22nd Czech – Slovak – Polish Palaeontological Conference

ABSTRACTS

October 17–19, 2023
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CONTENT

PREFACE

The conference as a platform for scientific exchange within Czech, Slovak and Polish palaeontological communities, supports the development of palaeontological research in the Middle East European region by maintaining contacts between different scientific centres including universities and research institutes, as well as museums and industry units. Various aspects of palaeontology and interdisciplinary studies based on traditional and innovated methods with researchers of other European countries and representatives from other continents.

This year, the twenty-second year of this event was organized by geologists from the Department of Geological Engineering of the VSB-Technical University in Ostrava. It is the second time that this conference was held in Ostrava. The 4th Czech-Slovak Paleontological Seminar took place in Ostrava. Paleontological research at the workplace in Ostrava has a long tradition, and it follows on from the research of palaeontologists from VSB-TUO, such as prof. Bohuslav Růžička, prof. Otakar Kumpera, or prof. Zdeňek Vašíček.

The conferences also included regular field trips. This year it is focused on three important locations. One of them is represented by the *Landek section* in the Ostrava, where the Upper Carboniferous non-marine and marine sequences can be studied. The second locality, *Baška*, located at the Podbeskydská pahorkatina Upland, is outcropping Barremian marine sediments and volcanics. The third locality, *Štramberk*, from a paleontological point of view represents one of the most significant European Mesozoic sites. More than 600 faunistic species have been described from the Štramberk limestone since the beginning of the 20th century.

Participants from many countries in Europe and the world have recently become actively involved in Czech-Slovak-Polish paleontological conferences, which earns this event on credit. We believe that the tradition of organizing paleontological conferences will be maintained in the future and will be carried in the same working, creative and friendly atmosphere as before.

Each conference is focused on the latest research and discoveries in the field of broadly understood palaeontology and related topics. By the lively discussion on a wide range of subjects from different fields, we demonstrate that palaeontology is an integral part of geology and Earth sciences. In addition to information exchange, during this event scientists from Central Europe share their experience and establish international and interdisciplinary collaboration, often proliferating in joint research projects. Our conference has attracted almost 50 scientists from 5 countries, including a considerable number of doctoral and graduate students.

Petr Skupien

Chairman of 22nd CSPPC

Nannofossil biostratigraphy of Paleogene sediments from the Handlová basin: a new evidence for age dating and significant reworking

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The Paleogene sediments of the Handlová basin belong to the Subtatric Group of the Central-Carpathian Paleogene basin (*sensu* Gross et al.1984). Besides of rare outcrops, they are also known from the boreholes (Zlinská & Gross 2013) or even from Handlová coal mine. The later has been studied for nannofossils and foraminifers. The nannofossils from the three samples are composed of 16 autochthonous and 9 allochthonous – Paleocene and 8 Mesozoic species.

The most abundant autochthonous nannofossils in the sample were species *Cyclicargolithus floridanus*, *Coccolithus pelagicus, Discoaster saipanensis* and *D. barbadiensis*.

Allochthonous nannofossils are composed mainly of Mesozoic species *Watznaueria and Eiffelithus*. Paleocene allochthonous species comprise of *Discoaster splendidus, Fasciculithus tympaniformis, F. alanii, Sphenolithus anarrhopus* and *Thoracosphaera sp.* Their Lutetian age has been constrained based on the species *Discoaster tani, D. saipanensis, Cylicargolithus floridanus* and *Sphenolithus kempii*, corresponding to the nannoplankton zone NP 15 and MECO-type association (Martini, 1971, Bohaty et al. 2009). Rare planktonic foraminifera are formed by minor species of *Globoturborotalita*, *Subbotina*, *Tenuitella* and *Chiloguembelina*.

The new results are important not only from the Middle Eocene deposition in the Handlová basin, but also from redeposition of Paleocene sediments and denudation of the Upper Gosau basins of this area. The Gosau-type formations of the Upper Cretaceous – Paleocene sediments were also described from the Horná Nitra Depression (Soták et al. 2021). Consequently, the Handlová basin was founded in Late Lutetian, and that after tectonic inversion and denudation of Late Cretaceous – Paleocene basins of Gosau or Myjava-Hričov Group.

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The first record of a turbinellid gastropod from the Barremian of Bulgaria and its importance for the evolution of Neogastropoda

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Several taxa of Neogastropoda attained worldwide distribution by the end of the Cretaceous due to rapid mid-Cretaceous radiation, whereas in the Early Cretaceous their records are excessively rarely. Only one specimen represented by juvenile shell was recorded from the Valanginian (Kaim, 2004). A few other species are known from much younger Aptian-Albian sediments (Tracey, 2010) while their record from the remaining ages remains elusive.

Barremian gastropod assemblages are uncommon and only occasionally they yield well-preserved specimens (e.g., Gründel & Kollmann, 2013). A collection of gastropods from the Lower Cretaceous of Bulgaria under our study consists of approx. 500 gastropod shells with only one specimen identified as neogastropod. Morphological characteristics allowed to determine its systematic position within the family Turbinellidae as a new species of the genus *Fimbrivasum*, which previously was known only from the Santonian-Campanian (?Maastrichtian) of the Pacific Coast of North America (Squires & Saul, 2001). The species of Turbinellidae typically possess medium to large fusiform to ovate-conic shells with prominent spiral cords and axial nodes or blunt spines, and columellar folds. The species of *Fimbrivasum* are characterized by a shell with a distinct shoulder, cancellate sculpture with strong spiral cords, a columella with two or three columellar folds and slightly twisted siphonal canal. All these characteristics are observed in the new species except for the shell size, which is much smaller.

The discovery of this species indicates much earlier origin of this family than previously thought and dates it back to the Barremian. It also extends the area of the genus distribution and indicates its emergence in the northern part of the Tethys Ocean. This new turbinellid shows that the evolution of neogastropod diversification started already in the Early Cretaceous but the density of taxa was very low.

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An enigmatic jaw fragment from the Late Carboniferous of Nýřany (Czech Republic)

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The locality of Nýřany represents a limnic deposits of the late Carboniferous (Moscovian) age, containing a well-known vertebrate assemblage. The convenient depositional conditions, persisting in the lake basin for a relatively short period of time, enabled an extraordinary preservation potential, thus providing an important insight into the late Carboniferous faunal association occurring in the lake deposits of the Central Europe. The site has been known since the late 19th century and yielded hundreds of vertebrate specimens, including numerous fish and amphibian forms, as well as rare remains of early reptiles and synapsids (Fritsch 1870; Milner 1980). Here, we report on a new, well-preserved, large fragment of a probable lower jaw with teeth from the locality of Nýřany, which represents so far unknown morphotype in the vertebrate assemblage of the locality. The jaw fragment measures 55 mm and preserves the posterior portion of the dentary with teeth in lingual view. The mandible is dorsoventrally deep and possesses a prominent coronoid process. The lateral surface of the jaw bears a distinct ornamentation restricted to the central part of the bone, which consists of elongate ridges and grooves. The homodont, upright, smooth marginal teeth have bulbous bases, lingually recurved crown tips, and are implanted in shallow sockets. The suite of characteristics present in the mandible and dentition, as well as the large proportions of the jaw, distinguishes the newly reported specimen from all other vertebrates known from the late Paleozoic deposits of the Czechia. Consequently, a possible taxonomic attribution of the jaw is discussed.

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Brachiopods from the Early Oligocene Lower Red Formation of Central Iran

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Contrary to Europe, where Palaeogene and Neogene brachiopods have been intensively investigated, from Iran they are still poorly known. So far the only records describing taxonomically brachiopods are those from the Lower Miocene deposits of the Qom Formation in the Isfahan-Sirjan Basin (Pedramara et al. 2019; Bitner et al. 2023). In the present study we describe a newly collected brachiopods from the Early Oligocene Lower Red Formation of the Isfahan Basin, Central Iran. The Lower Red Formation overlies unconformably the Eocene volcanic rocks and is overlain by the Qom Formation of Late Oligocene-Early Miocene age, usually with angular unconformity difficult to identify (Morley *et al*., 2009). Lithologically, it is very variable, composed of black shales, siltstones, marls, sandstones, red conglomerates, and evaporates.

The assemblage comprises six brachiopod taxa belonging to five genera, *Novocrania* Lee and Brunton, 2001, *Thecidellina* Thomson, 1915, *Argyrotheca* Dall, 1900, *Joania* Álvarez, Brunton and Long, 2008, and *Platidia* Costa, 1852. This is the first record of brachiopods from the Lower Red Formation, while the genera *Novocrania* and *Thecidellina* are reported for the first time from Iran. Additionally, the discovery of *Thecidellina* in Iran is the first confirmed occurrence of this genus in the Oligocene deposits, filling the gap between Eocene and Miocene occurrences (see Pajaud 1970; Baker 2006). The brachiopod fauna from the Lower Red Formation share no species in common with that described from the Lower Miocene deposits of the Qom Formation.

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New record of Middle Miocene (Badenian) brachiopods from Moravia, Czech Republic

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Although brachiopods are a very common element of the Middle Miocene benthic communities of the Central Paratethys, in Moravia, Czechia, they are scarce and of low diversity. Here we describe a newly discovered brachiopod fauna from the sand pit at Oslavany in southern Moravia. The deposits cropping out at the pit are represented by sands and sandstones of Early Badenian age and contain impoverished Badenian fossils accompanied by reworked fossils of the Ottnangian *Rzehakia* Beds (Nehyba et al. 2009, 2016). Although the sediment samples were collected in the second half of the 1970s when the sand pit was still active and uncovered to a quite large extent, the shells of brachiopods were recognized only in 2022 within the study of the outwashed residues. The brachiopod assemblage comprises five species belonging to five genera within three families. The families Terebratulidae and Platidiidae are represented by one species each, *Terebratula* sp. and *Platidia* sp., respectively. The remaining three species, *Megathiris detruncata* (Gmelin, 1791), *Joania cordata* (Risso, 1826), and *Argyrotheca cuneata* (Risso, 1826) belong to the family Megathyrididae. Among them *J. cordata* dominates in the studied material. Interestingly, the latter species was already described from Oslavany under the name *Cistella* cf. *cistellula* (Wood, 1841) by Rzehak (1893). The other species described here are reported for the first time from this locality. All those species, well-known in the Middle Miocene of the Central Paratethys, were also earlier recognized in its Moravian part (Bitner et al. 2013; Kopecká et al. 2018).

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Forgotten unique locality of lower Miocene macromammals in Carpathian Foredeep Basin (Brno city – Nový Lískovec, Czech Republic)

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Lower Miocene terrestrial fauna of the Moravian part of the Carpathian Foredeep Basin is known from the Ottnangian deposits (e.g., Fejfar 1990, Ivanov & Musil 2002). Nevertheless, Anton Rzehak (*1855, †1923) reported terrestrial fossil vertebrates from his „Oncophora Beds“ in Brno and its vicinity. Later Rzehak's stratigraphical interpretation has become unreliable as he included into "Oncophora Beds“ also the lower Badenian "Brno sands“ which contain redeposited bivalves of the genus *Rzehakia* from Rzehakia Beds (Ottnangian). The best preserved material (isolated teeth, almost complete mandibles and postcranial elements of large mammals) comes from the lost sandpit near Nový Lískovec in Brno-Bohunice. From this sandpit (also: „Grosse Sandgrube“ near „Neu-Leskau“ above „Teufelsschlucht“ or Topinka's sandpit) were reported finds of rhinocerotids and proboscideans during 1875-1925 (Rzehak 1908, 1917; Knies 1926).

In the paleontological collections of Masaryk University were identified original Rzehak's sandstone specimens with accumulations of *Rzehakia* shells from the sandpit near Nový Lískovec. A review of the newly recognized historical collection of fossil mammals from the same locality housed at the Moravian Museum showed: archaic gomphothere (*Gomphotherium* sp.), Rhinocerotidae (*Lartetotherium sansaniense* and *Plesiaceratherium* sp.), Equidae (*Anchitherium* sp.) and undetermined Cervidae and Carnivore.

In the area of Nový Lískovec are currently known only Miocene deposits of the Ottnangian age. The lithological similarity of the sedimentary profile reported by Knies (1926) from the sandpit near Nový Lískovec with the Ottnangian sequence published by Nehyba et al. (2007) from occasional outcrop in the close vicinity of the former sandpit near Nový Lískovec prove the Ottnangian age of the site. Determined fossil fauna from Nový Lískovec well corresponds to those known from the Ottnangian (MN4, Burdigalian) and represents new well-preserved material of relatively rare lower Miocene mammal taxa such as *L. sansaniense* and *Gomphotherium.*

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Agglutinated foraminifera record across the Jurassic-Cretaceous boundary in carbonate turbidites of Carpathian Flysch

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Jurassic-Cretaceous (JK) boundary was studied in two sections in the Silesian Unit of the Carpathian Flysch belt near Třinec town in Silesia, Czechia. Both sections comprise the Ropice Member of the Vendryně Formation (paraconglomerates and pebbly mudstones) and the overlying Cieszyn Formation (limestone turbidites and hemipelagic marlstones and shales). Based on calpionellids and calcareous dinocysts, the Karpentná section ranges within the upper Tithonian and the Ropice section from the Tithonian to lower Berriasian. The base of the Berriasian in Ropice was placed 4 m above the base of the Cieszyn Formation in biomicritic mudstone with packstone laminae, based on the Alpina Subzone of the Calpionella Zone (Reháková, personal communication).

Foraminifers were extracted using standard methods: soft shales and marlstones disintegrated in sodium-bicarbonate solution, limestones dissolved in 80% acetic acid (method of Lirer 2000), and washed on a 0.063 mm sieve. The acetolysis enable obtaining nodosariids and spirillinids, but the calcareous agglutinated taxa (*Nautiloculina, Falsogaudryinella, Dobrogelina* etc.) are dissolved. Therefore, thin sections of limestones were also studied. While the shales and marlstones of the Cieszyn Formation contain autochthonous flysch-type agglutinated fauna, the limestones contain calcareous-agglutinated taxa, reworked from carbonate platform and slope by turbidite currents.

Some agglutinated taxa demand further taxonomical study: e.g. *Thuramminoides* sp. – form similar to *Saccammina placenta* (G.) but without apparent aperture, small species of *Ammosphaeroidina*, and *Ammolagena*? sp. – form similar to *Caudammina silesica* (H.), but apparently attached to substrate, that is not preserved. The form tentatively identified as *Bulbobaculites* aff. *fontinensis* (T.) is close to *Ammobaculites fontinensis* (T.) figured by Geroch (1966) in shape and arrangement of chambers but lacks uncoiled part.

Geroch and Nowak (1984) placed the JK boundary to their *Pseudoreophax cisovnicensis* Zone below the lowest occurrence of *Verneuilinoides neocomiensis* (M.) at the base of the Valanginian. Olszewska (1997) placed the boundary to her *Trochammina quinqueloba* Zone below the *Pseudoreophax cisovnicensis* acme at the base of the Valanginian. Both *A. quinqueloba* and *P. cisovnicensis* are abundant in the studied sections and do not help with correlation within the JK transition. The assemblage of calcareous agglutinated foraminifers observed in thin sections of turbidite limestones is composed of taxa co-occurring in the upper Tithonian–lower Berriasian interval. Their appearance correlates with the onset of turbidites that transported reworked lime mud and microfauna from shallower habitats of the basin.

Although *Hippocrepina depressa* (V.), *Bulbobaculites* aff. *fontinensis* (T.) and *Gaudryina oblonga* Z. have their lowest occurrence 0.5 m above the JK boundary at Ropice section, they cannot serve as the JK boundary markers, because they occur in the upper Tithonian of the Karpentná section. Early stratigraphical occurrences of *Thalmannammina* sp. and *Verneuilinoides*? sp. cannot be identified to species level with certainty because of poor preservation and juvenile status of specimens. The lowest occurrence of *Eobigenerina variabilis* (V.) in the Tithonian part of the Cieszyn Formation is biostratigraphically more useful. Also, the lowest occurrence of *Gaudryinella sherlocki* (B.), which is just 1.4 m above the JK boundary, seems to be interesting.

Acknowledgement: This research was supported by grant GAČR No 20-10035S.

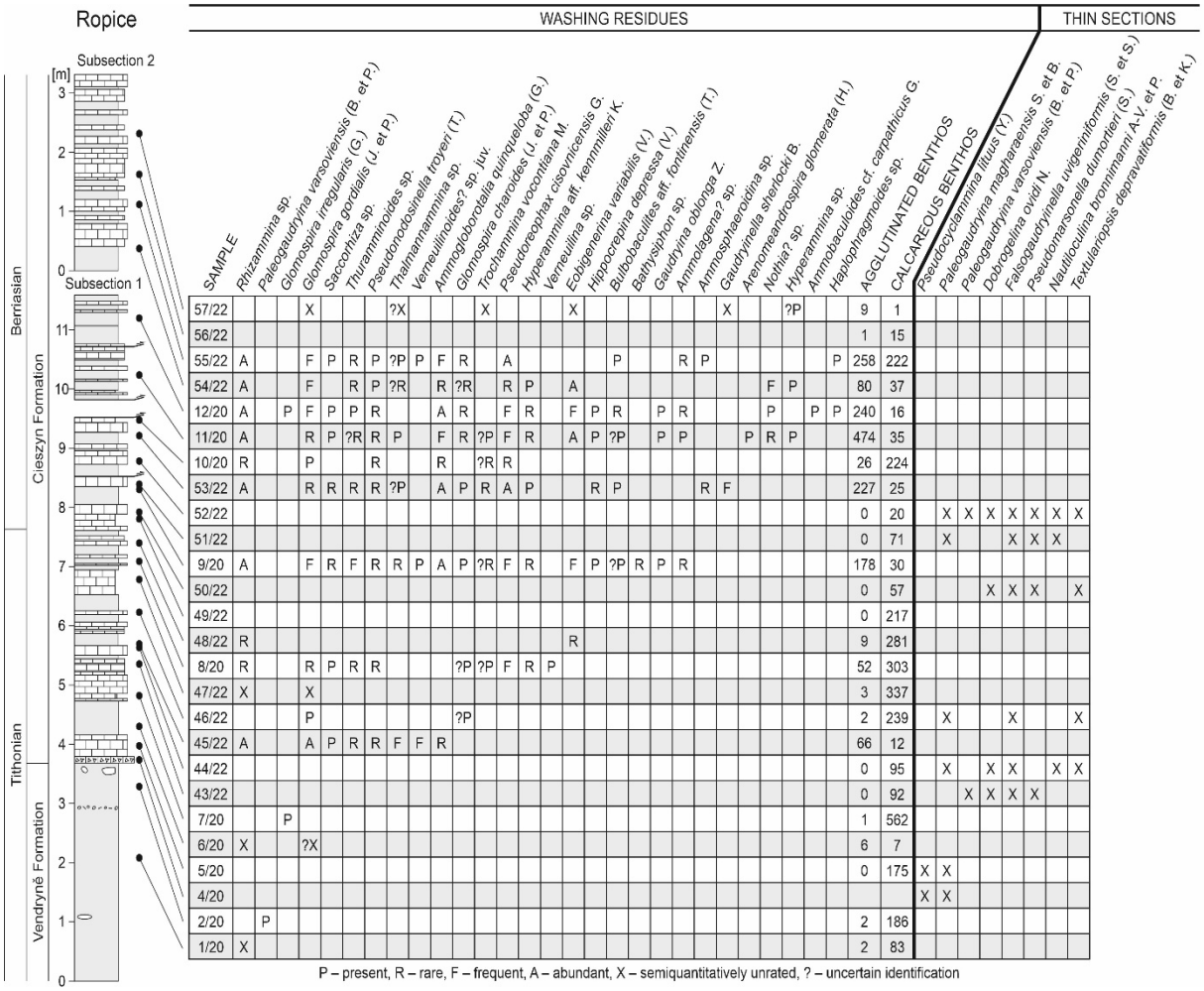

Fig. 1 Distribution of foraminifers at the Ropice section.

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Lamellar structured Jurassic Laevaptychi (Kimmeridgian, Mecsek Mountains, Hungary) as reliable paleotemperature archives

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Jurassic–Cretaceous aptychi from the Mecsek Mountains (South Hungary) have never been tested for stable isotope research. Field work (Bujtor & Albrecht, 2021, 2022) provided well preserved *Laevaptychus* sp. ex gr. *hoplisus–obliquus* specimens from the lower Kimmeridgian of Zengővárkony (Mecsek Mountains, South Hungary). Optical and scanning electron microscopic analyses of laevaptychi and control samples from brachiopods (*Nucleata* and *Pygope*) derived from the same bed revealed unexpected structures in the upper lamellar layers of the studied laevaptychi and showed 24–32 concentric lamellae that represent primary textural features and indicate excellent preservation. After careful screening for diagenetic effects, stable oxygen isotope compositions yielded seawater temperatures (SSTs) close to 26 °C in good agreement with earlier studies on Jurassic formations, but with improved precision. Our research presents for the first time that well preserved laevaptychi could provide a reliable data source for paleoclimate and paleotemperature reconstructions. Acquired data are well controlled by the stable isotope data from the shells of sessile faunal elements from the same environment. Our results open a new method to use laevaptychi that are considered not only useful biostratigraphical tools but precise palaeotemperature indicators as well.

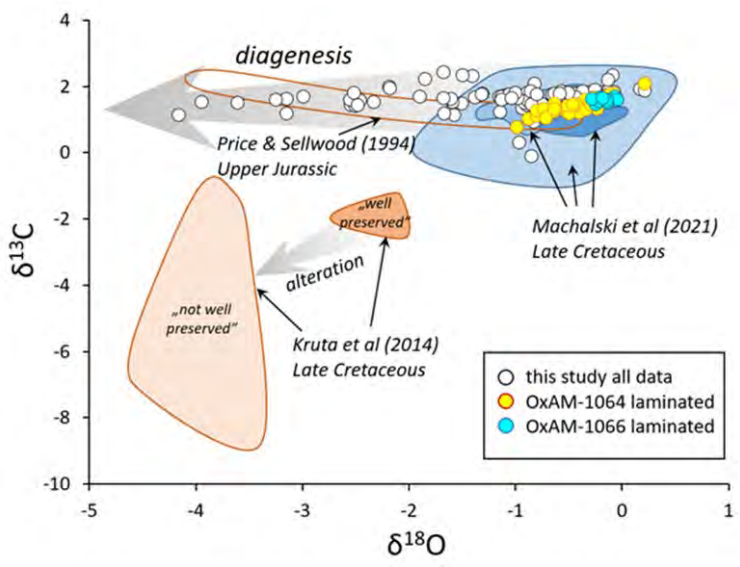

Fig. 1. Carbon and oxygen stable isotope compositions (in ‰ relative to V-PDB) of the laevaptychi studied as well as literature data on aptychus calcite.

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Krkonoše Piedmont Basin (Bohemia, Czech Republic): a forgotten but still significant area in the study of early Permian tetrapod footprints

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The Krkonoše Piedmont Basin (KPB) represents a historically significant area for early Permian tetrapod paleoichnology. Horní Kalná (Prosečné Formation, Asselian) is the type locality of the three early Permian tetrapod ichnotaxa: *Amphisauropus kablikae* (Geinitz & Deichmüller, 1882*), Batrachichnus salamandroides* (Geinitz, 1861), and *Dromopus lacertoides* (Geinitz, 1861). Another important locality Libštát (Vrchlabí Formation, Asselian) provides one of the first described tracks of *Ichniotherium cottae* (Frič 1912) but also e.g., still unpublished well-preserved *Amphisauropus kablikae* tracks and trackways of various sizes accompanied by swimming traces. In addition, tetrapod footprints come also from lesser-known localities of Ploužnice, Kyje, and Košťálov (Vrchlabí Formation). The main aim of this contribution is the description of hitherto unpublished tetrapod tracks from the KPB based on the collections stored at the Natural Museum in Prague, the Moravian Museum, and the Masaryk University in the Czechia which demonstrate the presence of seymouriamorphs, smaller temnospondyls, parareptiles or diapsids, and diadectomorphs. The latter three named groups have not yet been discovered based on skeletal remains in this basin.

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Basal angiosperms - new leaf forms from the Peruc-Korycany Formation

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The Cenomanian flora is undoubtedly one of the best-preserved fossil floras in the Czechia. *Todziaphyllum saportanum* (Velen.) Čepičková et J. Kvaček comb. nov. and *Ascarinophyllum pecinovense* Čepičková et J. Kvaček, gen. et sp. nov., originating from the locality Pecínov from the Peruc-Korycany Formation, represent two newly described leaf forms.

The aim of this work was to describe a new genus and species of *Ascarinophyllum pecinovense* and its comparison with existing taxon *Banksites saportanus* and their adaptability to the environment. The main methodologies for this study were the study of veins using the 'venation visualisation' method and cuticle analysis. The first method allowed differentiation based on venation; the second method was not applied due to the absence of cuticle on the material of *Todziaphyllum saportanum*. The information obtained from the cuticle analysis of *A. pecinovense* material allowed us to observe micromorphological modifications of the external surface of the abaxial side of the leaf epidermis, which is ornamented with radial and randomly oriented striations. The striation of the epidermis surface is an indicator of possible freshwater stress, which the taxon defines as a possible meso- to xerophyte. Mesophytes to xerophytes generally have stomata embedded in the stomatal pits, which may be surrounded by papillae or striations. Surface epidermis may also be striated or covered with papillae.

Based on macro- and micromorphological comparison with the fossil (*Longstrethia varidentata*, *Mesodescolea plicata*) and recent material (*Sarcandra*, *Chloranthus*, *Ascarina*), the affinity of the taxon *Ascarinophyllum pecinovense* with the family Chloranthaceae is most likely. At the same time, it is not excluded that *Ascarinophyllum pecinovense* may represent an extinct lineage of the evolutionary branch ANITA.

Presence of meso- to xerophytes of angiosperms in the fossil record of the Peruc Member is rare and is explained by the seasonal climate in the Bohemian Massif during the Cenomanian.

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Acritarch and chitinozoans clusters and their palaeobiological implications

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Monogeneric clusters of five acritarch genera (*Adara*, *Cymatiosphaera*, *Eliasum*, *Synsphaeridium* and *Timofeevia*) were discovered in palynological residues of fine-grained siliciclastic samples from the middle Cambrian (Miaolingian) Jince Formation of the Příbram–Jince Basin (Czechia). The clusters consist of two to more than 100 individual specimens and lack a common pattern of organization. Acritarchs within clusters fall within a similar size. The most plausible explanations for the formation of acritarch clusters are aggregation within algal blooms or primary colonial behavior. Acritarch clusters have been documented from rocks of early Cambrian to Late Devonian age.

Chitinozoans are commonly known to occur as isolated vesicles, and, less commonly, in chains. These clusters are critical to the question of the biological affinity of chitinozoans. Bedding-plane assemblages and acid-digestion residues from Ordovician rocks of the Welsh Basin (Llanfawr, UK) and the Prague Basin (Beroun, Czechia) have yielded exceptionally preserved monospecific chitinozoan clusters arranged as parallel vesicles, with apertures either facing in the same direction or in opposite directions. These clusters are newly termed ‘P-clusters’. A literature review of previously described clusters confirmed that P-clusters occur in all three chitinozoan families. Modelling simulations of the relative abundances of different cluster morphologies suggest that P-clusters originated from a hypothetical, large cluster, functionally comparable with the already well-known *Desmochitina* clusters and interpreted as an egg mass. Our findings support the interpretation of all chitinozoans as metazoan eggs.

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Biostratigraphy and microfacies of the Urgonian-type limestones at selected sections in the Manín Unit (Strážovské vrchy Mts.)

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On the northwestern edge of the Strážovské vrchy Mts., several sections were studied for biostratigraphy and microfacies of the Manín and Podhorie formations (Urgonian- type limestones). Sections are situated in Jankov háj (abandoned quarry near Dolný Lieskov), Bôrova hôrka (NE of Belušské Slatiny) and Jelenia skala (SE of Belušské Slatiny).

The layer sequence of the Podhorie Fm is mainly formed by dark grey fine-grained biodetrital limestones with irregularly scattered cherts of various shapes. Limestones have intrabiopelmicrite/ intrabiopelmicrosparite structure (packstone/ wackestone) locally with fields of intrabiopelsparite (grainstone). Microfossils are represented by filaments and fragments of thick-walled bivalves, echinoderms, *Colomiella recta*, benthic foraminifers *Patellina* sp., *Spirillina* sp., *Lenticulina* sp., *Dorothia* sp., *Gaudryina* sp., *Bolivinopsis* sp., *Anomalina* sp., *Nodosaria* sp., *Frondicularia* sp., *Akcaya* sp. Planktonic foraminifers *Blefuscuiana infracretacea*, *Muricohedbergella* cf. *planispira*, *Hedbergella trocoidea*, *Globigerinelloides* sp., *Globigerinelloides ferreolensis* are indicating late Aptian age of the sediment. *Ticinella roberti* (early Albian) can be observed in the sediments with echinoderm microfacies in the Jelenia skala section. Calcareous nannoplankton *Assipetra terebrodentarius, Cyclagelosphaera margerelii, Micrantholithus hoschulzii, Nannoconus circularis, Nannoconus globulus globulus, Nannoconus steinmannii steinmannii, Nannoconus truittii, Retecapsa octofenestrata, Rhagodiscus asper, Watznaueria barnesiae, Zeugrhabdotus embergeri*, etc. also occurs within the Podhorie Fm.

The Manín Fm. is characterized by light grey and grey organodetritic limestones. They also consist of protruding boulders that reach a thickness of around 0.5 m. The amount of biodetritus is variable. Microstructurally, the limestones belong to the intrabiosparites/intrabiopelsparites (grainstones) rarely with remnants of micrite/microsparite matrix (intrabiomicrite/intrabiomicrosparite (wackestone/packstone). Calcareous cement occurs in some passages. Allochems are unsorted and well-rounded. Components that belong to the rudite fraction in size are rarely found. Fragments of thick-walled bivalves (part of which comes from rudists) with traces of burrowing organisms and representatives of late Aptian *Orbitolina* genus are present in association with probably older redeposited orbitolinids. Other fossils are represented by fragments of echinoderms, benthic

foraminifers *Lenticulina* sp., *Dorothia* sp., *Gaudryina* sp., miliolid forms, and rare unidentified planktonic foraminifers.

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Lower Jurassic of the czech Outer Western Carpathians – an unique olistolith Lukoveček

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Sedimentary rocks of the Lower Jurassic are exceptional within the territory of the Czechia. Due to the tectonic development of the Outer Western Carpathians, they are more often represented within Slovakia and other states east of the Czechia. Here we present the only known fossiliferous rocks of this age from our territory. The Lower and Upper Jurassic sediments recorded closely to Lukoveček belong to the Magura flysh, specifically to its marginal part of the Rača unit. The olistolith is a part of the lower Soláň beds (Soláň Formation, Upper Cretaceous), and is exposed in the vicinity of the axis of the emerging and widening Ondřejov anticlinal belt The Jurassic olistolith exposed near Lukoveček (*Klein-Lukow*) near Fryšták (*Freistadtl*) provides extraordinary insight into the sedimentological history of the Outer Western Carpathians. Geological and palaeontological investigations of this uniquely (it represents a single record within the Magura unit of the Carpathian flysh in the Czechia) preserved sediments are very few. The relatively little scientific interest in this locality was probably also due to the poor preservation of fossils, which often do not allow a closer taxonomic determination. In the middle of the 19th century, pelosideritic concretions (*Brauneisensteingkugel*) were mined here and transported to ironworks. Quarry near Lukoveček was in 1880 flooded and perished. Thanks to the reopening of the quarry in 1902, the Lower Jurassic macrofauna has been recorded (Rakús 1987). Further research was conducted by Oppenheimer (1913). Unfortunately, he found out and described only Upper Jurassic strata in the locality (Oxfordian and Kimmeridgian). Subsequent scientific works follow previous research and discuss the Lower Jurassic and Upper Jurassic (Andrusov 1959; Rakús 1987). Several species of bivalves, ammonites, echinoids, brachiopods, forams, and, last but not least, belemnites were described and known (Rzehak 1904).

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The Plenus Cold Event in NW Bohemia (Bohemian Cretaceous Basin) preliminary results

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We present belemnite-bearing strata (Upper Cenomanian) of the Bohemian Cretaceous Basin (BCB) at the onset of the Oceanic Anoxic Event II (OAE2). High-resolution climate records reveal considerable changes in temperature, carbon cycling, and ocean chemistry during the OAE2 (O'Connor et al. 2020). A prominent cooling phase within the greenhouse Cretaceous period – the Plenus Cold Event (PCE) has for the first time been recognised in the English Chalk, based on an invasive Boreal fauna (North Boreal Group) and subsequently by stable-isotope excursions within the OAE2 (Jefferies 1963; O'Connor et al. 2020). The PCE is generally accompanied by faunal shift and temperature decrease worldwide (O'Connor et al. 2020). We have investigated the occurrence and geochemical characteristics of the belemnite species *Praeactinocamax plenus* (Blainville, 1827) within several parts of the BCB and we have received relevant data especially from NE part of the BCB. The characterisation of rostra is performed by $\delta^{18}O_{bel}$, $\delta^{13}C_{bel}$ and $^{87}Sr/^{86}Sr$ and accompanied by preliminary results of the $\delta^{13}C_{carb}$ (locality Masty). The *plenus* beds represent a very narrow stratigraphical interval corresponding to a part of the *Metoicoceras geslinianum* ammonite Zone (Košťák et al. 2018). Studied rostra of *P. plenus* are morphologically consistent with all typical morphotypes of this species distributed from Kazakhstan to Great Britain (Košťák 2004). A relatively thin horizons bearing belemnite rostra show stratigraphical stability in the NE Bohemia. Based on biostratigraphy and stable isotope curve, these records can be correlated with Jefferies´s beds in the Anglo-Paris Basin (Jefferies 1963), Lower Saxony (Wiese et al. 2009), Northern Peri-Tethys (France, Provence; Gale et Christensen 1996) and other sites.

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Moravian paleontologist Ferdinad Stoliczka (1838–1874): life and work in India

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Ferdinad Stoliczka (1838–1874) was an outstanding Moravian scientist who contributed significantly to paleontology, geology and even zoology of India. He was born (original name Stolička) in Kroměříž. After finishing the high school in Kroměříž he studied in Vienna and finished PhD in geology at the University of Tübingen (1861). After study he accepted a position in the Kaiserlich Königlichen Geologischen Reichsanstalt where he worked two years. His early work at the Austrian Geological Survey was focused on the geological research and mapping in the Alps, Dalmatia and Hungary.

At the end of 1862 he accepted the invitation to work at the Geological Survey of India in Calcutta (Kolkata). His palaeontological studies were focused on the Cretaceous fossils from India. Results from India were published in *Palaeontologia Indica* (1864–1873; four volumes, nearly 1500 pages, 178 plates) and concerned with various fossil groups: cephalopods, gastropods, bivalves, brachiopods, echinoderms, corals and other fossils. For example, Stoliczka (1873) described 57 species, many of them proposed as new species. Stoliczka studied the geology of the western Himalayas and Tibet. Briefly he was the curator of the Indian Museum and the Natural History Secretary of the Asiatic Society of Bengal. He also visited the Andaman and Nicobar Islands, Burma, Malaya and Singapore. Stoliczka was interested also in modern birds, reptiles, amphibians and mammals from India, and described many new species.

Stoliczka's first Himalayan trip was in 1864. The third and the last expedition was in 1873–1874 (Second Yarkand Mission; Blanford, 1878–1891). During this expedition, Stoliczka died of altitude sickness on 19 June 1874 at Murgo in Ladakh. Untimely death finished his extremely productive research life. The life and research work of Ferdinand Stoliczka are described by Kolmaš (1982).

Fig. 1. Ferdinad Stoliczka ca. 1870 (wikipedia.org; left); statue of Ferdinand Stoliczka on the building of the Judicial Academy (Justiční Škola) in Kroměříž (right).

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Late Cretaceous Spirellea ellipsoides, seed or insect remains?

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Phasmatodea commonly mimic the shape of plants, and their eggs mimic seeds. This phenomenon has also been described from the Cretaceous period, where some species of insect eggs are very similar to seeds. The species Spirellea ellipsoids Knobloch et Mai is also studied in this respect. The material was collected and prepared by E. Knobloch and D.H. Mai from Walbeck locality, a terrestrial sediments of upper Maastrichtian age. The mesofossils were extracted from gray claystone by bulk maceration, followed by washing on a sieve. After sieving, some of the organic residue was treated with H2O2, rinsed in water and dried in air. The mesofossils are preserved as three-dimensional charcoal fossils ca. 1 mm. Chemical analysis carried out on a charcoal showed neither traces of cutin nor traces of chitin in the fossil. Therefore, it is not possible to decide the systematic affinity of the fossil on the basis of chemical analysis – it must be determined by morphology and external features.

The possible systematic affinity of Spirellea ellipsoids to recent Stemonaceae has been discussed by Knonobloch et Mai in 1984. Recent Stemonaceae have seeds longitudinally ridged, without sarcotesta, similar to S. ellipsoids, but with elaiosomes of juicy hairs originating from hilum, raphe, or micropyle, which is distinct from S. ellipsoids. Some of the insect eggs, for example, from the groups Phasmatodea and Lepidoptera, are very similar to S. ellipsoids in their surface ornamentation. We conclude that S. ellipsoids is the remains of insect eggs rather than plant seeds, but their systematic affinity cannot be precisely determined.

Paleo-ecology and systematics of the coralline algae from the northern Vienna Basin, Slovakia

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Limestones of the Upper Baden age from the north-eastern edge of the Vienna basin exhibit traits of mixing of biocenoses. Arguments are packstone microfacies, rhodoliths morphology and internal structure and coralline-algal growth forms – i.e., hooked structures which point to the seagrasses. Distribution of coralgal and rhodalgal microfacies in recent oceans and overall coralline algal assemblage suggests that biocenoses were formed in subtropics and below the level of wave action under the fair-weather. However, analyzes of the thin-section material using an optical microscope and a scanning electron microscope with the support of micro-CT suggest that coralline algae were exposed to mechanical disturbance and re-deposited within the Lakšár elevation. Given above, we came to the conclusion that examined limestones are distal tempestites.

Paleocene molluscan fauna from Carpathian deep-sea hydrocarbon seep deposit

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We report Paleocene seep deposit and associated molluscan fauna from Bystřice, Czechia. The material studied belongs to the deep marine Frýdlant Formation (Subsilesian nappe, Outer Western Carpathians). Dinoflagellate cysts *Cerodinium speciosum, Palaeocystodinium golzowense, Palaeoperridinium pyrophorum* indicate Seladian (Middle Paleocene) age of the sediments. The deposit composed of three metre-scale carbonate boulders is interpreted to have formed at ancient hydrocarbon seep based on carbonate textures and presence of δ13C-depleted biomarkers typical for methanotrophic archaea. Benthic macrofauna found within the carbonates is of low diversity (3 species) and composed of molluscs: a small thyasirid bivalve, forming mass accumulation of thousands of clustered individuals, a species of large, high spired gastropod, possibly belonging to *Abyssomelania*, and species of a yet unidentified lucinid bivalve. The composition of the molluscan fauna, with the abundance of thyasirid bivalves and abyssochryssoid gastropods, is similar to that of some Palaeogene and many Late Cretaceous seep faunas.

Pistol shrimps (Decapoda: Caridea: Alpheidae) in the fossil record: state of the art

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Alpheid shrimps, popularly known as snapping shrimps or pistol shrimps, are benthic marine crustaceans, widely distributed in the subtropical and tropical waters (Anker et al. 2006). They are famous for their greatly enlarged snapping claw of the major cheliped, which is a multifunctional tool used for communication, defence, and aggression in various interspecific and agonistic interactions (Anker et al. 2006). The snapping claw is considered a key morphological innovation, resulting into an extreme diversity (600+ extant species) and abundance of alpheid shrimps. The fossil record of snapping shrimps, however, is sparse and poorly understood. As shown by Hyžný et al. (2017), the fingertips of the snapping claws of the genus *Alpheus* (accounting for ca. 45% of the total alpheid diversity) have a high fossilisation potential and the preserved structures are highly characteristic. In the past, they were misinterpreted as remains of coleoid cephalopods (Ciampaglio & Weaver 2008) or brachyuran crabs (Müller 1998). Recognition of the snapping claw fingertips as a distinct type of a mesofossil with a specific mode of preservation (Hyžný et al. 2017) allows a systematic evaluation of the alpheid fossil remains. Until now, the snapping claw fingertips, either of the pollex or the dactylus, have been recorded from many localities exposing Cenozoic sediments across the world (Austria, Czechia, France, Italy, Netherlands, Poland, Slovakia, Japan, Egypt, Brazil, USA: Alabama and Mississippi) and ranging from early Oligocene (31–32 Ma) to late Pleistocene (117–126 ka) age (Hyžný et al. 2017; Lima et al. 2020; Cluzaud & Ossó 2022; and references therein).

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Fig. 1. Fossil snapping claw fingertips from various localities. The specimen in square represents a tip of pollex (fixed finger), all other specimens are tips of dactyli (movable fingers). All specimens are to the same scale, modified from Hyžný et al. (2017).

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Palaeoclimatic signal captured in growth rings of fossil wood from the Albian to Danian of Antarctica

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At present, there does not exist a comparative instance of a polar forest from the Late Cretaceous and Paleogene era. This ecosystem type presents an exclusive prospect for comprehending the extreme conditions that prevailed in this region, as well as the specific adaptations of organisms to such circumstances. The extensive palaeobotanical record from the Antarctic region serves as evidence that during a greenhouse type of climate, this region was densely inhabited by vegetation. Nonetheless, these plants had to adapt to a distinct solar regime: a period of half-year mild polar nights.

The fossil material utilized for the study was extracted from the uppermost Lower Cretaceous to Paleocene (Albian - Danian) strata at James Ross and Seymour Islands, located in the Antarctic Peninsula. For a detailed analysis of growth rings, 36 samples were selected from several Formations (Whisky Bay Formation, Santa Marta Formation, Lopez de Bertodano Formation, Sobal Formation) out of 114 samples studied and analyzed from the collections of Czech Geological Survey and British Antarctic Survey. These 36 samples are derived from the two most frequently encountered taxa of gymnosperms in the collections: *Agathoxylon* and *Podocarpoxylon.* All these samples exhibit more than 10 growth rings. Based on Mean Sensitivity Index and Mean Ring Width values, a climatic trend for the period was created and compared to existing research (Barral et al. 2017; Huber et al. 2018; Poole & Cantrill & Utescher 2005). The climatic signal extracted from the growth rings corresponds to the existing climatic trends of this region. This study confirms that growth rings of fossilized wood can be used to reconstruct paleoclimate with a sufficient number of samples for the research.

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Stratigraphy of the sedimentary rocks accompanying submarine volcanism in the Silesian Unit

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As part of a detailed investigation of the relationship between sediments and submarine volcanism in the Lower Cretaceous in the Silesian Unit, 29 localities from Czechia and 8 localities from Poland were studied.

The oldest sediments were identified on the profile near Bruzovice (Jurková et al., 2022). Accompanying sediments representing Těšín Limestone provide taxonomic species of dinoflagellate cysts, which are *Circulodinium vermiculatum, Cymososphaeridium validum, Muderongia tabulata, Oligosphaeridium albertense, Oligosphaeridium asterigerum, Pseudoceratium pelliferum, Systematophora palmula*. The assemblage represents the Upper Valanginian to the lowermost Hauterive.

Most of the sites were monitored in the Hradišť Formation. The oldest belongs to the upper Valanginian, locality is Stříbrník – Ostravice, whose stratigraphic classification was determined on the basis of the species *Circulodinium vermiculatum* (first occurrence at the base of the Verrucosum ammonite zone, lower part of the upper Valanginian) and also the species *Systematophora silybum* (lower Valanginian). From the point of view of stratigraphy, however, we can determine that most of the studied localities are Barremian. The youngest sediments were identified at the Požaha locality, whose belongs to the lower Aptian (Forbesi ammonite zone), this is evidenced, among other things, by the identified species *Florentinia mantellii,* which has first occurrence in the Lower Aptian.

From the palynofacies composition significant resedimentation can be interpretedit. In particular, at the locations Čertův mlýn, Bruzovice, Paskov, Řeka Morávka, Staříč, we observe an increased content of plant phytoclasts, spores and pollen grains. The paleoenvironment of the studied samples is variable, but most belong to the distal dysoxic-anoxic shelf, the pelitic oxic shelf and the marginal dysoxic-anoxic basin.

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Gastropods in ancient hydrocarbon seeps and hydrothermal vents – history of the adaptation to extreme environments

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Gastropods are one of the most important groups of organisms adapted to chemosynthesis-based communities. The fossil record of gastropod occurrences in the ancient hydrocarbon seeps shows that the trochomorph gastropods are already known from Paleozoic seeps and vents though they are poorly preserved and thus researched. In the Late Triassic seeps from Turkey, gastropods are well diversified, including the first possible abyssochrysoids. The Jurassic and Cretaceous were times of abyssochrysoid dominance in seep and vent gastropod communities not only in number of taxa but also in number of individuals. The Jurassic and Early Cretaceous seeps were dominated by Hokkaidoconchidae and Paskentanidae while in the mid-Cretaceous Provannidae and Desbruyeresidae appeared. Abyssochrysidae, Rubyspriridae and Alviniconchinae are only Cenozoic/Recent groups. The oldest report of neomphalid gastropods in seeps is from the Jurassic though their diversity is restricted to small-sized *Retiskenea*-like taxa and apparently, they are absent at Mesozoic vents. Most likely, the neomphalid radiation in vents came much later. Limpet-shaped gastropods occur at seeps already in the Jurassic but became common only in Late Cretaceous. Similarly, colloniid vetigastropods appear in large quantities only in Late Cretaceous seeps although they were present already in the Early Cretaceous. Eucyclid seguenziids are extremely common in Jurassic seas and they apparently migrated to Jurassic seeps while cataegids appeared in the Cretaceous and still occur at seeps today. Stem and/or sister groups of neogastropods (Purpurinidae and Maturifusidae) first appeared at seeps in the Jurassic, while true neogastropods are nearly absent in Mesozoic seeps, apart from a single poorly preserved specimen in a Campanian (Late Cretaceous) seep in Japan. Otherwise, neogastropods appear in larger numbers in Oligocene seeps. Cephalaspids are recorded at seeps from the Triassic but never occur in larger numbers, being apparently only opportunistic in these environments.

Preliminary notes on sessile barnacles from an Ottnangian (Early Miocene) rocky shore deposit in the North Alpine Foreland Basin (Allerding, Austria)

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This study describes a diverse assemblage of sessile cirripedes collected from Ottnangian (Early Miocene) sediments deposited in the Central Paratethys Sea near Allerding, Upper Austria. Four genera were identified, the first two, *Amphibalanus* and *Tesseropora* are representative of rocky coastal systems. The second two, *Archaeobalanus* and *Chesaconcavus*, have depth ranges from shallow water to upper shelf. These observations compliment earlier studies on decapod crustaceans (Hyžný *et al.*, 2015) gastropods (Harzhauser *et al*., 2014) and on scalpellomorph barnacles (Carriol & Schneider, 2016). Some barnacle plates show circular borings of *Oichnus* isp., which were made *in vivo*. The taphonomic conditions preserved some *Amphibalanus amphitrite communis* on fossilized wood (*Taxodioxylon* sp.), sometimes with opercula retained *in situ.* Nonetheless, most barnacle plates were dissarticulated, reflecting a moderately energetic shallow marine environment. The effects of diagenesis is limited, with little or no pressure solution pitting. They were extracted from sediments of moderate induration. These are the first records of barnacle-substrate relationships from the early Miocene of the Central Paratethys of Austria.

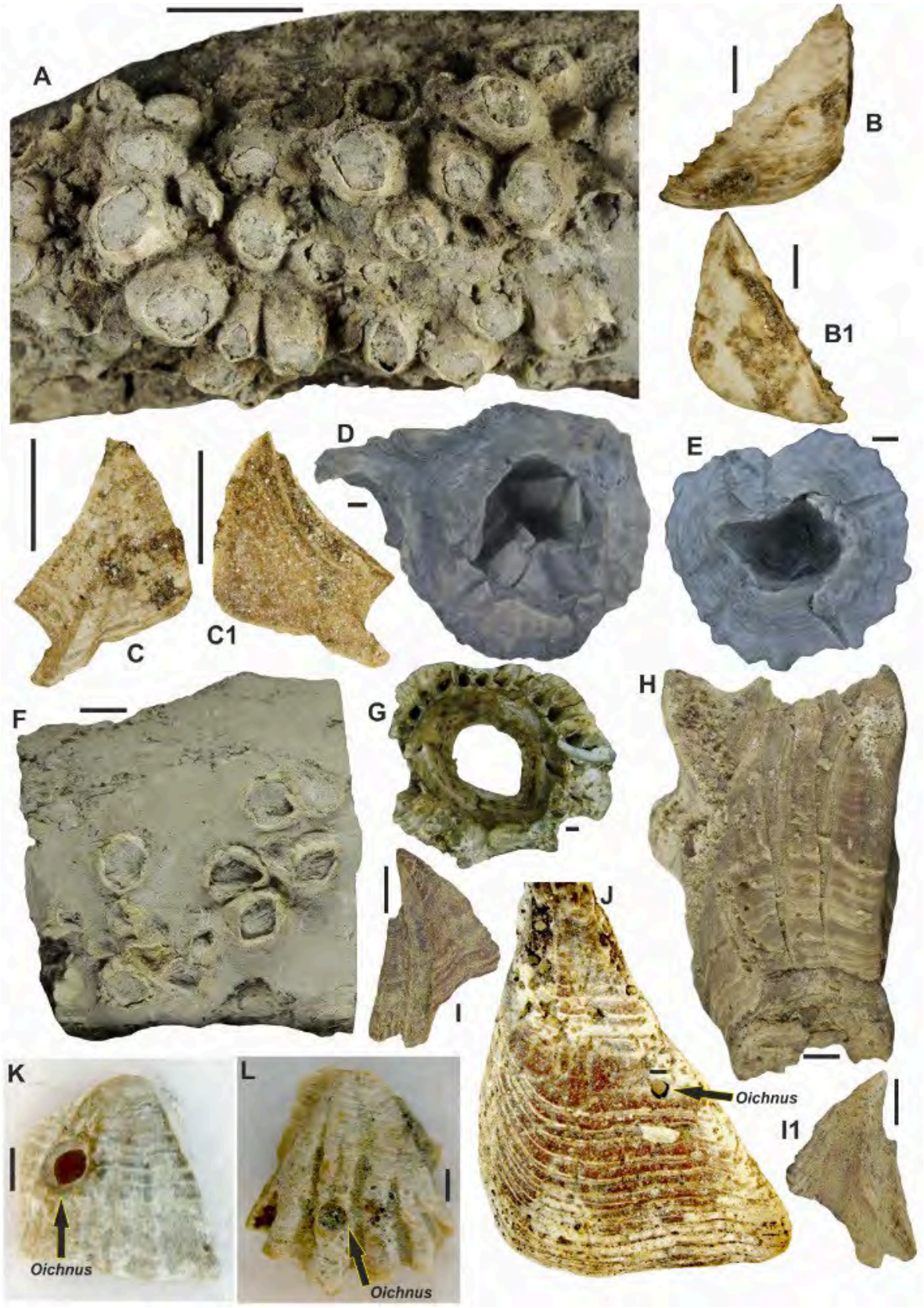

Fig. A. and F. *Amphibalanus amphitrite communis* (Darwin, 1854) attached to *Taxodioxylon* sp. B. *A. amphitrite communis* right scutum (exterior), B1. interior. C. *A. amphitrite communis* right tergum exterior, C1. interior. D. *Archaeobalanus* sp., with opercula *in situ*. E. *Archaeobalanus* sp. G. *Tesseropora* cf. *dumortieri* (Fischer, 1866), basal view. H. *Chesaconcavus gurlanensis* (Pilsbry, 1916). I. *C. gurlanensis*

tergum – exterior. I1. internal view. J. *C. gurlanensis* scutum with *Oichnus* isp. (see small yellow black arrow). K. *Archaeobalanus* sp. rostrum with *Oichnus* isp. L. *Archaeobalanus* sp. carinolatera with *Oichnus* isp boring. Scale bars for A, F: 10 mm; for H, I, J: 5 mm; for B, C, D, E, G, K, L: 1 mm.

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Brachyuran crab assemblage from the Late Cretaceous near-shore facies in the Bohemian Cretaceous Basin, Czechia

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Based on nine years of intensive research in the Cenomanian–Turonian near-shore deposits situated along the south and southeastern margin of the Bohemian Cretaceous Basin (Chrtníky, Nová Lhota, Kaňk, Radim, Turkaňk, Velim, Vítězov), a rich brachyuran crab assemblage is described. Numerous specimens were also found in sieved residues coming from currently overgrown and inaccessible outcrops (Předboj, Zbyslav). Brachyurans from dynamic near-shore environment (Žítt et al. 1997a, b) were affected by frequent transport and physical disturbance, and thus only more calcified parts (mainly cheliped dactyli) were more likely to be preserved in the sediment. Most of the carapaces were probably destroyed under high hydrodynamic energy regimes, which explains their scarcity in the area. Our research follows the paper of Kočová Veselská et al. (2014) in which we reported on dozens of dynomenid cheliped fragments from various late Cenomanian–early Turonian near-shore localities as well as one necrocarcinoid carapace fragment and two dynomenid carapaces of *Graptocarcinus texanus* Roemer, 1887. These carapaces are Fritsch's originals (in Fritsch and Kafka 1887) from the lower Turonian calcareous siltstones at Kamajka representing the only known carapaces from near-shore deposits in the Bohemian Cretaceous Basin to date. Although the authors conducted 120 additional fieldworks to accessible outcrops and washed and screened a total weight of *c*. 8 tons of residue through a 1 mm sieve, no other carapaces have been found in this type of paleoenvironment. This effort, however, yielded hundreds of chelipeds and isolated dactyli of dynomenid and dozens of etyoid brachyurans indicating that these crabs dominated the late Cenomanian–early Turonian high-energy marine environment in the Bohemian Cretaceous Basin. One paguroid dactylus additionally found in sieved residue from Předboj near Prague represents the first record of the group in the Bohemian Cretaceous Basin.

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Štramberk Limestone in the Kotouč quarry (Moravia): biostratigraphy, facies, reefs and drone-captured images

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The Kotouč quarry is the main place where the Štramberk Limestone is exposed. Štramberk is one of the most renowned paleontological sites with rich fossils studied since 19th century (Vašíček & Skupien, 2004). Here, the world's most diversified coral assemblages in the reefs developed at the Jurassic/Cretaceous transition were described (in the 19th century by Maria Ogilvie, recently by Helena Eliášová). The Štramberk Limestone and the Štramberk-type limestones (Poland) are remnants of the carbonate platforms developed on the intra-basinal highs collectively designated the Štramberk Carbonate Platform (Eliáš & Eliášová, 1984; Kołodziej et al., 2023). The Štramberk Limestone occurs as olistoliths and large blocks embedded in the Cretaceous flysch of the Silesian Unit, Outer Carpathians. Until 1980s the Štramberk Limestone was considered as Tithonian in age. However, ammonites and calpionellids indicate that limestones were deposited in the Tithonian–early Berriasian (e.g., Vašíček and Skupien, 2013, 2016, Vašíček et al., 2017, 2018).

The Štramberk Limestone is mainly known for the coral-microbial reefs. The second type of reefs is represented by the microencruster-microbial-cement boundstones. Corals in these reefs are very rare or absent. Such reefs were described only from the carbonate platforms of the Tethyan domain, were they developed in a high-energy, upper fore-reef slope environment. The third type of reefs is represented by the sponge-microbial boundstones. Such reefs were common in the Late Jurassic on the northern margin of the Tethys but are poorly known from the Tethyan domain. The second and the third type of reefs were only recently recognized in the Štramberk Limestone (Hoffmann et al., 2017; Kołodziej et al., 2023). The Štramberk Limestone includes various facies of the carbonate platform and its slope (Eliáš & Eliášová, 1984). In particular, detrital facies are common (Hoffmann et al., 2017; Vaňková et al., 2019).

Drone Mavic 3E was used to document the quarry (Fig. 1). All the data acquired will improve distribution of olistoliths, main facies, neptunian dykes and the boundaries between limestones and

flysch in which they are embedded. These data will be helpful in the structural interpretation of the quarry.

Fig. 1. Drone-captured images of the Kotouč quarry; general view of the quarry (top); olistoliths of the Štramberk Limestone embedded in the black Cretaceous flysch (bottom).

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Exceptionally preserved fossils in the Upper Turonian of the Bohemian Cretaceous Basin: A new Lagerstätte-type locality?

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We report exceptionaly well preserved macro-fossils of the Solnhofen-type preservation from the Bohemian Cretaceous Basin (BCB). The Upper Turonian strata exposed in the Úpohlavy working quarry provided rich palaeontological material in the past (Wiese et al., 2004). Inside the material, unusually preserved specimens were recorded from the 80 cm thick Bed 15 (sensu Wiese et al., 2004), which is currently studied in great details. Sedimentary structures of the bed are indicative of fine-grained allochtonous sedimentation and are explained like a deposition from suspension clouds (Košťák et al., submitted). Polished sections of the sediments show a shallow-angle cross-stratification and laminated intervals yielding fossil remains. The bioturbation is well expressed at the top of the Bed 15 including also burrows with in-situ buried decapodian crustaceans. Generally, crustaceans (including also crabs and cirripeds) are articulated also outside the burrows. From other fossils, we have recorded articulated vertebrate remains (reptiles, sharks), cephalopods with jaws preserved in-situ, plant remains, etc. The similarity to the Solnhofen-type preservation is well seen also in the overall ammonite preservation including phosphatised siphuncles. Moreover, the original organic matter was clearly documented in cephalopod jaws/aptychi by Raman spectroscopy.

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New data on organic-walled microfossils from the Cambrian of the Barrandian area

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In the Barrandian area, Cambrian microfossils have been studied for more than fifty years (e.g., Slavíková 1968, Vavrdová 1982, Fatka 1989). Application of new methods (such as 'low-manipulation HF extraction' method of Butterfield & Harvey 2012) and widening knowledge from other regions open the opportunity to restudy Cambrian sedimentary sequences and to analyse contained microfossils in a different light. Herein, we present new data on organic-walled microfossils from various Cambrian units of the Barrandian area, complementing our understanding of their respective microfossil assemblages. These include findings of small carbonaceous fossils and putative ciliates from the Paseky Shale Member of the Holšiny-Hořice Formation and acritarch clusters as well as metazoan remains from the Jince Formation, both Příbram-Jince Basin. We further present preliminary results of the first systematic research of acritarchs from the Buchava Formation of the Skryje-Týřovice Basin, which will allow a better correlation with sediments of the Příbram-Jince Basin as well as with other regions.

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Palaeoenvironmental preferences of early homolodromioid Middle Jurassic crabs

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The first stage of colonization of marine realms by early primitive crabs is crucial in determination of palaeoenvironmental regimes of these fauna and their later descendants. Seven years ago, during the same conference, I mentioned that decapod crustaceans are one of the largest association of extant marine invertebrates and are represented by almost fifteen thousand of species including brachyuran crabs (over seven thousand species) but in the fossil record are about 3700 species of decapod crustaceans (over 1000 genera) and over two thousand species (2100) of crabs (Krobicki, 2016 with literature cited therein). Analysis of palaeoenvironmental preferences of early homolodromioid Middle Jurassic crabs indicated that during first step in the origin of true crabs they were connected with shallow marine, high energetic carbonate deposits, dominated by oolitic(ferruginous)/oncolitic bioclastic-rich deposits of shallow-sea environments, coralliferous reefs, and grey/black clays with carbonate concretions which hosted these crabs. Krobicki and Zatoń (2008, 2016) discussed in more detail a wider context of the distribution of these Middle Jurassic crabs following the Early Jurassic origin of brachyurans (*Brachyuran Pliensbachian Origin Event* – BPOE) (the oldest, undoubted crab is known from Early Jurassic, Pliensbachian, time – *Eoprosopon klugi* Förster, 1986) (Schweitzer & Feldmann, 2010; Haug & Haug, 2014; Jagt *et al.*, 2015). The origin of several new dromiacean homolodromioids took place during Middle Jurassic time (*Brachyuran Bajocian Expansion Event* – BBEE), and finally, after rapid Callovian transgression, the explosion of the Late Jurassic crustaceans (including anomurans) have been during the *Brachyuran Oxfordian Explosion Event* (BOEE) due to origin of Oxfordian sponge-megafacies and Tithonian-Berriasian coralliferous Štramberk/Ernstbrunn-type carbonates (Fig. 1). Because the Toarcian-Aalenian gap in fossil record of brachyurans, the key moment in understanding of the first step of their history was connected with BBEE when new species appeared in several, generally shallow-sea environments both in the epicratonic European basins and on the margins of the Tethys. The most tolerant, eurytopic forms (*Tanidromites* genera), which occurred during that time in several different regimes – in oolitic bars, large migrated ooid dunes and/or bioclastic-oolitic shoals, coralliferous facies and silty/shale-substrate seafloor (Krobicki and Zatoń, 2016). In conclusion, during Bajocian–Callovian time, the early brachyurans occupied, with some exceptional cases, environments outside reefal habitats (Krobicki and Zatoń, 2008, 2016; Jagt et al., 2015), and when such bioconstructions with cryptic habitats expanded (Late Jurassic

sponge/coral buildups/reefs, respectively) the BOEE took place, and crustaceans other than brachyurans flourished as well.

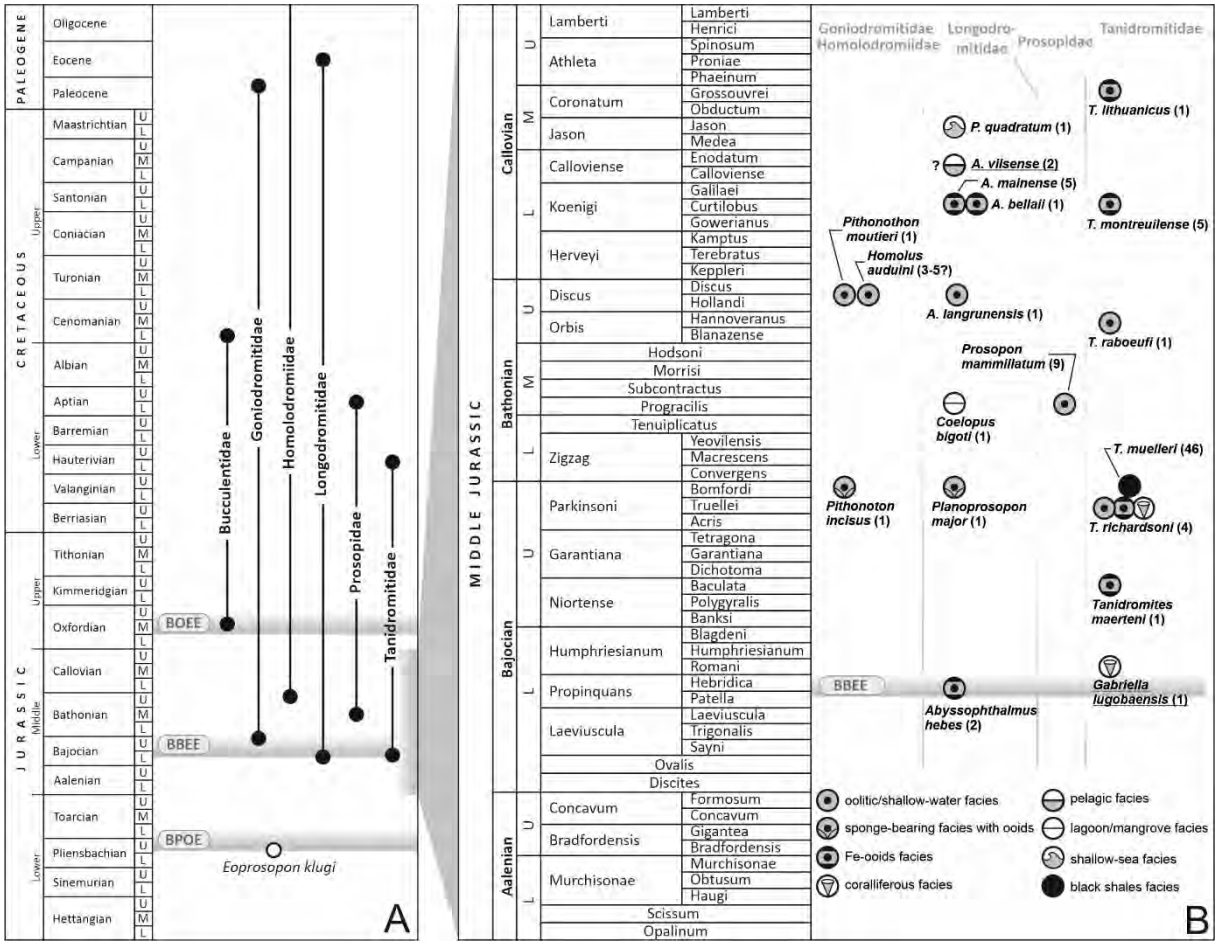

Fig. 1. Stratigraphical distribution of: A – families of the Homolodromioidea Superfamily and three brachyuran events during Early-Late Jurassic times (BPOE – *Brachyuran Pliensbachian Origin Event*; BBEE – *Brachyuran Bajocian Expansion Event*; BOEE – *Brachyuran Oxfordian Explosion Event*); B – Middle Jurassic dromiacean homolodromioid crabs according to their detail stratigraphic position and palaeoenvironmental preferences. Question marks indicate vulnerable position of taxa; underline – Tethys locations; number of specimens in brackets (after Krobicki & Zatoń, 2016; modified).

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Taxonomic and biostratigraphic notes on some advanced Tournaisian (Mississippian) siphonodellids (Conodonta)

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The conference talk is based on the results published in the study by Zhuravlev et al. (2021) and provides new data on the taxonomy and biostratigraphy of stratigraphically important conodonts of the genus *Siphonodella* Branson and Mehl. The phylogeny of the genus is traditionally used for the biostratigraphy of the terminal Famennian (Upper Devonian) and lower part of the Tournaisian (Mississippian). This study focuses on a *Siphonodella* species with a long taxonomical history. For the last three decades it has been known as *S. hassi* Ji, 1985 and has been used as a zonal index for the eponymic *hassi* Zone, used worldwide. However, this species faces several taxonomical problems.

The main issue is the homonymy of *S. hassi* and *S. cooperi hassi* Thompson and Fellows, 1970. However, *S. cooperi hassi* is a subjective junior synonym of *S. obsoleta* Hass, 1959. The oldest junior synonym of *S. hassi* is *S. wilberti* Bardasheva, Bardashev, Weddige and Ziegler, 2004, and, according to a statement of the International Commission on Zoological Nomenclature, the latter represents the only available name for this species. An additional problem is the similar morphology of early ontogenetic stages of *S. wilberti* and *S. quadruplicata* Branson and Mehl, 1944, the younger stratigraphically important siphonodellid species. In advanced ontogenetic stages, P1 elements that possess two rostral ridges belong only to *S. wilberti*. The smaller P1 elements having two or less rostral ridges comprise the *S. wilberti- S. quadruplicata* plexus. After solving the taxonomical problems of *S. wilberti*, the eponymic wilberti Zone (=*hassi* Zone, *S.* (*S.*) *jii* Zone) is proposed to maintain the Tournaisian siphonodellid zonation. (Fig. 1).

S. wilberti is a transitional form from the early siphonodellids with a thick platform and rough ornamentation to the late representatives of this genus, which are characterized by a thin platform and finer ornamentation. As a result of this transition, a number of descendant species evolved from *S. wilberti* (Fig. 2).

ISS		Conodont zonations					
		Sandberg et al., 1978	Ji, 1985 Kaiser et al., 2009	Becker et al., 2016	Corradini et al., 2016	Hogancamp et al., 2019	This study
Mississippian	Tournaisian	U. *crenulata - isosticha*	*punctatus*			*G. punctatus*	
		L. *crenulata*	*isosticha*			*S. crenulata*	*S. crenulata*
			crenulata	*S.(S.) crenulata*			
		sandbergi	*quadruplicata*	*S.(S.) quadruplicata*		*S. sandbergi*	*S. quadruplicata*
			sandbergi	*S.(S.) sandbergi*			*S. sandbergi*
		U. *duplicata*	*hassi*	*S.(S.) jii*	*Si. hassi*	*S. cooperi*	*S. wilberti*
		L. *duplicata*	*duplicata*	*S.(S.) duplicata*	*Si. duplicata*	? *S. duplicata*	*S. duplicata*
			bransoni	*S.(Eo.) bransoni*	*Si. bransoni*	*S. bransoni*	*S. bransoni*
		sulcata	*sulcata*	*S.(Eo.) sulcata* *Pr. kuehni*	*Pr. kockeli*	*Pr. kockeli*	*S. sulcata*

Fig. 1. Conodont zonation schemes of the lower-middle Tournaisian.

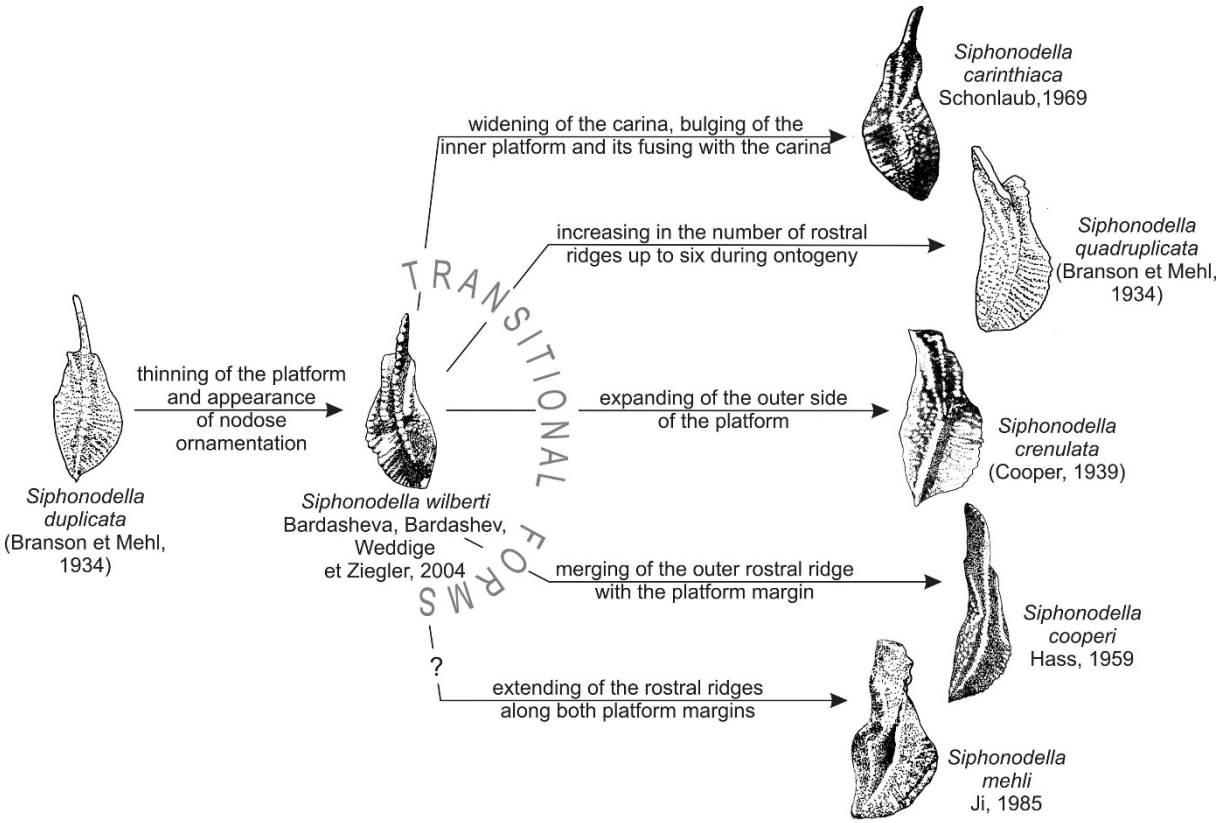

Fig. 2. Supposed phylogenetic relationships of *Siphonodella wilberti*. Drawings are based on the photographs of holotypes and paratypes.

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New data on the Neogene sponge fauna from the Atlanto-Mediterranean seaway

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Sponges (Porifera) are a diverse group of early-diverging metazoans that originated more than 535 million years ago (Antcliffe et al. 2014). Their evolutionary history is commonly tracked through the record of their skeletal elements, called spicules, that tend to be preserved in extraordinary abundance and quality, and provides crucial information with respect to the sponge taxonomy, ecology, and environmental preferences (Łukowiak 2020). Here, we report a new and unique assemblage of isolated sponge spicules from the upper Miocene of southwestern Spain. The material is significant because it was unearthed from a former corridor between the Mediterranean and the Atlantic Ocean. It documents a rich sponge fauna that consisted of members of "soft" and "lithistid" demosponges and hexactinellids. Demosponges are represented by at least thirty-four taxa, while hexactinellids are significantly rarer; only six taxa have been identified (Fig. 1). From among eighteen taxa recognized to the species level, at least nine seem to be inhabiting this area to these days; six are recorded from adjacent areas, such as Western Mediterranean, South European Atlantic Shelf, and the Azores, and three are present in the Red Sea and/or the Northern Atlantic (de Voogd et al. 2023). This shows that the sponge fauna has been unexpectedly stable in this part of the world during the last eleven million years.

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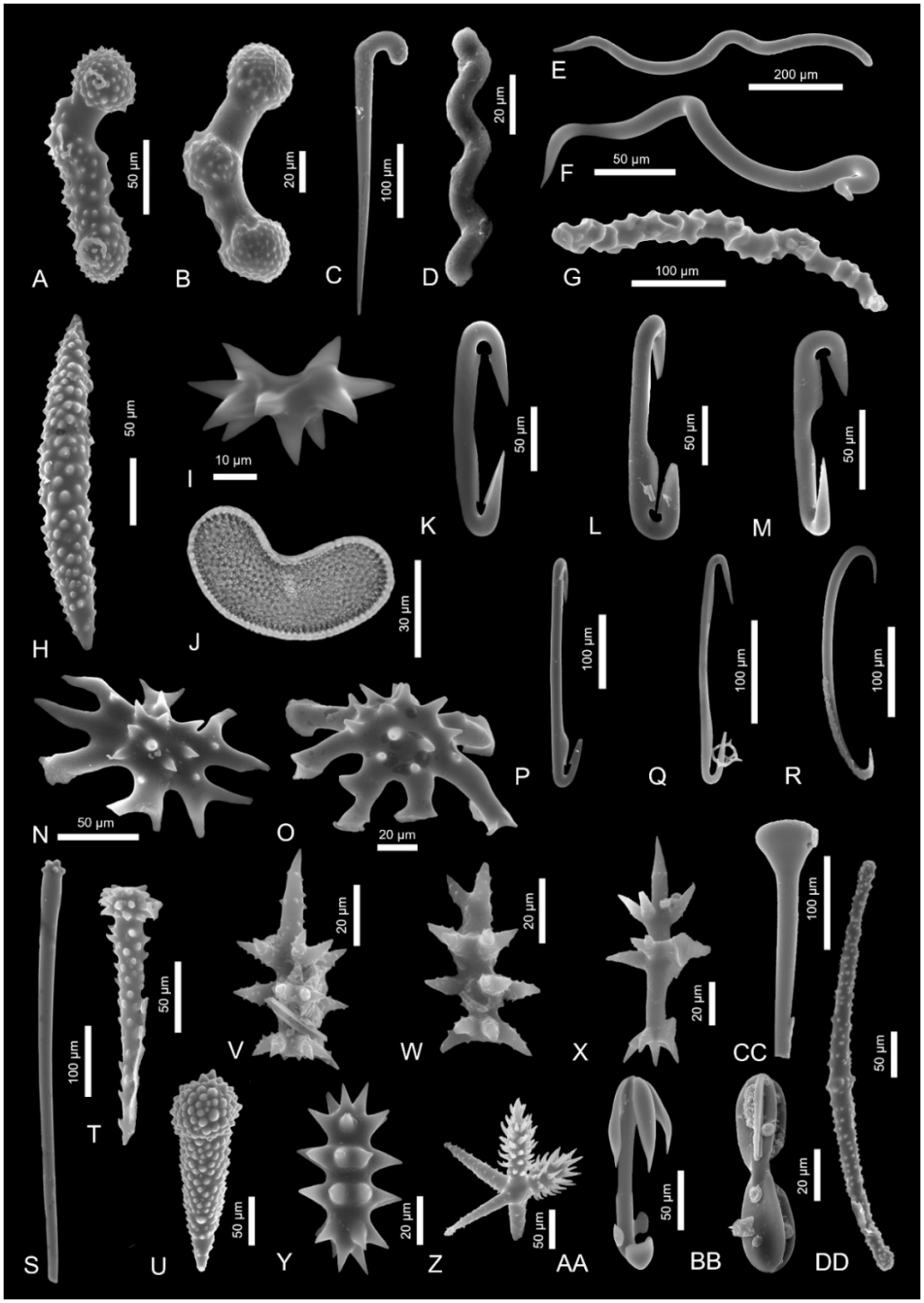

Fig. 1. Selected sponge spicules of the late Miocene of the Guadalquivir Basin. A, B. Acanthostyles of *Plocamione dirrhopalina*; C. Styles of *Rhabderemia* sp.; D. Spiral strongyle of *Spiroxya* sp.; E. Wavy diactne; F. Wavy diactne of *Bubaris subtyla*; G. Vermicular diactine of *Monocrepidium vermiculatum*; H. Acanthoxea of *Histodermella* cf. *ingolfi*; I. Diplaster of *Diplastrella* sp.; J. Selenaster of *Placospongia decorticans* (transmitted light); K, L. Diancistras of *Hamacantha* (*H.*) *johnsoni*; M. Diancistra of ?*Hamacantha* (*Hamacantha*) *lundbecki*; N. O. Spicules of *Crambe* cf. *tuberosa*; P, Q. Diancistra of ?*Hamacantha* (*Vomerula*) *papillata*; R. Sigma of unknown sponge; S, T. Spicules of *Discorhabdella tuberosocapitata*; U. Acanthotylostyle of *Discorhabdella* sp.; V, W. Aciculospinorhabds of Poecilosclerida indet 1; X, Aciculorhabd of Poecilosclerida indet. 2; Y. Spiny strongyle of *Sceptrella* cf. *biannulata*; Z. Anisochelae of *Mycale* (*Mycale*) *grandis*; AA. Pinule of Rossellidae or Euretidae; BB. Placochela of *Eucheliplumа pristina*; CC, Club-shaped spicule of *M.* (*Rhaphidotheca*) *marshallhalli*; DD. Diactine of Hexactinellida indet.

Rhizoliths from the Namurian Wałbrzych Formation in the Intra-Sudetic Basin (SW Poland)

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The Intra-Sudetic Basin is a large Variscan intramontane basin located in the Central Sudetes. It is filled with the Carboniferous–Permian volcano-sedimentary rocks, which are overlain by the Lower Triassic and Upper Cretaceous strata (e.g., Awdankiewicz et al., 2003). The geological recognition of the Carboniferous rocks from the Intra-Sudetic Basin is really good and the coal-bearing Wałbrzych Formation is one of the best known lithostratigraphic units in this basin. In the Wałbrzych Formation first rhizoliths have been discovered.

Rhizoliths are organosedimentary trace fossils produced by roots. Klappa (1980) used the term rhizoliths to include tubular voids remaining from decayed roots, sediment and/or cement-filled root voids, cemented sediment surrounding tubular voids (root casts), mineral concretions around living or dead roots and root petrification where root organic material has been replaced by minerals (Cramer and Hawkins, 2009). First descriptions of cylindrical concretions around living or decaying roots are known from the beginning of 20th century (Todd, 1903; Barrel, 1913; Kindle, 1925; vide Genise et al., 2011). But first full description of rhizoliths and their classification was presented by Klappa (1980). They appeared in the fossil record in the Devonian (e.g., Wang et al., 2019; Alekseeva, 2020). Rhizoliths were often described from the Pennsylvanian to the Recent from many sites (e.g.,Wright et al., 1995; Rankey and Farr, 1997; Rodríguez-Aranda and Calvo, 1998; Kraus, 2006; Mancuso, 2009; Gocke et al., 2011; Da Silva et al., 2019).

Macromorphology analyses of the Pennsylvanian rhizoliths were described by several authors (Loope, 1988; Rankey and Farr, 1997; Hembree et al., 2011), while Da Silva et al. (2019) presented physico-chemical characterization results of the Upper Carboniferous root fossils.

The aim of the paper is to describe first rhizoliths from the Sudetes. Some authors mentioned root fossils in the Carboniferous of Intra-Sudetic Basin (e.g., Nemec, 1984), but not described them.

In the Wałbrzych formation the rhizoliths were found in the grey medium to fine-grained sandstones in the Wałbrzych basin near the Chełmiec Mountain. For the research 4 polished cuts and 2 longitudinal petrographic cuts and 3 transverse petrographic cuts of the found structures were made. A Nikon stereoscopic zoom microscope (SMZ1500) and Nikon Optiphot2 with camera were used to study and photograph the rhizoliths.

The most abundant forms of studied rhizolits are root casts. The rhizoliths are 2-4 cm long and are commonly oval in cross-section and cylindrical in shape. Rhizoliths are oriented vertically in relation to the layers. The presence of rhizoliths and Stigmaria confirms the presence of fossil soils in the profile, which was also mentioned by Nemec (1984).

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Insights into the phylogenetic relationships of European ornithischian dinosaurs

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Ornithischian dinosaurs were a diverse and globally distributed clade of archosaurs and represented a dominant group of Mesozoic high-fiber herbivores. The first ornithischians originated in the Late Triassic or the earliest Jurassic, while their last representatives died out during the end-Cretaceous extinction event (Madzia et al., 2021). However, despite that ornithischians are being thoroughly researched, from a phylogenetic perspective they still remain surprisingly poorly known. Recent studies that have attempted to resolve their interrelationships provided substantially different tree topologies; especially near the root of Neornithischia. Here, I present the results of multiple phylogenetic analyses based on revised datasets that are focused especially on early-diverging neornithischians, including early ornithopods and marginocephalians, and comprise a broader specter of European taxa. In contrast to some recently inferred phylogenies, heterodontosaurids are again reconstructed near the base of Ornithischia (*contra* Dieudonné et al., 2021) and the 'diverse Thescelosauridae' (Boyd, 2015; Madzia et al., 2018) forms a grade of rootward ornithopods. The analyses further support the European clade Rhabdodontidae to have a possible southern Gondwanan origin and the obscure German taxon *Stenopelix* as a chaoyangosaurid ceratopsian. Despite that these results are still subject to further thorough investigations, it appears that some long-proposed hypotheses of the ornithischian phylogenetic relationships may already be considered 'sealed', while some topologies inferred in recent years for early neornithischians are increasingly less likely.

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Lorica ultrastructure of hyaline calpionellids from the Jurassic / Cretaceous boundary

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Tiny calpionellid lorica were believed to be formed of hyaline organic substance, 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, and its very early transformation into calcite has been indicated by another 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 of 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.

Chitinoidellid tests appearing dark in optical microscope have been supposed to be built of chitinous substance. However, the wall is little resistant against 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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Jurassic Gastropods from Štramberk in the Collection of the Regional Museum in Nový Jičín

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The processing of the paleontological collection deposited at the Museum of Novojičínsko region in Nový Jičín is part of a dissertation work dedicated to the research and detailed study of the current knowledge of Jurassic gastropods mostly from the Kotouč locality near Štramberk. So far, this group of organisms has been rather marginal in the interest of paleontologists, and the research on the fauna has mainly focused on the study of cephalopods, corals, and other groups of organisms. In the past, gastropods from Štramberk were studied in more detail by researchers such as Zittel (1868, 1873) or Remeš (1909a, b), followed by a longer period of research hiatus. More recent efforts on Štramberk gastropods have been undertaken by Lehotský (2012) and Lehotský and Škrobáková (2015). However, their investigations were limited to the collection at the Regional Museum in Olomouc.

The collection in Nový Jičín Museum has, unfortunately, remained a relatively overlooked subject, waiting for closer examination. It contains 627 fossils, which are more or less well-preserved in the form of internal molds. All fossils have been documented with detailed descriptions. Based on this documentation, they have been subsequently redetermined and systematically classified into 31 genera and 84 species. Due to their poor state of preservation, 17 fossils could not be determined.

The genus Cerithium emerged as the most abundant with 121 described individuals. Further division of Cerithium resulted in 14 species, with Cerithium crenatocinctum (21 specimens), C. nodosostriatum (16 specimens), C. collegiale (15 specimens), and C. confracter (14 specimens) being the most numerous. The second most abundant genus was Tylostoma with 81 specimens, within which the species T. ponderosum (34 specimens) and T. subpupoides (28 specimens) were the most common. The third most represented genus was Pleurotomaria with 61 specimens, with a notable dominance of Pleurotomaria multiformis (43 specimens).

Unfortunately, the classification of Jurassic gastropods is presently outdated and incomplete, relying heavily on incomplete classification schemes that no longer align with modern classification methodologies. One of the objectives of the dissertation work is, therefore, to create an overview and map the knowledge about individual genera and species of Jurassic gastropods from this rich locality. It's important to note that the collection held in Nový Jičín represent only a fraction of the total fossil material available, which will be the subject of further study.

The described organisms are primarily considered representatives of epifauna from a paleoecological perspective. However, there are also instances of infauna among them, such as some members of the Naticidae family. These organisms encompass genera that inhabit rocky substrates, like the Trochus genus, as well as genera that favor softer substrates, such as the Natica genus. These mollusks are commonly found in the coastal regions of shallow, warm, and sometimes even tropical seas.

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Paleoecological and paleobiological interpretations of the C and O stable isotope signatures of the fossil bones and carbonates from the Lower Permian Letovice Formation (Boskovice Basin, Czech Republic)

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An analysed material comes from the northern part of the Boskovice Basin from the Letovice Formation (Asselian after Opluštil et al., 2017), specifically from its Lower Letovice Member (Lubě, Zbraslavec, Malá Lhota, Kladoruby) and Middle Letovice Member (Kochov, Bačov, Obora, Míchov). The investigated fossil bones (bioapatite) comes from paleoniscid fish (scales), acanthodians (scales and fin spines), and amphibians (cranial and postcranial skeleton of discosauriscids and temnospondyls). The C and O stable isotopes of the bioapatite are carried out for the first time in the Boskovice Basin. Clean bioapatites without diagenetic impurities [calcite, Fe and Mn oxides - using a cleaning protocol for clay minerals (Jackson, 1975)] were analysed for the C and O isotope composition of the carbonate ($\delta^{18}O_{APCO3}$, $\delta^{13}C_{APCO3}$) and phosphate ($\delta^{18}O_{APPO4}$) components of the bioapatite. Moreover, we supplemented these analyses by stable isotope analysis of organic C ($\delta^{13}C_{ORG}$) from carbonised organic matter (plants, animals, bitumen from rocks, and in some cases from bioapatites) and C and O isotopes of carbonates ($\delta^{18}O_{CARB}$, $\delta^{13}C_{CARB}$) from the fossiliferous layers. Based on the $\delta^{18}O_{APPO4}$ signatures of the bioapatites together with the support of the $\delta^{18}O_{CARB}$ and $\delta^{13}C_{CARB}$ signatures of the carbonates, we have proven different demands on hydrological lake regimes between studied amphibian taxa from Lower and Middle Letovice Member. The $\delta^{13}C_{APCO3}$ signatures indicate the presence of both carnivorous and herbivorous vertebrates and support previous hypotheses regarding the feeding habits of the studied taxa. In

contrast, $\delta^{13}C_{ORG}$ signatures from carbonised specimens appear to be diagenetically or microbially altered and thus, they may be likely not suitable for interpreting trophic relationships.

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Jurassic Flora and Palaeoecology of the Kamala Formation (Kansk-Achinsk coal basin), Central Siberia

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The Kansk-Achinsk Basin is one of the biggest reserves of brown coal in Russia. Jurassic coal-containing terrestrial deposits bearing plant remains crop out in several localities. This work is focused on five localities of the Kansk Basin of the Middle Jurassic Kamala Formation within the Rybinskaya Formational Zone containing fossil plants. The studied material comprises 30 plant morphospecies. They are assigned to: pteridophytes *Equisetites*, *Coniopteris, Cladophlebis and Raphaelia*, Bennettitales *Pterophyllum*, Ginkgoales (*Ginkgo*, *Sphenobaiera* and *Eretmophyllum*), Czekanowskiales (*Czekanowskia* and *Phoenicopsis*), Coniferales (*Pityophyllum*). There are several plant remains of uncertain systematic position such as roots (*Redicites* sp.), cones (*Equisetostachys* sp.) and fossil wood. Palaeoecological analysis identified three palaeoenvironments (facies): periodically flooded alluvial plain dominated by *Czekanowskia-Phenicopsis*, swamp-semiaquatic dominated by *Equisetites, Coniopteris, Cladophlebis, Phenicopsis* and slope and upland vegetation dominated by *Sphenobaiera, Ginkgo, Eretmophyllum, Pityophyllum*.

Palaeoclimatological conditions of the studied area are reconstructed as warm temperate climate with seasonal temperature variations.

Presence such index-species of flora as *Coniopteric maakiana*, in association with *Phoenicopsis markovitchae* and *Czekanovskia kanensis* indicate Early-Middle Jurassic age. Absence of typical for Jurassic Siberian flora *Podozamites* leaves among the plant remains presumabely demonstrate semi-isolated sedimentory basin for species invation. The composition of the plant-bearing Kamala Formation allows us to conclude that the deciduous vegetation was growing in a temperate climate with annual fluctuations in temperature.

Geochemical composition and ultrastructure of chitinoidellid and calpionellid tests at high stratigraphic resolution in pelagic deposits across the Tithonian/Berriasian boundary

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During the Mesozoic, the locus of carbonate production has moved from shallow to deep-sea environments. During the Tithonia-Berriasian transition, the role of climatic and oceanographic factors in changes in abundance, diversity and ultrastructure of calcareous microplankton remains poorly known. For example, the cooling during the Tithonian followed by warming across the J/C boundary was detected in pelagic sections (Tremolada et al., 2006). The ultrastructure and biomineralization pathways that characterize the formation of microgranular chitinoidellids and bi-layered semichitinoidellids loricae remain disputed. The stratigraphic transition between chitinoidellids and calpionellids, represented by the two-layered praecalpionellids (*Praetintinnopsella* and *Semichitinoidella*) has not yet been evaluated under the scanning electron microscopy (SEM). Firstly, it is not clear whether calcite crystals in microgranular loricae were agglutinated or whether they were directly segregated by cells. Secondly, the basic ultrastructure of semichitinoidellids has not been documented until now. Thirdly it is not known what environmental causes led to the replacement of the microgranular by hyaline loricae during Tithonian.

Our aim is (1) to quantify concentrations of magnesium and other elements using the electron microprobe analyses (EMPA) to examine stratigraphic changes in Mg that can reflect changes in seawater temperature and (2) to assess ultrastructure of chitinoidellid and calpionelid tests using the SEM and back-scattered electrons (BSE). The measurements are compared with the δ18O observations in Tithonian-Berriasian samples from the same section (Michalík et al. 2009; Michalík et al. 2016; Grabowski et al. 2019).

The analysed samples were collected from the transition from Czorsztyn (Kimmeridgian-Lower Tithonian) and Pieniny formations (Upper Tithonian-Berriasian) in the Tithonian and Berriasian deposits at Brodno and Snežnica section (Pieniny Klippen Belt). The concentrations of Ca, Mg, Mn, Fe, S and Sr were measured in micrite, in loricae and in lorica interiors. The ultrastructure of chitinoidellid and calpionellid tests (genera *Chitinoidella*, *Praetintinnopsella*, *Crassicollaria* and *Calpionella*) was examined by scanning electron microscope (SEM).

At each stratigraphic level, we measured element concentrations in four different calpionellid tests. Stratigraphic trends in micrite in Mg and Sr concentrations and loricae show that lorica Mg concentrations remain relatively constant and sediment Mg concentrations ~~(lower on average (~ 500~~ show a slight decrease in the Berriasian part of the succession. Towards the top of the section, the micrite Sr concentrations increase, while Sr concentrations of loricae remain constant. The consistent differences in the chemical composition of the loricae and micrite may indicate that diagenesis did not reset the composition of the loricae.

The BSE revealed that the chitinoidellids have a microgranular layer (about 5 μm thick) that is composed of angular needles or platelets of low-Mg calcite (consistently < 1 μm). Larger rhombohedral crystals of diagenetic origin are often scattered in this layer and replace the original network formed by needles. The SEM shows that the microgranular layer in chitinoidellids is enveloped by a thin (2-3 μm thick) outer hyaline layer formed by blade-like crystal prisms. This type of test can be assigned to semichitinoidellids, as described by Nowak (1978). Electron microprobe maps of chitinoidellids cross-sections indicate that 1) Mg content in the microgranular layer does not differ from Mg concentrations in the matrix, 2) the microgranular and outer layer are enriched in sulfur, in contrast to the micritic matrix, which is poor in sulphur. Under the optical microscope, praetintinnopsellid loricae are formed by a hyaline layer, which is surrounded by a dark rim of unknown structure. BSE images show that the hyaline layer is very thin (less than 2-3 μm) and is formed by of densely packed equidimensional crystals that are 1 μm in size (thus exceeding the size of acicular crystals in *Chitinoidella*). BSE and SEM images indicate that the dark rim (visible under the optical microscope) is probably an organic lining. The BSE imagines show that the calpionellid lorica is formed only by the hyaline layer, as documented in former studies. Based on SEM, this layer consists of prisms of fibrous or bladed crystals that are oriented perpendicularly relative to the wall surface.

The preliminary analyses indicate that 1) based on analyses from the Mg concentration, the composition of the lorica remained remarkably constant, while the Mg concentration of the matrix decreased slightly, and the different composition of the lorica suggests a lack of diagenetic resetting and 2) that the particles in the microgranular layer are agglutinated, i.e., they are formed by nannoplankton plates which would need to be further research.

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Early Cretaceous radiation of teleosts recorded by the otolith-based ichthyofauna from the Valanginian of Wąwał, central Poland

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We report a Valanginian (Early Cretaceous) otolith-based ichthyofauna from a section at Wąwał in central Poland. We describe one new genus (*Palaeoargentina* gen. nov.), six new otolith-based species (*Pteralbula polonica* sp. nov., *Protalbula pentangularis* sp. nov., *Kokenichthys kuteki* sp. nov., *Protoelops gracilis* sp. nov., *Palaeoargentina plicata* sp. nov., *Archaeotolithus aptychoides* sp. nov.) from Wąwał and compare them to species known from similar assemblages elsewhere. The comparison of teleost diversity shows similarity to the Aptian (late Early Cretaceous) and less distinctly to the Maastrichtian (latest Cretaceous) assemblages, rather than to its coeval equivalents from Germany and southern England and indicates that a considerable teleost diversity already existed before the mid-Cretaceous. The vertical succession of otolith taxa in the Wąwał section is in concordance to the pattern already revealed from the succession of bivalves and other benthic invertebrates and it is attributed to sea level and temperature variations. Previously identified causes of benthic invertebrate succession in the Wąwał section are used to infer paleoenvironmental factors governing fish distribution in the Valanginian marine environment recorded at this site. The new findings suggest that the radiation of teleosts started before the Valanginian, and it was a relatively long and apparently gradual process. This fossil association also reveals a significant shift in the abundance ratio of fish otoliths vs. cephalopod statoliths in fully marine deposits, with otoliths much more abundant than the statoliths in Valanginian and younger sediments while it is otherwise in the Jurassic deposits.

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Eocene phymaraphiniids (Demospongiae) from Southwest Australia: filling the gap

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The first report and descriptions of sponges from the upper Eocene rocks of SW Australia were by Chapman and Crespin (1934) and Laubenfels (1953), however their determinations and attributions to families and genera were mostly wrong. The new very rich material, collected by us, has very well-preserved spicules, showing that some specimens attributed by the above authors to such Cretaceous genera as *Thamnospongia* or *Stachyspongia*, and *Discodermia* have triders (and not tetraclones or rhizoclones, respectively) as desmas. In result, we transferred those sponges to the family Phymaraphiniidae that is characterized by triders, and propose for them two new genera, *Twertupia* and *Pickettispongia*. This is the first record of bodily preserved phymaraphiniid sponges from Eocene rocks, as well as from the southern hemisphere. Reported occurrence is filling the stratigraphical gap between well-known Cretaceous phymaraphiniids from Europe and extant phymaraphiniids, as well as geographical gap (Cretaceous of Europe and Eocene of Australia).
The scope of extant phymaraphiniids and their present-day and fossil occurrences are discussed leading to conclusion that the observed pattern of their occurrence is a relict, most probably, of much wider Mesozoic Tethyan distribution, feature present also among other groups of marine invertebrates.

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Computed tomography of small vertebrate fossils from Miedary (Middle Triassic, Poland)

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Computed tomography (CT) is a method of non-invasive imaging of fossils widely used in paleontology. It allows visualization of the morphology or anatomy of examined specimens without interfering with their structure. This method is particularly promising in the case of small vertebrate fossils embedded in the rock matrix.

The paleontological site in Miedary exposes a vertebrate-bearing layer composed of variegated quartz-glauconitic clastics of the Middle Triassic (Ladinian) age. The fossil fauna of the glauconite beds is dominated by large aquatic predators (*Nothosaurus, Tanystropheus)* and fish (*Gyrolepis, Serrolepis*). Small vertebrate fossils occur mainly in two lithofacies within the glauconite beds: the greenish quartz sandstone rich in the glauconite, and the reddish quartz mudstone with a low glauconite content. The precise taxonomic composition of this assemblage remains largely unknown. Among the preliminary recognized taxa are procolophonid reptiles and teleosteomorph fish.

The aim of the current project is the preliminary investigation of the small vertebrates from Miedary using the CT. The first step is to determine which lithofacies represent a better mode of preservation and contrast for the CT-scanning purposes. A similar case to Miedary is the well-studied fossil site in Vellberg (southern Germany). Both localities represent similar ages, sedimentological settings, and both are located within the same depositional basin.

The CT-scanning of small vertebrate remains from Vellberg revealed new reptile taxa like *Vellbergia* (Sobral et al., 2020) and *Stauromatodon* (Sobral et al., 2021). Hence, the obtained 3D models of the fossils from the Miedary site will likely lead to the further improvement in the understanding of the Middle Triassic ecosystems.

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Tracing of greenhouse to icehouse transition in Eocene-Oligocene sequences of the Central-Carpathian Paleogene basin (Istebné section, Orava)

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A high-quality reference section near Istebné in Orava region has been studied in purpose to define the Eocene/Oligocene boundary. The lower part of the Istebné section dominates by non-calcareous claystones with deep-water agglutinated foraminifera. Their middle Eocene age is constrained by the presence of *Ammodiscus latus* (cf. Waśkowska & Kaminski, 2012). Plankton-rich hemipelagic intervals contain foraminiferal species *Hantkenina alabamensis,* which last occurrences marked the E/O boundary (cf. Coccioni 1988). Moreover, the boundary tuffite beds correspond to "Tuff 25" dated around 32,8 – 34.6 Ma in the Carpathians (cf. Van Couvering et al. 1981).

Above the E/O boundary, the sequence considerably changes in productivity and dwarfing of planktonic foraminifera. Beside of rich small-sized forms of *Globigerina*, *Tenuitella* and *Chiloguembelina,* a new species of *Dentoglobigerina* (*D. tapuriensis*), *Turborotalia* (*T. ampliapertura*) and *Paragloborotalia* became to appear. Since the E/O boundary, the agglutinated foraminifers were significantly impoverished in responce of the Oligocene climatic cooling (cf. Ortiz, & Kaminski & 2012).

The E/O boundary is also indicated by calcareous nannofossils. This boundary is predated by first appearance of *Isthmolithus recurvus* in the NP19/20 zone and characterized by co-occurence of *Lanternithus minutus* a *Zygrhablithus bijugatus* (Nyerges et al., 2021). The base of the Rupelian is marked by nannofossils of the NP 22 zone, like species *Helicosphaera bipuncta* and *H. recta*, and appearance of *Reticulofenestra ornata* in the NP 23 zone. The climatic index taxa of the calcareous nannoplankton imply a decrease of species with warmer preferences (e.g., *S. moriformis*) to species with colder preferences (e.g *Z. bijugatus, L. minutus*).

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Boundary events, biotic changes and environmental responces across Late Cretaceous to Paleocene pelagic sequence of the Žilina core section, Slovakia

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Žilina core section reveals a number of biotic and paleoenvironmental events from the end-Cretaceous to the Paleocene/Eocene boundary.

- The K-Pg event is recorded by abrupt change in planktonic biota and magnetic properties. The abrupt change after extinction of Late Maastrichtian large rugose forms towards blooming and dwarfing of *Guembelitria* and small-sized forms of early Paleocene species, implies swift excessive biotic stress and environmental instability. The lowermost beds of the Danian are enriched in organic matter, densely bioturbated and reworked, implying eutrophic and cooler conditions.
- The Dan-C2 hyperthermal event, preceded by minor Hg spike, is evidenced in ZA-1 section by *Parasubbotina* acme, high benthic productivity, enhanced terrigenous input and nutrients, and oxygen deficiency (cf. Jehle et al. 2015).
- Transient warming during the LDE-2 led to water-column stratification and appearance of *Morozovella angulata* and *Fasciculithus spp.*, being followed by diversification of morozovellid and igorinid species during the Selandian (e.g., *M. occulsa*, *I. albeari*). This trend changes in *Subbotina*- and *Globanomalina*-rich interval, which reveals a high-rate productivity and preference of deep-dwelling habitats during the mid-Paleocene biotic event (MPBE – Bernaola et al. 2007).
- A favourable condition was recovered in the Thanetian sequence, which markedly increases in abundance of large-sized, diversified and heavily calcified morozovellid and igorinid foraminifers (e. g. *M. velascoensis*, *I. tadjikistanensis*). Microfauna of ornate morozovellid species (*marginodentata – gracilis* group) in the topmost sequences of the Žilina section implies $CaCO_3$ dissolution and environmental stress conditions related to the Paleocene-Eocene thermal maximum (PETM).

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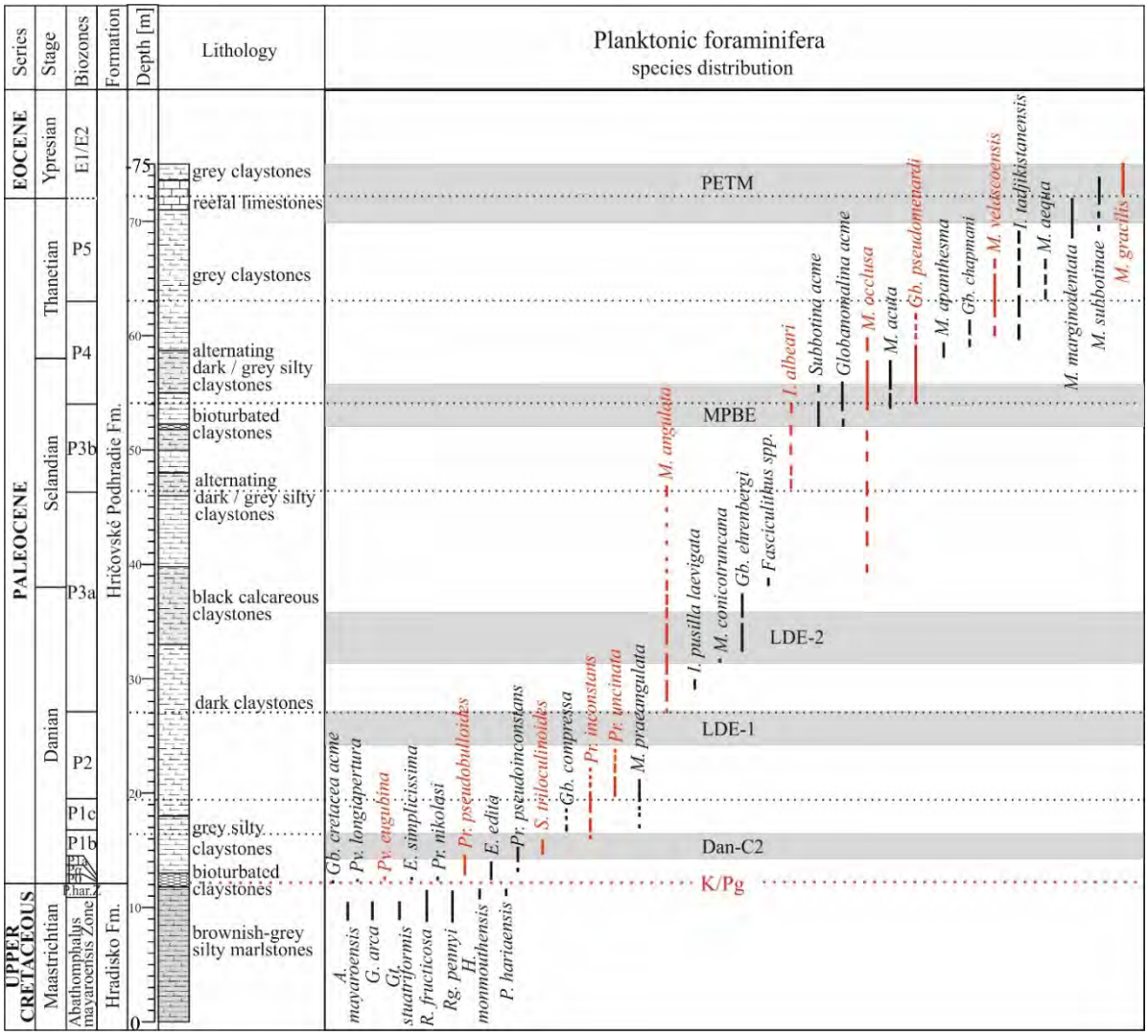

Fig. 1 High-resolution biostratigraphy of the Žilina section based on lowest and highest occurrences of index species of the planktonic foraminifera, their range zones, acme zones, biohorizons and another datum events.

Palaeoecological and palaeobatymetric evaluation of the Miocene ichthyofauna from the Ochoz-Skalka locality (Moravian Karst)

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The evaluation of the species composition of fossil fishes serves not only to understand the palaeobiogeographic evolution of fish fauna but is also an effective tool to assess the palaeoecological and palaeobathymetric conditions of the closest surroundings of the study area. Fish from the Baden sediments of the Carpathian Foredeep, mainly documented by the findings of otoliths, are only rarely represented by well-preserved osteological remains suitable for the study (Přikryl and Carnevale 2018; Schultz 2003; Gregorová et al. 2020).

The material was obtained from the Neogene filling of the karstic fissure, which provided unique findings of disarticulated remains of the Badenian fish fauna. Based on taxonomically important cranial elements (premaxilla, dentale), a relatively diversified fish community was identified including orders Spariformes, Lutjaniformes, Labriformes, Carangaria incearte sedis and Gadiformes, and in total 6 families: Sparidae *[Diplodus* cf. *capensis* (SMITH, 1844), cf. *Pagellus* sp., cf. *Pagrus* sp.], Haemulidae (*Pomadasys* sp., cf. *Pomadasys* sp.), Labridae (Labridae gen. et sp. indet.); Lotidae [*Brosme brosme* (ASCANIUS, 1772), *Ciliata mustela* (LINNAEUS, 1758)], Gadidae (Gadidae gen et sp. indet.) and Latidae (*Lates* sp.). Palaeoecological analyses have revealed the marine (all taxa without *Lates* sp.) or brackish (e.g. *Pagrus* sp., *Lates* sp.) environment, with dominance of benthopelagic species (e.g. *Diplodus* cf. *capensis*, *Pomadasys* sp.) accounting for up to 70% of all taxa, with absence of pelagic taxa. Palaeobathymetric analysis indicate a community corresponding to the shallow water environment up to 200 m deep. *Brosme brosme* is the only species which exceeds significantly this limit extending the mesopelagic zone up to depth of 1000 m.

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Lower Telychian species of *Parapetalolithus* from *linnaei*, *turriculatus* and *crispus* biozones in the Prague Synform: taxonomy in the light of astogeny and intraspecific variability

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The topic of this study are the development series and morphological variability of graptolites belong genus *Parapetalolithus*, which are found in the Litohlavy Formation of the Prague Synform. The species *P. palmeus* and *P. hispanicus* divide the *linnaei* biozone (base of the Telychian stage) into the eponymous *palmeus* and *hispanicus* subzones.

However, the morphological variability of genus *Parapetalolithus* is so hight that it has caused their excessive division into separate species or even subspecies.

Based on biometric measurements and subsequent revision, several species and subspecies are newly synonymized and the following 6 species are identified (in comparison with the original 9 species and subspecies): *P. ovatus, P. elongatus, P. hispanicus, P. palmeus*, *P. altissimus and P. tenuis*.

The key topic of this study is the developmental series of selected species of genus *Parapetalolithus* and their morphological variability during astogenesis, which has a significant impact on their systematic classification.

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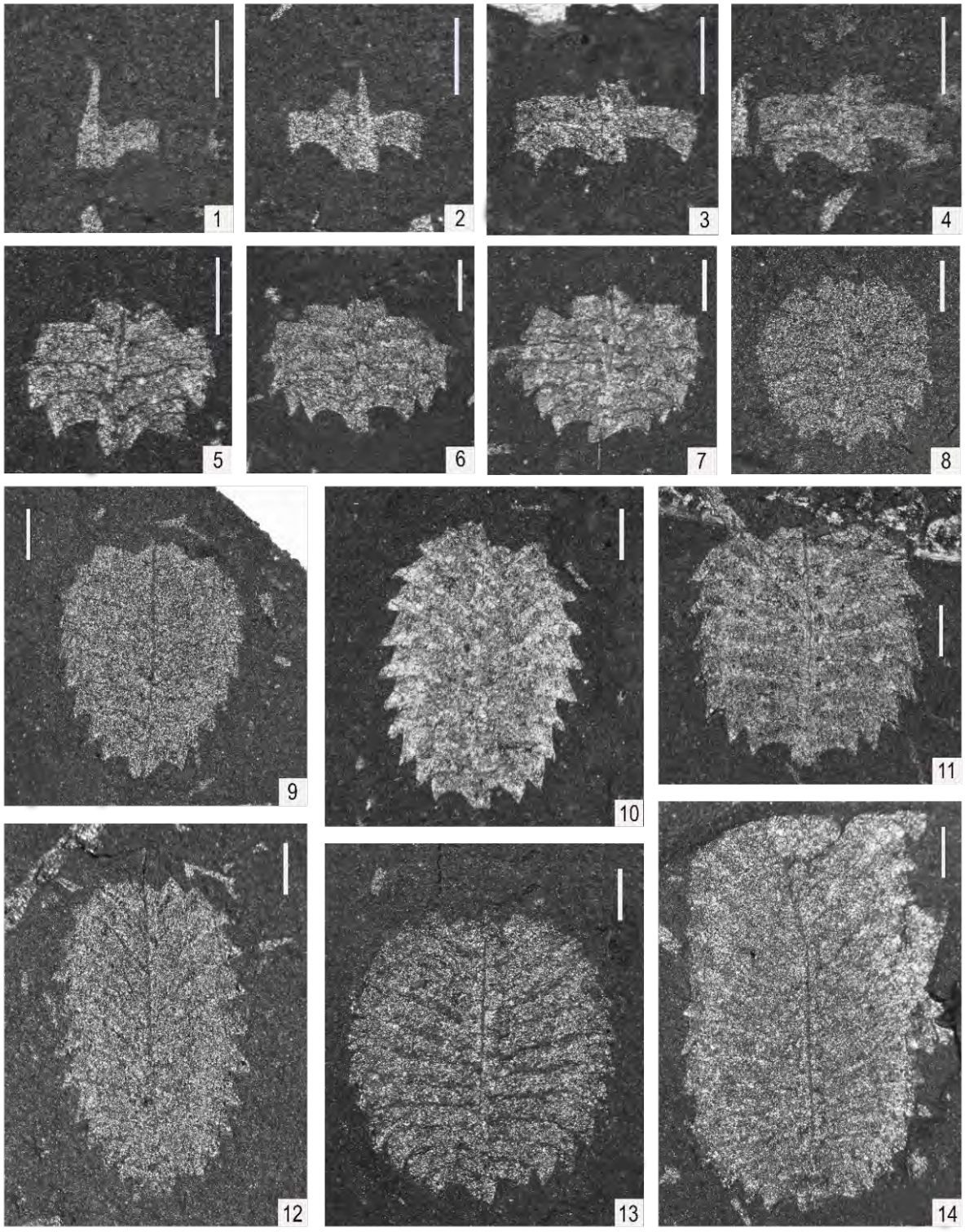

Fig. 1. The developmental series of the species *Parapetalolithus ovatus* from the juvenile stage (fig. 1-5) to the adult stage. Scale shows 1 mm.

Terrestrial paleoenvironments during the deposition of the Peruc-Korycany Formation

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Fluvial to shallow-marine deposits are exposed in many boreholes as well as quarries and nature exposures. Some places were studied in detail, i.e., Pecínov quarry, W of Prague. It provided major frame for multidisciplinary studies combining sedimentology, palaeobotany, palynology and geochemistry. These studies provided new insight into the relationship between Cenomanian Floras, paleoclimate and regional paleogeographic view into changing conditions during the Cenomanian transgression.

Five major paleoenvironments were distinguished based on the studies of micro- and macroflora of more than 20 localities:

Salt marsh environment

This type of vegetation is influenced by the sea, i.e., frequent tidal conditions what could damage it through the higher amount of salt water. From the palynological point of view prevailing are the gymnosperm pollen *Classopollis classoides*, produced by the *Frenelopsis alata* (Konzalová, Hluštík, 1976). Some monocolpate angiosperm pollen *Clavatipollenites,* small reticulate tricolpate *Retitricolpites,* gymnosperm pollen *Cycadopites, Monosulcites* appear while bisaccate pollen are rare. Marine microplankton is rare, dinoflagellate cysts are broken, some foraminiferal linings and acritarchs are found as well as non-marine green algae (*Tetraporina, Chomotriletes*). Most common plant macrofossils are the cheirolepidiaceous *Frenelopsis alata,* ginkgophytes *Nehvizdya bipartita,* angiosperm *"Diospyros" cretacea.* We can observe such palynomorphs in Pecínov, Unit 3a, Praha-Hloubětín, borehole Veselí u Přelouče.

Freshwater, wetland associations

a) Braided river flood plain association – sporomorph assemblage is dominated by a well-preserved angiosperm pollen, dicotyledonous small tricolpate reticulate forms *Retitricolpites,* periporate *Bohemiperiporis zaklinskai,* psilate tricolporate *Perucipollis minutus,* as well monocolpate *Liliacidites.* Spores consist of the Gleicheniaceae and Cyatheaceae. Lauroid angiosperms (*Mauldinia bohemica, Pragocladus lauroides*), Gleicheniaceae ferns and cycads *Nilssonia holyi* appear. (Pecínov U1, Brník).
b) Meandering river flood plain association – high percentage of angiosperm pollen, prevailing reticulate tricolpate and tricolporate types, monosulcate pollen of

Clavatipollenites minutus, C. hughesii, related to the Chloranthaceae family, first triporate pollen of *Complexiopollis vulgaris* appears. Pteridophyte spores consist of thick-walled types, i.e, *Cicatricosisporites, Camarozonosporites,* conifers represent by the Pinaceae, less observable are Taxodiaceae, rare *Sequoiapollenites*. Platanoid angiosperms (*Ettingshausenia bohemica*), lauroid (*Myrtoidea geinitzii*) in understorey hosting lycopods (*Selaginella cretacea*), ferns (*Cladophlebis frigida*, *Protopteris punctata*) and cycads (*Microzamia gibba, Jirusia jirusii*) (Vyšehořovice, Horoušany)

c) Coastal swamp association – sporomorph assemblage is dominated by gymnosperms of Cycadaceae family and prevailing pteridophyte spores of Gleicheniaceae. Angiosperm pollen are less frequent, some non-marine algae *Tetraporina, Schizosporis* occur. Cupressoid conifers (*Cunninghamites lignitum, Quasisequoia crispa, Elatocladus velenovskii*) with lycopods and ferns in understorey. (Praha-Hloubětín Hutě)

Upland plant association – sporomorphs assemblage is dominated by spores of Gleicheniaceae, (*Gleicheniidites senonicus, G. lamontensis, Clavifera triplex, Clavifera rudis*), gymnosperm pollen *Cycadopites,* angiosperm pollen, thick-walled *Tricolpites barrandei,* small tricolpate about 10um *Tricolpites parvulus.* Non-marine green algae occur. Ferns prevail (*Konijnenburgia*), cycads (*Pseudoctenis pecinovensis, Nilssonia mirovanae*), bennettits (*Cycadeoidea, Zamites bayeri*), Caytoniales (*Sagenopteris variabilis*) and araucarioid conifers (*Dammarophyllum striatum, Brachyphyllum squamosum*). Shruby angiosperms were particularly common on slopes of the rivers *Araliphyllum dentiferum, Debeya coriacea, Dicotophyllum labutae*. (Praha-Malá Chuchle, Pecínov)

Analysis of microstructures in trilobite exoskeletons (Prague Basin, Barrandian area): preliminary results

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Trilobites are a highly diverse and worldwide distributed group of marine arthropods with a rich fossil record from Cambrian to Permian. As a common component of vagrant benthos, trilobites are important for regional stratigraphy as well as for global correlation, paleoecological studies and paleogeographical reconstructions in the Lower Paleozoic.

Despite intensive studies of trilobites, the microanatomy and composition of their exoskeleton remain comparatively poorly known. Particularly the general subdivision of the exoskeleton, homology of individual structures with extant arthropods, effect of diagenesis and variability between different taxa are still understudied.

Diverse methods, like microscopy of thin sections, observation of external and internal exoskeletal surfaces or study of broken samples have been used for study of trilobite exoskeletons. However, one of the most successful methods has been etching of oriented thin sections with ethylendiamintetraacetic acid (EDTA). This method uses different resistance to etching of individual layers and other structures of the trilobite exoskeleton and allows observation of tiny details using scanning electron microscopy. This method was used to study trilobite exoskeletons by several authors, but it was never applied on material from the Barrandian area.

The presented research is focussed on the application of above mentioned methods in study of Silurian and Devonian trilobites from carbonate rocks of the Prague Basin, including evaluation of preservational potential of trilobite exoskeletons in stratigraphically diverse and lithologically varied units. Preliminary results confirm preservation of internal structures in most of studied lithologies and have shown that material from the Prague Basin has a high potential for improving the understanding of trilobite exoskeletons.

Trace fossils from shallow-water marine sediments from the locality Sandberg (Middle Miocene, Slovakia)

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The assemblage of trace fossils from the Sandberg Section is characteristic of shallow marine Upper Badenian sediments in the eastern area of the Central Paratethys. Rich paleontological research at the Upper Badenian Sandberg section reveals broad assemblages of bivalves, gastropods, sea urchins, decapods, bryozoans, red algae, calcareous nannoplankton, foraminifera, fishes, reptiles and mammals of shallow seas and coastal ecosystems. Stratigraphic data about the Sandberg Section was summarised in the work of Hyžný et al. (2012). The sedimentary transgressive succession of the Sandberg Section belongs to the Sandberg Member of the Studienka Formation (Baráth et al. 1994). Ten ichnogenera and escape structures - fugichnia are identified on the profile, which are characteristic of shallow water environments. These trace fossils indicate shallow marine environments ranging from rocky shores (*Entobia, Gastrochaenolites*) backshores (*Psilonichnus*) across foreshore to middle shoreface environments (*Macaronichnus*, *Ophiomorpha, Rosselia*, *Thalassinoides*, ?*Häntzschelina*) to lower shoreface and upper part of offshore (*Scolicia*). Trace fossil within wood substrate *Teredolithes* is also occurred. Escape structures (fugichnia) and sting ray predation traces (*Piscichnus*) are significantly associated with *Thalassinoides*. Bowel-shaped *Piscichnus* filled by gravelly sediment and biodetritical material dominated by several layers. The most visible bioturbated parts on the section contain several ten decimetres thick sandstone beds with cross lamination texture with *Scolicia* which are crossed by *Thalassinoides* and *Ophiomorpha.* The repetition of parts of the profile with such a trace fossil association can indicates the pulsating character of transgressive sedimentation cycles.

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Floristic changes in the faunal Enna and Barbara marine horizons in the Carboniferous of the Upper Silesian Basin

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Floral content of the two basin-wide faunal marine horizons is compared. The Enna Horizon from the Ostrava Formation (Serpukhovian) is composed of several separate marine bands in the roof of the Hrušov Member and reaches locally up to 200 m in thickness (Dopita et al., 1997). The Barbara Horizon in the roof of the Jaklovec Member reaches up to 90 m.

The most complete floristic data from both horizons came from the Frenštát district, where boreholes have yielded rich and diversified floral spectra. The Enna Horizon contains the last occurrences of the Viséan upland flora, which includes 54 species, in contrast to about 30 species in the Barbara Horizon (Gastaldo et al., 2009). The common feature for both horizons is scarce occurrences of lycopsids (*Lepidodendron veltheimii*). Sphenopsids are a little more common. Whorls of *Sphenophyllum tenerrimum* are irregular occurrences in the Enna and Barbara horizons. Practically, only the genus *Mesocalamites* occur in the Enna Horizon, whereas there are more representatives of the genus *Calamites* in the Barbara Horizon. Ferns (*Pecopteris aspera*) are rare in both horizons, whereas pteridosperms are common. Species of *Lyginopteris* are stratigraphically important with different species found in the Enna and Barbara horizons. The genera *Sphenopteris*, *Sphenopteridium* and *Mariopteris* belong also to the group Lyginodendrales. The group Medullosales diversify in the Barbara Horizon; whereas *Alethopteris* species are practically the same in the Enna and Barbara horizons, there are several new species of *Neuropteris* and *Neuralethopteris* in the Barbara Horizon.

The difference between peat-forming roof-shale flora and the flora from the marine horizons is the absence of lycopsids in the marine horizons and their abundance in the roof-shale flora.

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Biochronology and diversity of Miocene elephantimorphs (Proboscidea, Mammalia) in the Slovak part of the Western Carpathians

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The fossil record of Miocene mammals in Slovakia is relatively continual, except for shorter hiatuses (Sabol *et al.* 2021). However, remains of proboscideans are relatively rare.

The oldest record of elephantimorphs in Slovakia is dated to the lower Miocene (Orleanian, Ottnangian, MN4). Unfortunately, only limited material of archaic unspecified gomphothere (*Gomphotherium* sp.) is known from the Southern Slovak Basin. In the middle Miocene (Astaracian, late Badenian, MN6, Vienna and Danube basin) *Zygolophodon turicensis* is dominant species, *Gomphotherium angustidens* is less abundant. From the Sarmatian (MN7/8) only *G. angustidens* is known. The late Miocene documents a significant turnover in the proboscidean fauna. During the early Pannonian (Vallesian, MN9-?10) only *Tetralophodon longirostris* was present (East Slovakian Basin). In the Late Pannonian (Early Turolian, MN11, Danube Basin) ?*Zygolophodon* sp., *Konobelodon atticus* and tetralophodont gomphothere with a possible affinity to the genus *Anancus* (*Tetralophodon - Anancus* intermediate form by Schlesinger 1922) appeared. In the middle-late? Turolian (MN12-13?) primitive *Anancus* (*A. lehmanni*?) is abundant, sometimes in association with earliest "*Mammut*" and the last occurrence of *K. atticus* is recorded. Starting with the Pliocene, the diversity of non-elephantid proboscideans declined and only "*Mammut" borsoni* and *Anancus arvernensis* were present.

Updated overview of the biochronology and diversity of Miocene elephantimorphs well reflects general changes in the faunistic assemblages of Central Europe. The determined taxa belong to the mammutids, bunodont gomphotheres (trilophodont and tetralophodont) and amebelodontids. Compared to other parts of Central Europe, mammutids in the Slovak territory of the Western Carpathians were relatively abundant and mentioned Early Middle Turolian taxa are generally rare throughout Europe.

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Molluscs from new Lower Badenian localities in the Moravian part of the Carpathian Foredeep

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New research of molluscan fauna in the southern part of the Carpathian Foredeep in Moravia, focusing predominantly on Lower Badenian sediments in the Boskovice Furrow, brought a large number of gastropods, bivalves and scaphopods. In the past this area has been researched by f.e. Augusta a Buday (1938), Vašíček (1941) and Hladil (1976). More than 5,000 individuals of molluscs were found at the below mentioned new localities, of which more than 120 species were determined. In the studied material of molluscs two different groups can be distinguished.

The first one consists of shallow-water species with the dominant gastropods *Turritella badensis*, *Aporrhais pespelecani*, and even *Amalda glandiformis* and *Aspa marginata* at some localities, bivalves *Glycymeris pilosa deshayesi* and *Cardites partschi,* scaphopods *Gadila ventricosa* and *Fustiaria jani* and coral *Tarbelastrea reussiana*. This association was found predominantly in sandy clays with frequent fragments of sandy or algal limestones (Sebranice 2, Knínice-Kovářovice 2). The interpreted sedimentation depth for this group was probably up to 50 m.

The second group consists of deep-water species with the dominant gastropods *Turritella spirata* and *Ancillaria pusilla*, and - at some localities - *Nassarius striatulus* and *Roxania utriculus*. Among bivalves, *Corbula gibba* and *Limopsis anomala* are the most abundant, whereas *Entalina tetragona* and *Fissidentalium mutabile* dominate among scaphopods. At most localities (Knínice - south, Šebetov - north, Šebetov - Čtvrtě) this molluscan association represents the dominant component of the fauna, often exceeding 90% of the individuals found. Locally, there were found even solitary corals together with the molluscs. This association was found mostly in calcareous and the sedimentation depth for this group could exceed 100 m.

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Scientific object "Collection of fossils of plant and animal remains of the Paleontological Museum of the Ivan Franko National University of Lviv" assigned national treasure status

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On November 4, 2022, the Government, in order to preserve unique scientific objects of exceptional importance for domestic and world science, granted the status of the national treasure "Collection of fossils of plant and animal remains of the Paleontological Museum of the Ivan Franko National University of Lviv." The collection consists of monographic collections (4850 units) and scientific-thematic exhibition and exhibition collections (5825 units) and has no analogues in Ukraine and the world.

A collection of plant and animal remains fossils is a true creation of nature, preserved in stone. Samples are of significant value for science, because they are evidence of life that lived on our planet hundreds, millions and billions of years ago, and are not subject to reproduction.

Well-preserved fossils create an idea of the morphological features of organisms that lived in the distant past, their lifestyle. They also play a major role in elucidating the Earth's "biography," a sequence of events that scientists reproduce from the completeness of the geological and paleontological record.

In general, the Collection of fossils of plant and animal remains of the Paleontological Museum is represented by phyto- and zoofossils (95%): trunks, bark, stems, leaves, algae, entire skeletons and their fragments, external and internal cores, traces of vital activity (ichnofossils).

Some of them are unique, rare and valuable forms that were first discovered and described from the territory of Ukraine. These exhibits are of global importance.

An early land plant with circinately coiled fertile ends from the upper Silurian (Přídolí) of the Barrandian

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Circinate vernation is a widely observed morphological trait in vascular plants that has evolved as a response to the challenges of life on land. This trait is frequently seen in many vascular plants, where the young leaves or fronds curl up as they emerge from the bud. This adaptation is believed to have developed as a means to conserve water and provide protection. The coiling pattern is spiral, found in basal lycophytes (Gensel and Berry, 2001), ferns (Vasco et al., 2013) and seed plants as cycads (Brenner et al., 2003) and some angiosperms (Fleischmann et al., 2018). Several questions regarding circinate vernation remain unanswered, including when this pattern originated and if it occurred independently multiple times.

Interestingly, the coiling pattern is not limited to leaves but also occurs in axes of Devonian plant lineage, the zosterophylls (Gensel, 1992). While it is possible that the earliest terrestrial plants also developed a similar adaptation, no clear evidence has been discovered in the fossil record.

In a recent study, we examined a fossil plant from the upper Silurian of the Prague Basin, Czechia. This plant shows leafless dichotomously branched axes with terminal "trefoil" structures. We explored the nature and origin of these structures from various perspectives, including the possibility of circinate vernation. Our research focused on the distribution and thickness of the coaly matter, which reflects the structure of the original organic matter. We also discuss the taxonomic affinities of the specimen.

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New insights into the internal structure of *Pachytheca* Hooker from the Silurian of the Barrandian area

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The study of plant terrestrialization is mainly focused on plant-derived macro- and microfossils and the use of molecular biology to estimate the origin of embryophytes. However, there are also cryptic non-embryophyte fossils whose affinities are still unknown, yet they might be related to the terrestrialization process. One of such enigmatic organisms is *Pachytheca* Hooker, represented by small spheroids exhibiting an internal structure consisting of a central part (medulla), a cortical part (cortex), and an outer layer (Gerrienne, 1991) occuring in Silurian to Lower Devonian sediments. In this study, we present a detailed description of several Silurian specimens of *Pachytheca* from the Czechia, including previously unpublished material from the collection of J. Obrhel. Based on data obtained via a combination of different observational methods and the study of residues recovered from macerated specimens, we present a reconstruction of *Pachytheca* and provide new insights into its internal structure. Furthermore, we discuss the possible relationship between *Pachytheca* and *Prototaxites* Dawson, as they are often found together. Considering morphological characteristics of *Prototaxites*, which closely resemble representatives of fungi or lichens (Honegger et al., 2018), similar affinity might be assumed for *Pachytheca*.

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The Plenus Cold event in lower and higher latitudes (Central Europe and Northern Siberia)

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The Upper Cretaceous „Plenus cold event“ (PCE) belongs to intensively studied, however, not quite satisfactorily explained phenomenon. The rapid cooling at the onset of the Upper Cretaceous greenhouse is accompanied by the expansion of the Boreal fauna (Jefferies, 1963) including typical belemnite *Praeactinocamax plenus*. The incursion of this belemnite from East-European Platform seas is in direct relation to the temperature fall. The climatic and environmental changes also affected the northern margin of the Tethys Ocean (Peri-Tethys) – e.g., France (Gale and Christensen, 1996) and Bohemian Cretaceous Basin (Košťák et al., 2004). Palaeoenvironmental changes during PCE are possible to demonstrate using belemnite geochemistry (e.g., Voigt et al., 2003). It is notable that the cooling event in the Peri-Tethys and central Europe is reflected in the decrease of sea-water temperature, however, the subtropical character of the climate persisted.

The PCE at higher latitudes is less studied. According to new geochemical data, values of $\delta^{13}C_{org}$ and $\delta^{13}C_{carb}$ from sedimentary rocks are correlatable at many sections (e.g., Canada) and the event had a global character. We have investigated belemnite rostra from N Siberia (Nizhnyaya Agapa River) from the same stratigraphical interval. Stable isotope data from belemnite material are in the range from -1.60 to -3.54‰ for $\delta^{18}O_{bel}$ and from 2.04 to 5.43‰ for $\delta^{13}C_{bel}$. Completely new $^{87}Sr/^{86}Sr$ isotope data show a gradual trend (0.707350 – 0.707387) which is in fully accordance with the global Sr curve. The Turgai Strait opening in the Late Cenomanian enabled the dispersion of faunal components also up to polar areas. Palaeothermometers – the $\delta^{18}O_{bel}$ from N Siberia provided similar values to those in the Peri-Tethys – around 15°C. These values evidence subtropical climate conditions also in the Polar circle vicinity and they are in accordance with the presence of stenothermic animals (Zverkov et al., 2023).

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Lower Cretaceous carbonate formations in the Štramberk area (Baška Development of the Silesian Nappe, Outer Western Carpathians, Czech Republic)

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The Štramberk area (near the town of Nový Jičín) is famous for the rich occurrence of macrofauna in the Štramberk Limestone, which should belong to the uppermost Jurassic (Tithonian stage). However, the mentioned limestones are not limited to the Jurassic, as they end in the lowest Cretaceous. These limestones are followed by two younger carbonate sequences, namely the Čupek and the Kopřivnice Limestones. The age of these limestones is determined mainly by the findings of leading ammonites and in the Čupek Limestone mainly by calpionellids.

Štramberk Limestone

The Štramberk Limestone is characterized by set of final reef sedimentation in the form of whitish to light gray, fine grained to bioclastic deposits with a variable amount of carbonate matrix.

According to ammonites, the highest part of the Štramberk Limestone belongs to the Early Berriasian Jacobi ammonite Zone (Vašíček and Skupien, 2013, 2016, Vašíček et al., 2017, 2018). Stratigraphically significant species include *Berriasela jacobi*, *B. oppeli*, *Riasanella* cf. *rausingi*, *Pseudosubplanites lorioli*, *Pseudoargentiniceras abscissum*, *Delphinella* cf. *janus*, *Substeueroceras broyonense*, *Riasanites* cf. *swistovianus* and *Pseudosubplanites grandis*.

According to the current Lower Cretaceous ammonite zonation (Reboulet et al., 2018), *Berriasella jacobi* represents the Jacobi ammonite Zone for the Early Berriasian. *Pseudosubplanites grandis* dominates the uppermost part of the Štramberk Limestone, while *B. jacobi* does not occur there. In older publications (e.g. Hoedemaeker and Bulot, 1990) *Ps. grandis* was listed as a subzone species for the upper part of the Jacobi Zone. *Calpionella alpina* occurs in thin sections from the samples with ammonite specimens.

From a palaeogeographical point of view, besides the ammonites of the Mediterranean bioprovince, the coeval occurrence of representatives of the genera *Riasanites* and *Riasanella*, which occur in the subboreal region of the Russian Platform, is also significant.

Čupek Limestone

The Čupek Limestone are mainly light green-gray, muddy, sometimes organodetritic, obscure bedded with layers of limestones of Štramberk-type (mostly subangular clasts).

The results of biostratigraphic and microfacies studies of thin sections of collected specimens occurring in the type locality of the Obecní Quarry and the Čupek Hill in Štramberk, as well as in the topographically higher and abandoned Skalka Quarry with the natural monument Kamenárka are presented.

Thin sections of specimens collected in the Čupek Limestone were studied from a microfacies and microbiostratigraphic points of view. The amount and diversity of allochems, mainly of organic origin, as well as the microscructure of Čupek Limestone are variable. There are significant changes in microfacies character resulting from the conditions of sedimentation and redeposition of clasts and fossil material originating from the Štramberk-type carbonate platform. The age of the Čupek Limestone was determined on the basis of calpionellids, exceptionally foraminifera and calcareous dinoflagellate cysts.

In previous studies (Houša, 1990; Houša and Vašíček, 2004; Vašíček et al., 2010), calpionellid standard zones of Calpionella with the Elliptica Subzone and Calpionellopsis with the Simplex Subzone were found in the Čupek Limestone. This was also confirmed by specimens collected later in the first and second levels of the Obecní Quarry. *Calpionellopsis oblonga* was later identified in specimens from areas of the Čupek Hill (Calpionellopsis Zone, Oblonga Subzone). The determination of this index form proves that the sedimentation of the Čupek Limestone occurred without interruption from the Middle Berriasian to the upper part of the Late Berriasian (Boorová et al., 2014). Thus, the definition of a hiatus by Houša (Houša in Houša and Vašíček, l.c.) in the Late Berrisian has lost its justification. In specimens from the topographically higher, abandoned Skalka Quarry with the natural monument Kamenárka, we found the stratigraphically significant form of *Calpionellites major*, indicating the Early Valanginian (Calpionellites Zone, Major Subzone). The Valanginian age is also confirmed by the occurrence of *Praecalpionellites siriniaensis*.

The obtained biostratigraphic knowledge allowed us to determine the extent of sedimentation of the Čupek Limestones in the range of the Middle Berriasian - the base of the Late Valanginian. This shows that the definition of the Gloriet Formation by Houša (in Houša and Vašíček 2004) with the beginning of sedimentation at the base of the Early Valanginian is not justified, because the lithologically similar sediments, which Houša (l.c.) considered to be the Gloriet Formation, are in fact the rocks of the continuous sedimentation of the Čupek sequence.

Compared to the Štramberk Limestone, the Čupek Limestone are poor in macrofossils. In the lower part of the Čupek Limestone (according to the original concept of Houša in the Obecní Quarry), the location with the richest occurrence of brachiopods from the genus *Moutonithyris* is known. An

exception is the fragment of *Subthurmannia* cf. *boissieri* (Pictet) from the ammonite collection of Houša (Houša and Vašíček, 2005). In the uppermost part of the Čupek Limestone according to our conception (the Gloriet Formation in Houša), Houša and Vašíček (l. c.) mention the occurrence of ammonites of the Early Valanginian (Pertransiens Zone), namely *Thurmanniceras thurmanni, Vergoliceras salinarium, Kilianella roubaudiana* and *Protancyloceras* cf. *punicum*.

Kopřivnice Limestone

Compared to the Čupek Limestone determined at the end of the 20th century, the Kopřivnice Limestone together with the Štramberk Limestone are already known from the previous century.

The Kopřivnice Limestone are lithologically significant. They are usually characterized by a brownish-red colour. They are fine-grained to nodular and breccia-like with variable admixtures of clay. The matrix often contains clasts especially of the Štramberk Limestone, as well as redeposited fossils.

The Kopřivnice Limestone are rich in benthic organisms. Only rarely occurring ammonites are significant. Stratigraphically important (not redeposited) are ammonites *Kilianella roubaudiana, K.* cf. *clavicostata, Neocomites neocomiensis, Karakaschiceras* ex gr. *quadristrangulatus, Platylenticeras* sp. (Houša a Vašíček, 2004). Skupien and Vašíček recently found *Kilianella roubaudiana, Karakaschiceras* cf. *quadristrangulatum* and undeterminable phylloceratids together with sessile oysters. The mentioned ammonites belong to the higher Early Valanginian (Campylotoxus ammonite Zone). Here the coeval occurrence of the subboreal genus *Platylenticeras* is remarkable.

Due to the abundant redeposited material, the micropaleontological research of the thin sections from the Obecní Quarry did not provide with usable stratigraphic data.

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The Miocene Climatic Optimum at the interface of epicontinental sea and large continent: A case study from the Middle Miocene of the Eastern Paratethys

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The Miocene Climate Optimum (MCO, Zachos et al., 2001) and the subsequent Miocene Climate Transition (MCT, Holbourn et al., 2005; Shevenell et al., 2006) are important biotic, environmental and geologic events. Here we address whether this holds true for the epicontinental Eastern Paratethys Sea (today's Black – Caspian Sea region). Two Tarkhanian – lower Chokrakian (Nevesskaya et al., 1975, 1984) sequences of Middle Miocene age in the Kerch Peninsula were investigated using foraminifera, calcareous nannofossils, molluscs, fish otoliths, spores and pollen, oxygen and carbon stable isotopes and strontium isotope stratigraphy (SIS).

Our results show that the marine environment during the Tarkhanian to early Chokrakian in the study area was characterized by open shelf conditions (near upper part of lower sublittoral zone), variable water column stratification and bottom water oxygen levels. Biostratigraphy and new SIS data suggest an age of > 15.5 (~16.0?) – 14.75 Ma for the Tarkhanian, which implies a considerably longer duration (> 0.75 Ma vs. 0.1 Ma) than was previously suggested. The maximum transgression seen in the middle Tarkhanian could be dated to ~15.5–15.1 Ma and correlates with the highstand of sequence Bur 5/Lan 1 (15.2 Ma) and terminal phase of the MCO.

The vegetation indicates a gradual change from subtropical humid (early Tarkhanian) to a more seasonal with cooler winters and drier summers in the late Tarkhanian and to more arid (early Chokrakian) with significant continentality in the early Chokrakian. The climate change in the Eastern Paratethys occurred slightly earlier than in the Central Paratethys, possibly related to the existence of the large flat Eurasian continent (Vernyhorova et al., 2023).

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Palynological investigation of Cenomanian locality Hloubětín-Hutě, Prague

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The sedimentary rocks of locality Hloubětín-Hutě, which is found in the northeastern part of Prague, belongs to the Peruc-Korycany formation of the Bohemian Cretaceous Basin and shows a periodic alternation of clay, silty and sandy rocks with coaly clays, which indicates brackish to brackish-marine sedimentation. The environment has evolved from periodically flooded lakes and lakes to fluvial and estuarine environments. In the past this hypothesis has been supported by sedimentological and palaeoecological studies of fossil floras (e.g., Velenovský 1889, Hluštík 1985, Kvaček J. 1992 and Kvaček Z. 1992).

The material used for the palynological investigation is partly from old permanent slides from the collection of Prof. B. Pacltová and partly from newly acquired samples. To obtain new specimens, the classical maceration method consisting of the traditional HCl-HF-HCl treatment was used.

The preliminary study showed a rich palynological assemblages characterized mainly by pteridophyte spores from the family Gleicheniaceae, and pollen grains of gymnosperms represented mainly by *Eucomiidites* sp., *Classopollis* sp., *Taxodiaceaepollenites* sp., *Cycadopites* sp., *Alisporites* sp. and *Parvisaccites* sp. Gymnosperm pollen grains are also abundant, mainly monocolpate pollen grains of *Clavatipollenites* sp., and tricolpate pollen grains of *Tricolpites* sp. and *Retitricolpites* sp.

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The otoliths from the locality Štúrovo (Danube Basin, Slovakia)

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Research on otoliths from the Danube basin in Slovakia is primarily known from Miocene sediments from various localities. Currently, there are no known works devoted to the research of otoliths from the older Tertiary of Slovakia. Works by Nolf & Brzobohatý (1994), Nolf & Reichenbacher (1999) and Bosnakoff (2011) deal with otoliths from Paleogene sediments of the Danube Basin on the other side of the Danube River, from the territory of Hungary. Was available 63 otoliths belonging to three families, namely Gobiidae Bonaparte, 1832, Apogonidae Jordan & Gilbert, 1882 and Sciaenidae Cuvier, 1829.

The location consists of cuts on the bank and in the bed of the Danube River near Štúrovo (South Slovakia) on its left bank. When the water level of the Danube is low, layers of dark gray clays with inserts of black coal marls are exposed, which are rich in finds of fossil shells of molluscs, especially gastropods of the genera *Mesohalina* and *Granulolabium*. In terms of age, the sediments can be classified as Egerian (late Oligocene/Early Miocene). The paleontological site has probably not yet been scientifically explored.

Otoliths were obtained by floating and separating under a binocular magnifier. The described material is deposited in the SNM-Natural History Museum in Bratislava. Some samples are strongly eroded and therefore it was not possible to determine them more closely.

The most numerous were otoliths belonging to the family Gobiidae. Some of them represent juvenile specimens without diagnostic features at the specific and generic level. The species *Lesueurigobius suerii* (Risso, 1810) - 24 pcs., *Lesueurigobius vicinalis* (Koken, 1891) - 7 pcs., *Gobius dorsorostralis* Weinfurter, 1954 - 1 pc., *Deltentosteus eggenburgensis* Schwarzhans, 2010 - 2 pcs., *Gobius* sp. – 1 pc and *Pomatischistus* sp. - 1 piece. Gobiid otoliths are very common in many neritic Neogene sediments. Gobies are among the largest groups of extant marine fish. Gobies are globally distributed in a variety of marine, brackish and freshwater habitats and also play an important role in reef ecology.

Otoliths belonging to the Apogoniidae family were further separated in the sediment. The five pieces of rights sagittae belonging to the species *Apogonidarum kosdensis* (Schubert, 1912) were found. Otoliths of the genus *Apogon* Lacepede, 1801 and most other Apogonid genera show a strongly developed predorsal part as a characteristic feature. This feature is not developed in *Apogonidarum kosdensis*, here only the middle part of the dorsal margin is more pronounced. Apogonids are very common especially in reef environments. They also represent a quantitatively important proportion of whistlers living in tropical mangrove waters influenced by estuaries

(Reichenbacher et al., 2004).

A single otolith from the family Sciaenidae could belong to the species *Sciaena pseudoradians* (Dante & Frizzel, 1965). The sciaenids have large otoliths and are known for their specific differences in sound production. They are neritic fishes living in the temperate and warm shallow seas and estuaries. Only a few genera are known from deeper shelf environments. Sciaenids are generally bottom-dwelling species feeding on invertebrates and smaller fishes with a key role in estuarine ecosystems (Bosnakoff, 2008).

The work brings preliminary results of research at the locality Štúrovo. In addition to otoliths, foraminifera, ostracods, bivalves, gastropods and vertebrae and small fish teeth were found in the sediment. Their professional processing will be the subject of further research.

The high numbers of gobies and also findings the sciaenids and apogonids are indicative of shallow water, suggesting a definite nearshore environment, probably less than 50 m.

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