Slovak Paleontological Conference in Banská Bystrica (November 19–20, 2014), p. 35.

Koutecký V., Sakala J. 2015: New fossil woods from the Paleogene of Doupovské hory and České středohoří Mts. (Bohemian Massif, Czech Republic). Acta Musei Nationalis Pragae, Series B, Historia Naturalis 71, 377–398.

Koutecký V., Teodoridis V., Čáp P., Mantzouka D., Sakala J. 2019: Fossil wood from the Doupovské hory and České středohoří volcanic complexes: latest overview and new angiosperms from the locality Dvérce. Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen, 293, 283–306.

Koutecký V., Sakala J., Chytrý V. 2023: *Paradiospyroxylon kvacekii* gen. et sp. nov. from the Paleogene of the Czech Republic: a case study of individual variability and its significance for fossil wood systematics. Historical Biology 35, 1186–1196.

Koutecký V., Mysliveček J., Rapprich V., Laufek F., Benkó Z., Sakala J. 2024: First evidence of Pinaceae and Fagaceae in the fossil wood record of the České středohoří Mts. (Czech Republic): A comprehensive study of fossiliferous sites in pyroclastic rocks surrounding the late Oligocene Milá stratovolcano. Review of Palaeobotany and Palynology 325, 105097.

Mysliveček J., Koutecký V., Rapprich V., Sakala J., Pour O., Laufek F. 2021: Zeolites-permineralized fossil-woods from Soutěsky near Děčín lahar. Geoscience Research Reports 54, 77–85 (in Czech with English abstract).

Mysliveček J., Koutecký V., Rapprich V., Sakala J., Hora J.M., Laufek F., Pour O., Benkó Z., Magna T. 2023: Zeolitized fossil woods from alkaline volcaniclastic rocks: Unravelling an uncommon mineralization process. Geochemistry 83, 126023.

Acritarch assemblages of the Skryje-Týřovice Basin and their biostratigraphic implications

VOJTĚCH KOVÁŘ[1,2], OLDŘICH FATKA[1]

[1]*Charles University, Faculty of Science, Albertov 6, 128 43 Prague 2, Czech Republic*
[2]*Czech Geological Survey, Klárov 3, 118 21 Prague 1, Czech Republic*

The Cambrian (Miaolingian) deposits of the Skryje–Týřovice Basin and their fossil content have been studied since the 19th century. The Cambrian strata occur in a narrow, tectonically delimited strip overlain by volcanites. Recently, a detailed lithostratigraphic scheme has been proposed (Fatka et al. 2011). However, a satisfactory biostratigraphic division is yet to be established.

Acritarchs have been demonstrated to be of great value in the Miaolingian stratigraphy (e.g. Palacios et al. 2021). While Cambrian acritarchs have been studied in the Barrandian area, the research in the Skryje–Týřovice Basin has been limited to several localities (Konzalová 1974; Vavrdová 1982; Chlupáč et al. 1998). Our current study represents a more comprehensive approach. Samples were taken at 13 localities representing diverse levels of the basins infill. The productive samples indicate a nearly uniform presence of *Timofeevia lancarae*, *Retisphaeridium* sp., *Eliasum llaniscum*. *Cristallinium cambriense* is generally rare. The presence of *T. lancarae* alongside lack of forms typical for lower stratigraphic levels of the Jince Formation of the Příbram–Jince Basin (e.g. *Adara alea*) document a later onset of the sedimentation within the Skryje–Týřovice Basin than expected. Furthermore, the local presence of an impoverished assemblage of organic-walled microfossils from shales occurring within coarse clastics in the basal portions of the succession hints at a local record of a restricted marine environment.

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References:

Chlupáč I., Fatka O., Prokop R.J., Turek V. 1998: Výzkum klasické paleontologické lokality "Luh" ve skryjském kambriu. Journal of the Czech Geological Society 43, 169–173.

Fatka O., Micka V., Szabad M., Vokáč V., Vorel T. 2011: Nomenclature of Cambrian lithostratigraphy of the Skryje–Týřovice Basin. Bulletin of Geosciences 86, 841–858.

Konzalová M. 1974: Acritarchs from the Bohemian Precambrian (Upper Proterozoic) and Lower-Middle Cambrian. Review of Palaeobotany and Palynology 18, 41–56.

Palacios T., Jensen S., Álvaro J.J., Zaldeugui J.F.S., Eguiluz L., Corfu F., Ibarguchi J.I.G. 2021: Acritarch-based chronostratigraphic and radiometric calibration of the Cambrian volcanosedimentary Vallehondo and Playón formations in the Cambrian Ossa–Morena Rift, Spain. Palaeogeography, Palaeoclimatology, Palaeoecology 565, 1–32.

Vavrdová M. 1982: Phytoplankton communities of Cambrian and Ordovician age of Central Bohemia. Věstník Ústředního ústavu geologického 57, 145–155.

Hot spring oases in the periglacial desert as the Last Glacial Maximum refugia for temperate trees in Central Europe

JIŘÍ KVAČEK [1], JAN HOŠEK[2], PETR POKORNÝ[3], DAVID STORCH[3, 4], JEFF HAVIG[5, 6], JAN NOVÁK[7], PETRA HÁJKOVÁ[8, 9], EVA JAMRICHOVÁ[9], TOMÁŠ RADOMĚŘSKÝ[2, 10], VLADISLAV RAPPRICH[2], IVAN HORÁČEK[11]

[1]*Department of Palaeontology, National Museum Prague, Václavské nám. 68, Prague, Czech Republic*
[2]*Czech Geological Survey, Klárov 3, Prague 1, Czech Republic*
[3]*Center for Theoretical Study, Charles University and the Czech Academy of Sciences, Jilská 1, Prague 1, Czech Republic*
[4]*Department of Ecology, Faculty of Science, Charles University, Vìničná 7, Prague 2, Czech Republic*
[5]*Department of Plant and Microbial Biology, University of Minnesota, Saint Paul, MN 55108, USA*
[6]*Department of Earth and Environmental Sciences, University of Minnesota, Minneapolis, MN 55455, USA*
[7]*Department of Botany, Faculty of Science, Charles University, Benátská 2, Prague 2, Czech Republic*
[8]*Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, Brno, Czech Republic*
[9]*Department of Paleoecology, Institute of Botany, The Czech Academy of Sciences, Lidická 25/27, Brno, Czech Republic*
[10]*Institute of Geology and Palaeontology, Faculty of Science, Charles University, Albertov 6, 128 43 Prague, Czech Republic*
[11] *Department of Zoology, Faculty of Science, Charles University, Viničná 7, Prague 2, Czech Republic*

Fossil plant macrofossil preserved as impressions and permineralizations in silica fossil sinter from Ratíškovice near Hodonín from the Last Glacial Maximum are reported as an important argument for existence of northern glacial refugium in south Moravia.

This is a long-standing idea that many temperate organisms survived the Last Glacial Maximum (LGM; ~26.5 to 19 thousand years) in several sites across central and northern Europe as understood from phylogeographic analyses, yet direct fossil evidence has thus far been missing.

In this contribution we present the first unequivocal proof that thermophilous trees such as oak (*Quercus* – fragments of leaves, bud and wood), linden (*Tilia* – fragments of wood), and common ash (*Fraxinus excelsior* – bud) survived the LGM in Central Europe. There are other less significant arborescent taxa documented as alder (*Alnus glutinosa* - fructifications, seeds) and *Pinus* (twigs). The persistence of the refugium was promoted by a steady influx of hydrothermal waters that locally maintained a humid and warm microclimate resembling situation in a "natural greenhouse". As a part of the study, we reconstructed the geological and palaeohydrological factors responsible for the emergence of hot springs during the LGM and argue that refugia of this type, allowing the long-term survival and rapid post-LGM dispersal of temperate elements, were not exceptional in central Europe.

Microsporangiate cones *Classostrobus* from the Late Cretaceous of the Bohemian Cretaceous Basin, Czechia

ANASTÁZIE LUDVÍKOVÁ[1], JIŘÍ KVAČEK[2]

[1]*Charles University, Albertov 6, 128 43 Prague 2, Czech Republic*
[2]*Department of Palaeontology, National Museum Prague, Václavské nám. 68, Prague, Czech Republic*

This contribution focuses on microsporangiate cones referable to the genus *Classostrobus* Alvin, Spicer et Watson bearing *Classopollis* pollen, which are associated with leafy shoots of cheirolepidiaceous conifer *Frenelopsis alata* (K. Feistmantel) Erw. Knobloch.

The fossil specimens studied here were found in unit 3 of the Peruc Member, the Peruc-Korycany Formation in the active Pecínov quarry. This unit is characterized by dark grey to black, pyrite-rich mudstones. Based on the sedimentology and the occurrence of *Frenelopsis alata*, unit 3 is interpreted as an environment of intertidal to supratidal marshes. The age of Unit 3 is determined to be middle Cenomanian (Kvaček et al. 2024).

Pollen cones of the extinct coniferous family Cheirolepidiaceae are frequently found in many mesofossil floras recovered from the Late Cretaceous strata of Czechia (Kvaček 2000). These cones are typically rounded to oval-shaped, consisting of a central axis with a helically arranged, triangulate microsporophylls that are approximately 12 per cone. Each microsporphyll shows a short stalk and a head with a mostly obtuse apex, fringed with long trichomes. The microsporophyll heads exhibit stomatal complexes that are more prominent on the abaxial cuticle, with each stomatal chamber surrounded by distinct papillae.

Within these cheirolepidiaceous microsporangiate cones, there are presumably two to three pollen sacs situated on the abaxial side of the microsporophylls. These sacs bear pollen grains attributed to the species *Classopollis classoides* (Pflug) Pocock et Jansonius. Prominent features of the *Classopollis* pollen include the rimula, distal cryptopore, proximal scar and the frequent presence of orbicules. In contrast to other *Classopollis* species, *C. classoides* is characterized by a less prominent microechinate sculpture and minimal striation.

References:

Kvaček J. 2000: *Frenelopsis alata* and its microsporangiate and ovuliferous reproductive structures from the Cenomanian of Bohemia (Czech Republic, Central Europe). Review of Palaeobotany and Palynolynology 112, 51–78.

Kvaček J., Svobodová M., Čepičková J., Veselá V., Špičáková L., Uličný D., Teodoridis V., Dašková J., Mendes M.M., Zahajská P. 2024: Cenomanian terrestrial paleoenviroments from the Bohemian Cretaceous Basin in Central Europe and their implications for angiosperm paleoecology. Palaeogeography, Palaeoclimatology, Palaeoecology 650, 112348.

Lorica ultrastructure of hyaline calpionellids from the Jurassic / Cretaceous boundary

JOZEF MICHALÍK[1], DIANA ÖLVECZKÁ[1], SILVIYA PETROVA[2]

[1]*Earth Science Institute, Slovak Academy of Sciences, Bratislava, Slovakia; geolmich@savba.sk*
[2]*Geological Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria; silviya_p@geology.bas.bg*

There is believed that fossil calpionellid loricae were formed of hyaline organic substance, later replaced by skeletal calcite. Other specialists supposed, that the loricae could have been formed by agglutination of calcitic particles of preyed coccolitophorids. Possibility of original aragonite lorica composition, very early transformed into calcite has been indicated by another test ultrastructure studies.

Representatives of *Calpionella alpina* from the Tithonian Crassicollaria Zone were 75–85 µm wide, instead of 50 to 65 µm in the Berriasian Alpina Zone. Lorica wall thickness attained 4–5 µm; however, this value could have been secondary enlarged by test recrystallization and by accretion of individual crystallites, or (less frequent) thinned by dissolution. Result shows that lorica ultrastructure seems to be variable not only in individual lithologies, but also between individual parts of the same specimen. It is built of thin laminar layer parallel with inner surface. Transparent matter This layer easily (often laterally) turned into columnar crystals normal to the surface (possibly, a difference between "slowly formed" and "quick formed" parts of the lorica must have existed).

Anterior cross sections of *Calpionella alpina* from the Brodno section (Intermedia Subzone up to the Alpina Zone) show laminar pattern of several (3–4) parallel laminae, while the outer surface is covered by spiral hexagonally arranged rhombi. Also, lorica wall could be changed into columnar densely spaced skalenoeders (1–3 µm thick, up to 17 µm long), oriented normally to the test surface ("slowly formed" part of lorica). Outer test outline is blurred by crystal growth, the infilling of test cavity can be recrystallized into irregular calcite crystals which penetrate through the inner test surface. During diagenesis, the whole test wall could has been transformed into an aggregate of rhombi. Very early diagenetic changes affected parts the lorica more intensively than the surrounding matrix.

Under optical microscope, dark appearing chitinoidellid tests have been supposed to be built of chitinous substance. However, the wall is little resistant in an acid bath. SCAN observations has shown dispersed calcite rhombi in fine matrix. Both sides of the lorica have been smooth, nevertheless, new post mortal increments of calcite rhombi are oriented out of the lorica. The inner (almost plane) lorica surface is ornamented by calcite rhombi imprints. Sharpness of these planes indicates that the wall was rimmed by different layers in contrast with "hyaline" calpionellid loricae, where the external surface can be smoothed during recrystallization.

Parallels in loricae architecture of Mesozoic calpionellids with modern tintinnids are interesting. Chitine, cellulose, other polysaccharides, neutral polysaccharides, glycolipids, phospholipids and unsaturated fatty acids have been excluded as lorica building materials, and hyaline organic matter, most probably proteins are regarded as main components. Due to calcium carbonate composition, many micropaleontologists excluded affinity of modern tintinnids with calpionellids. However, character and abundance changes of uppermost Jurassic/Lower Cretaceous calpionellids associations evokes assumption that the calcite saturation of loricae walls was not the primary sign of these animals and perhaps they could survive e.g. late Hauterivian–Barremian time with non-calcified tests.

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References:

Michalík J., Olvéczká D., Petrova S. 2023: Lorica ultrastructure of hyaline calpionellids from the Jurassic–Cretaceous boundary – Abstracts of the 22nd Czech–Slovak–Polish Palaeontological Conference Ostrava, October 17–19.

New findings of the Late Carboniferous fauna from Dobšiná (Slovakia)

MARIKA MIKUDÍKOVÁ[1], ŠTEFAN MESZÁROŠ[2], PETER AGRICOLA[3]

[1]State geological institute of Dionýz Štúr, Mlynská dolina 1, 817 04 Bratislava, Slovakia
[2]Dúbravské múzeum, Pod záhradami 39, 841 02 Bratislava, Slovakia
[3]Adamusova 1315/2, 70030 Ostrava, Czech Republic

Late Carboniferous localities near Dobšiná represent a unique relic of unmetamorphosed sedimentary rocks with preserved Late Carboniferous fauna and flora from Slovakia. One of the most famous, the Jeruzalemberg locality, is known for more than 160 years (Kiss 1858). Stratigrafically it belongs to a lower part of Zlatník Formation and the age was determined biostratigraphically to Westphalian A-B (Vozárová & Vozár 1988). Despite the fact that it is a significant paleontological locality in Slovakia, it has not been studied for more than 30 years.

New outcrops near Jeruzalemberg locality contain rich macrofossil remains from predominantly marine environment (algae, brachiopods, gastropods, bivalves, crinoids, bryozoans and trilobites) and rare remains of terrestrial flora (fragments of plant stems and isolated leaves). In the new outcrops we documented alternation of laminated grey aleuritic shales with rare psammitic layers with organodetrite (thickness approx. 2–3 m) and thinner layers of massive dark-grey limestones containing rich fossil remains (thickness approx. 0.5–1 m) (horizon gamma or delta after Rakusz 1932). Fossil assemblage of the shales and limestones is relatively identical with exception of trilobites and terrestrial flora, which were found only in the grey shales. The alteration of the shales and limestones could probably reflect the sea level changes during Upper Carboniferous glaciation.

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References:

Kiss A. 1858: Dobsina in geologischer und mineralogischer Hinsicht. Magyarhony Természetbarát 2. 3. Nitra

Rakusz Gy. 1932: Die oberkarbonische Fossilien von Dobsina /Dobšina/ und Nagyvisnyó. Geologica Hungarica: Series Palaeontologica 8, Budapest, 224 p.

Vozárová A., Vozár J. 1988: Late Paleozoic in West Carpathians. Štátny geologický ústav Dionýza Štútra, Bratislava, 314+22 p.

How did the Meliata Unit evolve? Triassic–Jurassic radiolarites and their chemical composition based on handheld XRF and whole-rock analyses

MARÍNA MOLČAN MATEJOVÁ[1], TOMÁŠ POTOČNÝ[1], DUŠAN PLAŠIENKA[1]

[1]*Department of Geology and Palaeontology, Faculty of Natural Sciences, Comenius University, Mlynská dolina, Ilkovičova 6, 842 15 Bratislava, Slovakia; marina.matejova@uniba.sk*

A study was conducted at several localities (Bohúňovo, Držkovce, Čoltovo) in the southern Slovakia, which yielded new information about the geochemistry and stratigraphy of the Triassic and Jurassic sedimentary formations of the Meliata Unit. Data from the geochemical analysis of siliceous rocks using hXRF (miniaturized portable handheld-XRF) were compared with conventional whole rock geochemical analysis (laboratories in Canada and Romania) performed on the same samples. Attention was targeted on major oxides which bear important information about the origin of the sediment and the paleoenvironment. The results obtained from both methods were consistent and represent a significant contribution to the stratigraphic data that have been acquired from the radiolarites.

Based on the paleoenvironment diagrams according to Murray (1994), the majority of samples indicate a pelagic environment at the vicinity of a continental margin. The discrimination diagrams by Dhannoun & Al-Dlemi (2013) and Mortazavi et al. (2013) indicate vicinity to a shallow marine environment, too. In the provenance discrimination diagram of Murray (1994), most of the samples plot in the fields of mature continental sources. However, one sample from the Bohúňovo locality falls into completely different fields regarding the provenance and paleoenvironment. It corresponds to the deeper-water environment in the vicinity of the middle-ocean ridge and to a mafic igneous provenance.

Based on the studied localities, the story of the Meliata Ocean started on a continental slope and rise with deposition of Middle Triassic red and green siliceous rocks, shales, siltstones and limestones that are presently associated with basic volcanics. The Middle Triassic age of these formations was proved by radiolarian fauna. Middle–Upper Triassic sedimentary formations are composed of distal turbidites alternating with radiolarians-bearing autochthonous siliceous shales. Geochemical analyses reveal terrigenous provenance of the mature, quartz-dominated fine-grained siliciclastic material, most probably derived from the northern (Austroalpine) passive margin. This material was transported from the margin to the oceanic slope or rise, where it alternated with radiolarian ooze.

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References:

Dhannoun H.Y., Al-Dlemi A.M.S. 2013: The relation between Li, V, P_2O_5, and Al_2O_3 contents in marls and mudstones as indicators of environment of deposition. Arabian Journal of Geosciences 6, 817–823.

Mortazavi M., Moussavi-Harami R., Mahboubi A., Nadjafi M. 2013: Geochemistry of the Late Jurassic–Early Cretaceous shales (Shurijeh Formation) in the intracontinental Kopet–Dagh Basin, northeastern Iran: implication for provenance, source weathering, and paleoenvironments. Arabian Journal of Geosciences 7, 5353–5366.

Murray R.W. 1994: Chemical criteria to identify the depositional environment of chert: general principles and applications. Sedimentary Geology 90, 213–232.

Middle Jurassic Flora from the East Gobi Basin of Mongolia: Systematics and palaeoecology

ANATOLII MURAVIEV[1], JIŘÍ KVAČEK[2]

[1]Charles University, Albertov 6, 128 43 Prague 2, Czech Republic
[2]National Museum, Václavské nám. 68, 110 00 Prague, Czech Republic

This study initiates palaeobotanical research in the East Gobi Coal Basin, reporting preliminary results on systematic diversity and its phytostratigraphic implementation for the Middle Jurassic Khamarkhovor Formation within the Dovtsogkhudag locality in Mongolia.

We examined 35 core samples from 7 wells and 56 hand specimens containing plant remains. Through morphological and cuticular analysis, 32 morphospecies from 15 genera were identified, including liverworts, horsetails, ferns, cycadophytes, ginkgophytes, czekanowskialeans, and conifers. The plant remains were represented by stem impressions, leaf impressions and compressions with cuticles. Additionally, the sedimentary record of the study area was analyzed.

The flora analysis revealed an abundant diversity of ferns – *Coniopteris* and *Cladophlebis*, cycadophytes, and numerous czekanowskialeans such as *Phoenicopsis*. Based on the fossil plant remains, we assign the studied deposits to the Khamarkhovor Formation that is coeval with sedimentary basins in Mongolia (Tsagan-Ovoo, Bakhar) and China (Ordos Basin), suggesting an Aalenian–Bajocian age.

The sedimentary record indicates fluvial–lacustrine sequences and coal swamp. The plant assemblage is closely associated with the *Coniopteris–Phoenicopsis* flora of Siberia (Vahrameev 1988). However, several characteristics suggest the studied area had a warm temperate climate, such as hypostomatic leaves of gymnosperms, higher diversity of cycads associated with reproductive structures.

In conclusion, we propose that the studied area corresponds to the southern margin of the Siberian palaeofloras region. The analyzed deposits were supplied by river flows and consisted of terrigenous sediments including sandstone, siltstone, and mudstone. A warm temperate climate with annual temperature succession is indicated by the presence of deciduous trees with seasonal foliage drop, such as Czekanowskiales.

References:

Kostina E.I., Herman A.B., Kodrul T.M. 2015: Early Middle Jurassic (possibly Aalenian) Tsagan-Ovoo Flora of Central Mongolia. Review of Palaeobotany and Palynology 220, 44–68

Kostina E.I., Herman A.B. 2016: Middle Jurassic Floras of Mongolia: Composition, Age and Phytogeographic Position. Paleontological Journal 50, 1437–1450.

Vakhrameev V.A. 1988. Jurassic and Cretaceous Floras and Climates of the Earth. Cambridge Univ. Press, Cambridge, p. 318.

Evaluating the transition between the two-layered Praetintinnopsella and thehyaline Crassicollaria

DIANA ÖLVECZKÁ[1,2], ADAM TOMAŠOVÝCH[1]

[1]Earth Science Institute of the Slovak Academy of Sciences, Dúbravská Cesta 9, P.O.Box 106, 840 05 Bratislava, Slovakia; diana.olveczka@savba.sk; adam.tomasovych@savba.sk
[2]Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University in Bratislava, Ilkovičova 6, 842 15 Bratislava, Slovakia; olveczka3@uniba.sk

The ultrastructure and biomineralization pathways involved in the formation of microgranular chitinoidellids and bi-layered semichitinoidellids loricae remain disputed. The environmental factors that affected the appearance and turnover of calpionellids during the Late Jurassic, as well as the transition from microgranular chitinoidellids to hyaline calpionellids and what caused this replacement of the microgranular by hyaline loricae during Tithonian, remain poorly understood. There are many hypotheses and opinions explaining the formation of calpionellid loricae and their agglutination (Aubry et al. 1975; Vincent et al. 1980; Duchamp-Alhonse 2009). The group of praecalpionellids (i.e. semichitinoidellids), represented by the genera *Praetintinnopsella* Borza (1979) and *Semichitinoidella* Nowak (1978), stratigraphically occur at the transition between single-layered chitinoidellids and calpionellids. It was assumed that the hyaline layer of the lorica effectively displaced the microgranular layer of chitinoidellids towards the external side of the lorica in praetintinnopsellid (Remane 1998), and this layer was later lost in calpionellids possessing the hyaline layer only. However, Nowak (1978) observed that the genus *Semichitinoidella* exhibits the microgranular layer on the internal side and the hyaline layer on the external side.

Here, we compare the ultrastructure and chemical composition between the two-layered *Praetintinnopsella* and the hyaline *Crassicollaria*, using the scanning electron microscope (SEM) and electron probe micro-analysis (EPMA). The samples were collected in the Tithonian and Berriasian pelagic deposits of Czorsztyn and Pieniny Limestone formations in Pieniny Klippen Belt (Western Carpathians), specifically at Strapkova, Brodno and Snežnica sections.

Under the light microscope, a hyaline layer is surrounded by a dark rim in *Praetintinnopsella*. However, our SEM and BSE analyses indicate that this rim is not microgranular as in *Chitinoidella*. BSE images show that the hyaline layer of *Praetintinnopsella* is very thin (less than 2–3 μm) and is composed of densely packed equidimensional crystals that are 1 μm in size (and thus exceed the size of acicular crystals in *Chitinoidella*). Notably, the microstructure of the hyaline layer in *Praetintinnopsella* is more similar to that of *Crassicollaria* than to the external hyaline layer of *Semichitinoidella*. The hyaline layer of *Crassicollaria* also differs from the hyaline layer of the genus *Calpionella* in terms of crystals size.

Due to the difference in chemical composition (especially Mg) this layer is frequently indistinct between the tests and the surrounding micrite in BSE images. According to SEM analysis, the hyaline wall of *Crassicollaria* is formed by very thin (approximately 1 μm in size) small polyhedric arranged crystals close each other. The hyaline wall of *Calpionella* consists of slender crystal prisms oriented perpendicularly to the inner surface of the wall.

References:

Aubry M.P., Bignot G., Bismuth H., Remane J. 1975: Premiers résultats de l'observation au M.E.B. de la lorica des calpionelles et de quelques microfossiles qui leur sont associés. Revue de Micropaléontologie 18, 127–133.

Borza K. 1979: Tintinnina Aus dem Oberem Apt und Unteren Alb der Westkarpaten. Geologica Carpathica 30, 341–361

Duchamp-Alphonse S., Fiet N., Pagel M., Jürgen R. 2009: A chemical method for extracting calpionellids from indurated calcareous rocks. Micropaleontology 55, 87–93.

Nowak W.A. 1978: Semichitinoidella n. Ge. (Tintinnina) of the Upper Jurassic of the Czorstyn Succession, Pieniny Klippen Belt (Carpathians, Poland). Rocznik Polskiego Towarzystwa Geologicznego Annles de la Sociéte Géologique de Pologne XLVIII, 3–25.

Remane J. 1998: Calpionellids. In: Introduction to Marine Micropaleontology, 161–170. https://doi.org/10.1016/B978-044482672-5/50006-4

Vincent E., Lehmann R., Slkiter W.V., Westberg M.J. 1980: Calpionellids from the Upper Jurassic and Neocomian of deep sea drilling project Site 416, Moroccan basin, Eastern North Atlantic. Deep Sea Drilling Initial Reports 79, 439–465.

Plants from the Late Jurassic island in the Holy Cross Mountains (Poland)

GRZEGORZ PACYNA[1], MARIA BARBACKA[2,3], JADWIGA ZIAJA[2]

[1]*Jagiellonian University, Faculty of Biology, Institute of Botany, Department of Taxonomy, Phytogeography and Palaeobotany, ul. Gronostajowa 3, 30-387 Kraków, Poland; grzegorz.pacyna@uj.edu.pl*
[2]*W. Szafer Institute of Botany, Polish Academy of Sciences, ul. Lubicz 46, 31-512 Kraków, Poland; j.ziaja@botany.pl*
[3]*Hungarian Natural History Museum, Botany Department, H-1431 Budapest, Pf. 137, Hungary; maria.barbacka@gmail.com*

In the Late Jurassic, most of western and central Europe was covered by epicontinental seas, but there were numerous islands which hosted rather xeromorphic vegetation, dominated by conifers and not taxonomically diverse. Other plant groups were also present but only bennettialeans and seed ferns are rather frequent (Barale, 1981). The best-known such island floras were found in France and Germany.

Based on palaeogeography, such floras should also be found in Poland. The 20th century indeed provided some discoveries of Late Jurassic plant macroremains from the Holy Cross Mountain region, but mostly single finds of leaves or indeterminable wood fragments (Gutowski 1998). Only the Wólka Bałtowska site yielded a diversified assemblage of shoots, leaves and cones with cuticle details preserved (Liszkowski 1972; Gedl & Ziaja 2004).

The macrofossil assemblage is dominated by araucariacean (leafy shoots of *Brachyphyllum mamillare* with male cones attached, *Araucarites* female scales) and cheirolepidiacean conifers (leafy shoots of *Brachyphyllum crucis* and *Pagiophyllum araucarinum*, male cones); some seed ferns (*Ptilozamites*) and ferns are also present. Interesting is the presence of numerous *Pseudotorellia* leaves, from a gymnosperm of unknown affinity.

The Wólka Bałtowska island vegetation probably was somewhat similar to that of today's New Caledonia in its dominance of a huge araucariacean conifer forest near shore. Ferns (Gleicheniaceae) and other gymnosperms, as seed ferns and bennettitaleans, grew along small rivers inside the island. Some groups have only a palynological record, including lycopsids, sphenopsids, some ferns (e.g. Cyatheaceae/Dicksoniaceae, Matoniaceae/Dicksoniaceae, Schizaeaceae), Erdtmanithecales and some conifers (Podocarpaceae, Pinaceae, Taxodiaceae). The location of their source plant assemblages is unclear; sporomorphs of these plants may have been transported over long distances. Non-pollen palynomorphs – green algae of Chlorophyceae (*Botryococcus*) and Prasinophyceae (*Pterospermella*) – were also found, pointing to the presence of brackish reservoirs.

This locality and neighboring ones have dinosaur tracks. Plants formed the base of the trophic pyramid, supporting probably diminutive dinosaur fauna (Gierliński et al. 2009). The taxonomic composition of the Wólka Bałtowska flora is similar to coeval floras from Western Europe in their dominance of conifers, but the presence of *Pseudotorellia* indicates biogeographic connections with eastern European floras that grew on the larger Ukrainian land.

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References:

Barale G. 1981: La Paléoflore jurassique du Jura francais: étiude systématique, aspects stratigraphiques et paléoécologiques. Documents des Laboratoires de Géologie de Lyon 81, 1–467.

Gedl P., Ziaja J. 2004: Preliminary results of palynological studies of Upper Jurassic flora-bearing deposits from Wólka Bałtowska, NE margin of Góry Świętokrzyskie, Poland). Volumina Jurassica 2, 49–59.

Gierliński G., Niedźwiedzki G., Nowacki P. 2009: Small theropod and ornithopod footprints in the Late Jurassic of Poland. Acta Geologica Polonica 59, 221–234.

Gutowski J. 1998: Oxfordian and Kimmeridgian of the northeastern margin of the Holy Cross Mountains, Central Poland. Geological Quarterly 42, 59–72.

Liszkowski J. 1972: First Upper Jurassic paleofloristic locality in Poland. Przegląd Geologiczny 20, 388–393.

Plant remains from the Upper Triassic Poręba site in south-western Poland

GRZEGORZ PACYNA[1], MARIA BARBACKA[2,3], JADWIGA ZIAJA[2], ALICJA WARZECHA[1,4]

[1]Jagiellonian University, Faculty of Biology, Institute of Botany, Department of Taxonomy, Phytogeography and Palaeobotany, ul. Gronostajowa 3, 30-387 Kraków, Poland; grzegorz.pacyna@uj.edu.pl
[2]W. Szafer Institute of Botany, Polish Academy of Sciences, ul. Lubicz 46, 31-512 Kraków, Poland; j.ziaja@botany.pl
[3]Hungarian Natural History Museum, Botany Department, H-1431 Budapest, Pf. 137, Hungary; maria.barbacka@gmail.com
[4] Jagiellonian University, Doctoral School of Exact and Natural Sciences, ul. prof. S. Łojasiewicza 11, 30-348 Kraków, Poland; alicja.a.dyba@doctoral.uj.edu.pl

Poręba is a recently discovered Late Triassic (Norian) plant-bearing locality in south-western Poland (Sulej et al. 2012). The strata represent the Patoka Member of the Grabowa Formation and are deposits of a braided river system. Besides plant remains, animal fossils were also found here: vertebrate bones including of one of the oldest European turtles, invertebrate isolated cuticles, clitellate cocoons, and numerous coprolites containing plant and animal cuticles (Bajdek et al. 2019).

Plant remains are numerous at this locality but represented mainly by isolated leafy shoots and charcoaled wood fragments (mainly *Agatoxylon keuperianum*). Plant reproductive structures are much rarer. Numerous sporomorphs were found in macrofossil-bearing levels; these are typical for local zone Classopollis meyerianus subzone b, pointing to Norian age.

The plant macroremains belong almost exclusively to conifers. *Brachyphyllum-Pagiophyllum*-type leafy shoots predominate. The leaf cuticle structure is highly xeromorphic. The leaves are small, triangular, more or less sharpened, the cuticle is thick, the stomata sunken in rows, with papillate subsidiary cells, frequently with a Florin ring. Papillae are more prominent at leaf apices. Some leaves are more elongated but cuticular details are the same as above. Some leafy shoots of *Brachyphyllum–Pagiophyllum*-type possess vascular bundles (xylem) preserved inside. There are also two types of enigmatic cabbage-like tufts of more elongated triangular leaves.

Isolated female cone scales and male cones belong to at least three genera. Reproductive structures and sterile remains are not preserved in organic connection, so it is very difficult to correlate them. Sterile leaves differ very slightly in gross morphology and have almost identical cuticle structure. Seed scale–bract scale complexes may represent new genera and/or scales described so far from the European Triassic but without cuticle preserved. Male cones are very small for Triassic conifers and have pollen grains preserved in situ in pollen sacs. The pollen from two types belong to the dispersed genus *Brachysaccus* and/or *Triadispora*, and from the other cone type to *Classopollis*. Although one type of female scale appears to belongs to *Patokaea* (Pacyna et al. 2017), no male cone with *Enzonalasporites* pollen typical for this plant was found.

Based on in situ pollen and female scale morphology, some early members of Cheirolepidiaceae and members of previously unknown Voltziales may be present in this material. Numerous charcoal fragments point to frequent forest fires.

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References:

Bajdek P., Szczygielski T., Kapuścińska A., Sulej T. 2019: Bromalites from a turtle-dominated fossil assemblage from the Triassic of Poland. Palaeogeography, Palaeoclimatology, Palaeoecology 520, 214–228.

Pacyna G., Barbacka M., Zdebska D., Ziaja J., Fijałkowska-Mader A., Bóka K., Sulej T. 2017: A new conifer from the Upper Triassic of southern Poland linking the advanced voltzialean type of ovuliferous scale with *Brachyphyllum–Pagiophyllum*-like leaves. Review of Palaeobotany and Palynology 245, 28–54.

Sulej T., Niedźwiedzki G., Bronowicz R. 2012: A new Late Triassic vertebrate fauna from Poland with turtles, aetosaurs, and coelophysoid dinosaurs. Journal of Vertebrate Paleontology 32, 1033–1041.

Late Miocene ostracod assemblages from lacustrine–deltaic and sublittoral environment

RADOVAN PIPÍK[1], DUŠAN STAREK[2]

[1]*Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 97411 Banská Bystrica, Slovakia*
[2]*Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 84005 Bratislava, Slovakia*

Emergence of the brackish Lake Pannon was a challenge for the polymorphic brackish ostracods of the Sarmatian Sea to adapt and diversified to diverse ecological niches. A contribution focuses on the ostracod taxa (species, genera, families) of the Pannonian lacustrine- deltaic sedimentary sequence gradually prograding to the mud sublittoral environment.

Sublittoral greyish-blue to greyish-brown mud with variable content of silt, bioturbation, and dispersed macrofossil shells was specific for offshore (bottomset) environment. TOC attended its maximum (1.16 %), but its content as well as and TIC, $CaCO_3$ and TC content fluctuated. Ostracod fauna was very diversified and abundant in individuals of endemic species and endemic genera. Candonidae were represented by *Camptocypria, Candona, Caspiocypris, Bakunella, Lineocypris, Pontoniella, Pseudocandona, Serbiella, Typhlocyprella* and *Typhlocypris. Zalanyella.* Hemicytheridae, Leptocytheridae and genus *Amplocypris* (Cyprididae) reached their maximum abundance. *Serbiella* and *Loxoconchidae* were restricted to this part of sedimentary sequence.

Towards the delta, an input of silt increased gradually and thin rhythmic deposition of clay, silt and very fine sand were the most noticeable feature. The parallel lamination, current ripples, and small-scale graded bedding were common in thin silty and sandy beds. Bioturbation and carbonised remains of flora were also present. These prodelta (foreset) deposits were characteristic of decrease of TOC content towards the shallower environment and more or less stable TC, TIC and $CaCO_3$ content. A diversity and abundance of ostracod taxa and individuals significantly dropped. Assemblage was characteristic of Candoninae (*Camptocypria, Lineocypris*), *Amplocypris* and *Cyprideis.* Hemicytheridae and Leptocytheridae reappeared in the thin mud layers without silt and very fine sand.

Prevalence of silty and sandy deposits signalized the delta front environment. It was typical of thin layers of fine-grained gravel, a horizon with shell concentration as well as abundance of well-preserved plant remains. This rhythmic development terminated by thick coarse-grained silt and sand with cross-bedding, current ripple bedding, scour-and-fill structures and erosional surfaces. It suggests deposition in distributary mouth bars and distributary channels of delta front within the action of the fair-weather wave base. The ostracod fauna was poor on species and individuals and settled by *Amplocypris-Cyprideis* association. Occasionally occurred *Hemicytheria* and *Pontoniella*. Coarse-grained silt and sand channel deposits were free of ostracods and TOC, TC, TIC and $CaCO_3$.

A deltaic sequence terminated by organic silty mud, dark peaty beds rich in organic matter (9.26 % TOC), roots corresponding to natural-levee and marsh environments which are together with delta front a component part of a delta topset. A badly preserved ostracod association is poor on individuals of *Amplocypris, Cyprideis, Cypria, Lineocypris* and *Camptocypria*.

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A new gadiform fish (Teleostei, Paracanthopterygii) from the Burdigalian deposits of Moravia (Czech Republic)

TOMÁŠ PŘIKRYL[1], RŮŽENA GREGOROVÁ[2]

[1]*Institute of Geology of the Czech Academy of Sciences, Rozvojová 269, 165 00 Prague 6, Czech Republic*
[2]*Moravian Museum, Zelný trh 6, 659 37 Brno, Czech Republic*

The Burdigalian deposits of Vážany nad Litavou site belong to Ždánice–Hustopeče Formation of the Ždánice–Subsilesian Unit (Stráník et al. 2007). Until now, remains of Clupeidae, Merlucciidae, Trichiuridae, Caproidae, Leiognathidae, and Gobiidae were identified (Jaroš 1937; Reichenbacher et al. 2018). A visit of the locality during 2016 enlarged collection by a new specimen that is represented by almost complete fish lacking posterior part of the body. Based on the overall physiognomy, anteriorly shifted pelvic fin and hyomandibula articulated with neurocranium in single condyle it can clearly be classified as a member of the order Gadiformes (Nelson et. al. 2016). This order is at the locality represented by specimens of genus *Merluccius*, but the new material is clearly distinctive taxon.

The order Gadiformes is separated to 13 families classifying about 613 species within 84 genera (Nelson et. al. 2016). The specimen under consideration shows a certain degree of similarity with subfamilies Gaidropsarinae and Lotinae (family Gadidae *sensu* Endo 2002), especially in the construction of the abdominal section of the vertebral column and selected skull characters. Both groups are easily recognizable by anatomy of unpaired fins and construction of the caudal skeleton – unfortunately, these structures are preserved insufficiently or completely missing.

Both subfamilies are recorded also in fossil record, including otoliths, in some cases preserved *in situ* (Carnevale & Harzhauser 2013; Schwarzhans et al. 2017, 2021 and references therein). The specimen should be classified for the moment within open nomenclature as a Gadidae indet.

References:

Carnevale G., Harzhauser M. 2013: Middle Miocene rockling (Teleostei, Gadidae) from the Paratethys (St. Margarethen in Burgenland, Austria). Bulletin of Geosciences 88, 609–620.

Endo H. 2002: Phylogeny of the order Gadiformes (Teleostei, Paracanthopterygii). Memoirs of the Graduate school of Fisheries Sciences, Hokkaido university 49, 75–149.

Jaroš Z. 1937: Paleogenní rybí fauna z Linhartských Vážan od Slavkova u Brna. Časopis Vlasteneckého spolku musejního v Olomouci 50, 99–106.

Nelson J.S., Grande T.C., Wilson M.V.H. 2016: Fishes of the World, Fifth Edition. John Wiley & Sons, inc., Hoboken, New Jersey, 1–752.

Reichenbacher B., Gregorová R., Holcová K., Šanda R., Vukić J., Přikryl T. 2018: Discovery of the oldest *Gobius* (Teleostei, Gobiiformes) from a marine ecosystem of Early Miocene age. Journal of Systematic Palaeontology 16, 493–513.

Schwarzhans W., Bannikov A.F., Carnevale G. 2021: A reappraisal of *Palaeomolva tarchanica* Daniltshenko, 1947 (Gadiformes, Lotidae), based on new skeletal material with otoliths in situ from the Miocene of North Caucasus, Russia. Bollettino della Societa Paleontologica Italiana 60, 125–133.

Schwarzhans W., Carnevale G., Bratishko A., Japundžić S., Bradić K. 2017: Otoliths *in situ* from Sarmatian (Middle Miocene) fishes of the Paratethys. Part II: Gadidae and Lotidae. Swiss Journal of Palaeontology 136, 19–43.

Stráník Z., Hrouda F., Otava J., Gilíková H., Švábenická L. 2007: The Upper Oligocene–Lower Miocene Krosnolitho-facies in the Carpathian Flysch Belt (Czech Republic): sedimentology, provenance and magnetic fabrics. Geologica Carpathica 58, 321–332.

Badenian/Sarmatian boundary detected at the south-west slopes of the Devínska Kobyla hill (Bratislava, Vienna Basin)

ANDREJ RUMAN[1], FILLIP CESNAK[1], TÁLIA CHABANOVÁ[1], DOMINIK KUVIK[1], PETRA ASTRID MICHEL[1], THEODOR HORVÁTH[1], MICHAL JAMRICH[1], ŠTEFAN MESZÁROŠ[1], NATÁLIA HUDÁČKOVÁ[1]

[1]*Comenius University in Bratislava, Faculty of Natural Sciences, Mlynská dolina, Ilkovičova 6, 842 15 Bratislava 4, Slovakia*

The research at the Meszároš site located ca. 700 m southwest of the Dúbravská hlavica (48.179985°, 17.008030°) was conducted as part of a field course with students of the Department of Geology and Paleontology in 2022–2023. This research brought new and valuable information about the paleoecology and biostratigraphy of the sediments of the Devínska Kobyla hill, a location of great geological importance. The sediments of the studied area were assigned to the Studienka Formation (*Bulimina/Bolivina* Zone) based on foraminifera associations, and to the NN6 Zone based on the nannofossils (Hyžný et al. 2012).

The site is formed by several outcrops in the ditch consisting of coarse- to fine-grained marine sediments. The examined outcrop is ca. 2 m high, starting with a 20 cm thick layer of very coarse-grained conglomerate (cobbles up to 25 cm in diameter), possibly interpreted as a result of a catastrophic event. The following interval (20–70 cm) is characterized by an alternation of very fine-grained and fine-grained sandstones. Upwards (70–190 cm) follows a very fine-grained sandstone body, which is interrupted by ca. 10 cm coarse-grained sandstone. The upper part of the outcrop is formed by an erosion boundary and continued by ca. 10 cm slope debris followed by forest soil. The locality is rich in fossils, dominantly consisting of decalcified molds of fossil mollusks (e.g., *Thracia* sp., *Linga* sp., *Archimediella* sp.) and shells of pectinid bivalves (e.g., *Flabellipecten leythayanus*) and oysters (*Ostrea digitalina*) as well as rare teeth and bones of fishes and rays (*Aetobatus arcuatus*) documenting shallow marine environment. On the contrary, finds of bones and shell fragments belonging to several turtle specimens (?*Testudinoidea* indet.) point to the terrestrial environment's proximity with the freshwater source. Besides turtle fragments, a tooth (Sparidae indet.), fish bones, and ichnofossils were also found.

The subjected locality is currently classified by foraminifers to the transition interval between upper Badenian (Studienka Fm.) and lower Sarmatian (Karlova Ves Fm., *sensu* Kováč et al., in press) based on specific keeled elphidias and the onset of the *Anomalinoides dividens*, an index taxon for the regional biostratigraphy of the Paratethyan area (Cicha et al. 1975) reflecting paleogeographic and paleoenvironmental changes around Badenian/Sarmatian boundary.

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References:

Cicha I., Čtyroká J., Jiřiček R., Zapletalová I. 1975: Biozonal division of the Upper Tertiary basins of the Eastern Alps and West Carpathians. IUGS Proccedings of the VI Congress Bratislava.

Hyžný M., Hudáčková N., Biskupič R., Rybár S., Fuksi T., Halásová E., Zágoršek K., Jamrich M., Ledvák P., 2012: Devínska Kobyla – a window into the Middle Miocene shallow-water marine environments of the Central Paratethys (Vienna Basin, Slovakia). Acta Geologica Slovaca 4, 95–111.

Kováč M., Csibri T., Fordinál K., Hók J., Hudáčková N., Jamrich M., Joniak P., Kováčová M., Ruman A., Šarinová K., Sliva Ľ., Tomašových A., Vojtko R., Šujan M., in press: The Miocene to Quaternary evolution of the Vienna Basin (northeastern part): Geodynamics, eustasy, stratigraphy and depositional systems. GSL Special Publication 1, Regional Geology.

The missing piece – unveiling the enigmatic Miocene palaeoceanography in the Mediterranean–Paratethys using the Nd isotopic record

FILIP SCHEINER[1], LUKÁŠ ACKERMAN[2], KATARÍNA HOLCOVÁ[1]

[1]*Institute of Geology and Paleontology, Charles University, Albertov 6, 128 43 Praha 2, Czech Republic*
[2]*Institute of Geology of the Czech Academy of Sciences, Rozvojová 269, 165 00 Praha 6, Czech Republic*

The evolution of the Mediterranean–Paratethys marine system during the Miocene represents one of the crucial milestones in the Earth's history. It fundamentally affected the climate evolution not just in Europe and the adjacent continents but also on a global scale. The progressive transition of the Mediterranean–Paratethys system from a latitudinal marine domain connecting two main Earth's oceans to a modern-day enclosed setting happened mainly from the Burdigalian to Serravallian period. It triggered a complex interplay of palaeoceanographic events such as overturns in water circulation regimes that affected the large-scale palaeoclimatic settings. We present 3D palaeoceanographic models for each period from the Burdigalian to Serravallian that are based on unique $^{143}Nd/^{144}Nd$ isotopic datasets illustrating the palaeoceanographic evolution of this area. Our results imply that the first indications of separation between the western and eastern parts of the Mediterranean occurred during the late Langhian and were linked to the pronounced circulation overturn. The modern-day setting with the characteristic ε_{Nd} signatures for the Western and Eastern Mediterranean developed during the Serravallian. Altogether, our set of models demonstrates the dynamics of these palaeoceanographic changes in the middle Miocene demonstrates two-step closure of the Indian–Atlantic gateway: (1) Interruption of Indian–Mediterranean connection indicated by formation of the Eastern Mediterranean Water; (2) Closing of Paratethyan connection accompanied by formation of specific Paratethyan water.

Identification of sea-grass accumulation using organic-geochemistry proxies: Case study from the Early Pleistocene, Rhodes Island

SANAH SHAIKH[1], MARTINA HAVELCOVÁ[2], KATARÍNA HOLCOVÁ[1], MARKÉTA CHROUSTOVÁ[1], KATARÍNA ŠARINOVÁ[3], RASTISLAV MILOVSKÝ[4]

[1]*Institute of Geology and Paleontology, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic*
[2]*Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, V Holešovičkách 41, 182 09 Prague 8, Czech Republic*
[3]*Faculty of Natural Sciences, Comenius University Bratislava, Ilkovičova 6, Mlynská Dolina, 842 15 Bratislava, Slovakia*
[4]*Earth Science Institute SAS, Ďumbierska 1, 847 11 Banská Bystrica, Slovakia*

Seagrass and seaweed meadows significantly enhance biodiversity in marine "deserts" composed of muddy, sandy, stony, or rocky substrates. To understand their role in fossil ecosystems, accurate identification in the fossil record is crucial. However, direct evidence through seaweed or seagrass body fossils is rare, necessitating indirect methods such as the study of associated protists, animals, and organic geochemical records. Fossil biomarkers, particularly lipids, are vital in this regard due to their resistance to degradation and preservation in sedimentary rocks. Lipid analysis can trace original biological sources, providing proxies for ancient ecosystems. Seagrass cell walls share characteristics with both land plants and marine macroalgae. Contemporary seagrass lipid studies have focused on fatty acids and alkanes, revealing specific patterns: C_{23} and C_{25} n-alkanes dominate submerged/floating macrophytes, contrasting with C_{15}, C_{17}, and C_{19} typical of cyanobacteria and microalgae. These geochemical proxies, though well-studied in modern contexts, have been seldom applied to fossil samples. This study tested geochemical proxies on fossil seagrass samples from the early Pleistocene of Rhodes, Greece, within the Kritika Member of the Rhodes Formation. These siliciclastic deposits contain well-preserved leaves of *Posidonia oceanica*, accompanied by a diverse skeletal assemblage of organisms also associated with modern *P. oceanica*. Despite the abundance of these fossils, the geochemical signal from this Member remains unexplored. Our research aimed to identify geochemical proxies for allochthonous accumulations of *Posidonia* leaves. By comparing organic geochemical signals from modern dead leaves with fossil material, we sought to develop reliable indicators for ancient seagrass deposits. This study enhances our understanding of seagrass preservation and their role in past marine ecosystems, providing a framework for future paleoecological research.

References:

Beca-Carretero P., Guihéneuf F., Krause-Jensen D., Stengel D.B. 2020: Seagrass fatty acid profiles as a sensitive indicator of climate settings across seasons and latitudes. Marine Environmental Research 161, 105075.

Ficken K.J., Li B., Swain D.L., Eglinton G. 2000: An n-alkane proxy for the sedimentary input of submerged/floating freshwater aquatic macrophytes. Organic Geochemistry 31, 745–749.

Koskeridou E., Thivaiou D., Giamali C., Agiadi K., Mantzouka D. 2019: Seagrass-associated molluscan and fish communities from the Early Pleistocene of the Island of Rhodes (Greece). IOP Conference Series: Earth and Environmental Science 221, 012050.

Marbà N., Santiago R., Díaz-Almela E., Álvarez E., Duarte C.M. 2006: Seagrass (*Posidonia oceanica*) vertical growth as an early indicator of fish farm-derived stress. Estuarine, Coastal and Shelf Science 67, 475–483.

Moissette P., Koskeridou E., Cornée J.J., Guillosheau F., Lecuyer C. 2007: Spectacular preservation of seagrasses and seagrass-associated communities from the Pliocene of Rhodes, Greece. Palaios 22, 200–211.

Pansini A., Beca-Carretero P., González M.J., La Manna G., Medina I., Ceccherelli G. 2023: Sources of variability in seagrass fatty acid profiles and the need of identifying reliable warming descriptors. Scientific Reports 13, 10000.

Pfeifer L., Classen B. 2020: The cell wall of seagrasses: Fascinating, peculiar and a blank canvas for future research. Frontiers in Plant Science 11, 588754.

Schneider S., Linse U., Stamatiadis P., Falkenberg J., Mutterlose J., Weich M. 2023: First record of Pliocene (Zanclean to mid Piacenzian) marine deposits on Rhodes (Greece): implications for eastern Mediterranean palaeo (bio) geography. Palaeobiodiversity and Palaeoenvironments 103, 109–128.

Exoskeletal microanatomy of selected phacopid trilobites from the Silurian and Devonian of the Barrandian area, Czech Republic (preliminary results)

MATĚJ ŠILINGER[1], OLDŘICH FATKA[1], PETR BUDIL[2]

[1]*Charles University, Institute of Geology and Paleontology, Albertov 6, 128 43 Prague 2, Czech Republic*
[2]*Czech Geological Survey, Klárov 3, 118 21 Prague 1, Czech Republic*

Trilobites represent one of the major components of Paleozoic fauna. They typically belong to vagrant benthos, but during their existence, spanning almost the entire Paleozoic, they occupied nearly all marine habitats. Despite being one of the most intensively studied fossil groups, the internal microanatomy of their exoskeletons still remains poorly understood.

Diverse methods had been used for study of trilobite exoskeletal microanatomy. The method of careful etching of oriented sections through the trilobite exoskeleton using ethylendiamintetraacetic acid (EDTA) has proved to be the most successful one. Such etching utilizes different resistance of individual layers and other structures of the trilobite exoskeleton and facilitates the observation of subtle details using scanning electron microscopy. This method was applied on trilobite exoskeletons collected by the authors from diverse lithologies of carbonate rocks throughout the Silurian and Devonian of the Barrandian area. This approach resulted in observation of microanatomical details preserved in large part of studied samples.

Considering their abundance in favorable lithotypes as well as relative thickness of their exoskeletons, trilobites of the family phacopidae were selected as most favorable for detailed studies. Among them, cephala of the trilobite species *Pedinopariops degener* from the Lower Devonian Zlíchov Formation were most extensively studied.

Microanatomical details observed on oriented sections through different regions of the cephalon were closely documented and compared with surface structures using the material from collections of the National Museum, Prague and the Czech Geological Survey, Prague, as well as newly collected samples.

The application of these methods has so far provided new observations regarding the internal anatomy and distribution of different kinds of cuticular organs in the trilobite cephalic exoskeleton, specifically terrace ridges and various types of both earlier described as well as entirely new types of tubercles. This approach, integrating information about surface sculpture with internal microanatomy, shows a great potential to bring new insights into possible functions of these organs and functional morphology of trilobite exoskeletons.

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Trace fossils from the Lower Miocene bathyal sediments of the Vienna Basin (Central Paratethys, Slovakia)

VLADIMÍR ŠIMO[1], ADAM TOMAŠOVÝCH[1], JÁN SCHLÖGL[2]

[1]*Earth Science Institute of the Slovak Academy of Sciences, Dúbravská cesta 9, 840 05 Bratislava, Slovakia*
[2]*Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University, Mlynská dolina G1, 842 15 Bratislava, Slovakia*

Bioturbation structures from deep-water fine-grained sediments (mostly silty-clay with occasional occurrences of a few mm thin layers of tempestite sandstone) of Lower Miocene (Burdigalian) age were identified to trace fossils ichnogenera of *Planolites*, *Thalassinoides*, *Phycosiphon*, *Scolicia*, *Bichordites*, *Cardioichnus* and other tiny subhorizontal traces (?*Planolites*), with one questionable occurrence of *Zoophycos*. The studied part of succession attains 15 meters and belongs to the Lakšárska Nová Ves Formation. Locality is situated near by the Cerová Lieskové Village. The locality is under research that was focused to molluscs (Harzhauser et al. 2011), shark teeth, fish otoliths (Underwood & Shlögl 2013), decapods (Hyžný & Schlögl 2011), cephalopods (Schlögl et al. 2011), sea urchins, asteroids, siliceous sponges (Lukowiak et al. 2013). Plants were described by Kvaček et al. (2014). Foraminifera, sponge spicules, bryozoans, crinoid ossicles and diatoms were also noticed (Underwood & Shlögl 2013).

Thalassinoides is occasionally represented with remains of burrowing decapods. Spatangoid deposit feeding trace fossil *Scolicia* and/or *Bichordites* have been identified on the locality. Two genera of sea urchins *Brissopsis* and *Lovenia* co-occur on the locality and theoretically it is possible that *Scolicia* and other form of spatangoid trace fossil *Bichordites* co-occur together. The occurrence of a central core in some specimens corresponds to *Bichordites* morphology. Oval-shaped trace fossils near the *Scolicia*/*Bichordites* present the urchin resting structure of *Cardioichnus*.

Thin layers of sandstone, silt material or diatom material are visible and, slightly disturbed by bioturbation, which means that sediment homogenization did not occur due to rapid sedimentation and dysoxic bottom water conditions. The deepest bioturbation structures are *Thalassinoides*. The second types of shallow horizontally oriented bioturbations are traces of spatangoid sea urchins. Tiny traces up to 1–3 mm in burrow diameters (*Planolites, Phycosiphon*) could be located up to the level of the oxidation-reduction interface.

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References:

Harzhauser M., Mandic O., Schlögl J. 2011: A late Burdigalian, bathyal mollusc fauna from the Vienna Basin (Slovak Republic, Karpatian). Geologica Carpathica 62, 211–231.

Hyžný M., Schlögl J. 2011: An Early Miocene deep-water decapod crustacean faunule from the Vienna Basin (Western Carpathians, Slovakia). Palaeontology 54, 323–349.

Kvaček Z., Teodoridis V., Kováčová M., Schlögl J., Sitár V. 2014: Lower Miocene plant assemblage with coastal-marsh herbaceous monocots from the Vienna Basin (Slovakia). Geologica Carpathica 65, 229–241

Łukowiak M., Pisera A., Schlögl J. 2013: Bathyal sponges from the late Early Miocene of the Vienna Basin (central Paratethys, Slovakia). Paläontologische Zeitschrift 88, 263–277.

Schlögl J., Chirat R., Balter V., Joachimski M., Hudáčková N., Quillévéré F. 2011: *Aturia* of the Miocene Paratethys: An exceptional window in nautilid habitat and lifestyle. Palaeogeography, Palaeoclimatology, Palaeoecology 308, 330–338.

Underwood C.J., Schlögl J. 2013: Deep water chondrichthyans from the Early Miocene of the Vienna Basin (Central Paratethys, Slovakia). Acta Palaeontologica Polonica 58, 487–509.

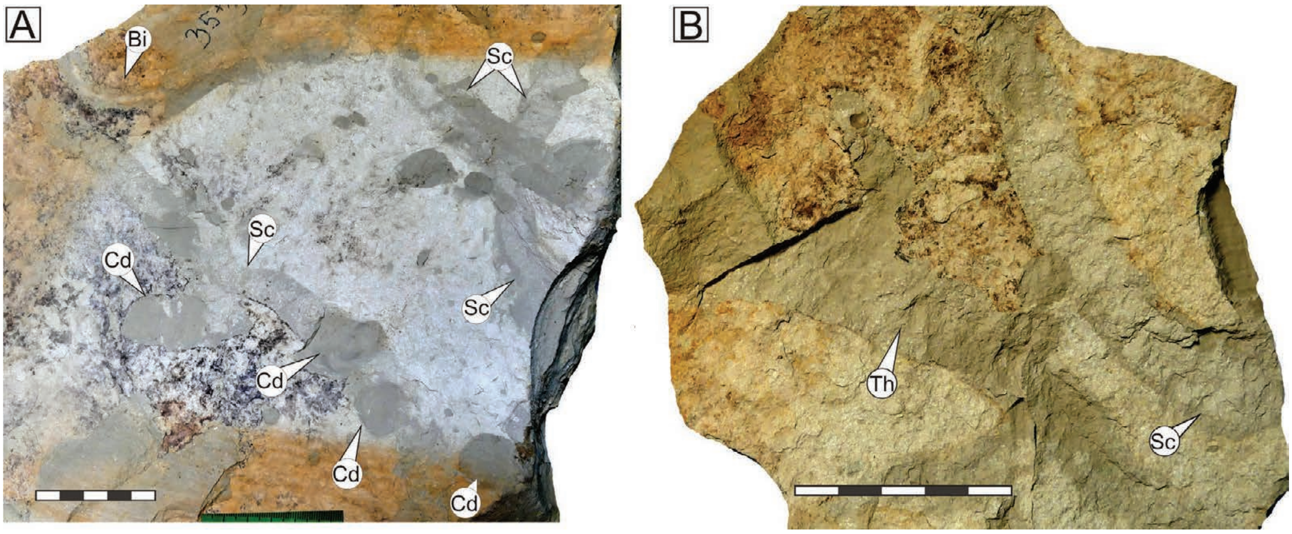

Fig. 1. Bed surfaces with horizontally oriented trace fossils. **A** – Trace fossils of spatangoid sea urchins. **B** – sea urchin trace fossils and decapods permanent structure burrow *Thalassinoides*. Bi – *Bichordites*, Cd – *Cardioichnus*, Sc – *Scolicia*, Th – *Thalassinoides*. Scale bar 50 mm.

Planktonic foraminiferal responce to Paratethyan anoxia and coastal upwelling: Clavate morphotypes, abnormalities and malformed specimens

JÁN SOTÁK[1], SILVIA ANTOLÍKOVÁ[2]

[1]Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 974 11 Banská Bystrica, Slovakia; sotak@savbb.sk
[2] Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 840 05 Bratislava, Slovakia

The deoxygenation of the Paratethyan basins considerably affected planktonic biota. Mesopelagic habitats, such as hasterigerinid foraminifera, pteropods, lanternfisches etc., tried to leave out the Oxygen minimum zone (OZM) with toxic hydrogen sulphide waters. The planktonic foraminifera became a clavate or stellate in test morphology, developing a various abnormalities and malmformed specimens. These adaptations exhibit a sack-like shape, perforate chambers, degree of inflation and enlargement of apertute to facilitate oxygen uptake in dysaerobic conditions and inhabiting the near-surface oxygenated waters (Coxall et al. 2000). Intoxication of pelagic biota was enhanced due to cool, oxygen-poor and nutrient-rich waters driven by upwelling through the OMZ. Upwelling conditions are also evidenced by increased production rate and test-size reduction of planktonic foraminifera (e.g. *Globigerina praebulloides* plexus).

Hantkeninid foraminifers became to appear in the Middle Eocene formations of the central Western Carpathians, where they indicate a climate cooling after The Paleocene – early Eocene hyperthermal periods (PETM, EECO). They evolved from ancestral forms of the genus *Clavigerinella*, which descendants were subbotinids belonging to cool-water and eutrophic planktonic foraminifers. Hantkeninids and clavigerinids occur mainly in the Eocene formations in the Rajec, Turiec and Liptov basins. They are represented by species like *Clavigerinella eocenica*, *C. caucasica*, *Hantkenina mexicana*, *H. liebusi* and *H. dumblei*. The last occurrence of *Hantkenina* species marked the Eocene/Oligocene boundary.

Homologous forms with digitate morphologies also occur in the Oligocene formations of the Western Carpathians in sulfidic-rich sediments of the Menilite formation. These clavate and stellate foraminifers belong to the species such as *Protentella rohiensis*, *Quiltyella clavacella*, *Q. nazcaensis*, *Beella digitata* and *Bolliella adamsi* (see Spezzaferri et al. 2018). The Carpathian findings of these species came from the Lower Oligocene formations revealing a conditions of anoxic regime of the Paratethyan basins. They were also described from the Transylvanian Basin (Popescu & Brotea 1989), the Ždánice Unit (Švábenická et al. 2007) and the Fore-Alpine molasse basins (Rögl, 1969).

Beside of the digitate species, the anoxic conditions of the Oligocene formations are also indicated by the development of forms with secondary apertures on the spiral side of the tests. They belong to the genus *Globigerinoides*, which initial species of *G. primordius* appeared in the Late Oligocene having a spinose type of test walls like the genus *Globoturborotalita* but with one supplementary aperture. Thus, a basal species of a polyphyletic lineage leading to Neogene species of the genus *Trilobatus* also appeared in dysoxic conditions of the Oligocene basins (Spezzaferri et al. 2015).

Upwelling conditions in Paratethyan basins are also inferred from reticulofenestrid nannofossils providing an adaptive morphology for eutrophication and oxygen-poor environment (e.g. dwarfing, reduction of central openings and endemic species like *Reticulofenestra ornata* in the NP23 zone (see Ma et al. 2023; Holcová 2013).

Acknowledgements: The research was supported by projects VEGA 2/0012/24 and APVV-20-0079.

References:

Coxall H.K. 2000: Hantkeninid depth adaptation: An evolving life strategy in a changing ocean. Geology 28, 87–90.

Holcová K. 2013: Morphological variability of the Paratethyan Oligocene–Miocene small reticulofenestrid coccolites and its paleoecological and paleogeographical implications. Acta Palaeontologica Polonica 58, 651–668.

Ma R., Aubry M-P., Bord D., Jin X., Liu Ch. 2023: Inferred nutrient forcing on the late middle Eocene to early Oligocene (40–31 Ma) evolution of the coccolithophore *Reticulofenestra* (order Isochrysidales). Paleobiology 50, 29–42.

Popescu G. & Brotea D. 1989: Genus Protentella (Foraminifera) in North Transylvania Oligocene. The Oligocene from the Transylvanian Basin. Cluj-Napoca, 255–260.

Rögl F. 1969: Die Miozäne Foraminiferenfauna von Laa an der Thaya in der Molassezone von Niederösterreich. Mitteilungen der Geologischen Gesellschaft 61, 63–123.

Spezzaferri S., Kucera M., Pearson P.N., Wade B.S., Rappo S., Poole R.Ch., Morard R., Stalder C. 2015: Fossil and genetic evidence of the polyphyletic nature of the planktonic foraminifera *"Globigerinoides"*, and description of the new genus *Trilobatus*. PLOS ONE, https://doi.org/10.1371/journal.pone.0128108

Spezzaferri S., Coxall H.K., Olsson R.K., Hemleben Ch. 2018: Taxonomy, biostratigraphy, and phylogeny of Oligocene *Globigerina*, *Globigerinella*, and *Quiltyella* n.gen. In: Atlas of Oligocene Planktonic foraminifera, 179–214.

Švábenická L., Bubík M., Stránik Z. 2007: Biostratigraphy and paleoenvironmental changes on the transition from Menilite to Krosno lithofacies (Western Carpathians, Czech Republic). Geologica Carpathica 58, 237–262.

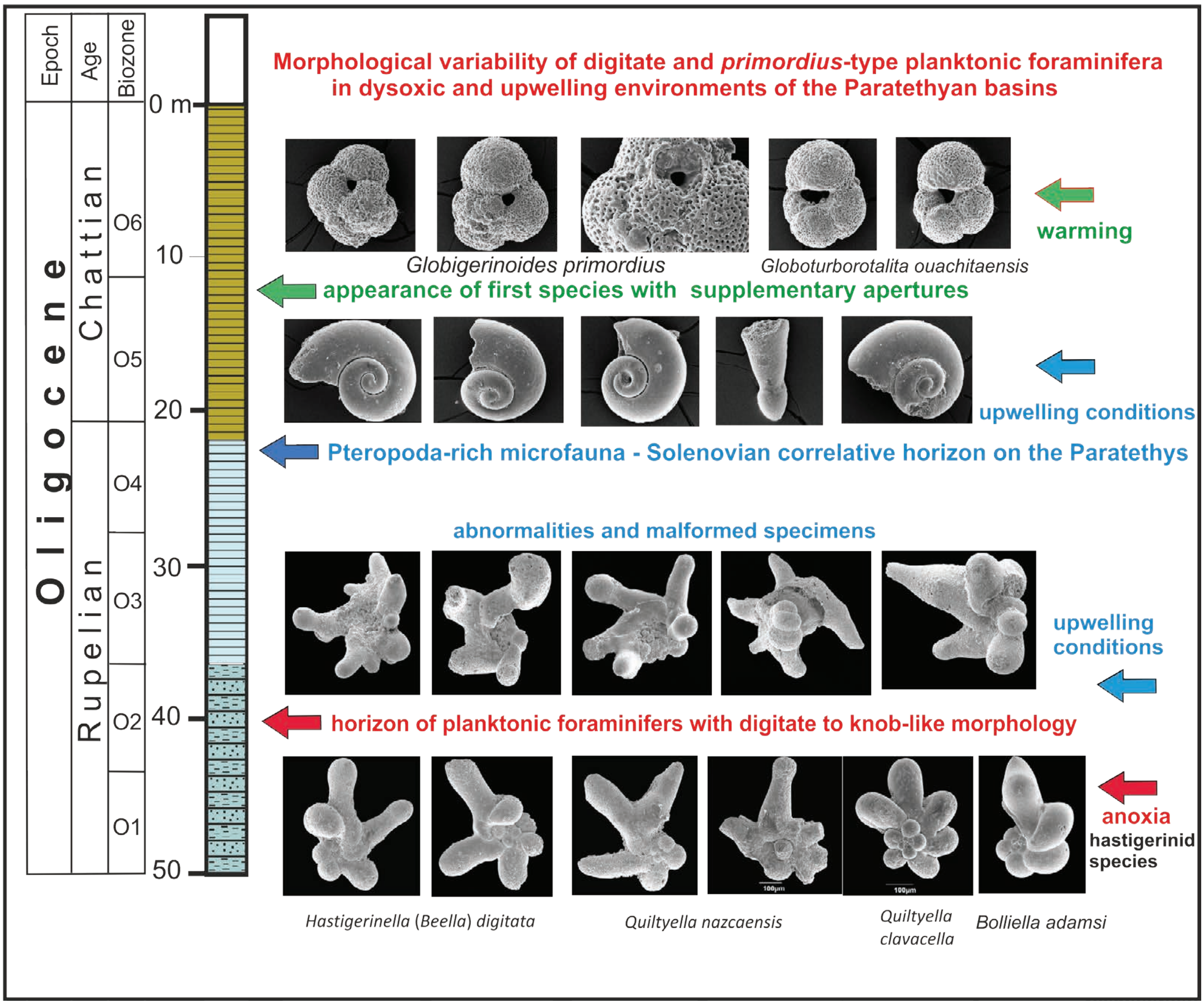

Fig. 1. Adaptive morphology of planktonic foraminifera to oxygen-poor and nutrient-rich conditions of the Paratethyan basins.

Stratigraphic data from sedimentary mélanges of the Pieniny Klippen Belt: Recognition of Upper Cretaceous to Oligocene formations dismembered by tectonic wedging

JÁN SOTÁK[1], SILVIA ANTOLÍKOVÁ[2], MARÍNA MOLČAN MATEJOVÁ[3], DUŠAN STAREK[2]

[1]*Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 974 11 Banská Bystrica, Slovakia; sotak@savbb.sk*
[2] *Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 840 05 Bratislava, Slovakia*
[3]*Department of Geology and Palaeontology, Faculty of Natural Sciences, Comenius University, Mlynská dolina, Ilkovičova 6, 842 15 Bratislava, Slovakia*

The contact of the Pieniny Klippen Belt (PKB) and Central-Carpathian Paleogene Basin (CCPB) was overprinted by multi-stage deformation, slumping and resedimentation. Such chaotic units of the PKB and basal beds of the CCPB cropping out near Kňažia in Orava region. This well-known location has been studied in the past, providing a different insights to CCPB stratigraphy and PKB tectonics (Andrusov 1959; Matějka & Hanzlíková 1962; Maheľ 1980; Gross & Köhler 1994). A new oportunity to study the contact of PKB and CCPB allows a technical works on the reconstruction of the road between Kňažia and Bziny in 2021.

The Kňažia locality exhibits a strongly tectonically disrupted Middle to Upper Cretaceous successions of the Kysuca Unit of the PKB. They are formed mainly by grey marstones with rotaliporid and thalmanninellid foraminifers (Kapuśnica Fm), variegated marlstones with marginotruncanid and dicarinellid foraminifers (Jaworki Fm) and breccia-bearing marlstones with globotruncanid and abathomphalid foraminifers (Záskalie beds). The Cretaceous formations are steeply deeping and overturned in position, the beds are inclined to the north. Shaly matrix is affected by ductile deformation, rigid sandstone beds are flattened, disturbed and separated to form a boudinage.

The Senonian formations of the PKB are discordantly overlapped by carbonate breccias, conglomerates, and calcareous sandstones. Their late Paleocene to middle Eocene age is dated by the microfauna of globanomalinid, rzehakinid, turborotaliid and subbotinid foraminifers, and by the presence of nummulites and discocyclines, as well. The middle Eocene age was also determined by nannofossils of the NP 15–NP 17 Zones, such as *Cyclicargolithus floridanus Reticulofenestra umbilicus* and *R. bisectus*. These Paleocene–Eocene sediments show an affinity to the Proč–Jarmuta formations of the PKB. Unconformity betweeen Senonian and Paleocene–Eocene formations corresponds to Laramian tectogenesis of the PKB. Post-Laramian formations are formed by transgressive sediments of the the Central Carpathian Paleogene Basin.

The sedimentary contact between the CCPB formations and PKB units is mostly overprinted by faulting and backthrusting. However, a southern part of the Kňažia outcrop exhibits a transgressive onlap of the PKB by marginal sediments of the CCPB. Above the Cenomanian marlstones, there are basal breccias, conglomerates and sandstones intercalated by thin mudstones. The transgressive origin of these sediments is also indicated by a mass redeposition of Cretaceous microfauna and a lot of clastic material from the PKB. Their „in situ“ microfauna of planktonic foraminifers and nannofossils, like *Globigerinatheka index*, *Dentoglobigerina tapuriensis*, *Isthmolithus recurvus*, *Reticulofenestra lockeri, Helicosphaera bipuncta*, etc., allow to determine the late Eocene–Rupelian age of basal formation of the CCPB.

Antiformal stacking of the PKB units in the Kňažia outcrop is recorded by a backthusting of the Upper Cretaceous formations over the CCBP units. Footwall units beneath the PKB backthrusts are formed by the Eocene–lower Oligocene sediments of the CCPB. Considering that, the late Oligocene–early Miocene backthrusting affected the sedimentary contact of the PKB with the CCPB (cf. Plašienka et al. 2013).

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References

Andrusov D. 1959: Geológia československých Karpát II. Vydav. Slov. Akad. Vied, Bratislava, 1–375.

Gross P., Köhler E. 1987: On Eocene transgression in Orava stretch of the Klippen Belt. Geologické Práce, Správy 86, 157–164.

Maheľ M. 1989: Bradlové básmo z aspektu geodynamického modelu. Mineralia Slovaca 21, 99–108.

Matějka A., Hanzlíková E. 1961: O paleogénu od obce Kňažia na Oravě. Zprávy o geologických výzkumech v r. 1961, 194–196.

Plašienka D., Józsa Š., Gedl P., Madzin J. 2013: Fault contact of the Pieniny Klippen Belt with the Central Carpathian Paleogene Basin (Western Carpathians): new data from a unique temporary exposure in Ľutina village (Eastern Slovakia). Geologica Carpathica 64, 165–168.

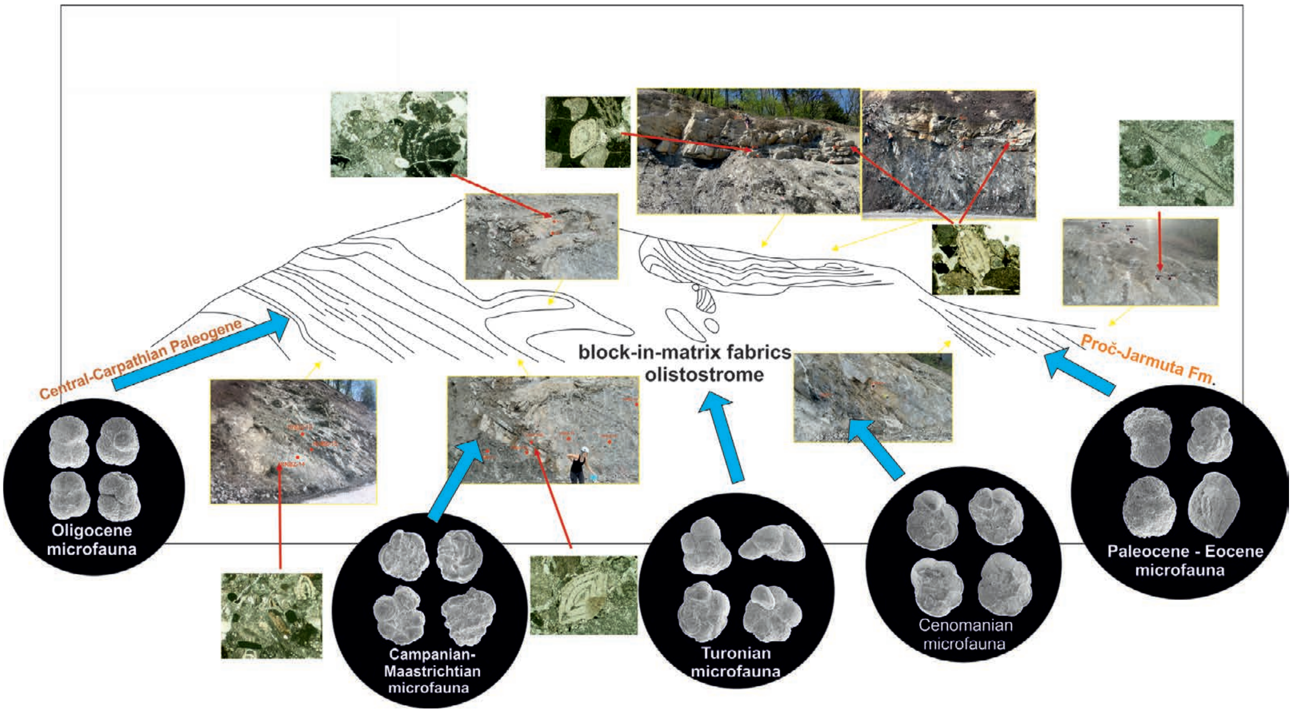

Fig. 1. Foraminiferal microfauna for stratigraphic dating of dismembered sequences of the Pieniny Klippen Belt (Kňažia section). Upper Cretaceous formations of the PKB with "block-in-matrix" structure (Záskalie breccias) are transgressively overlain by Paleocene–Eocene sequences (Proč–Jarmuta Fm) and overthrusted on the Late Eocene–Oligocene sediments of the CCPB.

Subsided block of calcareous claystone at Houska, N Bohemia – palynological evidence for Upper Turonian age

MARCELA SVOBODOVÁ[1], JIŘÍ ADAMOVIČ[1]

[1]Institute of Geology of the Czech Academy of Sciences, Rozvojová 269, 165 00 Praha 6, Czech Republic

The area of Houska lies in the northern part of the Bohemian Cretaceous Basin, which is characterized by the prevalence of coarse marine siliciclastics. All outcrops of sedimentary rocks within the study area pertain to the Middle to Upper Turonian Jizera Formation, dominated by quartzose sandstones (Adamovič 2016). The basin fill is transected by numerous intrusions of Tertiary volcanics, mostly of basaltic composition, constituting the Houska Volcanic Field. Some of the major intrusions are of trachytic composition, including the Vrátenská hora laccolith and a hidden body at Houska Castle. East of the castle, geological survey and trenching revealed a N–S-elongated block of calcareous claystone 300 by 100 m in size. Its elongation parallel to the near basaltic bodies suggests its origin by volcanotectonic subsidence. Calcareous claystone was studied from the palynological point of view. Rich and diverse palynomorph assemblage consists of prevailing dinoflagellate cysts, abundant fern spores and gymnosperm pollen. Angiosperm pollen are scarce due to the marine origin of the sediments. Nevertheless, biostratigraphically important pollen from the Normapolles group allowed to ascertain the age of the deposits. *Emcheripollis inflatius* W. Kr. 1959c first appears in the Late Turonian in the Boreal realm (Góczán et al. 1967). The composition of dinoflagellate cysts corresponds with Late Turonian age, too. It is comparable to that found in the Úpohlavy quarry (Uličný et al. 1996; Svobodová et al. 2002).

References:

Adamovič J. 2016: The Kokořín area: sandstone landforms controlled by hydrothermal ferruginization. In: Pánek T., Hradecký J. (eds.): Landscapes and landforms of the Czech Republic. Springer, 153–164.

Góczán F., Groot J.J, Krutzsch W., Pacltová B. 1967: Die Gattungen des “Stemma Normapolles PFLUG 1953b” (Angiospermae). Paläontologische Abhandlungen B, II, 3, 427–633.

Svobodová M., Laurin J., Uličný D. 2002: Palynomorph assemblages in a hemipelagic succession as indicators of transgressive–regressive cycles: example from the Upper Turonian of the Bohemian Cretaceous Basin, Czech Republic. In: Wagreich M. (Ed.): Aspects of Cretaceous, Stratigraphy and Paleobiogeography. Verlag der Österreichischen Akademie der Wissenschaften, Wien, Schriftenreihe der Erdwissenschaftlichen Kommissionen, Band 15, 249–267. ISBN: 3-7001-3089-9

Uličný D., Čech S., Voigt Th., Wejda M., Kvaček J., Špičáková L., Svobodová M., Hradecká L., Hladíková J., Štemproková D., Laurin J., Štaffen Z., Švábenická L., Tröger K.A. 1996: Stratigraphy and facies of the Bohemian–Saxonian Cretaceous Basin. Proceedings of the 5th International Cretaceous Symposium and Second Workshop on Inoceramids, September 16–24, Freiberg/Saxony, Germany, Field Trip B1. Freiberg, 1–23.

Sinemurian–Pliensbachian brachiopod assemblages with koninckinids in the Euroboreal Domain (Pieniny Klippen Belt, Ukraine)

ADAM TOMAŠOVÝCH[1], JÁN SCHLÖGL[2]

[1]*Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 840 05, Bratislava, Slovakia; geoltoma@savba.sk*
[2]*Department of Geology and Paleontology, Comenius University, Mlynská dolina, Ilkovičova 6, 84215, Bratislava, Slovakia; janci.schlogl@gmail.com*

The family Koninckinidae represents a unique family of micromorphic pedunculate brachiopods that radiated during the Early Jurassic in the western Tethys, expanded to the NW European shelf during the latest Pliensbachian–earliest Toarcian, and went extinct during the Early Toarcian at the onset of the Toarcian Oceanic Anoxic Event. This radiation was associated with their distributional shift towards soft-bottom habitats, with the evolution of snowshoe (alate) and iceberg (gryphaeoid) strategies (Vörös 2002). Although it was presumed that their geographic distribution during the Sinemurian and Pliensbachian was primarily limited to the deep-shelf and bathyal, typically condensed carbonate facies rich in crinoids in the western Tethys (e.g., Northern Calcareous Alps, Southern Alps, Transdanubian Central Range, Apennines), here we document occurrences of koninckinid brachiopods in macrofaunal assemblages in a marl-limestone succession spanning the Lower Sinemurian–Upper Pliensbachian at the Priborzhavske section in the Pieniny Klippen Belt (Ukraine, Eastern Carpathians). This section was located on the SE margin of the European shelf during the Early Jurassic, with ammonites typical of the Euroboreal Domain. Preliminary analyses indicate that the brachiopod assemblages consist of micromorphic brachiopods (koninckinids *Amphiclinodonta liasina, Koninckodonta styriaca*, and *Koninckodonta fornicata,* thecideids, *Zellania*) that co-occur with large-sized brachiopods (*Liospiriferina*). Surprisingly, the koninckinids occur at high abundance and stratigraphically persist through most of the succession that was deposited on a deep-shelf that was located below a storm wave base and was characterized by slow sediment accumulation. The brachiopod assemblages at this location inhabited mixed bottoms formed by burrowed muds and ammonite shells (Sinemurian) and muddy bottoms with abundant remains of siliceous sponges (Pliensbachian), documenting that their paleobiogeographic distribution crossed into the Boreal Domain and that they were adapted to soft or mixed-bottom already during the Early Sinemurian.

References:

Vörös A. 2002: Victims of the Early Toarcian anoxic event: the radiation and extinction of Jurassic Koninckinidae (Brachiopoda). Lethaia 35, 345–357.

Was *Tetralophodon longirostris* (Proboscidea, Mammalia) the only Vallesian elephantimorph species of the Central Paratethys area?

CSABA TÓTH[1], JAKUB BŘEZINA[2]

[1]*Earth Science Institute SAS, Dúbravská cesta 9, 840 05, Bratislava, Slovakia*
[2]*Department of Geology and Paleontology, Moravian Museum, Zelný Trh 6, 659 37 Brno, Czech Republic*

A noticeable drop in the diversity of Miocene elephantimorphs in Central Paratethys area can be recorded during Vallesian (MN9-10, early Pannonian). No trilophodont gomphotheres survived from Middle Miocene, and the presence of amebelodontids, as well as mammutids, has not yet been proved.

The only group known from Central Paratethys area are tetralophodont gomphotheres, however, the number of species is inconsistent (Gasparik 2001; Konidaris et al. 2024). A new review of the material from Slovakia and Hungary revealed two distinct taxa of tetralophodonts. One characterized by complicated dental morphology, longer symphysis with lower tusks and the second, rarely known from the Pannonian Basin (Gasparik 2001), with more simplified dental patterns and shorter mandibular symphysis without lower tusks. The first can be reliably determined as *Tetralophodon longirostris*, whereas the combination of characters in the second species is not consistent with the diagnosis of the type specimen of "*Mastodon* (*Stegotetrabelodon* or *Tetralophodon*) *gigantorostris*" (Tobien 1980), which is now considered to be only the morphotype of *T. longirostris* (Konidaris et al. 2023). There are two plausible taxonomic interpretations of the second type: (1) they belong to the *Anancus*-like tetralophodont with much more archaic characteristics than *Anancus lehmanni* as the oldest (from the Middle Turolian, MN12) hitherto described *Anancus* species in Europe (Konidaris & Roussiakis 2019); (2) the remains belong to an enigmatic tetralophodont species.

The brief coexistence of the two taxa may suggest their ecological competition at the transition between MN9 and MN10 zones which resulted in sudden extinction of *T. longirostris* in the Pannonian Basin. Teeth with some anancoid characters are rarely known also in the MN10?-11 zones. To resolve the taxonomic affiliation of this problematic material, further comparison with tetralophodont taxa from the Vienna Basin as well as from the Mainz Basin (Eppelsheim Formation) is needed. In any case, possible close relationship of the second species with *Anancus* could provide evidence for its earlier occurrence in Europe and also point to the possible mosaic evolution of mandibular and dental characters diagnostic for this group of proboscideans.

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References:

Gasparik M. 2001: Neogene proboscidean remains from Hungary; an overview. Fragmenta Palaeontologica Hngarica 19, 61–77.

Konidaris G. E., Roussiakis S.J. 2019: The first record of *Anancus* (Mammalia, Proboscidea) in Late Miocene of Greece and reappraisal of the primitive anancines from Europe. Journal of Vertebrate Paleontology 38, e1534118

Konidaris G.E., Lechner T., Kampouridis P., Böhme M. 2023: *Deinotherium levius* and *Tetralophodon longirostris* (Proboscidea, Mammalia) from the Late Miocene hominid locality Hammerschmiede (Bavaria, Germany), and their biostratigraphic significance for the terrestrial faunas of the European Miocene. Journal of Mammalian Evolution 30, 923–961.

Tobien H. 1980: A Note on the Mastodont taxa (Proboscidea, Mammalia) of the "Dinotheriensande". Mainzer Geowiss. Mitteilungen 9, 187–201.

Petrified wood of the Neogene of Roztocze (Western Ukraine): Stratigraphic position, mineral composition, burial features

YARYNA TUZYAK

Ivan Franko National University of Lviv, Hrushevskiy 4, 79005 Ukraine; yarynatuzyak@gmail.com

In the sedimentary cover of Ukraine, petrified wood is found in Carboniferous, Paleogene and Neogene deposits, each is unique and deserves attention. Since the full-scale military aggression of Russia against Ukraine, some of the unique places with natural phenomena of fossilized trees have been destroyed and cannot be reproduced, which contributed to the loss of the scientific, cultural and educational value of paleobotanical remains as objects of national treasure. The most famous are the silified wood of the Neogene Roztocze, 20-13 million years old, coal petrifications of Donbass (Druzhkivka), 300–280 million years old. There is also information about the findings of xylolites within Transcarpathia, Borislav, Crimea, Zaporizhzhya, etc.

The research is based on a collection of fossil wood collected during the scientific expedition of 2023 to Skvaryava, Glynske, Zaglyna, Dubrivka, Mount Vovkovytsa (Lviv region). Paleobotanical remains come from Miocene deposits of terrigenous composition and beds of brown coal. The collection is represented by logs of wood of various sizes (from 50–60 cm to 10–15 cm) and colors. The remains of wood from the beds of brown coal are grayish, brownish, black; fragments of phytofossils from terrigenous-carbonate layers – cream, pinkish, yellowish, white). Petrified wood with preservation of anatomical structure was found in dumps at the site of development of brown coal deposits located within the junction zone of Roztocze and Male Polissya (Zhovkva, Skvaryava, Glynske, Dubrivka, Potelich) and Podillya Upland and Male Polissya (Voronyaki, Pidhirtci, Yaseniv). This zone extends as a narrow strip 7–10 km wide. In the Miocene, they were wetlands (periodically flooded lagoon-lakes), which bordered Central Paratethys from the north.

The discovered petrified wood is represented by silicified (Zhovkva, Skvaryava, Glynske), partially and completely charred remains (Zaglyna, Dubrivka). As noted by A. Kuchumov et al. (Kuchumov et al. 2019), lignin is most often found among the residues of primary organic matter and can be clearly traced in all types of wood, except apatite–calcite. The wood found in Skvaryava and Glynske is replaced by various silica – opal, chalcedony, quartz, on Mount Vovkovytcya – only opal.

The process of petrification or silicification of Roztocze wood was complex and depended on a complex of factors and environmental parameters – tree species, geochemistry of the water basin and climate. Lignin trunks indicate primary burial conditions – stagnant waters of lagoon-lakes, silicified wood – diagenesis processes and other characteristics of the Eh and pH environment (conditions of coastal–marine facies).

References:

Kuczumow A., Nowak J., Kuzioła R., Jarzębski M. 2019: Analysis of the composition and minerals diagrams determination of petrified wood. Microchemical Journal 148, 120–129.

New terrestrial plant *Capesporangites petrkraftii* from the upper Silurian of the Prague Basin

MONIKA UHLÍŘOVÁ[1,2,3], JOSEF PŠENIČKA[2], JAKUB SAKALA[1]

[1]*Institute of Geology and Palaeontology, Faculty of Science, Charles University, Albertov 6, 128 43 Praha 2, Czech Republic; monika.uhlirova@natur.cuni.cz*
[2]*Centre of Palaeobiodiversity, West Bohemian Museum in Plzeň, Kopeckého sady 2, 301 00 Plzeň, Czech Republic*
[3]*Department of Paleobiology and Paleoecology, Institute of Geology of the Czech Academy of Sciences, Rozvojová 269, 165 00 Praha 6, Czech Republic*

The origin of terrestrial plants began the intensive transformation of ecosystems and life on land. The first fossil evidence preserved in the form of spores indicates the presence of land plants from the Middle Ordovician (summarized in Wellman et al. 2023). The plant macrofossil record is however very rare, starting from the lower Silurian (summarised in Pšenička et al. 2021). Land plants are generally divided into the group Polysporangiophyta (sensu Kenrick & Crane 1991), which includes all vascular plants, and Bryophytes (comprising mosses, liverworts and hornworts). These two lineages are still subject to debate with regard to their evolutionary relationship. Based on the structure, it has been suggested that the earliest land plants could have been at the bryophyte grade (Ligrone et al. 2012). However, the oldest plant macrofossils show dichotomously branched axes bearing terminal sporangia, characteristic features placing them among the Polysporangiophyta.

Our study (Uhlířová et al. 2024) provides a detailed description of an upper Silurian plant from the Prague Basin, which exhibits characteristics of polysporangiophytes as well as bryophyte-like features. A brief description of the plant was previously published by Kraft et al. (2019). The plant exhibits dichotomously branched axes with a terminal sporangium. Within the sporangium, bryophyte-like features can be observed. The characteristics of the plant do not correspond to previously known taxa, and therefore a new genus and species *Capesporangites petrkraftii* was established. The species was named after doctor Petr Kraft (Charles University), the finder of the plant fossil. Based on the branched sporophyte, the plant is classified as a polysporangiophyte. Nevertheless, we consider it important to mention the bryophyte-like features, as the search for analogies in bryophytes could help explain the origin and function of similar structures observed in the earliest land plants.

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References:

Kenrick P., Crane P.R. 1991: Water-conducting cells in early fossil land plants: implications for the early evolution of tracheophytes. Botanical Gazette 152, 335–356.

Kraft P., Pšenička J., Sakala J., Frýda J. 2019: Initial plant diversification and dispersal event in upper Silurian of the Prague Basin. Palaeogeography, Palaeoclimatology, Palaeoecology 514, 144–155.

Ligrone R., Duckett J.G., Renzaglia K.S. 2012: Major transitions in the evolution of early land plants: a bryological perspective. Annals of botany 109, 851871.

Pšenička J., Bek J., Frýda J., Žárský V., Uhlířová M., Štorch P. 2021: Dynamics of Silurian plants as response to climate changes. Life 11, 906.

Uhlířová M., Pšenička J., Sakala J. 2024: New early land plant *Capesporangites petrkraftii* gen. et sp. nov. from the Silurian, Prague Basin, Czech Republic. Review of Palaeobotany and Palynology 322, 105048.

Wellman C.H., Cascales-Miñana B., Servais T. 2023: Terrestrialization in the Ordovician. In: Harper D.A.T., Lefebvre B., Percival I.G., Servais T. (eds.): A Global Synthesis of the Ordovician System: Part 1. Geological Society, 171–190. London.

Multi-instrumental methods reveal mystery of uniquely preserved Upper Cretaceous marine macrofossils from Northern Siberia

LUCIE VAŇKOVÁ[1,2], MARTIN KOŠŤÁK[1], MIKHAIL A. ROGOV[3], ALEXEY P. IPPOLITOV[3,4], VIKTOR A. ZAKHAROV[3], MARTIN MAZUCH[1], RASTISLAV MILOVSKÝ[5], MATTHIAS LÓPEZ CORREA[6], JURAJ ŠURKA[5], ADAM CULKA[1], MARTINA KOČOVÁ VESELSKÁ[2], MARTIN RACEK[1]

[1]*Charles University, Albertov 6, 128 43 Prague 2, Czech Republic; lucie.vankova@natur.cuni.cz, martin.kostak@natur.cuni.cz, martin.mazuch@natur.cuni.cz, adam.culka@natur.cuni.cz, racek@natur.cuni.cz*
[2]*Institute of Geology of the Czech Academy of Sciences, v. v. i., Department of Paleobiology and Paleoecology, Rozvojová 269, 165 00 Prague 6, Czech Republic; vankoval@gli.cas.cz, kocovam@gli.cas.cz*
[3]*Geological Institute of the Russian Academy of Sciences, Pyzhevski Per. 7, 119017 Moscow, Russia; russianjurassic@gmail.com, ippolitov.ap@gmail.com, mzarctic@gmail.com*
[4]*School of Geography, Environment and Earth Sciences, Victoria University of Wellington, Te Herenga Waka, 21 Kelburn Parade, 6012 Wellington, New Zealand; alexey.ippolitov@vuw.ac.nz*
[5]*Earth Science Institute Slovak Academy of Sciences, Ďumbierska 1, 847 11 Banská Bystrica, Slovakia; milovsky@savbb.sk, surka@savbb.sk*
[6]*GeoZentrum Nordbayern, Universität Erlangen-Nürnberg, Loewenichstrasse 28, 91054 Erlangen, Germany; matthias.lopez@fau.de*

An exceptionally well-preserved macrofossils from the Cenomanian through the Coniacian strata of Northern Siberia (Turgai Strait) are known since 70´s of the last century (Naidin et al. 1978). New expeditions between 2021–2023 collected new, unique and extensive material which is currently under investigation (Zverkov et al. 2023; Mironenko et al. 2024; Rogov et al. 2024; Kočová Veselská et al. submitted). The investigated material yields vertebrate remains, crustaceans, echinoids, ammonites, belemnites, bivalves, and gastropods from 3 fossiliferous areas (Nizhnyaya Agapa, Yangoda and Ikon rivers located N from Norilsk). All fossil groups possess original biominerals that are not and/or only very slightly diagenetically overprinted.

Uniquely preserved macrofauna have been studied by various geochemical methods to fully understand the biomineral composition and its potential for further investigations and palaeoenvironmental reconstruction. The Micro-CT technique has proved 3D preservation with original components that are usually very poorly preserved. Raman spectroscopy, PXRD and SEM were used to characterise the biominerals, and UV fluorescence was used to determine the amount of organic matter. Elemental composition was detected by point analysis and mapping using XRF, WDS (EMPA), LA-ICP-MS and ICP-OES methods. Stable isotopes of oxygen and carbon were analysed by a MAT253 gas isotope ratio mass spectrometer coupled to a Kiel IV and a Gasbench II connected to a Delta V Plus mass spectrometer. Strontium isotope data were obtained using a Triton Plus TIMS instrument.

Results from these biological archives (especially $\delta^{13}C$, $\delta^{18}O$, $^{87}Sr/^{86}Sr$) are used for global stratigraphic correlations. Detailed geochemical investigation showed that the unique preservation of fossils in carbonate concretions is also linked to hydrocarbon seeps eliminating stronger diagenetic overprint.

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References:

Kočová Veselská M., Rogov M., Gašparič R., Hyžný M., Ippolitov A.P., Košťák M., Luque J.: An unique insight to growth of necrocarcinoid crabs (Malacostraca: Decapoda: Brachyura): evidence from the Upper Cretaceous of Siberia (Russia), with a description of a new species. (Cretaceous Research, submitted)

Mironenko A., Rogov M., Ippolitov A., Smurova I., Zakharov V. 2024: Ammonoid and coleoid jaws from the Upper Cretaceous of northern Siberia (Nizhnyaya Agapa River sections). Cretaceous Research 161, 105918.

Naidin D.P., Teis R., Kiselevskiy M.A. 1978: Oxygen isotope composition in nodules and enclosed organogenic carbonates from the Upper Cretaceous deposits of the Pyasina River basin (Western Taimyr). Vestnik MGU 4, 22–33.

Rogov M.A., Marinov V.A., Ippolitov A.P., Košťák M., Baraboshkin E.Yu., Zakharov V.A. 2024: Gateway to the Arctic: Late Cretaceous history of the Turgai Strait. In: The 6th International Conference of Palaeogeography. Life evolution, palaeogeography, resources. Abstracts, May 17–20, 2024, Nanjing, China, p. 62.

Zverkov N.G., Rogov M.A., Zakharov V.A., Danilov I.G., Grigoriev D.V., Košťák M. 2023: Northernmost occurrences of plesiosaurs and turtles in the Upper Cretaceous of Eurasia. Cretaceous Research 148, 105537.

News from the ongoing palaeobotanical research of the Klikov Formation with emphasis on fossil leaves and palynomorphs

VERONIKA VESELÁ[1,2], JANA ČEPIČKOVÁ[3], JIŘÍ KVAČEK[3], MARCELA SVOBODOVÁ[4]

[1]*Institute of Geology and Palaeontology, Faculty of Science, Charles University, Albertov 6, Praha 2, 128 43, Czech Republic; veronika.vesela@natur.cuni.cz*
[2]*Geological Institute, Department of Palaeobiology and Palaeoecology, Czech Academy of Sciences, Rozvojová 269, 165 00 Praha 6, Czech Republic*
[3] *National Museum, Václavské náměstí 68, 110 00 Praha 1, Czech Republic*

The upper Turonian to Santonian Klikov Formation is the most widespread and most fossil-rich unit of the South Bohemian Basins with mostly fluvial sediment infill. Claystones and sandstones from the highway road cut and tunnel at localities Dobrovodská and Pohůrka provided numerous charcolified mesofossils (leave fragments, reproductive organs, charcoals) and microfossils (palynomorphs).

Palynological research was carried out using a single-grain method and showed rich and diversified assemblage with prevailing angiosperm pollen including Normapolles (*Tricolporopollenites, Atlantopollis, Pecakipollis, Plicapollis, Trudopolis, Quedlinburgipollis*). Fossil spores indicate the presence of mosses and ferns *(Cyathidites, Cicatricosisporites, Gleichenidites, Laevigatosporites*). Majority of gymnosperms are represented by bisaccate *Pinuspollenites*, slightly granulate and quite thick *Inaperturopollenites*, monosulcate *Cycadophytes* and polyplicate *Ephedra* pollen.

Well-preserved fragments of angiosperm twigs and leaves were obtained from sediment by bulk maceration, followed by washing on a sieve. The fragments in number of cases show margins.

Leaf material includes entire-margined and dentate leaves, in some cases with visible venation. Their fragments were used for cuticle analysis. The leaf fragments were treated in the Schulze's reagent and then in potassium hydroxide.

Thin cuticles show micromorphological features – trichome bases, wrinkles and stomata preserved in most of the material.

The studied material shows significant diversity. Namely the families Platanaceae, Lauraceae and possibly Juglandaceae at the macro- to micro-morphological levels. Composition of the flora is similar to that of the very close and well-studied locality Zliv-Blana.

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Palynology of the Upper Triassic deposits from the Poręba outcrop, Upper Silesia (SW Poland)

ALICJA WARZECHA [1,2], ANNA FIJAŁKOWSKA-MADER[3], GRZEGORZ PACYNA[1]

[1]*Jagiellonian University, Faculty of Biology, Institute of Botany, Department of Taxonomy, Phytogeography and Palaeobotany, ul. Gronostajowa 3, 30-387 Kraków, Poland; grzegorz.pacyna@uj.edu.pl*
[2]*Jagiellonian University, Doctoral School of Exact and Natural Sciences, ul. prof. S. Łojasiewicza 11, 30-348 Kraków, Poland; alicja.a.dyba@doctoral.uj.edu.pl*
[3]*Polish Geoogical Institute – Natiomal Research Institute, Holy Cross Branch, Zgoda 21, 25-953 Kielce, Poland; anna.mader@pgi.gov.pl*

Poręba site, located in Upper Silesia west of Zawiercie, is known among paleontologists and paleobotanists for the Upper Triassic vertebrates and plant remains (Sulej et al. 2012; Szulc et al. 2015; Pacyna et al. 2024). Palynostratigraphic research allowed to precise the age of these sediments, belonging to the Patoka Member of the Grabowa Formation, as Norian (Fijałkowska-Mader et al. 2015). The uniqueness of the exposure in Poręba results from the fact that pollen grains appear here not only in disperse form, but also in male cones of conifers. The pollen grains, obtained from male cones, belong to *Brachysaccus*, *Triadispora* and *Classpollis* genera (Pacyna et al. 2024) and are still under study (Pacyna et al. 2024).

Miospore assemblage, recognized in the samples from both the outcrop and the drill core Poręba, represents the *meyeriana* b subzone of the *Corollina meyeriana* zone, which corresponds to the *Granuloperculatipollis rudis* GTS standard zone (Fijałkowska-Mader et al. 2015). The spectrum of disperse forms is strongly dominated by conifer assacate, cheirolepidacean pollen *Classopollis meyeriana* and *C. classoides* as well as voltzialean bisaccate pollen of the *Brachysaccus* (*B. neomundanus, B. ovalis*) and *Triadispora* (*T. crassa, T. polonica, T. suspecta*) genera. Less frequently occur *Duplicisporites granulatus, Lunatisporites* and *Ovalipollis* sp. div. and *Parillinites* pollen grains. Single fern spores are represented by *Verrucosisporites, Cyclotriletes* and *Taurocusporites* (*T. morbeyi, T. verrucatus)* genera, whereas lycopod spores are more taxonomically differentiated and belong to *Anapiculatisporites, Heliosporites, Nevesisporites, Aratrisporites, Polycingulatisporites* and *Neochomotriletes* genera. Moreover, occur single cirumpollens, represented by *Rhaetipollis germanicus* and *Sphaeripollenites* sp.

The miospore assemblage, presented above is typical for coastal plant community existing in dry climate conditions. The macrofossils found in Poręba coming strictly from conifers, also confirm dry environment, whereas presence of lycopod spores and an abundance of phytoclasts, indicates for wetter, coastal milieu.

During our research we had an opportunity to examine pollen obtained from sediments and also from male cones. That part of the work shed much light on the subject of intraspecific diversity, which can lead to pollen grains form the one parent plant species being described as two or more different dispersed sporomorph species.

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References:

Fijałkowska-Mader A., Heunisch C., Szulc J. 2015: Palynostratigraphy and palynofacies of the Upper Silesian Keuper (Southern Poland). Annales Societatis Geologorum Poloniae 85, 637–661.

Pacyna G., Ziaja J., Warzecha A., Barbacka M. 2024: 0-250-Conifer remains from the Upper Triassic Poręba site in south-western Poland. In: Bek J., Votočková-Frojdová J. (ed.): XV International Palynological Congress, XI International Organization of Palaeobotany Conference, 27–31 May, 2024, Prague, Czech Republic, Abstract Book, 133–134.

Sulej T., Niedźwiedzki G., Bronowicz R. 2012: A new Late Triassic vertebrate fauna from Poland with turtles, aetosaurs, and coelophysoid dinosaurs. Journal of Vertebrate Paleontology 32, 1033–1041.

Szulc A., Racki G., Jewuła K., Środoń J. 2015: How many Upper Triassic bone-bearing levels are ther in Upper Silesia(southern Poland)? A critical overview of stratigraphy and facies. Annales Societatis Geologorum Poloniae 85, 587–626.

Foraminiferal biostratigraphy of displaced deposits in Eocene Beloveza Formation in Osielec (Magura Nappe, Carpathians)

ANNA WAŚKOWSKA[1], MATEUSZ SZCZĘĆH[2], JAN GOLONKA[1]

[1]*AGH University of Krakow, al. Mickiewicza 30, 30-059 Krakow, Poland; waskowsk@agh.edu.pl, jgolonka@agh.edu.pl*
[2]*Jagiellonian University, ul. Gronostajowa 3a, 30-387 Krakow, Poland; mateusz.szczech@uj.edu.pl*

The Beloveza Formation (Racza Zone, Magura Nappe) in Osielec contains melange deposits, which have an olistostrome origin (Cieszkowski et al. 2017). Their deposition took place during the sedimentation of thick-bedded and conglomeratic sandstones of the Piasierbiec Member.

Micropaleontological studies identified the time of its deposition, determined its origin, and age of the displaced deposits, and established of its internal structure.

The deposition of the olistostrome took place between the late Ypresian/Lutetian (samples beneath the olistostrome contain *Reticulophragmium amplectens* (Grzybowski)) and the Bartonian (represented by the *Haplophragmoides* acme assemblage (*sensu* Waśkowska 2021) with *Reticulophragmium amplectens* (Grzybowski) and *Praesphaerammina subgaleta* Vasicek).

The structure of the displaced deposits is complex, it is comprised of three structurally distinct complexes. Each of them is characterized by separate assemblages of foraminifera. The Lower complex consists of muddy and sandy despoits with gabbro and nummulitic limestone blocks. There are 3 different types of foraminifera within: (1) typical for the *Glomospira* acme, which is related in structure and taxonomic composition to underlying the Łabowa Formation, (2) taxonomically poor assemblages of nodosarids with planktonic foraminifra, the Bartonian *Subbotina* cf. *gortanii* (Borsetti), Ypresian–Lutetian *Acarinina boudreauxi* Fleisher and *Reticulophragmium amplectens* (Grzybowski), (3) poor agglutinating assemblages with *Reticulophragmium amplectens* (Grzybowski) and *Praesphaerammina subgaletata* (Vasicek) of Bartonian–Praboniahn age. Above, there is a complex of deformed thin- and medium-bedded turbidites. Within it, two types of foraminiferal assemblages occur: (1) with the *Haplophragmoides* acme and *Subbotina eocaena* (Guembel), *Subbotina corpulenta* (Subbotina), and *Subbotina linaperta* (Finlay) of Lutetian to Bartonian age; (2) with the *Praesphaerammina subgaleata* (Vasicek) acme of Lutetian–Bartonian age. In both, *Haplophragmoides parvulus* Blaicher, which appears from the Bartonian, is present.

The melange deposits are overlain by a package of normally layered Beloveza deposits developed as typical thin- and medium-bedded turbidite facies, which contain olistoplaques composed of gray massive marls and variegated mudstones, as well as exotic blocks of granite and pelitic limestones. The foraminiferal assemblages from the Beloveza-type turbidites include *Haplophragmoides* acme assemblages with "*Ammodiscus" latus* Grzybowski forma *ovoidalis* and *Reticulophragmium amplectens* (Grzybowski) of Bartonian age. The variegated deposits contain Ypresian foraminifera with numerous radiolarians, including assemblages of the *Glomospira* acme, *Karrerulina* acme, and assemblages dominated by *Thalmannammina subturbinata* (Grzybowski) and *Trochamminoides* and *Paratrochamminoides*. There are also mixed assemblages containing Paleocene and Middle Eocene components with *Annectina grzybowskii* (Jurkiewicz) and the *Trochamminoides–Paratrochamminoides* assemblage, as well as *Reticulophragmium amplectens* (Grzybowski). Biostratigraphic studies from the marls did not yield positive results.

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References:

Cieszkowski M., Kysiak T., Szczęch M., Wolska A. 2017: Geology of the Magura Nappe in the Osielec area with emphasis on an Eocene olistostrome with metabasite olistoliths (Outer Carpathians, Poland). Annales Societatis Geologorum Poloniae 87, 169–182.

Waśkowska A. 2021: Agglutinated foraminiferal acmes and their role in the biostratigraphy of the Campanian–Eocene Outer Carpathians. Geosciences 11, 367. https://doi.org/10.3390/geosciences11090367

New data on olistostromes in the Kruhel Wielki area – microfacies types of the Upper Jurassic–Lower Cretaceous exotics and their stratigraphic position in the Ropianka Formation (Skole Nappe, Carpathians)

JAN WOYDA[1], ANNA WAŚKOWSKA[2], ZBYSZEK REMIN[1]

[1]*University of Warsaw, Faculty of Geology, Żwirki i Wigury 93, 02-089 Warszawa, Poland; j.woyda@student.uw.edu.pl; zremin@uw.edu.pl*
[2]*AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Kraków, Poland; waskowsk@agh.edu.pl*

The geological building of the Skole Unit in the Przemyśl area shows a diverse array of rock ages and tectonics. Among turbiditic and marl successions assigned to the Upper Cretaceous–Paleocene Ropianka Formation, assemblages of exotic rocks occur (Wójcik 1907, 1913, 1914; Bukowy & Geroch 1956; Olszewska et al. 2011). Due to complicated tectonic and limited exposures, establishing the precise age the exotic-bearing deposits and their structural arrangement is challenging.

A contentious aspect is the uncertain age of the exotic-bearing layers, with previous age dates ranging from Neocomian to Miocene, leading to significant age discrepancies. Therefore, the need for well-defined age determinations is crucial. To address this issue we established precise biostratigraphic constraints on selected sections in the northeastern part of the Skole Nappe. Planktonic and calcareous benthic foraminifera indicated the lower upper Maastrichtian, embracing the interval of the *Racemiguembelina fructicosa* and lower part of the *Abathomphalus mayaroensis* zones. The re-evaluation of the data of Bukowy and Geroch (1956) from the Iwanowa Hill section indicated its upper Maastrichtian age.

The second goal of this research was the recognition of microfacies of limestone exotics. According to Książkiewicz et al. (1965), the reconstruction of the almost complete Bajocian–Tithonian lithostratigraphic section based on the exotics identified in the studied area is possible, although further research showed the prevalence of the Tithonian and Berriasian limestone (Geroch & Morycowa 1966).

Current studies on the exotic rocks from the Kruhel Wielki area were based on macroscopic observations mainly (Wójcik 1907, 1913, 1914) or it constitutes a slight part of the broader analyses (Olszewska et al. 2011; Hoffman et al. 2021). The preliminary research on material collected from the new exposures revealed a diversity of limestones (twelve facies types were distinguished). It reflects a wide range of facies of the uppermost Jurassic–lowermost Cretaceous carbonate platform.

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References:

Bukowy S., Geroch S. 1956: On the age of exotic conglomerates at Kruhel Wielki near Przemyśl (Carpathians). Annales Societatis Geologorum Poloniae 26, 297–329.

Geroch S., Morycowa E. 1966: Przyczynek do znajomości facji i skamieniałości wapienia tytońskiego z Kruhela Wielkiego koło Przemyśla. Annales Societatis Geologorum Poloniae 36, 295–301.

Hoffman M., Kołodziej B., Kowal-Kasprzyk J. 2021: A lost carbonate platform deciphered from clasts embedded in flysch: Stramberk-type limestones, Polish Outer Carpathians. Annales Societatis Geologorum Poloniae 91, 201–251.

Książkiewicz M., Samsonowicz J, Rühle E. 1965: Zarys geologii Polski. Warszawa, Wydawnictwa Geologiczne 235–239.

Olszewska B., Paul Z., Ryłko W., Garecka M. 2011: Biostratygrafia olistolitów wapiennych zewnętrznego pasa skałkowego Karpat i skał otaczających. AEM Studio Kraków, 1–93.

Wójcik K. 1907: Exotica fliszowe Kruhela Wielkiego koło Przemyśla. Sprawozdanie Komisyi fizyograficznej Akademii Umiejętności w Krakowie 42, 3–24.

Wójcik K. 1913–1914: Jura Kruhela Wielkiego pod Przemyślem. Część I, II, III. Rozprawy Wydziały Matematyczno–Przyrodniczego Akademii Umiejętności 53, 141–182, 409–491, 543–618.

The fish otoliths from the Velké Bílovice locality (Czech Republic)

BARBARA ZAHRADNÍKOVÁ

Slovak National Museum – Natural History Museum in Bratislava, Vajanského nábr. 2, P.O. BOX 13, 810 06 Bratislava, Slovakia; barbara.zahradnikova@snm.sk

The material – the estate of prof. J. Švagrovský from the Department of Geology and Paleontology of the Faculty of Natural Sciences of the Charles University in Bratislava was transferred to the Paleontological Department of the Slovak National Museum – Natural History Museum in Bratislava in 2003. The material (washed residues) was in several plastic bags, which were marked only with labels with the information that they came from Velké Bílovice. During the processing of the washed residues, by separation under reflected-light microscope, mainly shells of small gastropods and bivalves, foraminifera, ostracoda and also teeth, bones and otoliths of bony fishes were separated.

The village of Velké Bílovice is located in the South Moravian Region in the district of Břeclav, 12 km North of Břeclav and 20 km Southwest of Hodonín in the Vienna Basin. The remains of fossil fish were found in seven washed residues – bags. For better orientation, they were numbered from 1 to 7. Bag number 6 had a label stating that the material came from a football field. The washed residues were probably obtained by prof. Švagrovský from the white-grey, medium to fine-grained sands of Sarmatian age found in the area. A more detailed sedimentological characterization is unfortunately not possible at the moment due to lack of information.

Two works are known from these sites in Velké Bílovice. Švagrovský (1971) in his work dealt with the research of the Sarmatian stage and included the Velké Bílovice locality, from where he described the molluscs fauna (43 species). Molluscs from several localities from the area of Velké Bílovice are also included in the work by Osičková (2010). Otoliths have not yet been described from here.

The studied material consisted of 7 otoliths (sagittae), which are deposited in the SNM–NHM in Bratislava in the Paleontological Department. The most numerous were otoliths belonging to the family Gobiidae (6 pieces). Species belonging to the genus *Gobius* Linnaeus, 1758, namely *Gobius brevis* (Agassiz, 1839) were determined. The species belonging to the genus *Lesueurigobius* Whitley, 1950 were - *Lesueurigobius magnijugis* Schwarzhans, 2017, *Lesueurigobius suerii* (Risso, 1810), *Lesueurigobius vicinalis* (Koken, 1891) and *Lesueurigobius* sp. One otolith belongs to the genus *Vanderhorstia* Smith, 1949 namely the species *Vanderhorstia prochazkai* Schwarzhans, Brzobohatý & Radwańska, 2020. One otolith found belongs to the family Myctophidae Gill, 1893 and to the genus *Lampadena* Goode & Bean, 1893 namely the species *Lampadena gracilis* (Schubert, 1912).

Gobiid otoliths are very common in many neritic Neogene sediments. Gobiidae are among the largest groups of marine fishes in existence. Gobiidae are globally distributed in a variety of marine, brackish and freshwater habitats and also play an important role in reef ecology. The Myctophidae are currently a family that is primarily represented by meso- to bathypelagic fishes with luminous organs. They mostly migrate between epi- (at night) and mesopelagic (during the day) environments and are cosmopolitan in distribution.

The association of otoliths found at the Velké Bílovice sites with a predominance of species from the family Gobiidae indicates a shallow-water environment of the continental sea or a partially isolated shallow-water bay. The isolated record of the otolith species *Lampadena gracilis* (Schubert, 1912) of the family Myctophidae suggests a connection with deeper parts of the basin.

References:

Osičková L. 2010: Mollusca neogénu okolí Velkých Bílovic a jejich ekologické aspekty. Online. Diplomová práce. Masarykova univerzita, Přírodovědecká fakulta, Brno, 75 p.

Švagrovský J. 1971: Das Sarmat der Tschechoslowakei und seine Molluskenfauna. Acta Geologica et Geographica Universitatis Comeniae, Geologica 20, Bratislava, 473 p.

Molecular palaeontology – the use of biomarkers in the reconstruction of the paleoenvironment in the postglacial period

LUCIA ŽATKOVÁ[1], RASTISLAV MILOVSKÝ[1], RADOVAN KYŠKA PIPÍK[1]

[1]*Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 974 11 Banská Bystrica, Slovakia*

After the retreat of the glaciers in high mountain areas glacial lakes were created. Deposited lacustrine sediments preserve information about paleoclimate and paleoenvironmental changes in the Postglacial and Holocene periods. By applying an actualistic approach to such archives in Tatra Mts. we interpret the fossil biomarkers through the organic molecular composition of present-day biota.

Sediments from mountain lakes Popradské pleso (1494 m a.s.l.; POP), Trojrohé pleso (1611 m a.s.l.; TROJ) and Batizovské pleso (1884 m a.s.l.; BAT) and 12 ecological vegetation groups collected from their catchments were processed using extraction and separation techniques (Freimuth et al. 2017; Bechtel et al. 2018) and analyzed for molecular and compound-specific isotopic composition by GC/MS and GC/IRMS.

Chemostratigraphic units were defined in POP, TROJ and BAT lakes, with boundaries and environmental changes roughly conforming to paleoclimatic intervals of the Holocene. The dry climate was recorded in the period 13,200 BP–11,500 BP, coincident with Younger Dryas stadial. In the sediment of TROJ lake at ca. 5,200 BP a sharp spike in the abundance of the aromatic terpenoid retene, decoupled from the trend of other abietane-type diterpenoids, may best be explained by episodic flooding due to the rise of the water table.

Appearance and subsequent increase of diploptene concentration suggest a formation and gradual expansion of soil synchronous with deglaciation of the valley (~13,300 cal. yr BP for BAT, ~9,800 cal. yr BP for POP). We assume the delay in the onset of soil formation in the vicinity of the POP lake is due to the shading of the Zlomiskova valley with the subsequent persistence of the glacier cooling the valley for a longer period.

Based on the absence of conifer biomarkers in the sediments of BAT lake, the upper limit of the continuous *Pinus mugo* scrub never reached the altitude above 1900 m a.s.l. between 16,200 and 4,400 BP, whereas conifer canopy was permanently present around TROJ lake at 1611 m a.s.l. between 10,400 and 3,100 BP.

A fingerprint of fossil molecular biomarkers (e.g., n-alkanes, fatty acids, sterols) could enhance the reconstruction of past environmental conditions and the tracing of organic carbon sources.

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References:

Bechtel A., Oberauer K., Kostić A., Gratzer R., Milisavljević V., Aleksić N., Stojanović K., Groß D., Sachsenhofer R.F. 2018: Depositional environment and hydrocarbon source potential of the Lower Miocene oil shale deposit in the Aleksinac Basin (Serbia). Organic Geochemistry 115, 93–112.

Freimuth E.J., Diefendorf A.F., Lowell T.V. 2017: Hydrogen isotopes of n-alkanes and n-alkanoic acids as tracers of precipitation in a temperate forest and implications for paleorecords. Geochimica et Cosmochimica Acta 206, 166–183.

Biostratigraphy of the Badenian transgressive deposits in the northenmost part of the Central Paratethys (Jaworzno 5902, Poland, the Carpathian Foredeep) – preliminary results

ZBIGNIEW JAN ZIAREK[1], MONIKA PILARZ[2], MAŁGORZATA GARECKA[3]

[1]*AGH University of Krakow; Student's Scientific Association „Geotourism"; Faculty of Geology, Geophysics and Environmental Protection; al. Mickiewicza 30, 30-059 Kraków, Poland; zbysiuziarek@student.agh.edu.pl*
[2]*AGH University of Krakow; Department of General Geology and Geotourism, Faculty of Geology, Geophysics and Environmental Protection; al. Mickiewicza 30, 30-059 Kraków, Poland; pilarz@agh.edu.pl*
[3]*Polish Geological Institute – National Research Institute, Skrzatów 1, 31-560 Kraków, Poland; mgar@pgi.gov.pl*

Miocene deposits are widespread in the Carpathian Foredeep. Jaworzno 5902 borehole is located in the western part of the Carpathian Foredeep in Poland, where the northern boundary of Miocene sediments is erosional in nature. Miocene sediments form an isolated patch in borehole area and lie on the Triassic Gogolin limestones. Studied profile is represented by deposits of the Skawina Fm. (19.6–26.6 m) as well as the Kłodnica Fm. (26.6–54.0 m) and contains a whole range sequence of the transgressive sediments. This kind of profiles are very rare in the north of this part of the Carpathian Foredeep.

The Kłodnica Fm. deposits generally consist of marls/clay marls complex and were formed in a shallow-marine and brackish environment. The Skawina Fm. deposits are represented as marine grey clays.

In the sediments of both formations, mainly specimens of Foraminifera and ostracods were found. Moreover, the Kłodnica Fm. deposits also contain *Charophytae* gyrogonites, sponge elements, fish remains, pyritizated fragments of sea urchin carapaces, mollusks detritus (mainly oysters) and radiolaria. To developthe biostratigraphy of the studied sediments, foraminifera, calcareous nanoplankton and ostracods were used.

The foraminiferal assemblage from the Kłodnica Fm. includes *Pappina parkeri* species and the index form *Orbulina suturalis* which indicates Middle Badenian age (*sensu* Hohenegger 2014) Orbulina suturalis–Praeorbulina glomerosa Zone (Cicha et al. 1975). Foraminifera identified in the Skawina Fm. sediments are typical of the regional assemblage zone IIA according to S.W. Alexndrowicz (1963) which corresponds to the Orbulina suturalis–Praeorbulina glomerosa Zone (Cicha et al. 1975).

Results obtained from analyse of calcareous nannoplankton occurring in the sediments of the Kłodnica as well as the Skawina formations indicate NN5 Zone (Martini 1971; Švabenická 2002) determined with *Helicosphaera waltrans*, *Helicosphaera walbersdorfensis*, *Helicosphaera carteri* and low number of genera *Discoaster*, *Umbilicosphaera*, *Calcidiscus* and *Sphenolithus heteromorphus* species.

Ostracoda assemblages from Kłodnica Fm. have a high species diversity. Based on identification of two index species *Acantocythereis hystrix* and *Bythocypris lucida* it was possible to determine age of the studied deposits as Middle Badenian (*sensu* Hohenegger 2014) ostracoda NO-7 Zone Acantocythereis hystrix–Bythocypris lucida (Jiřiček & Říha 1991). Moreover occurance of the species *Costa edwardsii* suggests, that the age of these deposits cannot be later than the Middle Badenian (*sensu* Hohenegger 2014).

The results of the analysis of ostracods, foraminifera and nanoplankton are consistent.

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References:

Alexandrowicz S.W. 1963: Stratigraphy of the Miocene deposits in the Upper Silesian Basin. Prace Instytutu Geologicznego 39, 1–147 (in Polish with English summary).

Cicha I., Čtyroká J., Zapletalová I., Vanova M. 1975: East Alps and West Carpathian basins: marine zones of benthic foraminifera. In: Cicha I. (Ed.): Biozonal Subdivision of the Upper Tertiary Basins of the Eastern Alps and West Carpathians. Proceedings of the VIth Congress RCMNS, Geol. Surv. Prague, 34–40.

Hohenegger J., Ćorić S., Wagreich M. 2014: Timing of the Middle Miocene Badenian Stage of the Central Paratethys. Geologica Carpathica 65, 55–66.

Jiřiček R., Říha J. 1991: Correlation of Ostracod Zones in the Paratethys and Tethys. In: Proceedings of Shallow Tethys 3, Sendai, 1990. Saito Ho-on Kai Special Publication 3, 436–457.

Martini E. 1971: Standard Tertiary and Quaternary calcareous nannoplankton zonation. Proceedings of the II Planktonic Conference, Roma 1970, 264–785.

Švábenická L. 2002: Calcareous nannofossils of the Upper Karpatian and Lower Badenian deposits in the Carpathian Foredeep, Moravia (Czech Republic). Geologica Carpathica 53, 197–210.

Index

Re-evaluation of the ammonite fauna from the Jurassic limestone olistolith(s) from Lukoveček (Magura Superunit, Carpathians, Czech Republic)

JÁN SCHLÖGL

Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University, Mlynská dolina, Ilkovičova 6, 842 15 Bratislava

Jurassic marine fauna from the Lukoveček locality is known from the very beginning of the 20th Century (Rzehak 1903, 1904), although the presence of the Jurassic rocks was already mentioned by Uhlig (1888). These are represented by olistolith(s) within a flysch deposits of the Lower Soláň Beds (Soláň Formation, Upper Cretaceous), belonging to the marginal Rača Unit of the Magura Superunit (Western Carpathians). Rakús (1987) described three stratigraphically-distinct cephalopod associations of Pliensbachian, Toarcian and Aalenian age. The undergoing revision of belemnites deposited in the collections of Moravian Museum in Brno by Jan Geist from the Charles University in Prague is the reason why we decided to critically check these results. The analysed 131 ammonite specimens (mostly fragmented) include the material collected and studied by Rzehak (however his material is mixed with the rest of the collection, so it is not clearly identifiable) and also the part of the collection studied by Rakús (~50 specimens, see Rakús 1987), their identifications are reviewed and if necessary emended. Specimens miss detailed stratigraphic information, so their attribution to separate faunal associations is based on lithofacies characteristics and the stratigraphic ranges of the identified taxa.

Rakús (1987) determined two late Pliensbachian ammonite associations belonging to the Stokesi Zone and to the Spinatum Zone, respectively, an early Toarcian association of the Tenuicostatum Zone, and a Middle Aalenian association of the Murchisonae Zone. Our investigation confirmed the Late Pliensbachian and the Middle Aalenian ammonite associations. However, the Toarcian ammonites described by Rakús (1987) belong to Upper Jurassic (Oxfordian – Kimmeridgian) perisphinctids. The misidentification was caused by high resemblance of some densely ribbed perisphinctids to the Toarcian dactylioceratids. These three stratigraphically separated groups of ammonites can be also distinguished on the base of the lithofacies. Middle Aalenian fossils are embedded in dark limestones, differing from the Upper Pliensbachian lithofacies (see also Rakús 1987). The Upper Jurassic ammonites are embedded in grey to pinkish micritic limestones that are similar to those with the Upper Jurassic ammonites from locality Cetechovice (JS, personal observation). The Upper Jurassic ammonites are preserved as external moulds, the shells being completely dissolved, no suture lines are visible. The Upper Pliensbachian and Aalenian ammonites still can bear a recrystallized shell. The Lukoveček Jurassic deposits (and their fauna) are unique within the whole Magura Superunit so the careful evaluation of the existing collections is the only window to the local marine life during this time period.

References

Rakús M. 1987: Cephalopod fauna of the Lias and Lower Dogger from olistoliths of the Rača Unit of the Magura Flysh (locality Lukoveček). Západné Karpaty. Séria paleontológia 12, 7–30.

Rzehak A. 1903: Spuren des Lias und Dogger im Klippenjura der karpathischen Sandsteinzone Mährens. Verhandlungen Der Geologischen Bundesanstalt 14, 276–277.

Rzehak A. 1904: Das Liasvorkommen von Freistadtl in Mähren. Zeitschrift Des Mährischen Landesmuseums 4, 89–156.

Uhlig V. 1888: Vorlage des Kartenblattes Kremsier-Prerau. Zone 8, Col. XVII. Verhandlungen der k. k. geologischen Reichsanstalt 16, p. 313.

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