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19th Czech-Slovak-Polish Palaeontological Conference
&
MIKRO 2018 workshop

Editors:
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West Bohemian Museum in Pilsen

Content

FOREWORD

The 19th Czech-Slovak-Polish Palaeontological Conference is an annual meeting for the presentation and discussion of research carried out by palaeontologists dealing with various fossil groups from different ages. This scientific meeting presents new research, multi- and interdisciplinary studies and innovative methods. The tradition of this Palaeontological Conference originally started as an opportunity for scientific exchange within Czech, Slovak and Polish palaeontological communities but it meets interest among researchers from the central–eastern European region every year, and this year is no exception. This year, the 11th Micropalaeontological Workshop MIKRO 2018 is held in cooperation with the annual Czech-Slovak-Polish Palaeontological Conference. The Grzybowski Foundation organizes the micropalaeontological workshop every two years.

Each Palaeontological Conference takes place in one of the three founding countries. The last conference held in Prague took place in the National Musem in 2010. In 2018, the conference comes back to Prague. For the first time, it is taking place in Villa Lanna, the Representative residence of the Czech Academy of Sciences. The capital of Prague is beautiful not only in its traditional historical monuments but also in a number of hidden interesting geological localities. The meeting will consist of two days of technical sessions and a one-day field excursion in the Prague area. The excursion will guide you to six stops in the Prague Basin: Hemrovy skály and Ostruha near Praha-Nová Ves, Butovické hradiště, Jezírko Quarry in Praha-Hlubočepy, Railway-cut in Praha-Hlubočepy, Kaplička Quarry and Barrandov Cliffs guided by RNDr. František Vacek Ph.D.

The Abstract book is a special volume of Folia which includes collections of abstracts summarizing contributions presented at both meetings and a field guide. This conference and this special volume are dedicated to the memory of Doc. RNDr. Hedviga Bystrická, CSc., an outstanding micropalaeontologist who left us in January this year.

We wish to thank all the members of the Organizing Committee as well as everyone who made this meeting possible. We are also grateful to the Institute of Geology of the Czech Academy of Sciences, the West Bohemian Museum in Pilsen and the Grzybowski Foundation. We would also like to thank the Sponsors of the Meeting – Geologica Carpathica and Earth Science Institute of the Slovak Academy of Sciences.

On behalf of the Organizing Committee,

Jana Frojdová

REMEMBERING DOC. RNDR. HEDVIGA BYSTRICKÁ, CSC.

* 2ND FEBRUARY 1924, † 8TH JANUARY 2018

Shortly after New Year 2018, a sad message came to us – another pioneer of paleontological research in Slovakia had gone to Eternity.

Doc. RNDr. Hedviga Bystrická, CSc., born Pánthy, was born on February 2nd, 1924, as the second of three children in the family of a school teacher in the village Močarany, near the town Michalovce (now a part of it).

She received her GCE at the advanced level from the school in Michalovce in 1942, and in 1948, finished her university studies in the subject Natural Sciences – Geography, at the Faculty of Natural Sciences of Comenius University (FNS CU) in Bratislava. In 1951, she passed doctoral examinations and defended her doctoral thesis on "Micropaleontological Study of the Tortonian in the Surroundings of Šaštín", and received the title RNDr. In 1966, she received the title Candidate of Geological Sciences (CSc.), having defended her candidate thesis on "Ortholithic *Coccolithophorida* of the Paleogene in Slovakia and their Stratigraphical Significance". In 1967, she was habilitated and appointed Associate Professor (Docent) of Micropaleontology.

From 1948 to 1960 she worked as Assistant Lecturer and Lecturer at the Department of Geology and Paleontology of FNS CU in Bratislava, under the leadership of Dimitrij Andrusov; from 1960 to 1962, after political screening under the regime of that time, as a librarian at the Geological Library of FNS CU; from 1962 to 1964 as a technician at the Department of Geology and Paleontology FNS CU, and from 1968 until her retirement in 1989 as Associate Professor at the Department of Geology and Paleontology FNS CU .

In her professional life, she belonged to pioneers in micropaleontology of foraminifers in Slovakia, and later in nannoplankton, mostly in such formations as the Cretaceous, Paleogene and Neogene, in almost all units of the Western Carpathians. She was the first to define the nannoplankton zones of the Middle Paleocene to the Middle Oligocene in Slovakia, pointing to possible correlation of nanoplankton assemblages not only within the Western Carpathians, but also interregionally, and the possibilities of their use in stratigraphy, paleoecology and paleoclimatology. She proved that Paleogene sedimentation had not terminated in the Lower Oligocene when documented using foraminifers, but had continued until the Upper Oligocene.

For many years, she gave lectures at the Department of Geology and Paleontology of FNS CU in Bratislava and conducted exercises in paleontology, mostly in micropaleontology. During her tenure at the Department of Geology and Paleontology (1948–1989), she supervised several outstanding domestic, foreign and post-graduate students in these fields.

In addition to teaching, she participated in research projects of the state plan as a researcher or co-researcher, at her department as well as at the J. E. Purkyně University in Brno (now Masaryk University) and the Geological Institute of Dionýz Štúr in Bratislava. In 1982, she gave lectures externally at the Department of Geology and Paleontology of the Faculty of Natural Sciences of J.E.Purkyně University in Brno (course: Methods and Techniques of Paleontological Research).

Associate Professor Bystrická was a member of the examination board for state final examinations, the vice-chair of the doctoral examination board for paleontology, a supervisor of CSc. students in paleontology, member for DrSc. defences in paleontology at the Czechoslovak Academy of Sciences, member of the National Committee of Paleontology at the Czechoslovak Academy of Sciences, member of the committee of paleontological expert group at the Slovak Geological Society, member of the editorial board of Acta Geological et Geographical Universitatis Comenianae.

She published results of her studies in approx. 40 articles in various professional geological periodicals, Slovak and foreign, with considerable success and favourable responses. In recognition of her educational activities, she was awarded the Bronze Medal of FNS CU (1980), Silver Medal of FNS CU and CU (1984), Gold Medal of FNS CU (1989) and the title Merited Teacher by the Ministry of Education (1984); and in recognition for the development and promotion of science the Ján Slávik Medal by the Slovak Geological Society (2007).

Preceded by her husband, geologist RNDr. Ján Bystrický, DrSc., she is survived by three children: daughter Katarína and sons Juraj and Pavel and six grandchildren.

She passed away suddenly of heart failure on January 8th, 2018. We said goodbye to her at the cemetery Slávičie údolie in Bratislava on January 15th, 2018.

Professor, we shall remember you as a modest, good and compassionate person.

May the Slovak earth be light upon you. May you rest in peace.

Adriena Zlinská

AALENIAN-BAJOCIAN CALCAREOUS NANNOPLANKTON AND BENTHIC FORAMINIFERA FROM THE SKRZYPNY AND SZLACHTOWA FORMATIONS FROM LITMANOVÁ AND KAMIENKA, PIENINY KLIPPEN BELT, SLOVAKIA: AGE AND AND PALEOENVIRONMENT

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The oldest deposits of the Skrzypny Fm. are present in the Kamienka Metiská quarry (middle Aalenian, Bradfordensis Zone). Samples yielded a different mixed agglutinated/calcareous assemblage. The samples did not contain any calcareous nannoplankton. Increased infaunal morphogroups show oxygen depletted conditions in the benthic habitat. In the Litmanová samples and samples from the upper part of the Kamienka quarry species of calcareous nannoplankton *Lotharingius barozii* Noël, *Lotharingius contractus* Bown & Cooper, *Lotharingius crucicentralis* (Medd) Grün & Zweili, *Lotharingius hauffii* Grün & Zweili, *Carinolithus cf. superbus* Deflandre Prins, *Crepidolithus cavus* Prins ex Rood et al., *Discorhabdus striatus* Moshkovitz and Ehrlich have been noted. The assemblage points to a late Aalenian-earlyest Bajocian.

The foraminiferal assemblage is dominated by calcareous benthic foraminifera (Epistomina, Ophthalmidium). The morphogroup analysis highlights the presence of these epifaunal foraminifera and points to better oxygenated bottom and pore waters. The third assemblage of foraminifera was documented in the Slachtowa Fm. in the Riečka stream. The assemblage is almost entirely represented by sessile tubulothalamids pointing to a well oxygenated environment. Species of calcareous nannoplankton *Biscutum finchii* Crux, *Carinolithus magharensis* (Moshkovitz & Ehrlich) Bown, *Carinolithus superbus* (Deflandre) Prins, *Discorhabdus criotus* Bown, *Discorhabdus striatus* Moshkovitz & Ehrlich, *Lotharingius barozii Noël, L. contractus* Bown & Cooper , *L. hauffii* Grun & Zweili, *L. frodoi* Mattioli, *L. primigenius* Bown, *Watznaueria fossacincta* Black, *W. manivitae* Bukry, *Triscutum sullivanii* de Kaenel & Bergen were identified. The index species *Watznaueria manivitae* and *W. fossacincta* point to a Bajocian age.

ACKNOWLEDGEMENT

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ON TWO NEW TAXA OF AGGLUTINATED FORAMINIFERA FROM THE FORE-MAGURA THRUST SHEET PALEOCENE DEPOSITS (POLISH OUTER CARPATHIANS)

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The characteristic feature of the Fore-Magura Thrust Sheet succession is the presence of hemipelagic and pelagic marls and shales deposited above the local CCD, that are rich in agglutinated, calcareous benthic, and planktonic foraminifera. In the course of studies on the foraminiferal assemblages of the FMTS deposits, one new taxon of agglutinated foraminifera has been found and one species has been recorded for the first time in the Paleocene mixed assemblages.

More than sixty specimens of a new taxon were found in five samples from two sections of the studied area. Its test is multilocular, coiled in a dome-shaped trochospire. The spiral side is strongly convex with two or three whorls. In each whorl six, sac-shaped chambers, slowly increasing in size are present. Chambers are connected by thin tubes. The umbilical side is characterized by a very distinct, wide and depressed umbilical area. Its wall is coarsely agglutinated with obscure sutures. The average size of a trochospire is 0,35 mm in diameter and 0,25 mm in height. According to Loeblich & Tappan (1988) this new taxon corresponds to the description of the family *Conotrochamminidae* Saidova, 1981 and genus *Conotrochammina* Finlay, 1940 but cannot be attributed to *C. whangaia* Finlay, which is also present in the studied material, due to significant differences in size as well as the character and width of the umbilicus.

Another new finding concerns the species *Ammoanita ingerlisae* Gradstein & Kaminski. Kaminski & Gradstein (2005) mentioned its absence in the flysch-type agglutinated assemblages of the Alpine-Carpathian region. In the studied material, three samples contain five, well to moderately preserved, specimens of *Ammoanita ingerlisae* Gradstein & Kaminski. Therefore, this species, although rare, is present in the Outer Carpathians.

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PERIODICAL CHANGES OF WATER COLUMN PARAMETERS IN PELAGIC ENVIRONMENTS OF THE WESTERN TETHYS DURING THE MIDDLE TO LATE JURASSIC – EVIDENCE FROM THE RADIOLARIAN RECORD

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Studies on contemporary climate change during the past few decades have highlighted the relevance of how atmospheric patterns affect climate conditions over the equatorial Pacific region and are important with respect to large-scale modes of climate variability, such as El Niño Southern Oscillation (ENSO) and Pacific Decadal Oscillation. Based on these recent studies, we attempt to apply their results to explain the main causes of changing circulation patterns in the equatorial zone during the Middle–Late Jurassic, which affected the changes in ocean water column parameters in the Western Tethys, relevant to the growth of siliceous plankton. The changes in radiolarian habitat group abundances, microfacies, and water column conditions was studied based on the examination of siliceous limestones and cherts from the Tatra Mountains, Central Western Carpathians. Deposition occurred on a morphological high with incised pelagic sedimentation within a tropical zone. High-resolution quantitative analyses of over 400 microlaminae in 18 thin sections show changes in microfacies constituents that most likely record the fluxes of nutrients and biological activity in superficial waters. Variability of radiolarian assemblages that are classified to represent (i) upwelling and (ii) stratified water taxa suggest successive changes in water conditions that fluctuated between periods of upwelling and periods of formation of a thick, stratified, warm superficial layer above a deep thermocline during middle Bajocian–late Oxfordian time. Such variations would be strongly influenced by ocean-atmosphere global circulation patterns, which are caused by pressure gradients and are the result of Walker circulation along the equatorial part of the Tethys and the Panthalassa Ocean, including the duration of El Niño-like and La Niña-like cycles, which affect sea surface temperature trends on decadal scales. The fluctuations in radiolarian assemblages in the sediments indicate that long-term palaeoceanographic changes occurred on multi-decadal to centennial-scales during the Bajocian, but lengthened in duration to millennial-scale during the the Bathonian through the Oxfordian.

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RADIOLARIAN EVOLUTION AND TURNOVER IN RELATION TO TURONIAN OCEANIC EVENTS IN THE WESTERN TETHYS

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A total of 195 radiolarian species from deep-water settings in the Umbria-Marche (UM) and the Outer Carpathian basins of the Western Tethys were used for interpretation of environmental changes during the late Cenomanian through the late Turonian time interval. Radiolarians experienced and responded to environmental changes during the 1.8 Ma. The OAE 2 event – a period of unquestionable eutrophication represented by the Bonarelli Interval (BI), did not result in great radiolarian extinction and turnovers. It was rather a time of radiolarian press extinction, where radiolarian radiation preceded this BI event over 330 ka (Bąk 2011). The extinction, directly connected with the OAE2 started ca. 240 ka before the end of the organic-rich sedimentation event, coinciding with the onset of enhanced diatom frustules deposition, recorded in middle and upper part of the BI. Many of the radiolarian species previously considered as terminating during the BI, in fact outlived up to "post-Bonarelli" times as Lazarus taxa.

The next environmental change which enhanced radiolarian extinction and turnover was recorded in the UM as lithological change between white limestone of the Scaglia Bianca and red limestone and marls of the Scaglia Rossa deposits, which took place during the early Turonian. In this period, dated as 940 ka after the BI, over 90 radiolarian species finally went extinct, and only a few species newly appeared. During the middle Turonian radiolarians were rare in the deposits of the Western Tethys and indicate cooling of the superficial waters and weakening of upwelling. The next episode of radiolarian extinction during the late Turonian indicated on further reorganization of the oceanic circulation system.

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TWO EXAMPLES OF PLANT-INSECT INTERACTION FROM THE PENNSYLVANIAN OF THE CZECH REPUBLIC AND CHINA

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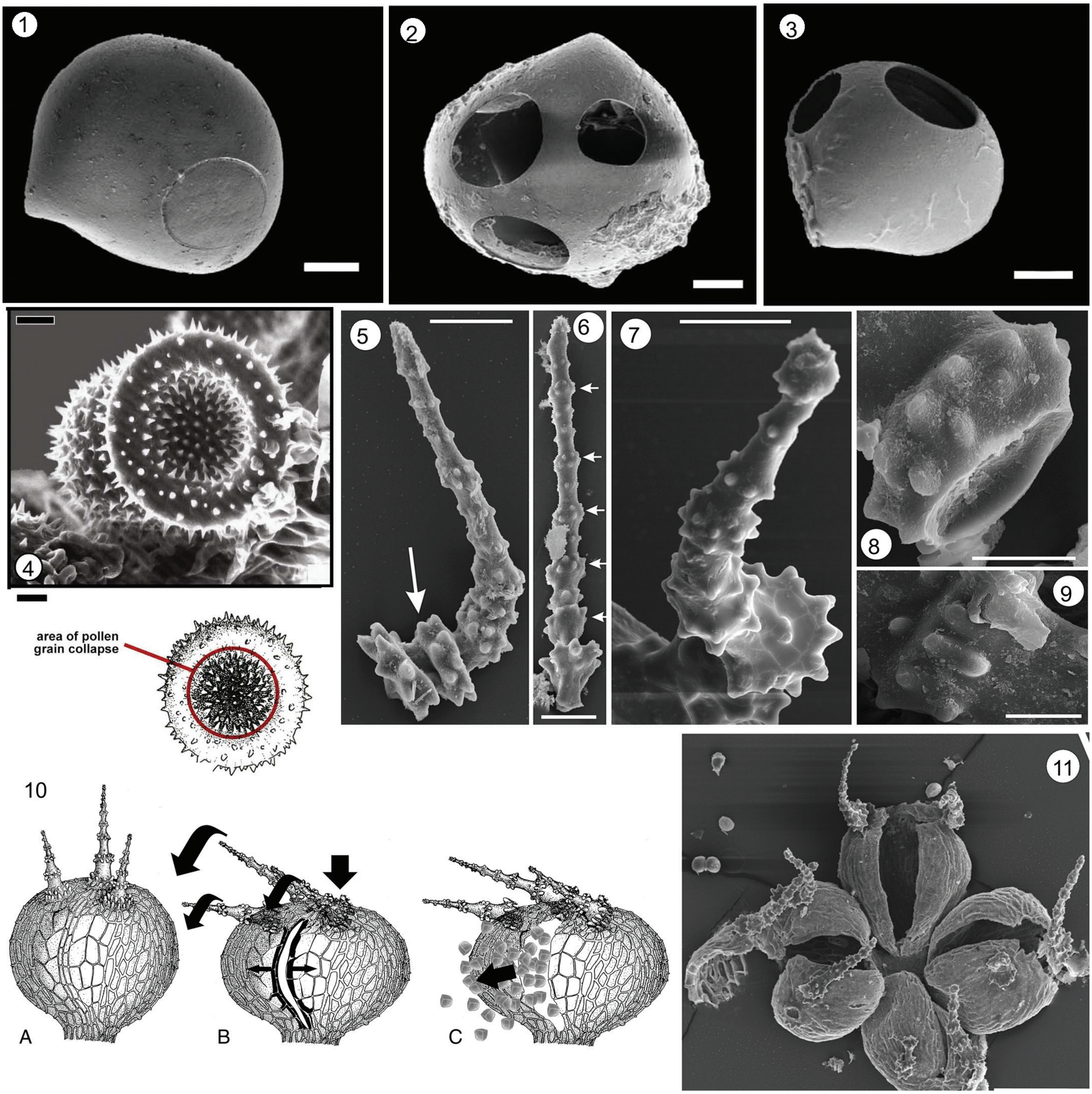
A new reproductive organ of uncertain affinity is described from macerations made from tuff deposits within the Pennsylvanian (Bolsovian) age Radnice Member of the Kladno Formation at the Doubrava locality in the Pilsen Basin of the Czech Republic, and named *Echinosporangites libertite* Pšenička *et al*. Remains comprise dispersed sori with each sorus consisting of 4–5 annulate sporangia. Sporangia possess four different types of cells and three specialised trichomes. In situ spores are characterized by a prominent labrum, irregular loaf-like sculpture of the distal surface, and may resemble some specimens of the dispersed spore genus *Punctatisporites*. As the reproductive organs of *E. libertite* occur in a dispersed state, its parent plant remains unknown. The specialised trichomes in *E. libertite* appear to have contributed to sporangial dehiscence, and the opening mechanism may have been facilitated by faunal-interaction.

Another example concerns noeggerathialean spores isolated from *Discinites sinensis* Wang et al. The generic name *Discinispora* Wang, Zhang, Bek *et* Pfefferkorn was originally created for spores with an operculum-like structure that were found in a permineralized noeggerathialean cone from the uppermost Pennsylvanian of China. Subsequently it was observed that up to three round and smooth openings can occur in different positions on the surface of a single spore. An interpretation implicating insect punch-and-sucking activity was suggested for these round structures. This interpretation makes it necessary to withdraw the original diagnosis and the taxon. The insect-inflicted damage now is assigned to the ichnotaxon *Circulipuncturites discinisporis* Labandeira, Wang, Zhang, Bek *et* Pfefferkorn under the rules of the ICZN, rather than those of the ICBN that typified the insect damaged host-plant spore.

Plate. 1. *Circulipuncturites discinisporis*. figured in Wang *et al*. as *Discinispora sinensis* Wang, Zhang, Bek & Pfefferkorn. An initially cut disk that did not separate from the spore wall. SEM. Scale bar 20 µm. **2.** *Circulipuncturites discinisporis*. figured in Wang *et al*. as *Discinispora sinensis* Wang, Zhang, Bek & Pfefferkorn. Three orifices of different sizes on the lateral distal wall, of which the upper-right one has a slightly irregular circular margin. SEM. Scale bar 30 µm. **3.** *Circulipuncturites discinisporis*. figured in Wang *et al*. as *Discinispora sinensis* Wang, Zhang, Bek & Pfefferkorn. Two orifices of different sizes on the lateral (left and smaller) and distal (right and larger) spore walls, respectively. SEM. Scale bar 30 µm. **4.** A SEM micrograph of a pollen grain of *Malva sylvestris* L. (Malvaceae), exhibiting a central collapsed area following a feeding puncture. Scale bar 20 µm. A drawing of the specimen in (4) above, showing the envelope of the circular collapsed area. Scale bar 20 mm. **5.** *Echinosporangites libertite* Pšenička & Bek. Inflexed isolated specialised trichome with ring-shaped thickening (arrowed) where papillae are concentrated; SEM. Scale bar 50 µm. **6.** *Echinosporangites libertite* Pšenička & Bek. Narrow isolated specialised trichome with ring-shaped thickening where papillae are concentrated; arrows — thickening delimit individual cells of multicellular trichomes. SEM. Scale bar 50 µm. **7.** *Echinosporangites libertite* Pšenička and Bek. Inflexed isolated specialised trichome with ring-shaped thickening where papillae are concentrated. SEM. Scale bar 50 µm. **8.** *Echinosporangites libertite* Pšenička & Bek. Detail of papillae at the basal part of the specialised trichome. SEM. Scale bar 20 µm. **9.** *Echinosporangites libertite* Pšenička & Bek. Detail of papillae at the middle part of the specialised trichome. SEM. Scale bar 20 µm. **10.** Reconstruction of split sporangium; **A)** sporangium before opening; **B)** specialised trichomes pressed the sporangium and the sporangium is splitting in dehiscence area; **C)** spores are catapulted out of the sporangium. **11.** *Echinosporangites libertite* Pšenička & Bek. Sorus consisting of four cracked sporangia (arrows) with clearly visible specialised trichomes. SEM. Scale bar 500 µm.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area of pollen
grain collapse
10
A
B
C
11

CHANGES IN LOWER FAMENNIAN (UPPER DEVONIAN) FOSSIL ASSEMBLAGE FROM KOWALA QUARRY (HOLY CROSS MOUNTAINS, CENTRAL POLAND)

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The lower Famennian (Upper Devonian) fossiliferous strata outcropping in the Kowala quarry (south-western part of Holy Cross Mountains, Poland) have been a subject of many studies. However, the contained fossils were never analysed as ecosystem. The most common fossils are brachiopods associated with very characteristic non-trilobite arthropods, such as Thylacocephala, Phyllocarida and Angustidontida.

During the fieldwork, 2438 specimens were collected. At least thirty-two specimens were collected from each of investigated beds, regardless the type or preservation. Each specimen was cleaned, properly described and identified. Based on these data, a database allowing investigation of changes in the assemblage regarding time arose.

In the studied strata, a gradual drowning of Holy Cross Mountains carbonate platform is marked by a slow increase of the amount of nektonic forms. Additionally, nine peaks of rapid increase of number of arthropod fossils (especially Thylacocephala) can be observed. After these "events" the number of thylacocephalans rapidly decreases. A similar decrease is seen also in brachiopods. In levels dominated by orbiculoid brachiopods, non-lingulate brachiopods decline and vice versa. Importantly, here are no new occurrences or definite declines of any taxa within investigated strata.

Such relatively short-term changes are most-probably associated with environmental fluctuations.

To test this geochemical (main and trace elements, biomarkers, total organic carbon, total sulphur analyses), mineralogical (clay minerals analyses) and sedimentological analyses have been performed. Their results will also be presented.

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BERRIASIAN FORAMINIFER FAUNA FROM THE ŠTRAMBERK LIMESTONE IN KOTOUČ QUARRY

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Foraminifer study in the type area of the Štramberk Limestone is still at the beginning. After preliminary study of foraminifers from pilot sample taken at Kotouč Quarry (Bubík 2012) the attention was shifted to the Berriasian part of the Štramberk Limestone, Jacobi Zone. Three sections in the Kotouč Quarry were studied. Each of them has amonite stratigraphic control: one section is already published (Vašíček & Skupien 2013), other two were sampled recently (2016). Isolated foraminifer specimens were extracted using acetolysis with 80% acid. Foraminifers were studied at thin sections as well, to check eventual loss of data by selective dissolution. First results show that Berriasian assemblages are very similar to the previously studied Tithonian one. *Nodobacularia bulbifera* Paalzow, *Andersenolina* div. sp. and *Trocholina* div. sp. keep their dominance in the Berriasian part of the Štramberk Limestone. Two assemblages can be distinguished: 1) *Andersenolina – Trocholina* assemblage and 2) *Nodobacularia* assemblage. Water energy seems to be main controlling factor. While the first may indicate a reef front, the second represents probably sheltered fore-reef habitat (talus). Other foraminifer taxa like miliolids, agglutinated forms with calcareous cement and nodosariids are rather rare. Stratigraphically valuable taxa were not found. Biostratigraphy may be uneasy if these strata were deposited as a reef talus affected by massive reworking.

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PALEOGENE OCTOCORALS (ALCYONACEA, ISIDIDAE) FROM THE SUBSILESIAN UNIT AT BYSTŘICE NAD OLŠÍ (OUTER FLYSCH CARPATHIANS, CZECH REPUBLIC)

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Macroscopic internodes and holdfasts of branched octocorals, as well as microscopic calcareous sclerites, are known in the fossil record starting from the Lower Cretaceous. They do not receive, anyhow, sufficient attention. In the Paleogene pebbly mudstones at the base of the Menilite Formation in Bystřice nad Olší (potok Jatný) a small macrofauna was found, composed of large foraminifera, sponges, bivalves, gastropods, scaphopods, brachiopods, bryozoans, echinoderm elements, serpulids, rare solitary hexacorals and internodes of octocorals. Among the macroscopic remains of octocorals at least three distinct forms can be distinguished. Inflated densely pitted segments 3 to 6.5 mm long can be compared with *Moltkia minuta* (Nielsen, 1918) reported from the Maastrichtian and Danian of Denmark, Netherland, Ukraine and Kazakhstan. More cylindrical striated internodes, 4.5 to 10.5 mm long, morphologically fit well to species *Moltkia foveolata* (Reuss, 1846). This species including synonyms is reported from lower Cenomanian to the Paleocene of Europe and the Lower Eocene of USA. Rare finds of narrow, 11.3 mm long internode with regular longitudinal striation is morphologically consistent with species *Parisis vertebralis* (Hennig, 1899) described from the Upper Cretaceous of Sweden. 0.4 cm long spindle-type granulated sclerites belonging to octocorals rarely occur in washing residues from mudstones.

Age of this fauna is questionable. A microfauna contains abundant reworked planktonic foraminifera from various levels of the Eocene, rarely also from the Cretaceous and Paleocene. Some benthic foraminifer taxa indicate Oligocene age of the pebbly mudstones. A habitat is not clear as the macrofauna consists from taxa reworked from various depth zones from inner shelf to the slope.

LIBEŇ AND LETNÁ FORMATIONS LAGERSTÄTTEN (SANDBIAN, PRAGUE BASIN, BARRANDIAN AREA): STATE OF ART AND PERSPECTIVES

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Upper Ordovician (Sandbian) Letná and Libeň formations provide a unique insight into the poorly known part of Lower Palaezoic life. Several levels within both formations show exceptional preservation of non-mineralized and poorly mineralized fossils. Non-trilobite arthropods, including marrellomorph (*Furca*), cheloniellid (*Duslia*), aglaspidid-like arthropods (*Zonozoe*, *Zonoscutum*, *Drabovaspis*, *Chacharejocaris*?, *Triopus* and *Caryon*), occur together with richly diverse trilobites. Soft parts have been documented in four trilobite genera, particularly in *Birmanites*, *Dalmanitina*, *Deanaspis*, and *Selenopeltis*. Some layers, characterized by massive occurrence of articulated trilobites, ophiuroids, asteroids and carpoids, represent cases of the Konzentrat-Lagerstätten. The *Drabovia-Aegiromena* Fauna dominated by rich brachiopods includes also the aforementioned trilobites and non-trilobite arthropods; these associations are characteristic for the inshore quartzose sandstones. A poor atheloptic trilobite association is, on the contrary, typical for the offshore slope settings. Very rare graptolites, rare trilobites of the Cyclopygid Biofacies and especially the brachiopods of the *Paterula* Community are confined to the poorly oxygenated black shales in the central parts of the basin. Diverse ichnofossils (especially in Letná Formation) play an important role in the understanding and interpretation of the environment and faunal diversity. New data make possible a better assessment of stratigraphy and understanding of depositional environment. Investigation of the classical and newly discovered outcrops and their comparison provides important data for the re-definition of faunal communities. New concept of water-depth and substrate-related trilobite, bivalve, echinoderm, brachiopod, and ichnofossil assemblages and associations is in progress. The recent study is associated with systematic and functional evaluation of separate trilobite, non-trilobite arthropod, bivalve and echinoderm taxa and ichnotaxa, and by the palaeoecological and taphonomical interpretations. All these studies, however, should be related especially to the parallel investigation of the analogous Fezouata and Tafilalt biotas.

ACKNOWLEDGEMENT

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IMPACT OF BEING EVERGREEN OR DECIDUOUS ON THE WOOD ANATOMY OF TREES IN POLAR REGIONS DURING WARM GEOLOGICAL PERIODS: CASE STUDY FROM THE UPPER CRETACEOUS OF THE JAMES ROSS ISLAND (ANTARCTIC PENINSULA)

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Extensive palaeobotanical records from the Antarctic region prove that under appropriate climatic conditions, during the Late Cretaceous and the Paleogene, both polar areas were inhabited by vegetation. Nevertheless, these plants had to adapt to a specific solar regime: half-year mild polar nights (Spicer 2003). The Cretaceous forest had been responding to these specific conditions in two different ways as to the type of terrestrial arborescent plants: evergreen or deciduous (Beerling 2007). Both strategies had their advantages and disadvantages and left an anatomic trace in the fossil wood of a respective plant (Falcon-Lang 2005). The fossil material for this study comes from the Upper Cretaceous (Cenomanian – Santonian) of Brandy Bay and Crame Col, James Ross Island, Antarctic. This material has an informational value due to the low species diversity and limited vegetation type during the Late Cretaceous. The research is focused on the specific adaptation strategies of terrestrial plants (evergreen vs. deciduous) and the influence of leaves longevity on the growth ring anatomy.

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FOSSIL CROCODILES FROM THE CZECH REPUBLIC

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Fossil crocodilian remains from the Czech Republic are rare and not abundant, but these occasional finds are important for understanding of European crocodilian diversity during the Cenozoic era. All fossil remains are restricted to Paleogene and Neogene localities. No fossil crocodile was found in Mesozoic sediments. The only known discovered and described genus is a fossil alligatoroid *Diplocynodon*. There are more than 600 hundred finds known from the Czech Republic; most of them come from NW Bohemia. The most frequent remains are isolated teeth and dorsal osteoderms. The majority of bone fragments miss the important diagnostic characters and their reliable species identification is impossible. Based on the current state of the art, historically described species are regarded as invalid and the only accepted Czech one is *Diplocynodon ratelii* from the lower Miocene (MN 3) of Most Basin, NW Bohemia. Other finds lack diagnostic features, but they are important for the palaeoclimatic and biogeographic interpretations. During the Eocene-Oligocene transition the cooling event had a negative impact to fossil herpetofauna, particularly to crocodiles. The only known survived genus in the Central Europe is *Diplocynodon*. Finds of *Diplocynodon* sp. from the Eocene-Oligocene transition of the Czech Republic confirm that this species did not migrate to the south refuges and resisted in its origin locations. The coldest month mean temperature did not fall below freezing between parallels of 45°and 50° N.

UPPER TURONIAN FORAMINIFERA AND LITHOLOGICAL VARIABILITY IN THE BĚCHARY BOREHOLE (BCH-1) (BOHEMIAN CRETACEOUS BASIN)

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The Běchary bore hole (Bch-1) was drilled as representative Upper Cenomanian – Lower Coniacian succession of Cretaceous sediments in the central part of the Bohemian Cretaceous Basin.

The geochemical result set was completed with detailed biostratigraphy (Jarvis *et al.* 2015), and especially detailed analysis of dinocyst species (Olde *et al.* 2015). Lithological and geochemical characteristics show 12 genetic sequences (Uličný *et al.* 2014).

Foraminifera were studied in two intervals of interest: 161–169 m and 221–253 m depths (Upper Turonian), 28 benthic and 13 planktonic foraminifera species were determined. Here we present the first results of a pilot study performed on a selection of 24 samples that represent contrasting lithologies and, presumably, also environmental conditions.

The foraminifera data are compared to the following geochemical proxy parameters: CaCO3 content, Al, Si, Al/Si, Zr/Si ratios. Abundances, diversity and P/B ratio of foraminifera were compared with the lithological proxies. The interval of 161–169 m differs by the appearance of *Cibicides* sp. and disappearance of *Casidella tegulata* and *Gavelinella polesica*. In some samples, alternation in abundance is observed between *Heterohelix globulosa* on one side and the genera *Whiteinella* and *Dicarinella* on the other side. Spearman correlation of foraminiferal species and geochemical data reveals two distinct groups in relation to the lithological proxies: Group 1, represented *by Cassidella tegulata*, *Praebulimina* sp., *Gaudrinella*, *Whiteinella paradubia* and *Dicarinella imbricata*, shows affinity to relatively carbonate-poor, and partly mud-enriched lithologies. Group 2, represented by the species *Lenticulina* sp., and *Gyroidina nitida*, correlates to carbonate--enriched samples with higher Si/Al, Zr/Al ratios.

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HEVLÍN – HYPOSTRATOTYPE OF THE KARPATIAN AGE

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Outcropping deposits of original clay pit were assigned as a hypostratotype of the Karpatian by Cicha *et al.* (1967) and Brzobohatý *et al.* (2003) corresponding to the upper Burdigalian in the standard chronostratigraphy. Our studies come from active brickyard about 100 m eastward from former locality. Sediments are grey calcareous bedded siltstones „schlier". Ca nannoplankton, foraminifera and palynomorphs were studied from 2 subsequent profiles. *Helicosphaera ampliaperta* indicated Early Miocene age (from middle part of NN2 to top of NN4 Zone). Foraminiferal assemblages dominated by *Bulimina elongata*, bolivinas and uvigerinas. Planktonic foraminifera were rare. *Uvigerina graciliformis* together with *Globigerinoides bisphericus* determined late Karpatian age (using stratigraphical ranges of Cicha *et al.* 1998)

Pollen and spores indicated mainly sub-tropical climate. The application of the PFT technique reveals shorter-term cyclic changes in plant diversity. The record of wet/dry index also shows short-term shifts. The marine environment was interpreted as the shallow sublittoral. Benthic foraminifera indicated low-oxic and high-nutrient environment with variegated paleonvironment at the sea floor. The changes may be both – spatial and/or temporal. Decrease of salinity in marginal part of basin cannot be excluded (presence of *Ammonia* and *Porosononion* and water plants *Salvinia x Azolla*, *Potamogeton*, *Nymphaea* indicate fresh water influx. Plankton assemblages indicate alternations (?seasonal) of mixed eutrophic water with *Turborotalita quinqueloba* and *Coccolithus pelagicus* with warm rather oligotrophic stratified water with *Globigerinoides*.

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THE NEANDERTHAL ENDOCAST FROM GÁNOVCE (POPRAD, SLOVAK REPUBLIC)

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A natural Neanderthal endocast was found in 1926 during quarrying of a travertine knoll in Gánovce, near Poprad, Slovakia. A young Czech paleoanthropologist, Emanuel Vlček, was the first who recognized that the endocast did not belong to a modern human, but rather to a Neanderthal (Vlček 1949). During his career, Vlček published several analyses of the cast. He provided a metric analysis of the specimen, a radiological study, and a morphological analysis including a geometrical comparison based on vault outlines and superimposition criteria (Vlček 1969, 1988). However, he wrote mostly in Czech or German, and thus most of his work remains unknown or inaccessible for current scholars. This study is aimed at summarizing the information available on the Gánovce endocranial cast, and at providing a metric evaluation of its morphology following a multivariate approach.

The cast of the endocranium was naturally formed by travertine and it has been dated to 105 ka BP (Jäger 1989). It is partially covered by attached mineralized bone fragments of cranial vault, mostly on the left and upper parts of the endocast. The volume of the endocast is about 1320 cc. The endocast has particularly well preserved inferior and occipital parts, with apparent *juga cerebralis*, venous sinuses, and even short segments of the middle meningeal vessels imprints. Here, we perform a multivariate analysis of its main diameters, further confirming its Neanderthal morphology. The endocast is particularly wide and flat, with an exceptional frontal width. The endocast shows an occipito-marginal sinus, not described previously, which represents an infrequent vascular trait. Its morphology suggests once more that the Neanderthal endocranial phenotype had already evolved at 100 ka (Bruner & Manzi 2008).

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PRELIMINARY REPORT ON PALAEOECOLOGY AND TAPHONOMY OF BOHUNICE SITE (MIOCENE, ČESKÉ BUDĚJOVICE BASIN, CZECH REPUBLIC)

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Large numbers of fossil plant and animal remains have been collected during a long-term activity at the Bohunice sandpit near Týn nad Vltavou. They enable basic palaeoecological and taphonomical interpretations. A rich collection of silicified stems, rhizomes of aquatic monocots, stem fragments of lotus-like plants as well as wood fragments have been found there. Conditions of fossilization process are still poorly understood at this site. Preliminary results of palynospectra studies can be used for interpretation of vegetation type in adjacent areas. A poorly diversified gastropod community has been described by Kadlecová & Kocura (2016), however, it is not fully clear if they were found in situ. Plant remains bear traces of insect borings. Fragmentary finds of fossil vertebrate remains could not be reliably determined. This may result e.g., from crushing of bones by large predators such as crocodiles, however, only a limited evidence for predation has been found so far (coprolite with fish remains).

Sedimentary record and fossil community indicate deposition in a richly vegetated lake littoral. Similar fossil community and fossilization style were reported from Ratká site, Hungary (Gregor 2008, Huber & Pavlicek 2008). This site undoubtedly represents a rare insight into shallow-lacustrine environment and will be subjected to further systematic study.

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POSSIBLE SHELL DISEASE SYNDROME IN TWO ORDOVICIAN TRILOBITES

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Swellings and other anomalies in exoskeleton of Cambrian to Carboniferous trilobites are only occasionally reported although they belong to an important source of information on possible parasitism and diseases in early metazoan communities. This contribution documents numerous swellings occurring in five large asaphid trilobites, particularly in an articulated exoskeleton of *Asaphelus desideratus* (Barrande 1872) earlier briefly described by Šnajdr (1979); in one articulated thoracopygon, two isolated pygidia and one isolated librigena of *Nerudaspis aliena* (Barrande 1872). All studied specimens come from the Darriwilian (Middle Ordovician) Šárka Formation of the Barrandian area (Czech Republic). Swellings observed on exoskeletons of all these late holaspid trilobites are tentatively interpreted as possible exoskeletal lesions comparable to „Shell Disease Syndrome“ (SDS) in Recent crustaceans (see Stewart 1993).

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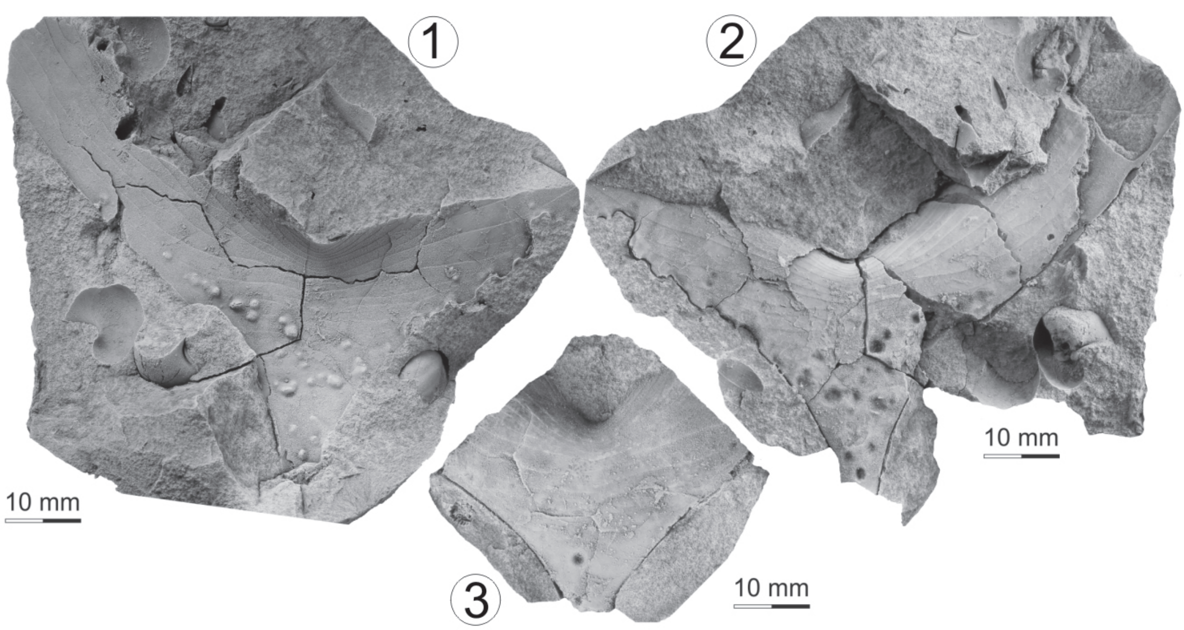

Figure 1. *Nerudaspis aliena* (Barrande, 1872), Middle Ordovician, Darriwilian, Šárka Formation. Specimens showing deep sub-circular pits and swellings. **1., 2.** Internal and external moulds of an incompletely preserved ventral part of a pygidium preserved in siliceous nodule. **3.** Internal mould of the ventral surface of an isolated pygidium. Specimens housed in the National Museum Prague (coll. F. Hanuš). Coated with ammonium chloride.

CORRELATION OF BIOSTRATIGRAPHY AND MICROFACIES OF SELECTED UPPER JURASSIC – LOWER CRETACEOUS SEQUENCES OF THE PIENINY KLIPPEN BELT (WESTERN CARPATHIANS, SLOVAKIA)

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The Pieniny Klippen Belt is a tectonic melange representing the boundary between the Outer and Central Western Carpathians. Within this melange, Jurassic and Cretaceous sedimentary rocks from deep-water to shallow-water environments occur. The corresponding sequences in the Orava area and Haligovce Klippe starts with facies of nodular Czorstyn Fm and passes upwards into pelagic/slope facies of biancone Pieniny Lst Fm (locally bedded: 5–35 cm) with cherts and facies of organodetrital bioclastic Nižná Lst. According to microstructure, light red, massive nodular Lst represent intrabiopelmicrite/intrabiopelmicrosparite wackestone to packstone in which planktonic crinoids *Saccocoma* dominate. Cysts of *Carpistomioshaera tithonica*, *Colomisphaera pulla, C. radiata*, rare *C. carpathica* from the Tithonica Zone and nannofossils *Conusphaera mexicana mexicana* and *Polycostella beckmanii* indicate Lower Tithonian age. According to microstructure, they represent calpionellid biomicrite (calpionellid wkst). Association of *Calpionellopsis oblonga*, *Cps. simplex*, *Calpionella alpina*, *C. elliptica*, *Tintinnopsella carpathica*, *Remaniella cadischiana*, *R. colomi*, *R. duranddelgai*, *R. filipescui*, *Lorenziella hungarica* and *L. plicata* indicating Calpionellopsis Zone, Oblonga Subz. can be identified. Within this zone, *Praecalpionellites murgeanui* also occur. *Calpionellites darderi*, *Cts. major*, *Tintinnopsella carpathica*, *T. longa*, *T. subacuta*, *Lorenziella hungarica*, rare *Calpionellopsis oblonga* associated with remaniellids mentioned above representing Calpionellites Zone, Darderi and Major Subz. were observed. *Crassicollaria brevis*, *Cr. colomi*, *Cr. intermedia*, *Cr. massutiniana* and *Cr. parvula* documented in the frame of Calpionellopsis and Calpionellites zones are rather redeposited. Nannofossils *Nannoconus kamptneri minor, N. k. kamptneri*, *N. st. steinmannii* and *N. gl. globulus*, cysts of *Cadosina semiradiata fusca*, *Shizosphaerella minutissima*, spores of *Globochaete alpina*, *Ostracoda* div. sp., benthic foraminifera, aptychi, and radiolarians are also present. Bioclastic Nižná Lst Fm occur along with the „biancone" Lst. They represent intrabiosparite/intrabiosparrudite (grainstones to rudstones) with fragments of rudist shell, obitolinids, small benthic, sessile foraminifera, gastropods, echinoderms and dasycladalean algae.

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ORGANIC MATTER ANALYSIS AND ITS PRESERVATION IN THE MENILITE BEDS IN SELECTED EXPOSURES FROM ROMANIA AND SLOVAKIA (EASTERN CARPATHIANS)

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The Menilite Beds are found in most of the main tectonic units of the Flysch Carpathians and they present large lithological diversity. The Menilite Beds are dominated by black or brown siltstone-mudstone with sandstones, marls, limestones, cherts and conglomerates. The Menilite Shales are considered as the potential source rock for the hydrocarbons of the Outer Carpathians, with TOC values reaching up to 20% (Kosakowski *et al.* 2009).

The dominating concept in the literature assumed a deep marine origin of the Menilite Beds, related to the deposition in the distal zone of turbidite currents and pelagic sedimentation on abyssal plains, slopes of underwater highs and in the lower parts of submarine fans (e.g., Górniak 2012). According to these concepts, the basin depths were significantly-deep, reaching several hundred metres, in places up to 2000 m (e.g., Kotlarczyk & Uchman 2012). Recent interpretations point to the shallow marine origin of the deposits and their counterparts from a number of successions, for example near Gorlice (e.g., Jankowski & Probulski 2011; Filipek *et al.* 2017). Moreover, most recent micropalaeontological analyses based on calcareous nannoplankton performed in the lower part of the Menilite Beds point to the predominance of species characteristic of shallow, low-salinity zones (Garecka 2012). For this reason the authors decided to do research based on qualitative and quantitative organic matter analysis.

Organic matter from the Slovakia area (Smilno and Dara Prislop exposures) is characterised by dominant dark amorphous organic matter (AOM) with a small amount of opaque phytoclasts. This is evidence of high thermal maturity of the organic matter. However, organic matter from the Romania area (Piatra Neamt and Nechit River sections) consists mainly of AOM, but also contains other particles, e.g., translucent and opaque phytoclasts, cuticles, dinofalgellate cysts, sporomorphs, foraminifera and freshwater microplankton (*Botryococcus* sp. and *Pediastrum* sp.) (Fig. 1). The presence of *Botryococcus* sp. and *Pediastrum* sp. call into question the genesis of the Menilite Formation as a deep-sea deposit.

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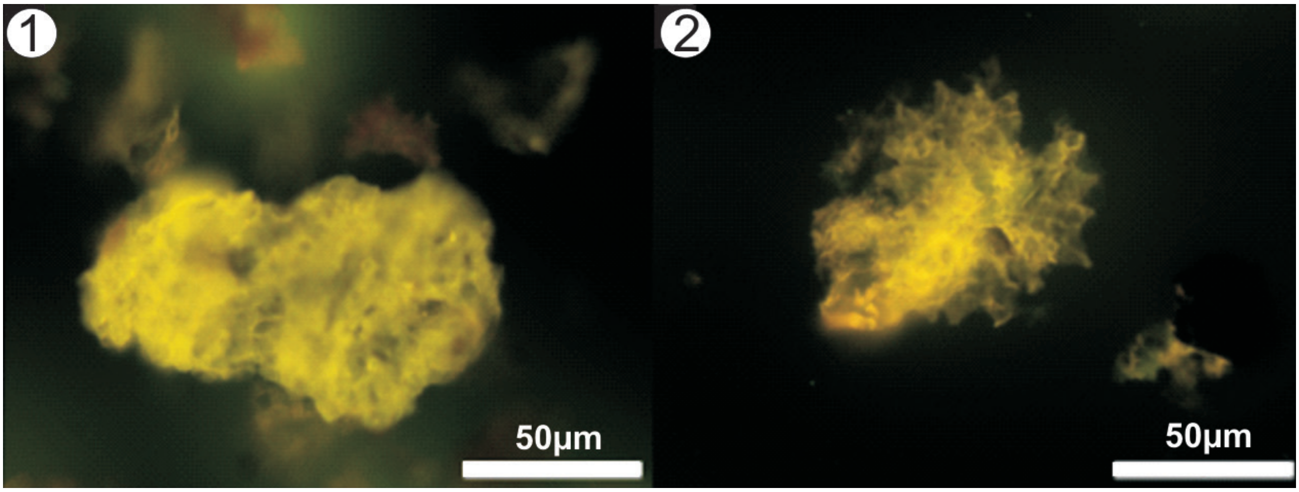

Figure 1. Photographs of freshwater microplankton from the studied samples; **1.** *Botryococcus* sp., **2.** *Pediastrum* sp.

PALEONTOLOGIC DATABASE OF THE STATE GEOLOGICAL INSTITUTE OF DIONÝZ ŠTÚR

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Paleontological research has been conducting in Slovakia since the mid-19th century. Up the present, a large collection of paleontological data has been picked up from the territory of Slovakia in sense of geological as well as specialized paleontological research. They are published in number of articles, manuscript reports and several monographs. To obtain some relational information is therefore time consuming such as the expansion of fossil taxa in the Slovak territory.

Within the state research project granted by the Ministry of Environment to the State Geological Institute of Dionýz Štúr entitled as "The Research of the Geological structure and Compilation of Geological Maps in Problematic areas of the Slovak Republic", one part of the project is focused on the compilation of single palaeontological database from the territory of Slovakia with aim of palaeontological data summarization, their quick access and querying.

The database resides on the Microsoft SQL Server 2012 (free license) and after logging (Fig. 1) allows the user´s parallel access to network server. The database management software is programmed in Visual Studio 2010.

The paleontological database includes complex processing of paleontological localities with surface profiles, boreholes, single outcrops etc.

Paleontological localities can be documented by photographs, sketches, litostratigraphic borehole schemes as well as microphotographs of individual fossils – remnants of organisms and plants.

The database is a powerful tool for making quick relational recherches and will contribute to better understanding of areal species distributions.

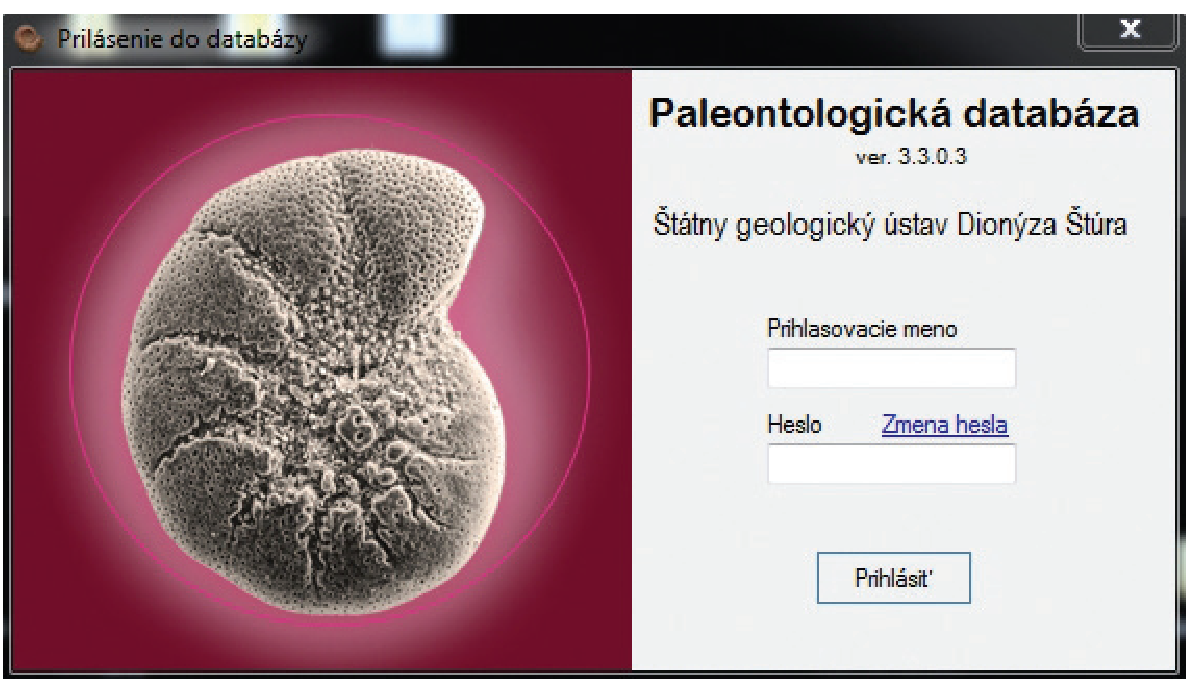

Figure 1. Login page.

A NEW COMBINATION OF FERN *SENFTENBERGIA ANGLICA* COMB. NOV. FROM THE PENNSYLVANIAN OF THE UK

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This study deals with revision of fertile specimens of *Myriotheca anglica* Kidston from two localities, Avenue No. 9 Colliery, Chesterfield, Derbyshire and Stanley Colliery, Liversedge, Yorkshire (middle Langsettian Substage), UK. Zeiller (1883, 1888) described the genus *Myriotheca* without annulus and mentioned the size of sporangia of *M. dessaillyi* 0.25–0.35 mm. Kidston (1923) defined *M. anglica* based on the differentiation of size of sporangia which are twice larger than those of the type species *M. desaillyi*. Kidston (1923) mentioned that *M. anglica* has pecopteroid type of pinnules and sporangia without annulus and assigned *Myriotheca anglica* to pteridosperms.

Based on the new observations, many characters appear to be really different from those of genus *Myriotheca* including the organization of sporangia, presence of annulus and *in situ* spores. Each pinnules bear up to 22 sporangia. Sporangia are of the *Senftenbergia*-type, it means sporangia are free or irregularly grouped to 4–5 with conspicuous apical annulus and stomium. Sporangia are free, sessile, oval with their longer axis 0.6–0.8 mm. The annulus is located on the upper part of each sporangia and consists of four-five rows of irregularly organised thick-walled elongated cells. The stomium cells consist of 5–7 rows of thick walled cells which are interrupted the apical annulus. We interpreted two different sets of *in situ* microspores as their different stages of maturity. The *Punctatisporites*-type is laevigate and relatively immature while strongly regulate *Convolutispora*-type is fully matured. The reproductive organs of this species correspond to the sporangia of *Senftenbergia*-type and therefore we suggest the new combination of *Senftenbergia anglica* (Kidston 1923) comb. nov.

ACKNOWLEDGEMENT

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PRELIMINARY REPORT ON PLANT REPRODUCTIVE STRUCTURES FROM RAKOWICE MAŁE (LATE CRETACEOUS, SOUTH-WESTERN POLAND)

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The quarry at Rakowice Małe (North Sudetic Basin, south-western Poland) is an outcrop of the Rakowice Wielkie and Czerna Formations (Coniacian to Santonian). The Nowogrodziec Member of the Czerna Formation (late Coniacian or early Santonian) contains several coaly layers that yielded plant mega-, meso-, and microfossils, including reproductive structures.

The material from Rakowice Małe locality studied here is a part of Ervín Knobloch's collection, housed in the National Museum, Prague (NMP). In the 1970s and 1980s, Ervín Knobloch assembled large collections of plant reproductive structures, from various localities in the Cretaceous of Central Europe. In the collections of the NMP, there are several small boxes labelled "Rakowice Male – nicht bearbeitet" (not described), which contain several quite well preserved reproductive structures, and are the object of the present study. Small fruits are mostly interpreted here as members of the Normapolles complex, which is an important part of Late Cretaceous floras of the northern hemisphere.

In 1986, E. Knobloch and D. H Mai reported two species from the Rakowice Małe locality: *Calathiocarpus octocostatus* and *Walbeckia guttaeformis*. In 2016, Z. Heřmanova mentioned one species from the Rakowice Małe locality: *Caryanthus microtriasseris*. The remaining part of the material from Rakowice Małe, collected by E. Knobloch, remained unidentified and unpublished. That material is identified here as: *Caryanthus communis*, *Caryanthus trebecensis*, *Caryanthus triasseris*, *Caryanthus* sp., *Zlivifructus vachae* and one unknown taxon (Taxon 1). One taxon of insect faecal pellets *Coprolithes* sp. was also found in the material. Overall, fruits from Rakowice Małe are larger than representatives of the same species from other locations, like Zliv Řídká Blaná and Vráto from Klikov Formation of South Bohemia Basins, or Aachen of the Aachen Formation from the Liège–Limburg Basin.

Mesofossils collected in 2017 include fragments of conifer twigs *Brachyphyllum*, *Cunninghamites*, *Pagiophyllum*, several angiosperm reproductive structures, and animal cuticles.

ACKNOWLEDGEMENT

Fieldwork in the North Sudetic Basin in 2017–2018 was financed through grant 2016/21/B/NZ8/02443 of the National Science Centre (Poland) to A. T. Halamski.

STRATIGRAPHY OF THE UPPER CRETACEOUS SEDIMENTS OF THE INNER UKRAINIAN CARPATHIANS

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In the Ukraine, the Inner Carpathians consist of: the Marmarosh Crystalline Massif and the Vezhany Nappe (= Marmaroch Klippen Zone), and the Monastyrets Nappe (= Between Klippen Flysch) and the Peniny Klippen Belt due to their geological position. The Vezhany Nappe continues to the Marmarosh Crystalline Massif to the northwest. The Monastyrets Nappe is thrust over both the Vezhany Nappe and the Marmarosh Crystalline Massif in a northwest direction and tectonically contacts the Peniny Klippen Belt at the southeastern side. The stratigraphy of this region was studied by previous researchers (Vialov *et al.* 1988 and references therein, Dabagyan *et al.* 1989, Oszczypko *et al.* 2005 and references therein). Biozones based on planktonic foraminifera ranging from the Cenomanian to the Maastrichtian have been identified in this area (Dabagyan *et al.* 1989 with references therein).

The Upper Cretaceous is part of the stratigraphic succession of the Marmaroch Klippen Zone and the Peniny Klippen Belt. These deposits are fragmentarily present on the Marmarosh Crystalline Massif and are not yet defined in the Between Klippen Flysch.

The Upper Cretaceous consists of calcareous siltstones and sandstones of the top of the Soymul Formation (Cenomanian), (hemi) pelagic gray marls of the top of the Tysalo Formation (Cenomanian), (hemi) pelagic red marls and argillites of the Puchov Formation (upper Cenomanian-Maastrichtian) and gray flysch of the Jarmuta Formation (Maastrichtian). Further micropaleontological and sedimentological studies of these Upper Cretaceous deposits are relevant both for the refinement of their age and for the analysis of the paleoenvironment.

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JÓZEF GRZYBOWSKI'S FORAMINIFERAL COLLECTION IN LVIV

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Józef Grzybowski (1869–1922) was a pioneer in the study of deep-water agglutinated foraminifera, and published four monographs that are the basis for all subsequent research on the topic of bathyal and abyssal assemblages. Grzybowski carried out his scientific work in Kraków, where he analyzed the microfossils from the Outer Carpathians. In addition to the four monographs, he left behind a collection of primary type specimens which to this day is housed in the collections of the Jagiellonian University, where he carried out this work.

However, a search of archived material reveals that the Jagiellonian University collection is not the only one that Grzybowski compiled. It turns out that in 1912, Grzybowski compiled a second collection of types from the material he studies, and sent them to the Lviv (Lwów or Lemberg) Museum along with a letter of introduction. This collection (and the letter) is preserved to this day in the State Museum of Natural History of the National Academy of Sciences of Ukraine. Thanks to the efforts of museum staff, the Lviv Grzybowski Collection has been preserved, and now it has been archived, catalogued, and partially revised.

The Lviv Grzybowski Collection consists of four parts, in agreement with the four locations that Grzybowski studied for his monographs. The specimens are stored in small glass vials sealed with a cork, with a small slip of paper in Grzybowski's handwriting giving the name of the taxon. On the reverse side of the slip is a catalogue number assigned by the museum curator. The Gorlice collection consists of three vials, the Wadowice collection – 17, the Krosno collection – 33, and the Dukla collection – 7. Over 300 specimens are contained in the collection. Five of the vials were empty, apparently any specimens these contained have been lost forever. In general the preservation state of the specimens is good, and only a few specimens are broken.

The Lviv Grzybowski Collection represents a valuable collection of paratypes and metatypes consisting of a total to 37 species that were originally described by the author. The majority of specimens appear to be paratypes of species, most of which are recognised as valid to this day. Our initial revision of the Lviv Grzybowski Collection reveals that the number of species is actually higher when modern taxonomic concepts are applied. This will be discussed later.

The specimens preserved in the Lviv Grzybowski Collection have been examined, cleaned, and photographed using state-of-the-art imaging techniques. The taxonomic revision of the collection, which is now in progress, will present over a thousand images on 90 plates.

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THE MICROPALEONTOLOGICAL RECORD OF THE POPIELE FORMATION MASS MOVEMENT DEPOSITS (OUTER CARPATHIANS) – PRELIMINARY DATA

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The Popiele Formation is characteristic for the external parts of the Skole (Skyba) Nappe in the Outer Carpathians. This nappe is composed of several skybas (tectonic slices). Our studies were conducted within the Oriv Slices, the second tectonic unit from the north, where the more distal part of the Popiele Formation is exposed. A very long and narrow strip of outcrops of this formation starts in the eastern Polish Carpathians and stretches to the Ukrainian part of the Skole (Skyba) Nappe. From a sedimentological point of view, the Popiele Formation originated as an effect of mass movements along the passive margin of the Carpathian Basin. It is composed of conglomerates, marly-mudstone predominated thin-bedded turbidities, and strongly plastically deformed mudstones arranged in various configurations of packages.

Micropaleontological and sedimentological studies have been initiated in order to determine the source of the transported clastic material and paleoenvironment of the Popiele Formation

Two different types of foraminiferal assemblages are found in washed material from mudstones and marls:

(1) a Middle Eocene assemblage dominated by agglutinated foraminifera with a significant admixture of calcareous benthic deep water and planktonic forms, (2) a Middle Eocene assemblage dominated by calcareous benthic fauna with the addition of planktonic foraminifera mixed with Late Cretaceous plankton (mainly globotruncanids and rugoglobigerinids) and calcareous benthos.

Type (1) refers to the bathyal zones and it can be connected with autochthonic fauna developed between particular slides, whereas type (2) represents mainly foraminifera that were transported from poorly lithified Cretaceous deposits originated in the shallower parts of the basin and redeposited to the deeper zone.

The conglomerates contain mostly pebbles of sandstones, limestones, and rare gaizes occurring within a sandy-marly matrix. The sandstones (with rather poorly rounded grains) represent various lithological types differentiated according to texture, structure, and mineral composition. These sandstones usually contain the Late Cretaceous planktonic foraminifera. The limestones represent the Stramberk-type with rich and diversified macro- and microfauna and microflora of Tithonian and Berriasian age. The microfossils found in the gaizes suggest a Late Cretaceous age.

KUMMERFORM GLOBIGERINAS FROM THE EARLY MIOCENE OF THE CENTRAL PARATETHYS

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During the Karpatian (late Early Miocene), a relatively deep and nutrient-rich sea was established in the northern part of the Pannonian Basin (Central Paratethys). Four- and five chambered globigerinas determined as endemic *Globigerina ottnangiensis, G. bulloides* and *G. praebulloides* characterize the planktonic foraminifera assemblages. Kummerform specimens occur commonly within both groups.

Ontogeny of the globigerinas was detailed study by X-ray imaging with average effective pixel size of 0.71 μm (Fig. 1). The scans were performed using a micro-CT system custom-built at IEAP CTU in Prague. The system providing true spatial resolution of 1 micrometer is equipped with a multi-focus X-ray tube FeinFocus FXE 160.51 and a large-area photon counting detector WidepiX$_{4\times5}$.

Morhological variability of kummerform globigerinas was confronted with paleoenvironmental interpretation based on paleobiological data (composition of foraminifera and calcareous nannoplankton assemblages) and geochemical proxies (δ13C and δ18O).

Two morphological types of kummerform globigerinas were distinguished:

(1) Five-chambered specimens in all ontogenetic stages (2) Originally four-chambered test. In adult and terminal stages, number of tests in last whorl may fluctuate from four to five.

Distribution of these morphotypes suggests to be paleoenvironmentally influenced: (1) Five chambered kummerform specimens occurred in mesotrophic stratified surficial water; (2) Four-chambered kummerform specimens lived in eutrophic mixed water, (3) Coexistence of both kummerform morphotypes indicate seasonal or interannual paleoenvironmental variability, (4) Absence of kummerform specimens indicate oligo-to mesotrophic stratified surficial water.

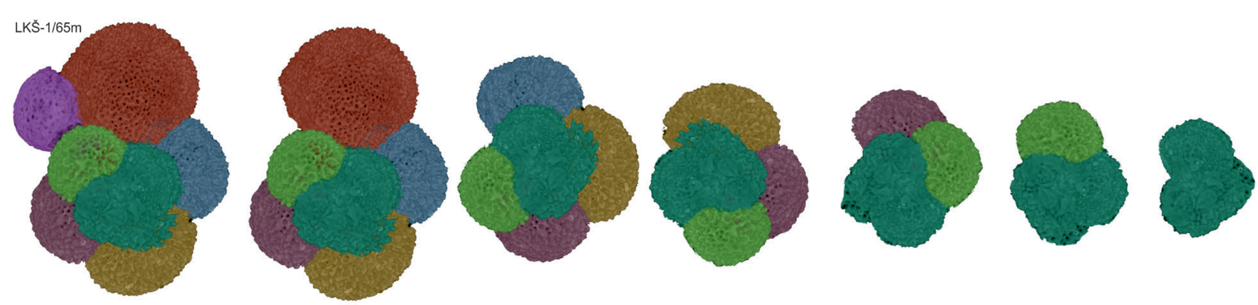

Figure 1. Ontogeny of kummerform Globigerina ex gr. Praebulloides reconstructed from micro-CT imaging. Core LKŠ-1, sample 65 m, Karpatian.

SABELLIDAE AND SERPULIDAE (POLYCHAETA, CANALIPALPATA) FROM THE DANIAN OF DENMARK, WITH SPECIAL CONSIDERATION OF SPECIMENS FROM THE FAXE QUARRY – PRELIMINARY REPORT

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The Faxe quarry is situated E of the village of Faxe (Sjaelland, Denmark) and constitutes the type locality of the Danian stage of the Paleogene. In the Faxe quarry two main mound complexes are developed: bryozoan limestones and coral limestones of Middle Danian age, NP3 nannoplankton zone, *Tylocidaris bruennichi* echinoid zone; for more detailed stratigraphy see Lauridsen *et al.* (2012) and Lauridsen & Bjerager (2014). The Faxe Formation is very fossiliferous, see e.g. Damholt *et al.* (2010) and Lauridsen & Schnetler (2014).

The polychaete worms from Faxe quarry were studied by Brünnich Nielsen (1931). Some Danian species were revised by Regenhardt (1961), Pasternak (1973), Lommerzheim (1979) and Jäger (1993). We studied hundreds of specimens collected by us, by Dr. Helmut Zibrowius (Marseille), Heilwig Leipnitz (Uelzen), Inga Krause and Hans Jäger (both Eimbeckhausen) and others from 1972 to 2010. Material from other Danian outcrops (Sangstrup Klint, Råsted, Karlby Klint, Stevns Klint, etc.) was collected by K.I.S., M.J., S.L.J. and others.

We recorded 56 sabellid and serpulid species in the Danian of Denmark (Table 1). Work is still in progress, therefore it is possible that some species may prove to be synonyms. Out of these 56 species, we recorded 43 species from the Faxe quarry (marked "F"), including one new microscopic species, *Filogranula* sp. nov. We have also found opercula of *Neomicrorbis* sp. indet. Diversity of ecological conditions in the coral and bryozoan mounds and other habitats and excellent taphonomic conditions result in high diversity of serpulid and spirorbid species and high number of specimens.

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species	original species
Glomerula serpentina (Goldfuss, 1831) F	*Serpula gordialis Varietas serpentina* "Goldfuss", 1831
Filograna ? faxensis (Brünnich Nielsen, 1931) F	*Filogranula faxensis* Brünnich Nielsen, 1931
Josephella ? filiformis (Brünnich Nielsen, 1931) F	*Serpentula filiformis* Brünnich Nielsen, 1931
Vermiliopsis dorsolineata (Brünnich Nielsen, 1931) F	*Serpentula dorsolineata* Brünnich Nielsen, 1931
Vermiliopsis costata (Brünnich Nielsen, 1931) F	*Proterula costata* Brünnich Nielsen, 1931
Metavermilia ? incrassata (Brünnich Nielsen, 1931) F	*Serpentula incrassata* Brünnich Nielsen, 1931
Metavermilia terundulata (Brünnich Nielsen, 1931) F	*Serpentula ter-undulata* Brünnich Nielsen, 1931
Filogranula sp. nov. F	
Semivermilia tripartita (Brünnich Nielsen, 1931) F	*Serpentula tripartita* Brünnich Nielsen, 1931
Semivermilia ? sp. F	
Pseudovermilia ? juliformis (Brünnich Nielsen, 1931) F	*Serpentula juliformis* Brünnich Nielsen, 1931
Hydroides ? quadrata (Brünnich Nielsen, 1931) F	*Serpentula quadrata* Brünnich Nielsen, 1931
Cementula applanata Brünnich Nielsen, 1931	*Cementula applanata* Brünnich Nielsen, 1931
Spiraserpula contorta (Brünnich Nielsen, 1931) F	*Cementula contorta* Brünnich Nielsen, 1931
Orthoconorca ? ascendens (Brünnich Nielsen, 1931) F	*Spirorbula ascendens* Brünnich Nielsen, 1931
Neovermilia ampullacea (J. de C. Sowerby, 1829) F	*Serpula ampullacea* J. de C. Sowerby, 1829
Neovermilia faxensis (Brünnich Nielsen, 1931) F	*Proterula faxensis* Brünnich Nielsen, 1931
Nogrobs ? (*Tetraditrupa ?*) sp.	*Serpula* sp. II Rosenkrantz, 1920
Rotularia hisingeri (Lundgren, 1891)	*Serpula Hisingeri* Lundgren, 1891
Rotularia ? conulus (Bronn, 1848)	"*Spirorbis conulus* Bronn, 1848"
Genus uncertain, *siphonata* Brünnich Nielsen, 1931 F	*Serpentula siphonata* Brünnich Nielsen, 1931
Pentaditrupa subtorquata (Münster in Goldfuss, 1831)	*Serpula subtorquata* Münster in Goldfuss, 1831
Ditrupa "schotheimi" Rosenkrantz, 1920 F?	*Ditrupa Schlotheimi* Rosenkrantz, 1920
Pseudochitinopoma ? annulata (Brünnich Nielsen, 1931) F	*Serpentula annulata* Brünnich Nielsen, 1931
Placostegus alatus (Brünnich Nielsen, 1931) F	*Serpentula alata* Brünnich Nielsen, 1931
Placostegus caesicius (Regenhardt, 1961) F	*Eoplacostegus* (*Caesicius*) *caesicius* Regenhardt, 1961
Placostegus dentatus (Brünnich Nielsen, 1931)	*Serpentula dentata* Brünnich Nielsen, 1931
Placostegus erectus (Brünnich Nielsen, 1931) F	*Serpentula erecta* Brünnich Nielsen, 1931
Placostegus indistinctus (Brünnich Nielsen, 1931) F	*Serpentula indistincta* Brünnich Nielsen, 1931
Placostegus undulifer (Brünnich Nielsen, 1931) F	*Serpentula undulifera* Brünnich Nielsen, 1931
Placostegus sp. F	
Serpulidae gen. et sp. indet. (aff. *Placostegus*) F	
Conorca consolida (Ødum, 1926)	*Serpula* (*Spirorbis*) *consolida* Ødum, 1926
Conorca dorsata (Brünnich Nielsen, 1931) F	*Spirorbula dorsata* Brünnich Nielsen, 1931
Pyrgopolon faxensis (Brünnich Nielsen, 1931) F	*Ditrupula faxensis* Brünnich Nielsen, 1931
Pyrgopolon sp. indet. F	
Neomicrorbis amplus (Brünnich Nielsen, 1931)	*Spirorbula ampla* Brünnich Nielsen, 1931
Neomicrorbis cingulatus (Brünnich Nielsen, 1931) F	*Spirorbula cingulata* Brünnich Nielsen, 1931
Neomicrorbis corrugatus (Brünnich Nielsen, 1931)	*Spirorbula corrugata* Brünnich Nielsen, 1931
Neomicrorbis distinctus (Brünnich Nielsen, 1931) F	*Spirorbula distincta* Brünnich Nielsen, 1931
Neomicrorbis expansus (Brünnich Nielsen, 1931) F	*Spirorbula expansa* Brünnich Nielsen, 1931
Neomicrorbis jodiformis (Brünnich Nielsen, 1931) F	*Spirorbula jodiformis* Brünnich Nielsen, 1931
Neomicrorbis multilineatus (Brünnich Nielsen, 1931) F	*Spirorbula multilineata* Brünnich Nielsen, 1931
Neomicrorbis parietalis (Brünnich Nielsen, 1931) F	*Spirorbula parietalis* Brünnich Nielsen, 1931
Neomicrorbis rosenkrantzi (Brünnich Nielsen, 1931)	*Spirorbula Rosenkrantzi* Brünnich Nielsen, 1931
Neomicrorbis serratus (Brünnich Nielsen, 1931)	*Spirorbula serrata* Brünnich Nielsen, 1931
Neomicrorbis sulcatus (Brünnich Nielsen, 1931) F	*Spirorbula sulcata* Brünnich Nielsen, 1931
Neomicrorbis ? striatus (Ødum, 1926)	*Serpula* (*Spirorbis*) *striata* Br. N. (Ødum, 1926)
Neomicrorbis tenuilineatus (Brünnich Nielsen, 1931) F	*Spirorbula tenuilineata* Brünnich Nielsen, 1931
Neomicrorbis ? sp. indet. F	Ormerør. Damholt, Rasmussen & Rasmussen, 2010
Neomicrorbis ? sp. indet. F	
Neomicrorbis sidereus Regenhardt, 1961	*Spirorbis sidereus* Regenhardt, 1961
Bipygmaeus pygmaeus (von Hagenow, 1840) F	*Serpula pygmaea* von Hagenow, 1840
Pileolaria sp. F	
Neodexiospira sp. F	
Spirorbinae indet. F	

Table 1. List of sabellid and serpulid species from the Danian of Denmark. Species occurring in the Faxe quarry are marked by "F".

Plate 1 Sabellids and Serpulids from Faxe quarry.

1. *Glomerula serpentina,* **2.** *Neovermilia ampullacea,* **3.** *Neovermilia faxensis,* **4.** *Vermiliopsis dorsolineata,* **5.** *Vermiliopsis costata,* **6.** *Pseudochitinopoma*? *annulata,* **7.** *Hydroides*? *quadrata,* **8.** *Filogranula sp. nov.,* **9.** *Spiraserpula contorta,* **10.** *Pyrgopolon sp.* indet., **11.** *Spiraserpula contorta,* **12.** *Vermiliopsis costata,* **13.** *Metavermilia terundulata,* **14.** *Semivermilia tripartita,* **15.** *Placostegus erectus,* **16.** *Orthoconorca*? *ascendens,* **17.** *Neomicrorbis expansus,* **18.** *Neomicrorbis parietalis,* **19.** *Semivermilia tripartita,* **20., 20a.** *Placostegus sp.,* **21.** *Bipygmaeus pygmaeus,* **22.** *Neomicrorbis multilineatus,* **23.** *Neomicrorbis distinctus,* **24.** *Neomicrorbis sulcatus,* **25.** *Neomicrorbis cingulatus,* **26.** *serpulid operculum or sponge*?, **27.** operculum of *Neomicrorbis* sp. indet.

Scale bars: 500 µm in 21 and 26, 1 mm in 1–3, 5–20, 20a, 22, 24 and 27, 1.5 mm in 23, 2 mm in 25, and 5 mm in 4.

PALYNOLOGICAL ANALYSIS OF CAVE ICE IN LODOWA CAVE IN CIEMNIAK, TATRA MOUNTAINS – PRELIMINARY RESULTS

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Ciemniak Mountain (2096 m a.s.l.) is the westernmost peak which belongs to the Czerwone Wierchy massif, in the Western Tatra Mountains (Poland). In the limestones within it there are caves, among others Lodowa Cave in Ciemniak (Jaskinia Lodowa w Ciemniaku in Polish), which is the largest ice cave in the Tatras. The ice volume is estimated at around 1500 m^3 and differentiated in two generations – older and younger with the border marked by the thermo-erosive surface. The ice layers vary into two types – transparent and opaque, whitish. These differences result from different conditions during the formation of ice (Hercman *et al*. 2010).

Following the information about the presence of pollen grains in Lodowa Cave in Ciemniak (Rygielski *et al.* 1995) two samples of ice were analyzed (about 100 ml each). One was collected from a layer of transparent ice, whereas the second from an opaque one. Microscopic observations confirmed the presence of pollen grains in Lodowa Cave in Ciemniak. Pollen grains e. g. *Alnus, Acer, Pinus,* Poaceae appeared in the layer of transparent ice. Pollen grains such as *Betula, Carpinus, Corylus, Pinus* occurred in the layer of opaque ice. These pollen grains belong to the plants currently found in the Tatra area.

Radiocarbon dating of organic remains in ice based on fossil moths proved the age of cave ice (Hercman *et al.* 2010). The younger generation of this ice was formed during the Little Ice Age. Therefore, the presence of pollen grains in ice of a certain age allows for the reconstruction of palaeovegetation in the cave region.

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RECONSTRUCTION OF FOSSILS: FROM BARE ROCK TO 3D PRINT

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Digital reconstructions are getting popularity as a tool for fossil morphology descriptions and measurements. 3D representation of data gives another point of view on a specimen and opens new doors for research opportunities. This poster presents techniques for accomplishing digital fossil reconstruction by using various methods in data acquisition and processing. There are different approaches in data acquisition: laser scanning, x-ray microtomography, photogrammetry (Mallison & Wings 2014) etc. All described methods have different benefits and drawbacks. One must choose a method, based on problems he wants to solve. Surface scanning methods can provide precise information about fossil exterior, while x-ray microtomography assists in internal structure reconstructions. 3D model of fossil can be used in morphometrics (Drake *et al.* 2017), as well as in structure analysis (Gee 2013) and various parameter testing applications (Kappelman *et al.* 2016).

Taking into account, that every method is providing a surface of the fossil, it is possible to prepare a model for 3D printing. 3D printed copy allows safe handling of fossil when the original specimen is too fragile to be handled, as well as it can be exchanged between members of a research team in order to speed-up research process. Microfossils can be enlarged significantly and examined without need of a microscope. 3D print is a good addition to presentational part of the research, as it provides not only visual information of the specimen, but also haptic contact.

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LATE ORDOVICIAN AGGLUTINATED FORAMINIFERA FROM SAUDI ARABIA

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We report the first discovery of a late Ordovician assemblage of primitive agglutinated foraminifera in the Ra'an Shale Member of the Qassim Formation in Central Saudi Arabia. The Ra'an Member in Saudi Arabia is dated as early Katian based on the occurrence of graptolites belonging to the Dicranograptus clingani Zone found in the lower part of the member. The shales at the base of the Ra'an Member correspond to the O40 Maximum Flooding Surface of Sharland *et al.* (2004).

The foraminiferal assemblage consists exclusively of agglutinated foraminifera, displays low diversity, and is highly dominated by monothalamids consisting mainly of the genus *Thuramminoides*. Additional monothalamid genera include a few specimens of *Amphitremoida*, *Saccammina*, *Saccamminita*, the tubular genus *Stegnammina*, and branching form of *Rhabdammina*. The assemblage also contains rare specimens of tubothalamid genera, including *Hyperammina* and *Subreophax*.

Multichambered foraminifera are represented by single occurrences of *Reophax* (a genus that has been previously reported from the Ordovician), and surprisingly, a single specimen that we assign to the genus *Bulbobaculites*.

In previous foraminiferal studies of the Paleozoic strata in the Czech Republic, no multichambered foraminifera have been reported from strata older than early Devonian (Holcova 2002). The finding of a single occurrence of *Bulbobaculites* at this Gondwanan locality pushes the evolutionary history of the lituolid foraminifera back to the late Ordovician.

During the Katian, Arabia occupied a mid-latitude position on the Gondwanan continent – the finding of an early lituolid in the Ra'an Member suggests that these forms first evolved in Gondwana and much later spread across the Rheic Ocean to other Paleozoic continents and terrains.

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EARLY PERMIAN TERRESTRIAL TRACE FOSSILS FROM THE LOWER ROTLIEGEND OF SW POLAND

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The research of the Early Perm (Lower Rotliegend) trace fossils assemblages was focused on sedimentary basins of Inner and Outer Variscides of SW Poland. The sedimentation and traces of organic life in these basins corresponds well with the Variscides basins of the NE Czech Republic and East Germany.

The systematics of the Rotliegend trace fossils encounters serious difficulties due to the lack of sufficiently transparent criteria in the description and determination of their individual ichnospecies. Most of the determinations originate from marine ichnocoenoses, which in many cases do not have their exact counterparts in terrestrial conditions. Additionally, many of the traces described contain diagnostic features that classify them simultaneously into various taxonomic groups. For this reason, some designations are approximate and reduced to their taxonomic level, if possible ichnogenus, or more specifically to ichnospecies.

Terrestrial ichnofacies *Scoyenia* contains all traces of organisms found in the red beds of continental deposits (e.g., Rotliegend strata). According to Frey & Pemberton (1984) typical for these traces sedimentary environments are: low-energy deposits from fine-grained to sandstone, periodically moist or wet; shallow lake or fluvial sediments, periodically emerging or periodically flooded coastal sediments; transitional environments between water occupied area and drayed up land. These sedimentation environments are characteristic of basins of the Lower Rotliegend. The importance of an environmental factor (Frey *et al.* 1984) defining the behavioral similarities of individual species.

Trace fossils, coming from collections from Poland, concern mostly Endichnia trace fossils, and thus traces of organisms penetrating sediments in search for food - Fodinichnia traces, or/and dwelling traces of the Domichnia type.

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Trace fosills taxonomy	Place of occurrence	
	I	II
Ichnogenus *Ancorichnus* Heinberg, 1974		×
Ichnospecies *Ancorichnus* (thick mieniscate back filling - TMBF)		
Ichnogenus *Taenidium* Heer, 1877 Ichnospecies *Taenidium serpentinum* Heer, 1877 (Type *Muensteria* Sternberg; Seilacher, 1958)	×	×
Ichnospecies *Muensteria* (thick mieniscate back filling - TMBF)		×
Ichnogenus *Palaeophycus* Hall, 1847	×	×
Ichnospecies *Palaeophycus striatus* Hall, 1852	× ?	
Ichnospecies *Palaeophycus tubularis* Hall, 1847		×
Ichnogenus *Planolites* Nicholson, 1873	×	×
Ichnospecies *Planolites montanus* Richter, 1937	×	×
Ichnospecies *Planolites beverleyensis* Billings, 1862		×
Ichnogenus *Skolithos* Haldeman, 1840	×	×
Ichnospecies *Skolithos linearis* Haldeman, 1840		× ?
Skolithos sp. cf. *Cylindricum antiquum* Plieninger	×	× ?
Unidentified		×
(I) Intra-Sudetic Basin: eastern part - drillings in the area of Wambierzyce; Dzikowiec trough - Dzikowiec IG 1 borehole , central part – outcrops of Słupiec Formation near Nowa Ruda (Lower Rotliegend).		
(II) Eastern fore-Sudetic Basin (former Laskowice Oławskie trough – A. Gąsiewicz & H. Kiersnowski, 1986): Odra 1, Odra 4 and Lipowa IG 1 boreholes (Lower Rotliegend).		

MICROSTRUCTURAL STUDY OF *CARYOPHYLLIA (ACANTHOCYATHUS) VINDOBONENSIS* REUSS 1871 CORALLITE

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Anthozoa are sessile marine invertebrate organisms belonging to phylum Cnidaria. Most of the post-paleozoic groups secrete calcareous elements that form an exoskeleton (corallum, corallite). During its growth, a polyp (organism forming the corallite) moves up and leaves previously inhabited space of its corallite and the abandoned areas remains preserved. This process gives us opportunity to study ontogenetic growth (initial, juvenile and adult stage) of the polyp´s corallum (Stolarski 1995).

Caryophyllia (*Acanthocyathus*) *vindobonensis* REUSS 1871 is a Miocene fossil coral from the Mediterrean and the Paratehys region. It forms ceratoid to trochoid corallum. The corallum has 6 rows of spines. Chalices are of round shape and contains up to 56 septa (5 septal cycles). Lateral sides of septa are granulated (Kleprlíková & Doláková 2016). Microstructure is being described from 4 transverse thin-sections. Study of microstructure in optical microscope shows subsequent ontogenic development of this specimen´s corallum (juvenile and adult stages). Very distinctive are the changes in formation of columella and septa. This contribution shows ongoing result of this study of 1 specimen AV3 (Fig. 1).

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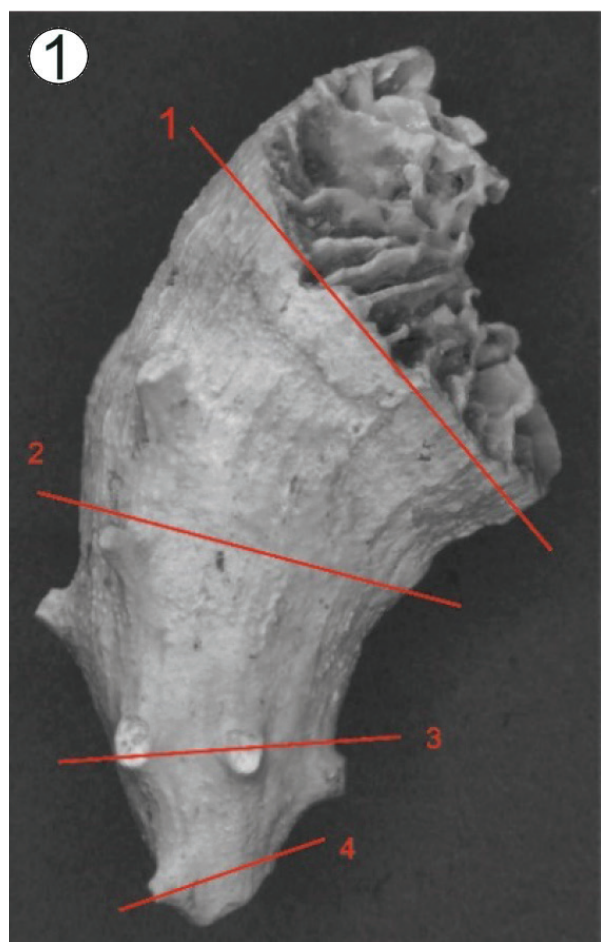

Figure 1. Specimen AV3 – distribution of thin-sections.

NEW BIOSTRATIGRAPHIC EVIDENCE OF THE MIDDLE CONIACIAN IN THE EASTERN BOHEMIAN CRETACEOUS BASIN

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Within the scope of investigating further the Březno Formation, new material was collected from Svinary. This locality was formerly studied by Frič (1889), Zahálka (1949) and Soukup (1962). The actual natural outcrop displays ca. 10–12 meters of fine greyish calcareous claystones and provides a continuous faunal record allowing a bed-by-bed collecting of abundant fossil material. The presence of inoceramid fauna (*Volviceramus involutus* ?, *Platyceramus mantelli*) lead us to assume the Coniacian age. In order to refine this stratigraphic assignment, the following microfossil groups were scrutinized: calcareous nannofossils, foraminifers, ostracodes. The calcareous nannofossil assemblage contains characteristic Coniacian species among which cardinal biostratigraphic taxa, such as *Broinsonia parca expansa* and *Micula staurophora*, documenting the UC 10 Nannofossil Zone (*sensu* Burnett 1998) and subsequently supporting the Middle Coniacian age. Foraminiferal assemblage includes benthonic (e.g., *Globorotalites* gr. *micheliniana, Tritaxia* sp., *Praebulimina* sp., *Neoflabellina suturalis suturalis, Frondicularia apiculata*), agglutinated (*Spiroplectammina praelonga*), and planktonic (*Planoheterohelix globulosa, Whiteinella brittonensis*, *Whiteinella baltica*, *Whiteinella archaeocretacea, Dicarinella canaliculata, Dicarinella imbricata*, *Marginotruncana pseudolinneiana*) species. Ostracodes are mostly represented by genus *Cytherella* (*C.* gr. *ovata*, *C.* cf. *parallela*) and *Imhotepia marssoni*?, *Bairdia* gr. *cretacea*, *Pterygocythereis spinosa*. Calcispheral specimens include *Calcisphaerula innominata*. The macrofossil assemblage consists of ammonites (*Scaphites* sp.), bivalves (*Tellina* sp., *Nucula* sp.), echinoids (*Hemiaster (Leymeriaster)* cf. *regulusanus*), ophiuroids, trochiid gastropods and glypheid lobster (?*Rectaglyphea bohemica*). Fossil plant remains were also recorded (*Pagiophyllum brachyphillum*, *Frenelopsis alata*).

ACKNOWLEDGEMENT

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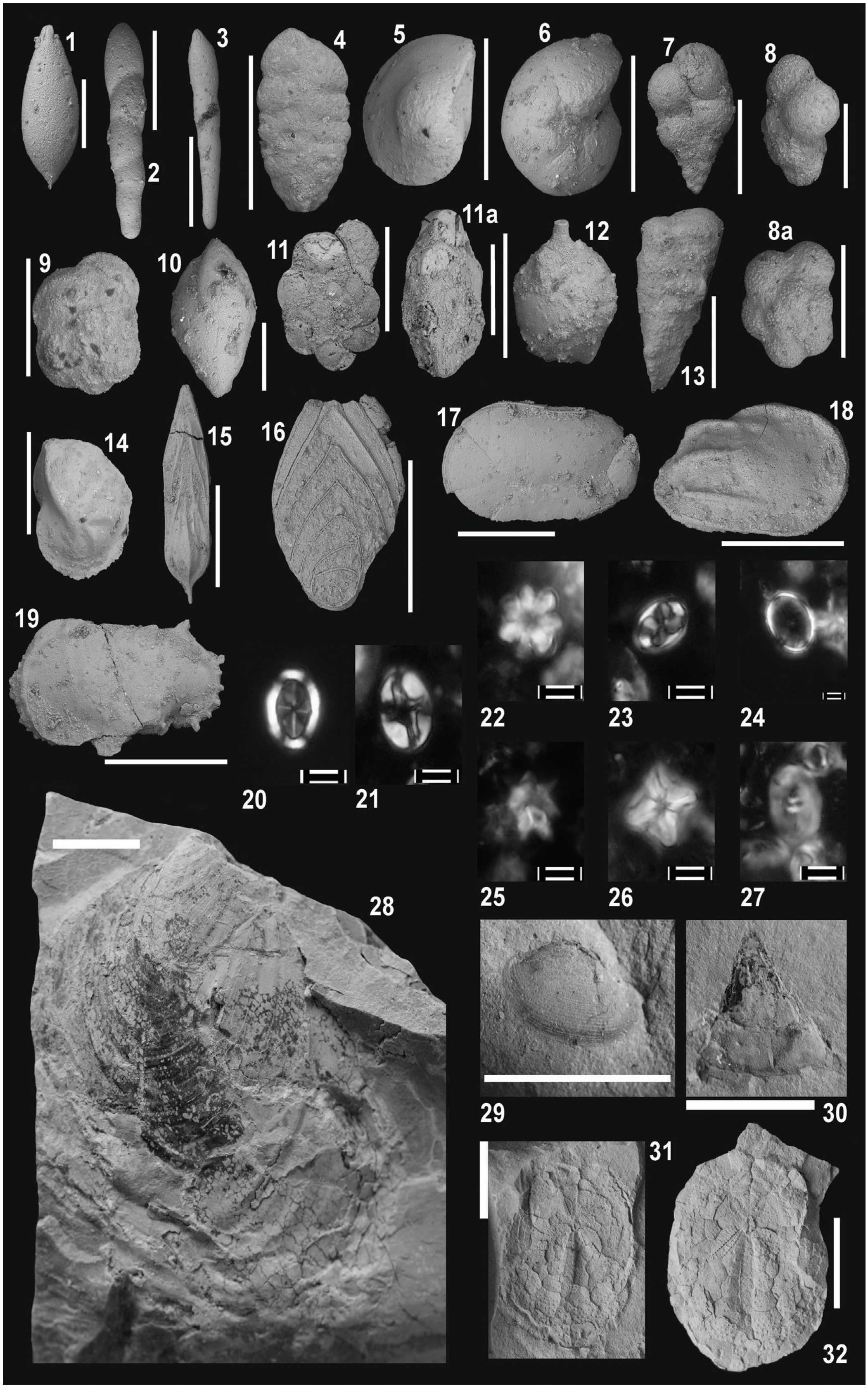
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Plate 1. The Middle Coniacian assemblage of the outcrop at Svinary.

Benthic foraminifera: 1. *Lagena* cf. *apiculata* (Reuss, 1850), scale bar is 100 µm. **2.** *Dentalina gracilis* (d´Orbigny, 1840), scale bar is 200 µm. **3.** *Nodosaria oligostegia* (Reuss, 1845), scale bar is 400 µm. **5.** *Lenticulina lobata* (Reuss, 1845), scale bar is 300 µm. **6.** *Gyrodinoides globulosa*, scale bar is 1 mm. **10.** *Praebulimina* sp. scale bar is 100 µm. **12.** *Lagena hispida* Reuss, 1858, scale bar 300 µm. **13.** ?*Astacolus parallelus* (Reuss) scale bar is 500 µm. **14.**?*Eggerellina* sp., scale bar is 500 µm. **15.** *Frondicularia apiculata* Reuss, 1844 scale bar is 400 µm. **16.** *Neoflabellina suturalis suturalis* (Cushman, 1935), scale bar is 400 µm.

Agglutinated foraminifera: 4. *Spiroplectammina praelonga* (Reuss, 1845), scale bar is 400 µm.
Planktonic foraminifera: **7.** *Planoheterohelix globulosa* (Ehrenberg, 1840), scale bar is 200 µm. **8.** *Archaeglobigerina cretacea* (d´ Orbigny, 1840), scale bar is 400 µm. **8a.** *Archaeglobigerina cretacea* (d´Orbigny, 1840), scale bar is 300 µm. **9.** *Marginotruncana marginata* scale bar is 400 µm. **11.** *Dicarinella canaliculata* (Reuss, 1854) scale bar is 500 µm. **11a** *Dicarinella canaliculata* (Reuss, 1854) lateral view, scale bar is 300 µm.

Ostracoda: 17. *Cytherella* gr. *ovata* (Roemer, 1841) scale bar is 500 µm. **18.** *Imhotepia marssoni*? (Pokorný, 1984), scale bar is 300 µm. **19.** *Pterygocythereis spinosa* (Reuss, 1846), scale bar is 400 µm.

Calcareous nannoplankton: 20. *Broinsonia parca expansa*. **21.** *Eiffellithus eximius*. **22.** *Eprolithus moratus*. **23.** *Helicolithus trabeculatus*. **24.** *Kamptnerius magnificus*. **25.** *Lithastrinus septenarius*. **26.** *Micula staurophora*. **27.** *Zeugrhabdothus biperforatus*. Scale bar represents 5 µm.

Mollusca: 28. *Platyceramus mantelli* (de Mercey, 1872; *sensu* Barrois, 1878). **29.** *„Tellina“* sp. **30.** *„Trochus“* sp. Scale bars are 1 cm.

Echinodermata: 31, 32. *Hemiaster (Leymeriaster)* cf. *regulusanus* (d´Obirgny, 1854). Scale bars are 1 cm.

LOWER AND MIDDLE TURONIAN AMMONITES FROM BOHEMIAN CRETACEOUS BASIN

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According to present knowledges, the Turonian ammonites from the Bohemian Cretaceous Basin (BCB) starts within the Mammites nodosoides ammonite Zone. It is in the strong contrast to the stratigraphic distribution of the ammonite fauna in European basins, as well as the West Interior Seaway (WIS), north Africa and other regions. The majority of the Middle/upper Lower Turonian ammonites in BCB are represented by the index species *Mammites nodosoides* (Schlüter) and other taxa of this Zone. Our new records of the genus *Fagesia* (Mantell) (4 specimens), *Paramammites* (Barbaer) (1 specimen) and *Watinoceras* (Henderson) (1 specimen), however, clearly document older strata than previously suggested. These samples were collected in the first half of the 20th century and they come from area around Žďánice u Kouřimi. Unfortunately, these very important localities are not exposed at present time. Based on these records, we extend the ammonite zonation down to the base (or to the lowermost strata) of the Turonian in the BCB. This significantly rises a correlational potential, especially within ammonite faunas from the NW Tethys and the WIS.

Few other interesting species of the Turonian ammonites were newly recorded and compared to those in older collections – i.e. *Prionocyclus albinus* (Fritsch). The taxonomic validity of species *Mammites curimensis* (named after Kouřim) is also discussed.

Figure 1. *Fagesia catinus*, Žďánice u Kouřimi locality, collected by Soukup in 1936, deposited in Chlupáč´s Museum, Faculty of Sciences, Charles University. Scalebar represents 3 cm.

IMPACTS OF CLIMATIC CHANGES DURING THE MIDDLE MIOCENE IN THE WESTERNMOST PART OF THE CARPATHIAN FOREDEEP

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The middle Miocene represents significant transition in Cenozoic climatic evolution, following the climax of Neogene warmth in the late early Miocene at ~16 Ma. The early stage of this climatic transition from ~16 to 14.8 Ma was marked by major short term variations in global climates, East Antarctic Ice Sheet volume, sea level, and deep ocean circulation (Flower & Kennett 1994). The Miocene sedimentation history was studied on material originating from borehole Brus-1. It is characterized by alternation of siliciclastic facies by carbonate and by the presence of low salinity foraminifera, high nutrient foraminifera and large benthic foraminifera (*Planostegina* sp. which point to Badenian age only). Missing of stratigraphically significant species *Orbulina*, *Praeorbulina circularis* and *Helicosphaera waltrans* could indicate interval older than 15 Ma. The significant alternation of siliciclastic facies by carbonate ones was caused probably by short term variations in global climates with episodic changes in precipitation regime. The humid regime is represented by siliciclastic facies, which is affected by river input into the basin. It is evidenced by relatively high concentration of Th and K and by presence of low salinity and high nutrient foraminifera. Following increase of aridity accompanied by decline of input of the terrestrial material was represented by the carbonate sedimentation. The onset of arid period is characterized by the rapid increase in U concentration and decline in K and Th concentration, decrease of nutrient input and the expansion of seagrass meadows with good oxic and light conditions. This aridification event may be correlated with one of the aridification events recorded in the Mediterranean, probably with date of ~15.074 Ma (cf. Hüsing *et al.* 2010).

ACKNOWLEDGEMENT

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PALYNOFACIAL AND GEOCHEMICAL ANALYSIS OF THE SEDIMENTS IN DANUBE BASIN – A CASE STUDY

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Palynofacies analysis is an important tool for an interpretation of palaeoenvironmental and hydrocarbon potential from the organic matter point of view and its distribution in sediments. In the sedimentary records of the Modrany-1 and Modrany-2 wells, only a few changes in the depositional environment were recorded.

During the NP21-22 biozone the redox conditions were more dysoxic. It was visible from palynofacies record (high portion of AOM) as well as from geochemical indicators such as increased TOC, TS and Ni / Co. AOM data and the sedimentation on the proximal part of the dysoxic to the anoxic shelf, respectively, in the distal part of the suboxic-anoxic basin indicate the I. kerogen type and oil rock potential.

NN5 biozone dated samples are originated on the transition between the shelf and the basin under the dysoxic to suboxic conditions.

NN6 biozone dated samples show the most distal source of organic matter and distal oxic shelf of origin based on the phytoclasts dominancy.

NN9 biozone dated samples reflects, the oxic sedimentation environment predominated and proximate (oscillated to distal) to the organic matter source with a prevailed palynomorphs (dinoflagellates, pollen) and phytoclasts.

Sedimentation during the Miocene was under oxic conditions, and mainly III. type kerogen was identified. The I. type kerogen was identified in the Oligocene age samples from the Modrany-1 well only.

LOWER CARBONIFEROUS BIVALVES AND THEIR JUVENILE FORMS FROM MYSLEJOVICE FORMATION, DRAHANY CULM FACIES

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The Drahany Upland is built of Lower Carboniferous flysch sediments. The occurrence of fossils in Protivanov and Rozstání formations is very sporadic. The highest diversity of faunal assemblages and trace fossils is well known in the Myslejovice Formation (Upper Visean). Sites with fossil fauna and ichnofauna are situated in the south-eastern part of the Drahany Upland. Eight hundred thirty-two samples collected at several localities at the Drahany Upland, 12 genera of bivalves were determined, including the following species: *Posidonia becheri*, *P. corrugata*, *P. kochi*, *P. radiata, P. trapezoedra*, *P. ?membranacea*, *Septimyalina sublamellosa*, *S. lamellosa*, *S.* cf. *minor*, *Paralellodon* sp., *Dunbarella mosensis*, *Streblochondria patteiskyi*, *S. praetenuis*, *Edmondia* sp. *Janeia böhmi*, *Polidevcia* cf. *sharmani*, *P.* cf. *attenuata*, *Anthraconeilo oblongum*, *Palaeoneilo luciniforme, Sanguinolites tricostatus, Sanguinolites* sp. The most abundant group of bivalve fauna belongs to the subclass Pteriomorphia (*Posidonia becheri* is a typical representative of the benthic assemblages in the Drahany Culm Facies – Fig. 1). Our research is based on evaluation of morphological features and dimensions of valves. Biometric data of the herein studied specimens were compared with results published by Żakowa (1971) and Amler (2004). Overall 94 specimens of *Posidonia becheri* have been tested for height/length ratio. Ontogenetic changes from juvenile to adult specimens were observed in *Posidonia becheri*, *Posidonia ?membranacea* and *Septimyalina sublamellosa* species.

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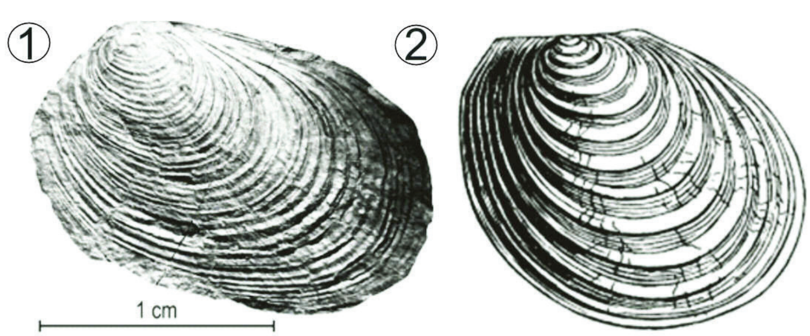

Figure 1. 1. *Posidonia becheri* Bronn, 1828, from the Ježkovice R, i. n. 10854/1 stored at the Regional Museum in Olomouc; **2.** the sketch of *Posidonia becheri*, idealised sculpturemorphology.

SMALL CARBONACEOUS FOSSILS (SCF) IN CAMBRIAN AND ORDOVICIAN

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Several years ago, a new term „Small Carbonaceous Fossils" (SCFs) has been proposed to accommodate organic remains on the boundary of macroscopic and microscopic fossils (Butterfield & Harvey 2012). While such fossils have been known for quite a long time (e.g., Butterfield 1990), their classification as a distinct group makes possible their systematic treatment. SCFs are obtained using diverse maceration methods from fine clastic as well as from other sedimentary rocks. Generally, the dissolution in hydrofluoric acid is utilized. Treatment using other acids (e.g., hydrochloric acid) is employed in some cases (e.g., Smith *et al.* 2016). Generally, the obtained fossils are highly fragile and require restricted manipulation (Butterfield & Harvey 2012).

Large part of published papers demonstrates, that SCFs are of significant importance for Cambrian and Ordovician palaeontology and could occur during the entire Palaeozoic. Such fossils show both palaeogeographic and stratigraphic restriction and their study could enlarge our understanding of different aspects of palaeontology, palaeogeography and stratigraphy. Furthermore, their occurrence is usually known from fine–grained siliciclastic/argillaceous rocks, but these fossils were also described from other lithologies, including carbonates or even coals. Occurrences from carbonates and coals were described from Silurian/Devonian and Carboniferous respectively (e.g., Errikson *et al*. 2016, Bartram *et al*. 1987).

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LATE CRETACEOUS FORAMINIFERAL AND CALCAREOUS NANNOFOSSIL ASSEMBLAGES FROM THE HYŻNE SECTION (SKOLE NAPPE, OUTER CARPAHIANS, POLAND)

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Late Cretaceous foraminiferal and calcareous nannofossil assemblages were studied in the Hyżne section in the Skole Nappe, Polish Outer Carpathians. The section consists of turbiditic flysch-type sediments, mostly marls or marly mudstones interbedded with thin fine-grained sandstones, which belong to the Ropianka Formation (Turonian–Lower Palaeogene). The biostratigraphical analysis based upon relatively well preserved foraminiferids, i.e., *Abathomphalus mayaroensis, Racemiguembelina fructicosa*, *Globotruncanita stuarti, Globotruncanita stuartiformis, Contusotruncana contusa* and other planktonic index taxa points out to a Campanian–late Maastrichtian age, mostly the *Racemiguembelina fructicosa* and *Abathomphalus mayaroensis* Zones. Analysis of the nannofossil assemblages gives similar age results with the youngest nannozone being NP1 (Danian) which include *Cruciplacolithus primus*, *Cruciplacolithus tenuis* and *Lanternithus duocavus* and the rest being ascribed to Maastrichtian or Campanian age (nannozones CC26 and lower). The studied assemblages are typical for a depths that correspond to an outer shelf–upper continental slope and belong to the Tethyan biogeoprovince.

RADIOLARIAN ASSEMBLAGES IN PALAEOCEANOGRAPHIC INTERPRETATIONS OF THE UMBRA-MARCHE BASIN (ITALY) AND THE SILESIAN BASIN (POLAND) DURING TURONIAN

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Radiolarian frequency and composition were determined for the Umbria-Marche Apennines, Italy (UMA) and Outer Carpathians, Poland (OC), to evaluate the relationship between species distribution and physical conditions in the northern sector of Western Tethys during the Turonian. The radiolarians have been found in the deep--water carbonate deposits belong to the Scaglia Bianca and Scaglia Rossa formations (UMA) and in the siliciclastic deposits of the Barnasiówka Radiolarian Shale Formation and Variegated Shales (OC).

Three ecological groups have been distinguished in the deposits investigated. These are: (1) group A including surface radiolarian assemblage from surface waters, (2) group B including radiolarian assemblage that could live near thermocline, and (3) group C that assembled specimens could live in deep water located under thermocline. In the UMA area the radiolarian group A contains 183 species and is characterized by small number of individual specimens. Group B contains 14 species. Average content in the samples is 16.9% with a maximum of 50.3%. Group C contains one species, *Holocryptocanium barbui* Dumitrică, with a ranges from 1.2% to 84.5% (ave. 37.9%). In the OC, radiolarian group A contains ten species. Group B contains two species (*Stichomitra communis* Squnabol and *H. barbui* Dumitrică). Group C contains also two species (*H. tuberculatum* Dumitrică and *Praeconocaryomma lipmanae* Pessagno).

The presence of particular groups in the samples indicates the depth of the thermocline, as well as the occurrence of upwelling. The radiolarian diversity and specimens richness is high in the lower Turonian. Period of highest radiolarian accumulation could indicate on existing of warm water pool in the Western Tethys. In the OC area the radiolarian assemblage was characterize by domination of subsurface radiolarian group indicated on prevailing upwelling conditions. Radiolarian abundance and richness dropped in the upper Turonian deposits indicated on possible reorganization of water circulation system accompanied with weakening of the warm waters pool that caused weakening of upwelling.

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TURONIAN RADIOLARIAN BIOSTRATIGRAPHY OF THE WESTERN TETHYS

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The local radiolarian biozones presented herein were considered to be appropriate for the Western Tethys settings, including the deep water carbonate environments represented by sections in the Umbria Marche Basin (UMB) in the Central Appeninnes and deep-water hemipelagic settings in the Silesian Basin (SB) in the Outer Carpathians. The uppermost Cenomanian through Turonian deposits are represented by the Scaglia Bianca and the Scaglia Rossa formations (UMB) and Barnasiówka Radiolarian Shale Formation and Variegated Shales (SB).

Two radiolarian zones and three subzones were established in the studied deposits. The *Hemicryptocapsa polyhedra* Radiolarian Interval Zone (Bąk 1999), *Alievium superbum* Radiolarian Taxon Range Zone Pessagno 1976 and *Alievium superbum-Xitus mclauglini* Radiolarian Concurent Range Subzone (Bąk 2011) have been used from previous local zonal schemes defined from the Western Tethys.

Two new subzones were newly established. These are: *Alievium superbum – Pessagnobrachia fabianii* Concurent Range Subzone and *Alievium superbum – Pseudodictiomitra tiara* Concurent Range Subzone.

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SHELLS AS A TIERING BOUNDARY AND A SUBSTRATE FOR COLONIZATION IN THE INITIAL STAGES OF THE PRAGUE BASIN, CZECH REPUBLIC (TREMADOCIAN TO EARLY DARRIWILIAN)

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Shells of living or dead organisms represent a special substrate. The colonization and biodegradation of the shell material such as microborings is beyond the scope of research. Three extensive ecospaces can be studied: above and below or inside. The former direction is occupied by epibionts, the latter offers space for hide but, especially, it is a source of food for (not only but especially endobenthic) feeders of decaying tissues of carcasses or microbial consorcia of decompositors and their metabolites. It is also a special substrate of its own role in tiering.

First significant shell colonization in the Prague Basin was recorded in the Klabava Formation (Dapingian). Ichnofossils following the inner surface of flattened shells are exceptional but exist. The key overturn is traced in the Šárka Formation. Holdfasts and thecae of echinoderms are occasionally preserved attached on shells, predominatly of hyolithids and molluscs. Ichnofossils of *Arachnostega*-type and simple and branched tunnels (e.g., *Pilichnus*) are very common inside or below shells. They are known from almost all fossil groups occurring in the Šárka Formation (Darriwilian). Their usual preferential distribution in each shell testifies a topology of the tissues serving as a food. An effective feeding habit of consumers often preferred soft tissues of intestine, e.g., in some trilobites (*Placoparia*) and gastropods. However, some taxa appear to offer food only as wide-ranging remains (?organic membranes) on the inner surface of their exoskeletons: the ichnofossils are distributed randomly along the surface.

The gradual increase of faunal diversity and complexity of communities in the Prague Basin is reflected in a stuck use of shells as a substrate for colonization.

REVIEW OF THE PALAEOZOIC LOCALITIES OF AMPHIBIANS FROM BOSKOVICE BASIN (CZECH REPUBLIC)

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The upper Palaeozoic sites of Boskovice basin are known for the rich material of fossil amphibians. Predominant species are *Discosauriscus austriacus* and *Discosauriscus pulcherrimus*, but some are also represented. Especially the older findings are localized very vaguely and inaccurately, so it was necessary to revise these sites and to locate them accurately. This review is a supporting work for the qualitative evaluation of more than 3000 specimens of fossil amphibians from the CHMHZ collections, which come from the prof. Z. Špinar and his colleagues. Nevertheless, it is necessary to review sites where other researchers worked (Stehlík 1924, Augusta 1926, Špinar 1952, Zajíc & Štamberg 2004, Štamberg 2013). The dominant area is the surroundings of the village Bačov, but the extension is much larger.

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REFERENCE SECTIONS OF THE PALEOFAUNAL SUBDIVISIONS OF THE MIDDLE PLEISTOCENE (EARLY-MIDDLE NEOPLEISTOCENE) IN THE SOUTH OF EASTERN EUROPE (ON THE BASIS OF SMALL MAMMALS)

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A new type of reference section, the *paleofaunal reference section* (PRS), was proposed to denote the most representative section (exposure), complete or partial, that contains a sufficiently informative fossil record characterizing a particular mono- or polytaxonomic faunal complex or association to be used for the purposes of stratigraphy. An integrated analysis of the geological, paleontological and dating evidence on 34 micromammalian localities of the Tiraspol faunal complex, ranging from the final Eopleistocene to early Neopleistocene, was undertaken. Reference sections for paleofaunal subdivisions (complex, association) are allocated (Fig.). The horizons 2 to 10 of the section Kolkotova balka were designated as the PRS for the Tiraspol faunal complex of small mammals. Also described were PRSs for several mammalian associations: the Karay-Dubina section for Luzanovska, the Protopopovka section for Protopopovka 2 and Protopopovka 1, the Kolkotova Balka section for Kolkotovka, the Utkonosovka section for Tikhonovka, the Krasnoselka 1 section for Krasnoselka, and the Nagornoye 1 section for Nagornoye. Thirty three micromammalian localities of the Singil and Khazar faunal complexes of the middle Neopleistocene in the South of Eastern Europe was undertaken. The horizons 2 to 4 of the section Ozernoje (locality Ozernoje II) were designated as the PRS for the Singil faunal complex of small mammals (Fig. 1). The horizons 5 to 7 of the same section (locality Ozernoje I) were designated as the PRS for the Khazar faunal complex. Also described were PRS for several mammalian associations: the locality Ozernoje II for Babel'ska, the Gunki section for Gun'kovska, the Matveevka section for Matveevska, the Khalepje section for Khalepjevska and the Beglitsa section for Beglitska (Krokhmal 2014).

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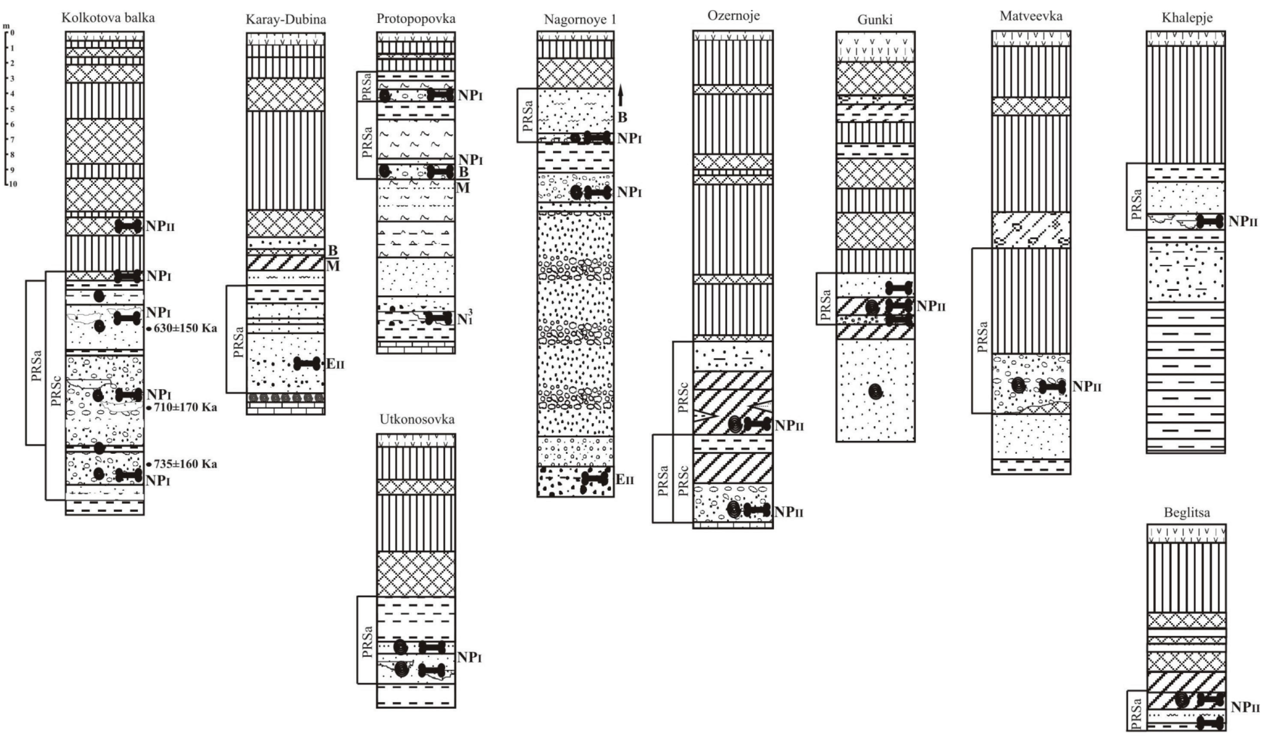

Figure 1. Paleofaunal reference section (PRS) of the final Eopleistocene and Early-Middle Neopleistocene in the South of Eastern Europe.

NEW PALAEOENVIRONMENTAL, PALAEOBIOGEOGRAPHICAL AND BIOSTRATIGRAPHICAL DATA FROM THE DEVONIAN AND CARBONIFEROUS OF THE MORAVIAN KARST

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This contribution provides a mosaic of recent palaeoenvironmental, paleobiogeographical and biostratigraphical discoveries from the Devonian--Carboniferous boundary interval of the Moravian Karst Palaeozoic. Carbonate petrography and REE geochemistry revealed microbial and authigenic origin of a laminated limestone representing the end-Famennian Hangenberg Crisis. The authigenic and microbial laminite, followed by siltstones, ooidal limestones and lower Tournaisian micritic limestones with common autochthonous microbialites in the aftermath of the Hangenberg mass extinction, represent a typical sequence of anachronistic facies (Kalvoda *et al.* 2018).

The overlying lower Tournaisian micritic succession yielded new conodont and bryozoan fauna. Two morphotypes of "unornamented siphonodellid" conodont *Siphonodella belkai*, and the species *Siphonodella kalvodai* nov. sp. were established. The new record revealed plausible FAD of *S. belkai* in the basal *jii* Zone and allows to correlate the *belkai* Zone of the East Europe and Uralian with the "pelagic zonation". Distribution of "unornamented siphonodellids" indicates their subordinate ecological dependence, but reveals provincialism tied to northern Palaeotethys or the palaeoequatorial realm (Kaiser *et al.* 2017).

The bryozoan association is characterized by a low taxonomic diversity represented by species belonging to the orders Cystoporata and Cryptostomata. Four species were found in the studied thin sections: *Nikiforovella* sp., *Saffordotaxis* sp., ?*Streblotrypella* sp., and *Eridopora moravica* nov. sp. The studied bryozoan association indicates links between the eastern and western parts of the northern Palaeotethyan, Siberian and Panthalassan realms (Tolokonnikova *et al.* 2017).

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RADIOGRAPHY OF CRETACEOUS GYMNOSPERMOUS REPRODUCTIVE STRUCTURES – CASE STUDY

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X-ray and neutron radiography is getting widely used as a non-invasive method of investigation of 3D-preserved fossil plants. Various modes of preservation require different approaches. Therefore both X-ray and neutron radiography is used for documentation of internal structures of 3D preserved fossil plants.

Charcoalified ovuliferous cones of *Pityostrobus andraei* from the type locality Baume from the Belgian Wealden was studied using X-ray radiography. Bracts are short, but separate from the scale base. Distally, the ovuliferous scales broaden and thicken to form a rhomboidal apophysis with a dorsal umbo. Their seeds are always two per cone scale. It represents one of the basal members of the Pinaceae.

Charcoalified ovuliferous cones found attached to and associated with twigs of *Stutzeliastrobus bohemicus* of the Bohemian Cenomanian were studied X-ray radiography. The ovuliferous cone scales are flat bearing two to four winged seeds per ovuliferous scale. They are born on *Cyparisidium*-like twigs. Flat ovuliferous scales with winged seeds are similar to basal members of the Cupressaceae as *Taiwania* and *Cunninghamia*.

Araucarian male cone *Rabagostrobus hispanicus* from the Albian of north eastern Spain was studied as an inclusion in amber using X-ray radiography. It was also analysed as a lignified fossil. It is formed by numerous spirally arranged sporophylls bearing up to eight elongate pollen sacs with in situ inaperturate *Araucariacites*-type pollen. The lignified cone is born on a twig of *Brachyphyllum obesum*.

Silicified ovuliferous cone-like structure *Dammarites albens* from the Bohemian Cenomanian was documented using neutron radiography. It is characterised by slender axis and densely, spirally arranged bract-ovuliferous complexes, which are long and curved. They form widely rhomboidal pattern on cone surface formed by the distal ends of the woody bracts. Seeds are large, ovoid. The plant is still difficult to assign to particular group of botanical system.

EVOLUTION OF PHASMIDS

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Phasmatodea is an order of tropical and subtropical insects. They are only herbivorous organisms. They are characterized by mimicry-becoming similar to the environment. Order Phasmatodea includes three morphological types of this insects which names are stick insects, leaf insects and stick bugs. Body of stick insects is elongated and covered by many spikes. Stick insects perfectly imitate branches of trees. Stick bugs living also among the treetops, their body is usually flattened and covered by spines. Leaf insects are confusingly similar to plant leaves. They have flattened body, which morphology imitates leaves. The phenomenon of convergence to the environment is called mimetism, which in Phasmatodea is extremely developed. Fossils of phasmids (insects and eggs) are rarely found and often are only a single wings. Few specimens are complete. The oldest taxa assigned to order Phasmatodea are from the Triassic, and some fossil traces indicate their presence in the Permian. The earliest representative of the contemporary phasmid clade (Neophasmatodea) is Echinosomiscus primoticus, a descendant from the Cenomanian and placed in the Phasmatidae family (Engel 2016). Some fossil of leaf insects, like Eophyllium messelensis which was first fossil leaf insects (Wedmann *et al.* 2006) indicate that even in the fossil rekord Phasmids show ability to mimethism. Some time ago, a new fossil of Phasmid *Cretophasmomima melanogramma* (Wang *et al.* 2014) was described in the Lower Cretaceous sediments of northern China (the famous Jehol biota). This species was very similar to the modern *Heteropterix dilatata*. This proves that this defense strategy has been present in these insects for a very long time.

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COOKSONIA BARRANDEI LIBERTÍN *ET AL.* THE OLDEST POLYSPORANGIATE LAND PLANT

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The colonization of land by plants is an extremely important phase in Earth's life history. This key evolutionary process is thought to have started during the Ordovician and continued through the end of the Early Devonian interval (485–393 Myr) of the Palaeozoic Era. *Cooksonia barrandei* from the *Monograptus belophorus* Biozone (Motol Formation, middle Sheinwoodian, Wenlock) Silurian of Barrandian area, Czech Republic, provides moderately well-preserved details of macro and micro- morphologies including *in situ* spores and stomata (Libertín *et al.* 2018).

Cooksonia barrandei resembles most *C. pertonii* ssp. *apiculispora* in having similar whole plant habitus and similar spores *in situ* (genus *Aneurospora*). Spores found in sporangia of *C. barrandei* show crassitate trilete monad with crassitate proximal surface. *Cooksonia barrandei* resembles also *Concavatheca banksii* in having similar shape of terminal subtending axes with characteristic rim. The above mentioned taxa are distinguished from *C. barrandei* in having smaller size of their axes and sporangia and having different *in situ* spores.

C. barrandei represents the oldest known macrofossil evidence of land plant diploid generation – sporophytes (~432 Myr). Their robust size makes them one of the largest known early polysporangiate land plants. This would mean not only that the plant was photosynthetically autonomous, but that the sporophytes might have been able to sustain a relatively gametophyte-independent existence. In the context of this record it might be therefore reasonable to consider again both – antithetic vs. homologous – hypotheses for the origin of land plant sporophyte.

ACKNOWLEDGEMENT

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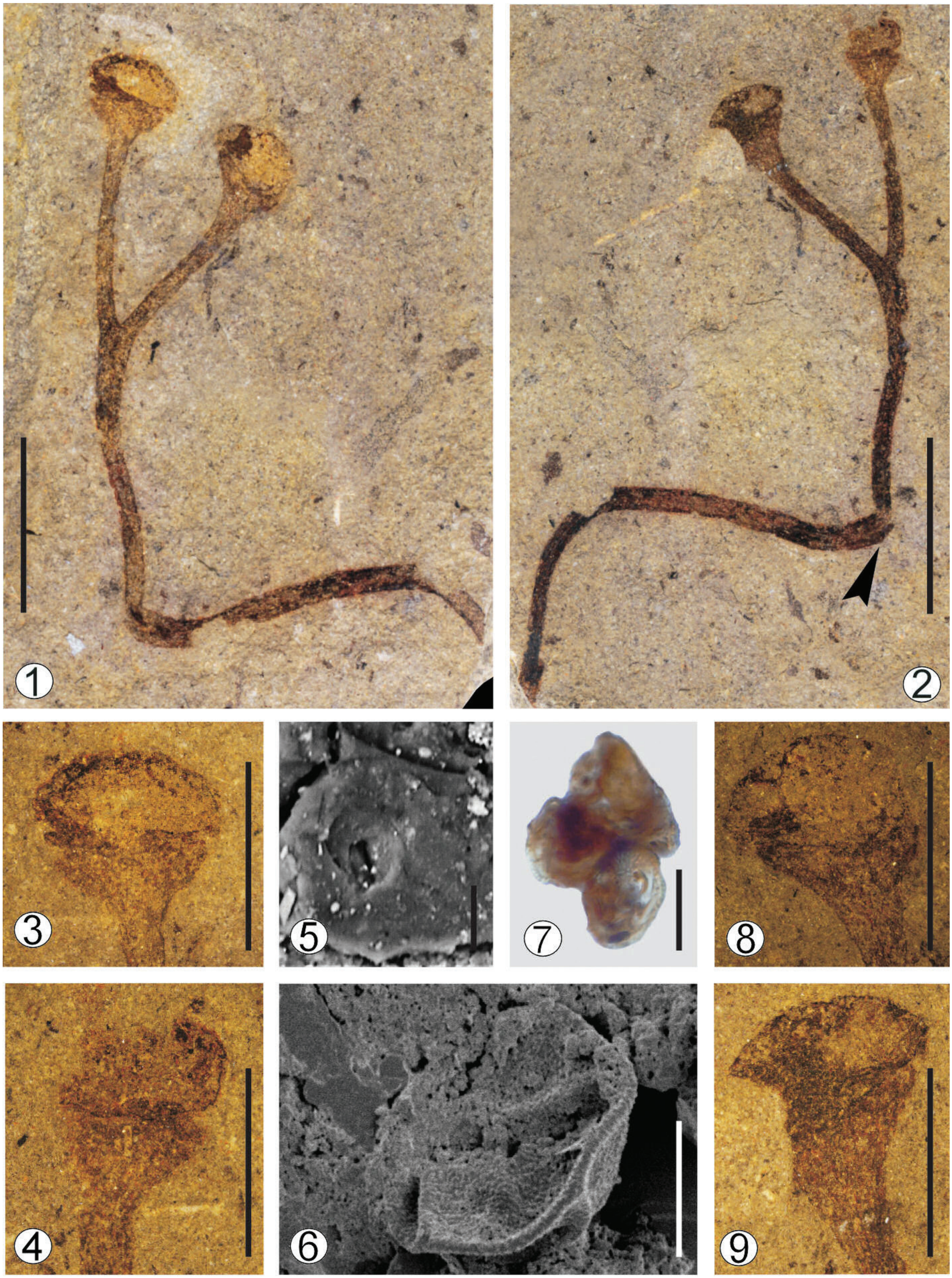
Plate 1. *Cooksonia barrandei* sp. nov., Loděnice, Špičatý vrch – Barrandovy Jámy, coll. J. Barrande, National Museum, Prague, Czech Republic. **1.** Isotomously branched axis with sporangia, No. D 552a (scale bar 10 mm). **2.** Isotomously branched axis (branching indicated by arrows) with sporangia, counterpart to Fig. **1.**, No. D 552b (scale bar 10 mm). **3.** Sporangium borne on subtending axis, detail of Fig. **1**. (scale bar 5 mm). **4**. Detail of sporangium borne on subtending axis, counterpart to Fig. **3.** (scale bar 5 mm). **5.** Detail of stoma-like structures recorded on upper part axes of specimen No. D 552a (scale bar 10 µm). **6.** SEM photo of *in situ* spores *Aneurospora* type isolated from sporangium of the specimen No. D 552a, (scale bar 10 µm). **7.** Tetrad of *in situ* spores *Aneurospora* type isolated from sporangium of the specimen No. D 552b, (scale bar 10 µm). **9.** Sporangium borne on subtending axis, detail of **Fig. 8.** (scale bar 5 mm).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EXAMINATION OF CALPIONELLID TEST ULTRASTRUCTURE

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Observations on ultrastructure of calpionellid tests are rather rare in the micropaleontological literature (Reháková & Michalík 1992). Some older authors believed that hyaline tests of these unicellular organisms have been agglutinated of skeletal nannoplankton fragments, while darker tests chitinoidellids should have been composed of chitinous substance. This statement was curious, as the chitin is never contained in tests of recent tintinnids, which are regarded as close relatives of calpionellids. However, newer observations indicated that the calpionellid tests originally always consisted of calcite lamellae. Thickened parts of these platy lamellae protruded from the test surface and created more-or-less regular reticulated pattern. The test could secondary recrystallize and during early diagenesis more or less regular layers of radially oriented rhomboeders or even skalenoeders could originate on both inner and outer surfaces. In several layers of the rock sequence, broken and compressed calpionellid tests occur (Reháková *et al.* 2016). The orientation of test fragments indicates an effect of early diagenesis and short transport of these lithified microfossils. The redeposition of calpionellids is not uncommon (Grün & Blau 1997) and its possibility could influence the accuracy of stratigraphic evaluations.

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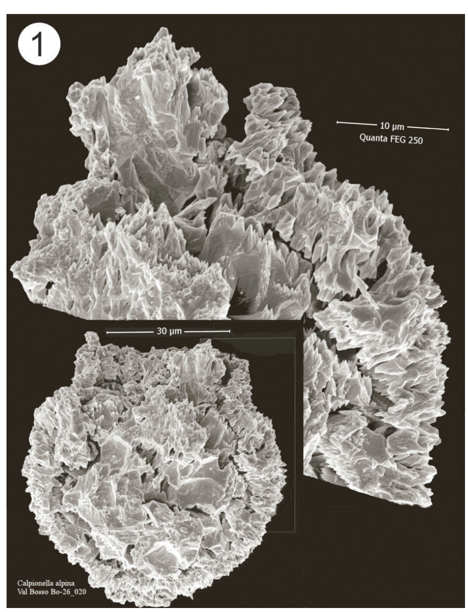

VIRTUAL 3D MODELS OF SKELETAL ELEMENTS OF THE LARGEST SPECIMENS OF DISCOSAURISCUS AUSTRIACUS (SEYMOURIAMORPHA, DISCOSAURISCIDAE) FROM THE LOWER PERMIAN DEPOSITS OF THE BOSKOVICE BASIN (CZECH REPUBLIC)

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For a long time, the discosauriscids from various localities of the Boskovice Basin were known on the basis of only larval specimens (Špinar 1952, Klembara 1995). Later, Klembara (2009) described a large, probably sexually mature specimen of *Discosauriscus austriacus* with the skull length of about 62 mm (OB 1). The skull length of the second largest specimen of *D. austriacus* has a skull length about 60 mm (OB 8). Both specimens were scanned in the Institute of Earth Sciences of the Slovak Academy of Sciences in Banská Bystrica using a micro-CT v|tome|x L 240 and the three-dimensional data were analysed in Avizo 8.

Here we show for the first time a three-dimensional visualization of the quadrate and articular of the *Discosauriscus austriacus* OB 1 specimen. The quadrate is more massive element than articular. This could point to the later or slower ossification of the articular in comparison with quadrate. On the ventral side of the skull (OB1) are visible relatively symmetrically distributed porous structures and small pieces of bones. These structures could be the remnants of the purely ossified endocranial bones, but their pure preservation makes difficult their exact identification. The neural arches and centra are dorsally fused. Moreover, on the proximal end of the right humerus of the specimen OB1 is visible a rounded structure, which probably represents a weakly ossified epiphysis; these were not yet described in this species. On the basis of the micro-CT data we plan to create the first reconstruction of the skull of the adult *Discosauriscus* skull.

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DINOFLAGELLATE CYST ASSEMBLAGES AS A TOOL IN LOCAL BIOSTRATIGRAPHIC CORRELATION: AN EXAMPLE FROM THE UPPER CAMPANIAN (UPPER CRETACEOUS) OF THE MIDDLE VISTULA RIVER SECTION, CENTRAL POLAND

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The Middle Vistula River composite section (central Poland) represents a series of discrete natural and artificial outcrops. The precise correlation between particular sections is thus of prime importance. The presented example demonstrates the case of the Piotrawin and Raj sections, the two abandoned quarries located on the opposite banks of the Vistula River valley, c. 3.5 km apart, about 150 km south of Warsaw. The monotonous facies development of the late Campanian successions (siliceous marls – opokas) in both locations precluded any attempt of a direct physical correlation. Consequently, they have always been correlated by means of biostratigraphy. Unfortunately, inoceramids, belemnites and ammonites, used so far, gave only approximate results. The correlation potential of dinoflagellate cysts is thus promising.

A dense sampling (critical strata were sampled every 25–30 cm) and the application of the palynological analysis was used for correlation between the two sections. In the standard biostratigraphic procedure, the correlation is based on the range of *Callaiosphaeridium* sp. A, which is quite common in the Raj succession, and the first appearance of which in Piotrawin was recorded in the uppermost part of the quarry. Additionally, the trends in dinocyst abundances, taxonomic composition of entire assemblages (based mainly on genera: *Areoligera*, *Callaiosphaeridium*, *Hystrichosphaeridium* and *Oligosphaeridium*), and palynofacies features, were applied. The results, being a combination of all listed methods revealed, that the uppermost strata (c. 30–50 cm) exposed in the Piotrawin quarry are stratigraphic equivalent to the lowermost strata as exposed in the Raj section.

These results provide a far more precise biostratigraphic correlation between the two sections than those based on inoceramid bivalves (Walaszczyk 2004) and/or belemnites (Remin 2015), and prove the usefulness of dinoflagellate cysts in very local correlations. Unfortunately, due to the environmental dependence of some of dinocysts (see e.g., Wilpshaar & Leerveld 1994) such a precise correlation, however, is not always possible on a larger scale.

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SILICEOUS MICROALGAE OF THE MIDDLE-UPPER EOCENE SECTION FROM KHARKOV AREA, NORTHERN UKRAINE

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Diatom-rich sediments and other biosiliceous rocks are widespread in the middle-late Eocene of the Northern Ukraine. According to the stratigraphic scale of Ukraine, these deposits are corresponded to the Kievian and Obukhovian regiostages of the Middle and Upper Eocene and are correlated with the Bartonian and Priabonian stages of the international scale. Diatoms (Bacillariophyta) is the predominate group of microalgae in these deposits. Their assemblage shows more than 200 species. Diatoms are used for the biozonal scales (Olshtynska 1999, Zosymovych *et al.* 2009).

The samples from outcrops near Kharkov and Liptsy towns were investigated in LM and SEM. Taxonomically poor diatom association with coarse-celled species *Paralia sulcata* var. *biseriata* are distinguished in the lower part of the Kievian regiostage. Diatoms are more varied and better preserved in the middle part of the Kievian regiostage. The layers with *Stictodiscus kossutii* is distinguished in this level. Diatoms have a peak of a rich and diverse association in the upper part of the Kievian regiostage. The zone Cristodiscus succinctus was established upon the appearance of the species *Cr. succinctus*. The appearance of a characteristic species layers with *Plagiogramma paleogena* was indicated in the base of the Obukhovian regiostage (Olshtynska 1999, Zosymovych *et al.* 2009). These diatom assemblages are used for biostratigraphic correlation in the study region. But there are some problems of interpretation of their age and correlation with the oceanic zonation scale.

The process of post-sedimentation transformation of silica is observed in the lower part of the studied sections from the bottom up. The transition of biogenic opal into abiogenic globular as well as the full or partially destruction of the primary structure of siliceous skeletons occurs here (Thyberg *et al.* 1999).

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MICROFOSSILS AND SEDIMENTOLOGICAL FEATURES OF KHARKOV DISTRICT EOCENE (NORTH-EASTERN SLOPE OF DNIEPER-DONETS DEPRESSION, NORTHERN UKRAINE)

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Eocene section of Kharkov district (Northern Ukraine, NU) more known as "Kharkov stage" and situated on the NE slope of the Dnieper--Donets depression is subdivided into the Visloye, Sergeevka, Tishki, Kasyanovka Suites (Semenov 1965, Zosimovich & Shevchenko 2015).

A grey-green silty to fine-grained quartz-glauconite sands of the Visloye Suite (Lutetian) contain sporadic poor preserved radiolarian, dinocysts, sponge spicules, fragments of bones and vertebrae of fishes, selachians teeth.

Sergeevka Suite (Lutetian). The lower part, represented by phosphorite-bearing quartz-glauconite calcareous sands with quarts-flour-apatite nodules in the bottom, and the calcareous clays of the middle one are characterized by typical assemblages of benthic and plankton foraminifera, calcareous nannoplankton, organicwalled microphytoplankton of the Kyiv Regional Stage (KRS). Numerous radiolaria, agglutinated foraminifera, sponge spicules characteristic for the KRS distinguish the upper part of the suite represented by green-gray calcareous clayey silts and fine--grained sands alternation.

Silty fine-grained quartz-glauconite sands and clayey silt of the Tishki Suite (Bartonian) are characterized by numerous and diverse sponge spicules and typical associations of agglutinated foraminifera and diatoms of the KRS upper part.

Kasyanovka Suite (Bartonian – Priabonian) is represented by light greenish-gray clayey--silty opoka-like rock with numerous and diverse sponge spicules and radiolaria, diatoms, bryozoan. The upper diatomaceous part is distinguished by rich assemblages of diatoms and numerous sponge spicules.

The above described section is a significant geological landmark of the Eastern European Platform marine Paleogene.

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PREDATORY ADAPTATIONS OF GRIFFENFLIES (ODONATOPTERA: MEGANISOPTERA)

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The myriapods (Arthropleurida), sea scorpions (Eurypterida), and especially the giant dragonflies – so called griffenflies (Meganisoptera) belong among the well-known giant arthropods of the late Paleozoic era. The griffenflies resemble modern dragonflies (Odonata), but cannot be considered as member of this order, because of several distinctive characters on wings and body structures. Specifically, the wing venation of Meganeuridae lack discoidal cell, nodus and pterostigma. These creatures have also longer antennae, but the most conspicuous difference is located on the tip of abdomen. Males of all modern Odonata bear secondary genitalia located on the abdominal segments II and III, to where are sperms transferred from primary genitalia before mating (located between abdominal segments IX and X). On the other hand, the male genitalia of meganeurids are developed in form of pair of gonopods with paired pennial lobes in the posterior part of abdomen. Caudal appendages differ in significantly longer multisegmented cerci.

Concerning the shared characters for Odonata and Meganisoptera it can be mentioned: head with large eyes covering most of head surface; strongly sclerotized mandibles with acute teeth; thorax slanted caudally; legs with spines. All of these characters are adaptations for capturing flying prey, so meganisopterans were probably as successful predators as dragonflies nowadays. They were able to hunt smaller odonatopterans or other insects like phytophagous palaeodictyopterids.

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FIRST COMPREHENSIVE INVESTIGATION OF THE PERMIAN INTRA-SUDETIC BASIN – NEW TRANSNATIONAL JOINT PROJECT

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Continental Permian deposits of the Polish--Czech Intra-Sudetic Basin are a unique source of paleogeographic and paleoenvironmental data of the eastern Variscides. The area includes numerous localities with abundant and exceptionally well-preserved fossils (e.g., Voigt *et al.* 2012). For the first time, there is an opportunity to do a comprehensive transnational investigation of the Permian of the Intra-Sudetic Basin by a three-year joint project (Grant 2017/26/M/ST10/00646, Polish National Science Centre) of scientists from the Polish Geological Institute NRI, Czech Geological Survey, Wrocław University, Czech Academy of Sciences (with support of RVO 67985831), Museum of Eastern Bohemia and the German Natural History Museum GEOSKOP. The project, running from the middle of 2018 to the middle of 2021, is focused on various ecologically and stratigraphically significant fossil biota such as plants, insects, fish and tetrapod footprints. Existing (e.g., Bors 1988) and new paleontologic, paleoclimatic, sedimentologic, tectonic and radioisotopic data will be integrated in order to get a most-detailed model of the basin development. The Intra-Sudetic Basin is one of the largest Permian intracontinental basins in Europe and its first comprehensive investigation promises valuable data for reconstructing evolutionary ecology around Pangean deglaciation and the transition from 'pelycosaurian'- to therapsid-dominated tetrapod faunas in the paleotropics.

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PALAEODICTYOPTERA: NEW CLUES TO THE ORIGIN OF INSECT WINGS

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The aquisition of wings along with holometabolous development are individually and together considered among the most important evolutionary novelties which fueled the rapid diversification of insects. However, the origin of wings remains a fiercely debated topic in insect evolutionary biology, and has spawned numerous hypotheses over the last 150 years. The recently proposed 'dual model' for insect wing origins represents a synergy of the epicoxal and more traditional paranotal hypotheses, and considers the thoracic-tergal edge as the source from which the wing blade structure, with the articulation derived genetically from the proximo-dorsal part of the arthropod leg relating to the development of an articulating joint. Evo-devo studies support the participation of the two genetic domains in the formation of the wing.

Our study revealed new details on wing pad joints of Paleozoic Palaeodictyoptera, observable on the three pairs of wing pads from exceptionally well-preserved Carboniferous nymphs. These wing pads were medially articulated to the thorax by associated sclerites but also markedly fused with the notum anteriorly and posteriorly, supporting the dual model for insect wing origins. Furthermore, the reconstructed structure of the wing base in adults of the palaeodictyopteran genus *Dunbaria* (Spilapteridae) reveal a prominent upright axillary plate with presumable position of 3Ax and markedly reduced humeral plate. Finally, these new results reveal the homologous structural elements between extinct Palaeodictyoptera and their extant relatives among the Ephemeroptera, Odonata, and Neoptera.

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A REVIEW OF THE OLIGOCENE FISHES OF THE KELČ LOCALITY (MORAVIA, CZECH REPUBLIC)

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Oligocene fish fossils has been described from many of Moravian places (see, e.g., Gregorová 2013). The locality Kelč is known for long time and providing specimens from two separate places: Kelč-Zámek and Kelč-Strážné. The Kelč-Zámek is now inaccessible, while the latter place is still prospected (the place is farmed land and such new pieces of fossiliferous sediments appear after plowing). The both places providing Dynów marlstones (Menilitic Fm.) of the Rupelian age (early Oligocene). This proceeding presenting a new data regarding fish specimens from the Kelč-Strážné place.

The assemblage is composed by two types of Chondrichthyes only – the families Cetorhinidae (*Keasius parvus*) and Alopiidae (*Alopias* cf. *superciliosus*) are presented. Teleost fish are much diversified and represented by members of Clupeidae (gen. et sp. indet.), ?Argentinidae (*"Glossanodon" musceli*), Bathylaconidae (gen. et sp. indet.), Gonostomatidae (*Scopeloides glarisianus*), Phosichthyidae (*Vinciguerria* sp.), Myctophidae (*Oligophus moravicus*), Merlucciidae (*Palaeogadus* sp.), Moridae (gen. et sp. indet.), Euzaphlegidae (*Palimphyes* sp.), Trichiuridae (*Anenchelum* sp.), ? Symphysanodontidae (*Oliganodon budensis*), and unidentified middle-sized acanthomorph.

The dominant part of the assemblage is represented by *"Glossanodon" musceli*, while other taxa are represented by much lower number of specimens. Morids and bathylaconids are reported for the first time from the Moravian region and although represented by single individual each, they providing important data regarding assemblage diversity and state of selected morphological features characteristic for these groups.

ACKNOWLEDGEMENT

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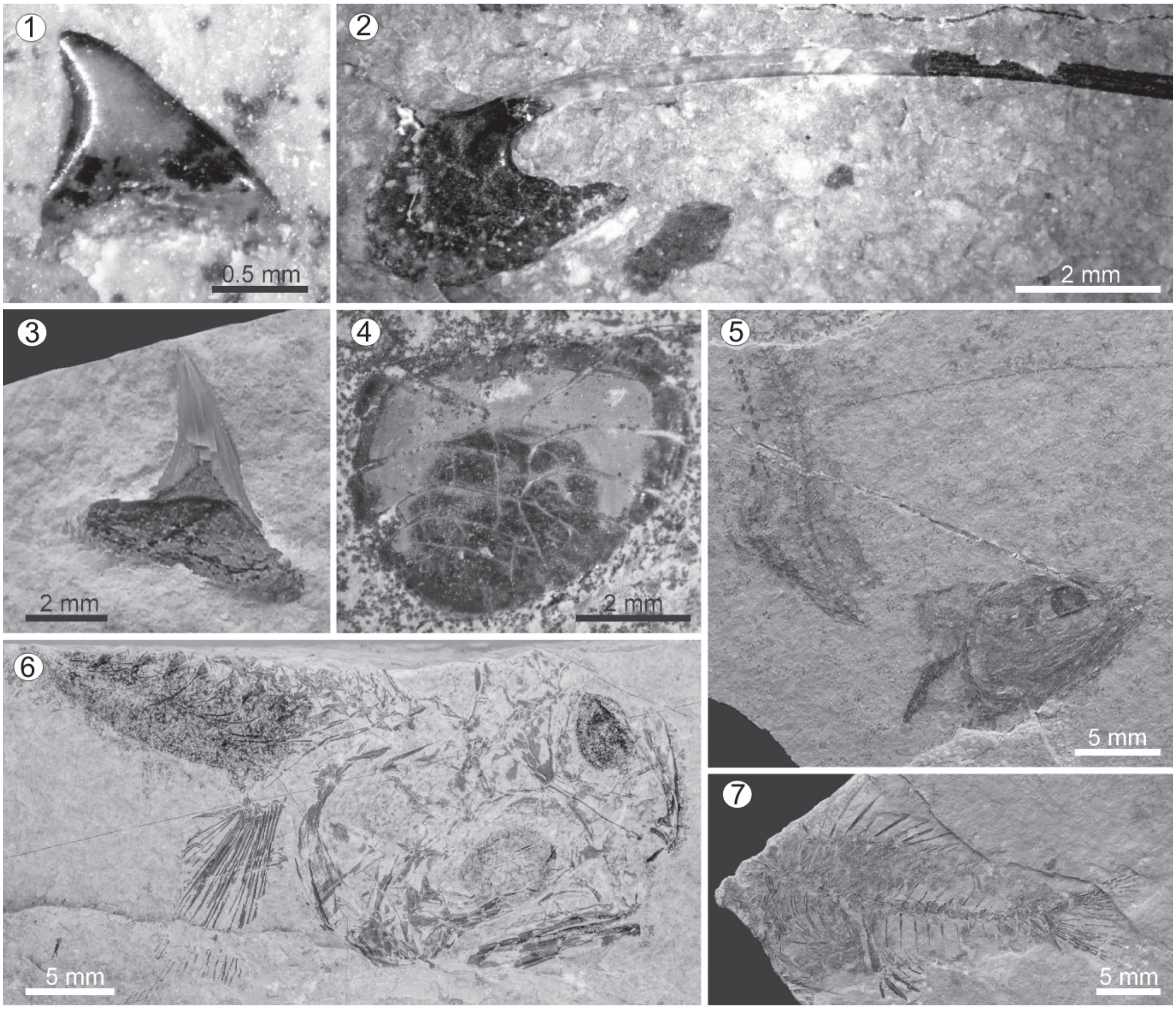

Figure 1. Selected fishes of the Kelč-Strážné locality (Czech Republic; Rupelian): **1., 2.** *Keasius parvus* (unnumbered tooth and gill raker respectively); **3.** *Alopias* cf. *superciliosus* (tooth MRV 146/08); **4.** Clupeidae gen. et sp. indet. (unnumbered scale); **5.** *Vinciguerria* sp. (specimen MRV 252/03); **6.** Moridae gen. et sp. indet. (specimen NMP Pv 10054a); **7.** *Oliganodon budensis* (specimen MRV 154/08).

LIFE IN THE EARLY PERMIAN - PALEONTOLOGICAL EXPEDITION NEAR TŁUMACZÓW (INTRASUDETIC SYNCLINORIUM, POLAND-CZECH BORDER AREA)

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The Intrasudetic Synclinorium pertains to a series of sedimentary basins active in the late Carboniferous and early Permian in the northern periphery of the Czech massif. Along with the North Sudetic Synclinorium and Krkonoše-piedmont it creates a sedimentary setting around the Krkonoše granite and its metamorphic shield (Karkonosze-Izera Massif). Probably in the early Permian good connections existed between these terrains, enabling a free migration of flora and fauna assemblages. Fossils preserved in the deposits document a lush development of life in this area. They are also an interesting record of environmental changes, primarily the climate. They are a great material for comparative studies on early Paleozoic assemblages of land fossils.

Numerous accumulations containing many remains of plants, invertebrates (mollusks, Conchostraca, insects) and vertebrates (mainly fish, but also skeletons of reptiles and amphibians) had been assembled in scientific collections, mainly in the Czech Republic, Poland, and Germany. Very interesting is an assemblage of trace fossils, with extraordinarily numerous traces of tetrapods and a differential assemblage of trace fossils of various invertebrates.

Most of those fossils had also been found on the Polish-Czech border, in the Tłumaczów-Broumov region. The goal of our project is to comprehensively document and describe this assemblage. Its culmination will be a study on the panorama of early Permian life in the area of mountainous river valleys and in lake basins in the period preceding an intense volcanic activity and during it. Through radiometric tests we are also counting on a precise age determination of one of the final stages of life development on the Paleozoic land in present Central Europe.

LATE-CRETACEOUS OYSTERS FROM ORLOVÉ SANDSTONES – RESPONSE FOR CLIMATIC CHANGES AND DECREASE OF FRESHWATER INFLUX (WESTERN CARPATHIANS, SLOVAKIA)

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Orlové sandstone represents one of the most significant lithostratigraphic unit of the Carpathian´s Klippen Belt (Marschalko & Samuel 1980). Association of organisms origin from this strata is characterized by huge accumulations of oysters belongings to the species *Rhynchostreon suborbiculatum* Lamarck (e.g., Andrusov 1945). Huge abundance of only one species of oyster, especially in connection with very low alpha diversity points to typical form of association in „pioneer stage“. This paper summarized results of several-years sustained multi-proxy research of Orlové sandstones. Presented research was focused to Hôrka Hill section near Považské Podhradie – litostratotype sequence of the strata. The main content of research is represented by population analysis and analysis of oyster´s taphonomy (preservation stage and position of specimens). Co-based on sedimentological (percentage of quartz content) and geochemical data (analysis of major components) we are coming with interpretations of several ecological phenomena (e.g., process of aridization, changes in salinity of sea water etc.) related to the climatic and eustatic changes which occured in the studied area during Late Cretaceous. Based on analysis of several major oxides ratios (e.g., Na_2O, Fe_2O_3, K_2O) we could recognized 2 main peaks of aridization within reported part of sedimentary record. We assume these changes are closely related to hydrological regime of river (fluvial-marine cycles) and influx of freshwater to estuary. It´s also strongly mirrored in character of oyster´s palaeopopulation in various oyster´s beds (in particular in changes of specimen´s size and abundance of shells). Based on results of our study we could confirm the validity of the eco-model used by J. R. Livingston (Livingston *et al*. 1997, 2000) during description of recent estuary of Apalachicola River (Florida, USA) and prove relevancy of them also for Late Cretaceous environment.

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CALPIONELLIDS – THEIR POTENTIAL FOR PALEOENVIRONMENTAL INTERPRETATION

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Characteristic morphology and the assemblage composition of the ancient planktonic ciliate protozoan loricas make them a favourable tool for the interregional correlation and biostratigraphy of the Upper Jurassic–Lower Cretaceous sequences, especially, but not exclusively, in the areas lacking in ammonites. Detailed comparative analysis of calpionellid associations along the Tethys shows variations in their relative species abundance, and changes of diversity and variability of their lorica structure. As oligotrophic organisms, they were sensitive to environmental perturbations. For instance, Reháková *et al.* (2017) supposed that observed thinning and deformation of loricas could have been associated with distant volcanic effusions producing metallic contaminants and salinity variations. Next example is a change in morphological parameters of *Calpionella alpina* Lorenz along the J/K boundary, which was analysed statistically (Kowal-Kasprzyk & Reháková, in press). Decline of the large forms of *Calpionella* (= *C. grandalpina* Nagy), the disappearance of the homeomorph of *C. elliptica* Cadisch (= *C. elliptalpina* Nagy), the last occurrences of *Crassicollaria brevis* Remane and *Cr. massutiniana* (Colom), and the increase in the relative abundance of small spherical forms of *C. alpina* prior to the J/K boundary, can be defined by the onset of the *C. alpina* ecoevent. In the Crassicollaria Zone (late Tithonian) lengths and ellipticities of *Calpionella* loricae are diversified, and some diminishing of sizes is observed in the uppermost Tithonian. In the J/K boundary theirs sizes and shapes are relatively uniform in all the studied assemblages, which could reflect the change of environmental conditions prior to the fall in the sea-level and increase of water temperature.

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IMMATURE STAGES OF THE ORDER PALAEODICTYOPTERA

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Palaeodictyoptera is extinct order of insects known from the late Carboniferous that disappeared in the Permian–Triassic mass extinction. The group is characterized by a pair of prothoracic winglets present in some members, two pairs of permanently outstretched wings and a specialized piercing-sucking mouthparts in form of a rostrum. This unique type of mouthparts is considered as a synapomorphy of Palaeodictyopterida and thus shared also by Megasecoptera, Diaphanopterodea and Permothemistida.

While the wings of palaeodictyopteran adults are found quite commonly in the fossil record, the nymphal wing pads or exuviae are scarce. Even more rare are the findings of numerous specimens of nymphal wing pads attributable to single species. Thus, we do not have enough information that would allow us to determine the type and course of the postembryonic development in this extinct group. It is also difficult to place these nymphs systematically because of the undeveloped venation. We cannot even determine the final number of instars and which instar is represented by the given fossil.

We believe that the nymphal wing pads are similar to those found in the nymphs of recent mayflies and dragonflies, as suggest their thick outer edges. It is also assumed that the ontogeny and wings growth progressed gradually and included several early nymphal instars with wing pads, late winged subimaginal instars, or even moulting adults (ametaboly). Hence, there are several questions to answer, e.g.: In which palaeoenvironment did these nymphs live, aquatic or terrestrial? Did the early instars exist in the same habitat as the later ones? Hopefully, some of the persisting problems may be uncovered by our future research focused on the ontogeny of wings of some extinct and extant insect orders.

MICROBORINGS PRODUCED BY CORAL-ASSOCIATED MICROENDOLITHS FROM THE CENOMANIAN OF DRESDEN (SAXONIAN-BOHEMIAN CRETACEOUS BASIN)

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Upper Cenomanian rocky shore conglomerates exposed in the abandoned Ratssteinbruch quarry in Dresden (Saxonian-Bohemian Cretaceous Basin) contain rich fauna, including diversified small corals, mostly up to 5 cm in diameter (Löser 2014). The skeletons are commonly encrusted by thin (up to few mm) ferruginous laminated microbial crusts. Abundant microborings filled with iron--rich minerals occur in coral skeletons. Those occurring directly below microbial crusts or are perpendicular to septal surfaces are post-mortem (Fig. 1). However, many microborings occur in central parts of colonies and their distribution pattern – along the septa in the direction of the coral growth – indicates that they were produced during coral life (Fig. 2).

SEM studies of natural casts of microborings revealed following ichnospecies: *Ichnoreticulina elegans* produced by chlorophyte alga *Ostreobium quekettii* (Fig. 2), *Scolecia filosa* (producer: cyanobacterium *Plectonema terebrans*), and *Conchocelichnus seilacheri* (producer: Bangialean rhodophytes). Like in modern corals, microborings produced by *O. quekettii* are the most common in the studied material. Post-mortem microborings are represented by *I. elegans*, *Scolecia serrata* (producer: unknown bacteria), and *Rhopalia catenata* (producer: chlorophyte *Phaeophila engleri*).

Symbiotic (in a broad meaning) boring microorganisms (algae, cyanobacteria, fungi) are commonly reported from skeletons of modern corals (Tribollet 2008), but fossil record is very sparse (Kołodziej *et al.* 2012). Although microborers that colonize skeletons of living corals contribute to bioerosion, euendolithic algae may be beneficial to corals. They can facilitate coral survival during bleaching events being alternative source of photoassimilates (for review: Tribollet 2008).

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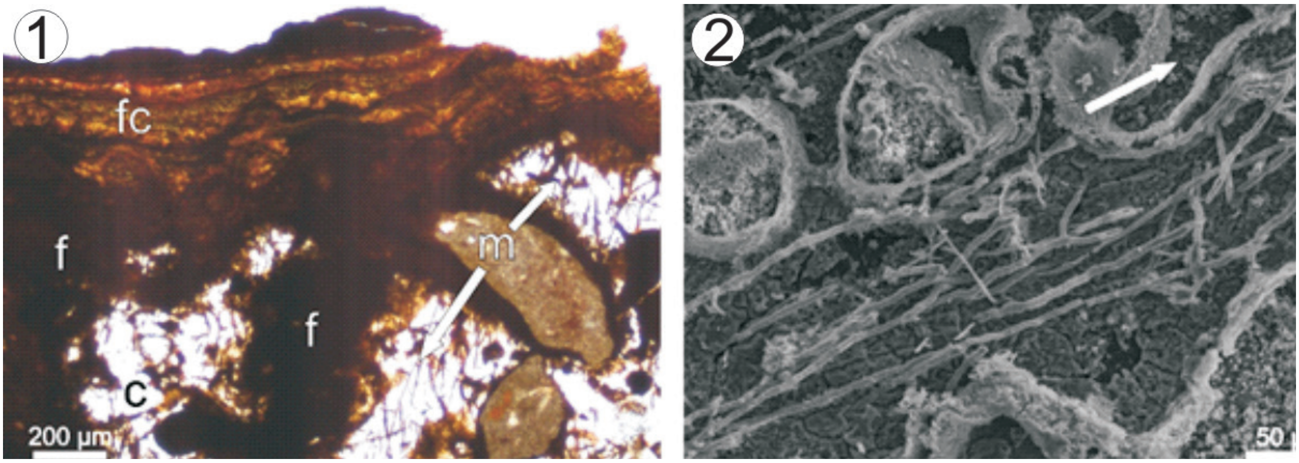

Figure 1. 1. Ferruginous laminated crust **(fc)** encrusting coral skeleton **(c); f)** ferruginous sediment filling space between coral septa; **m)** post mortem microborings (arrowed) filled with iron-rich minerals. View under the petrographic microscope. **2.** SEM image of *Ichnoreticulina elegans* in a longitudinal section of the coral skeleton. Note that the natural casts of microborings are oriented along the septa in the direction of the coral growth (indicated by the white arrow).

OLIGOCENE ORGANIC-WALLED DINOFLAGELLATE CYSTS FROM KHARKIV AREA (NORTHEASTERN UKRAINE)

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For Paleogene sediments of Northern Ukraine, the palynological method is the leading method at dating and regional correlations. Oligocene deposits, in particular, don't contain carbonate or siliceous microfossils. Zmiiv Formation (Karlov 1953, Zosimovich *et al.* 1963) consists mainly of dark-colored and black clays; they were treated as continental deposits. The age of this formation was controversial for a long time (Oligocene or Miocene). According to the current Paleogene stratigraphical sheme of Ukraine (1993), the stratigraphic position of the Zmiiv deposits is an Early Chattian.

The Kozak Mount section is located in the stratotypie area of the Zmiiv Fm. – near the Zmiiv city (south of Kharkiv). Organic-walled microphytoplankton assemblages have been studied from the Zmiiv Fm. of this section. Their distribution shows an uneven pattern: their most diversified and prolific assemblages occur in the middle and upper parts of the Zmiiv Fm.: *Wetzeliella gochtii*, *W. symmetrica*, *Wetzeliella* spp., *Chiropteridium galea*, *Rhombodinium draco*, *Membranophoridium aspinatum*, *Deflandrea heterophlycta*, *Lingulodinium machaerophorum*, *Thalassiphora pelagica*, *Selenopemphix nephroides*, *Pentadinium laticinctum*, *Apteodinium australiense*, *Hystrichokolpoma* sp., *Tasmanites consinnus*, *Ovoidites* sp. and etc. The lower part contains pollen and spores only: *Pediastrum* sp. and sporadic dinocysts. In general, the palynofacies is characterized by the dominance of terrestrial plant remains (mainly cuticle fragments, dark brown and black phytoclasts).

On the basis of the dinocyst assemblages, the Zmiiv Fm. of the Kozak Mount section is probably Late Rupelian in age. The palynological assemblages reflect coastal-shallow marine conditions in this part of the Sub-Paratethys during middle Oligocene time.

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BRACHIOPODS OF THE LATE TURONIAN HEMIPELAGIC STRATA OF THE SAXONIAN-BOHEMIAN CRETACEOUS BASIN (MIDDLE EUROPE)

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The north-western portion of the Saxonian--Bohemian Cretaceous basin shows typical hemipelagic siliciclastic-input oscillation. Whereas the area was relatively close to the source area, the siliciclastic influx was restricted for a longer period (hundreds of kyr) resulting in a formation of a carbonate platform in a part of the basin. This has been interpreted as a result of tectonically induced isolation from the sediment supply from the close land (Western Sudetic Island; Uličný *et al.* 2009). The alterations in siliciclastic supply as well as eutrophic/oligotrophic conditions (Wiese *et al.* 2004) have been reflected within the benthic taphocenoses.

Hemipelagic strata and their macrofaunal assemblages of the Late Turonian of the area have been object to research since the first half of the nineteenth century, however there are just several detailed modern studies on these brachiopod communities. Rhynchonellid brachiopods as well as rare Linguliformea were studied in detail by Nekvasilová (1974, 1977) and cancellothyrid *Gyrosoria* by Sklenář & Simon (2009).

Any comprehensive study on the Late Turonian brachiopods involving the rest of Terebratulida and Craniiformea as well as palaeoecological interpretation of structure of the taphocenoses responding to the changing environmental conditions has been hitherto missing. The purpose of the poster is to present the hemipelagic brachiopod fauna in general with special emphasis put on the so far neglected taxa as to the hemipelagic facies restricted Gibbithyrididae and free-lying Craniidae or opportunistic Cancellothyrididae of the area.

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THE PRAGIAN/EMSIAN BOUNDARY: COMPLICATIONS, ERRORS AND A STORY OF COMPLETELY VANISHED DEVONIAN STAGE

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The problematic basal Emsian boundary has been largely discussed at several meetings of the International Subcommission on Devonian Stratigraphy in the last two decades. In 2008 the Devonian subcommission reached an agreement regarding the redefinition of the base of the Emsian. The current boundary is located at a very low position, i.e. within the traditional Pragian Stage (= the Praha Formation) and it is not the same or even close to the base of the Emsian in traditional German or western European usage (Ulmen Gruppe). However, the repeated sampling of the GSSP section in Tien Shan Mts., Uzbekistan (in 2008 and 2015) failed to provide new data to progress with the definition of a new boundary. The problem of the position of the prospective lower Emsian boundary drastically affects the duration of the Pragian and Emsian stages. Data from other sections of different regions are now strongly needed for further discussion on the position and location of the new international stratotype of the basal Emsian.

The purpose of the presentation is to demonstrate both the possibilities and constraints for the boundary stratotype in the Prague Synform. In this area, the Pragian Stage has been originally proposed to correspond to the entire succession of the lithologically and biostratigraphically constricted Praha Formation. The correlation is based on extensive faunal datasets but also on high-resolution petrophysical correlation methods: magnetic susceptibility (MS), gamma-ray spectrommetry (GRS), isotope geochemistry and orbital time scale. The highest precision in the relative dating of Palaeozoic marine carbonate successions is, however, achieved using conodont biostratigraphy.

PHYLOGENETIC DEVELOPMENT OF EOCENE-OLIGOCENE PLANKTONIC FORAMINIFERS OF GLOBIGERINOIDES LINEAGE: JUVENILE STAGES, SUPPLEMENTARY APERTURES AND ECOLOGICAL RESPONCES

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Middle Eocene foraminifer of *Globigerinoides* lineage belong to the genus *Globigerinatheka*. They are polythalamous foraminifers with supplementary apertures, globigerinid juvenile stages and thick-walled adult tests. Late Oligocene species of *Globigerinoides* occurred above the Late Rupelian marls with large-sized subbotinids, turborotaliids, dentoglobigerinids and chiloguembelinids. Prior to the FO of *Globigerinoides,* the association became dominant by *Globigerina* and *Globoturborotalita* species. Ancestral forms of *Globigerinoides* are inferred in species *Globoturborotalita oachitaensis*. Transitional morphotypes to *Globigerinoides primordius* has been developed in Early Chattian by changing to cancellate spinose wall texture of *sacculifer*-type and appearance of single spiral apertures. Gradual phyletic changes of *primordius* plexus led to diversification of basal species without spiral apertures (*Globigerinoides praeprimordius*), the type species with single spiral aperture (*Globiderinoides primordius*) and successive species with 3/1 to 4 chambers and more than one aperture on spiral side (*Globigerinoides quadrilobatus primordius*). *Globigerinoides primordius* was a short-lived species as is indicated by its disappearance at the base of Zone O6. Appearance of *Globigerinoides* coincides with oxygen isotopic lightening, which indicate an increase in sea-water temperature. There is also a coiling preference of *Globigerinoides primordius* to dextral forms (67%), which provides an evidence for climatic warming. Considering that, the species with supplementary apertures seem to be a warm-water phenotypes of globigerinids, which became to evolve to a new lineage of *Globigerinoides – Trilobus* group (see Spezzaferri *et al.* 2015).

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EVOLUTIONARY ORIGIN OF DIGITATE PLANKTONIC FORAMINIFERA DURING THE MIDDLE EOCENE: A NEW INSIGHT TO CLAVIGERINELLA – HANTKENINA TRANSITION

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Digitate planktonic foraminifers were abruptly evolved in the Middle Eocene by developing of clavate forms and later stellate forms with tubulospines. A high-resolution study of two composite sections in the Western Carpathians has been performed for understanding of evolutional transition from earliest clavigerinellids to descendant hantkeninids. First appearance of *Clavigerinella eocanica* was detected above lowermost findings of *Morozovella* species. Considering that, the appearance of clavigerinellids is preceeded by morozovellid collapse. *Clavigerinella* ancesory is constrained in parasubbotinid species with extraumbilical aperture. Clavigerinellids evolved to highly clavate species (e.g., *C. caucasica*) and transitional forms of earliest hantkeninids with constricted chambers (*H. gohrbandti*). Cancellate wall structure of earliest hantkeninids imply that they are congeneric with ancestral clavigerinellids. Clavigerinellids became to develop to early Middle Eocene hantkeninids with slender chambers and very long tubulospines (*Hantkenina mexicana*). Late Middle Eocene hantkeninids were more diversified and completed by species *H. liebusi* and *H. lehneri*, later developing to *dumblei*-type species (e.g., *H. dumblei*, *H. compressa*). The monophyletic origin of hantkeninid species is problematic due to *Clavigerinella*-type walls in *mexicana*-group and *Pseudohastigerina*-type walls in *dumblei*-group. Recovery of clavigerinellids came to acme in horizons, which are baren of hantkeninids, which imply their different life strategies. It seem that *Clavigerinella* as cool-water and eutrophic protists proliferated in upwelling conditions, while hantkeninids were orginated by morphological adaptation to enhanced metabolic effectivity and thermocline dwelling (Coxall *et al.* 2000).

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INTEGRATED BIOSTRATIGRAPHY OF THE TURONIAN-CONIACIAN BOUNDARY INTERVAL IN THE FOLWARK QUARRY (OPOLE TROUGH, SW POLAND)

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The results of integrated biostratigraphy (dinoflagellate cysts, foraminifera and inoceramids) of the Turonian-Coniacian boundary of the Opole Cretaceous (SW Poland), based on the Folwark Quarry section, are presented in this study. The boundary interval consists of marl-clayey marl rhythmic couplets of the 'upper marls' unit of Alexandrowicz & Radwan (1973).

The boundary interval studied herein reveals a complete inoceramid record of the topmost Turonian–lower Coniacian, starting in the upper part of the *Mytiloides scupini* Zone, ranging up through the zone of *Cremnoceramus waltersdorfensis waltersdorfensis* (Andert) to the zone of *C. deformis erectus* (Meek) (Walaszczyk 1988, 1992).

Dinoflagellate cysts are well preserved and rich taxonomically; 67 species-level taxa were recognized. The boundary level is approximated by last occurrences of *Circulodinium distinctum*, *Stephodinium coronatum*, *Florentinia ferox*, and *Senoniasphaera rotundata alveolata*. Additionally, an acme of *Palaeohystrichophora infusorioides* was recognised in the basal Coniacian. Incidentally, many of biostratigraphically critical forms were not recognized in the assemblage.

Although both planktic and benthic foraminifers are abundant and well-preserved in the succession, planktic foraminiferal assemblages are of low diversity and are represented by taxa of low stratigraphic utility. In contrast, a few benthic foraminiferal lineages, including *Gavelinella vesca-G. praeinfrasantonica, G. ammonoides-G. lorneiana* and *Protostensioeina humilis-P. levis*, show distinct evolutionary transitions across the boundary. Of potential importance as a foraminiferal auxiliary marker of the base of the Coniacian could be the FO of *Protostensioeina levis*. Its FO, associated with the evolutionary development of chamber flaps covering the umbilicus, is recorded close to the FO of *C. deformis erectus*, the primary marker of the base of the Coniacian Stage.

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FIRST EVIDENCE OF ARTICULATED SHELLS AND CALCIFIED BYSSI OF *ANOMIA EPHIPPIUM* LINNAEUS, 1758 (BIVALVIA) FROM THE MIDDLE MIOCENE OF THE NOWY SĄCZ BASIN, POLAND

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Among the bivalves which live permanently attached to the rigid substrate the family Anomiidae is unique in its mode of attachment. As in the case of other members of this family, *Anomia ephippium* Linnaeus, 1758 lives closely adhering to substrate by means of byssus passing from the inside of the left (upper) valve through an irregularly pear-shaped byssal notch in right (lower) valve. It should be emphasized that reports on presence of right valves and articulated shells of *Anomia ephippium* are extremely scarce, despite that this species has been known since the Early Oligocene and during the Neogene it was widespread in all European provinces. In the Eggerian–Late Badenian Central Paratethys this widely distributed species has been hitherto represented exclusively by isolated left valves, whilst the occurrence of its right valves and articulated shells was only reported from the Pliocene and the Pleistocene of the Mediterranean.

For the first time, articulated shells of *Anomia ephippium* are described from the Central Paratethys. The most astonishing fact is the presence of the heavily mineralized byssus, which anchored the animal to hard substrates, preserved still inside the byssal notch. The byssus has highly complex hierarchical structure: it consists of a lamellar part (composed by aragonite) that forms the interface with the musculature of the animal, and a porous part (composed by calcite) closer to the substrate. The two structures are best recognized within the fossil material of *Anomia ephippium* derived from the Badenian Niskowa Fm. in the Nowy Sącz Basin, small intramontane basin situated in the Polish Outer Carpathians. Apart from articulated shells and left valves, collected material contains remains of some dozen of heavily mineralized byssi fixed to rigid substrate.

THE LATE PLEISTOCENE AND HOLOCENE THECAMOEBIANS FROM THE ŠUMAVA MTS.

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At the end of the last glacial period after glacier retreat the today defunct lake Stará Jímka was created (Břízová & Mentlík 2005; Mentlík *et al.* 2010). Its sedimentary record captures the climate fluctuations in the last glacial period and partly also in the Holocene, during which it was buried (Mentlík & Břízová 2005). For the study of the paleoenviroment of the Šumava lake we can use Thecamoebians (Arcellinida), whose species composition is preserved in the sediment of the defunct Šumava lake Stará Jímka (Břízová & Mentlík 2005; Mentlík *et al.* 2010).

In the past few years, in the frame of the project GA AVČR „Actuoecology of freshwater Thecamoebians from the Šumava Mts", Thecamoebians and hydrological changes in the recent sediment of the Lipno Dam were studied from the Šumava Mts. in the Czech Republic (Holcová & Lorencová 2004, Lorencová 2009).

A sedimentary well (profile thickness of 1.5 m, thickness of 3 cm, 36 selected layers) was taken from Stará Jímka Lake and provided by the Institute for the Environment. Associations of Thecamoebians were characterized from the collected samples. A large part of the associations consists mainly of species with the organic type of the test, a smaller part of species with agglutinated test. The individual samples differ not only in frequency and size, but also in species diversity, which includes only a few species. For some selected samples, higher tests damage can be observed.

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DINOFLAGELLATE CYST STRATIGRAPHY OF THE ZEMBRZYCE BEDS FROM THE MAGURA FORMATION (MAGURA UNIT, OUTER CARPATHIANS, GOŚCIBIA OUTCROP), PRELIMINARY RESULTS

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The Zembrzyce beds, lowermost part of the Magura Formation, exposed in Gościbia stream (north-western part of the Magura Nappe, Polish Flysch Carpathians) contain rich well preserved organic-walled dinoflagellate cysts assemblages. Dinoflagellate cysts are reported for the first time from this area. The assemblages are dominated by typical Eocene taxa, such as *Areosphaeridium michoudi, Areosphaeridium diktyoplokum, Rhombodinium porosum, Lentinia serrata* and *Charlesdowniea* spp. The abundance of dinocyst and diversity within taxa are variable according to the position in the investigated section. The age of this assemblage may be determined as the Priabonian (late Eocene) to the earliest Oligocene. It reveals the difference between the age of the same member in the north-eastern part of the Magura Nappe. The Zembrzyce beds were examined in Folusz outcrop and the Eocene-Oligocene boundary was located within the sediments below this member – in the upper part of the Szymbark Shale unit (Gedl 2005; Gedl & Leszczyński 2005).

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EVIDENCE FOR SHORT-TIME CONNECTIONS OF THE NW MARGIN OF TETHYS AND SUBBOREAL REALM DURING THE LATE TITHONIAN AND EARLY BERRIASIAN IN THE OUTER WESTERN CARPATHIANS

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Some macro- and microfossils highlight the effect of cold waters in the Outer Western Carpathians, Silesian Unit and Magura Group of Nappes respectively. In Tithonian and Berriasian, this depositional area was situated at the NW margin of Tethys and separated from the south (nowdays Pieniny Klippen Belt and Inner Carpathians) by the Czorsztyn Ridge and Silesian Cordillera (Golonka *et al.* 2006). Although the majority of ammonites found in the Silesian Unit is characteristic of the Mediterranean area, the occurrence of ammonites represented by genera *Riasanites* and *Riasanella* proves the communication with the Subboreal region of the Russian Plarform in the Lower Berriasian (Vašíček *et al.* 2017). Compared with other sites of Tethys, distinct differences were also recorded in microfauna in Magura group of Nappes (Svobodová *et al.* 2017). Cold waters in Tithonian and Berriasian are indicated by rare calpionellids represented mainly by hyaline forms, by the absence of chitinoidellids, and by the quantitatively different composition of nannofossil assemblages. This includes 1. quantitative dominance of Watznaueriaceae (up to 98%), 2. a significantly smaller percentage of genera *Nannoconus* (0.2–5.0 %), *Polycostella* (0.2–5.0 %) and *Conusphaera* (0.5–12.0 %), 3. presence of *Nannoconus compressus* known especially from the Atlantic Ocean (Casellato 2010), 4. only scarce "predominantly tethyan taxa" *Helenea chiastia, Cruciellipsis cuvillieri*, and *Speetonia colligata* (sensu Bown & Cooper 1998).

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FORAMINIFERAL EVIDENCE FOR THE CRETACEOUS-PALEOGENE (K-PG) BOUNDARY CRISIS IN THE WESTERN OUTER CARPATHIANS: DATA FROM THE SILESIAN AND SUBSILESIAN SERIES, POLAND

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Foraminifers from the flysch series outcropping in southern Poland have been reviewed in order to document the K-Pg boundary crisis in the Western Outer Carpathians. This marginal region of the northern Tethys was very sensitive to geodynamic processes and sea-level fluctuations. These processes periodically led to submarine movements and intensive erosion or sometimes they prevented the deposition. Under these conditions variegated marls and shales formed slumped bodies (Frydek Marls) and intercalations in siliceous turbidities (Istebna Formation) or separate formations (Weglowka Marls and Variegated shales).

Foraminifers from these deposits reflect unstable sedimentary conditions which were stimulated by abrupt changes in the sea and CCD levels at the K-Pg boundary. Marine water acidification and zonal hypoxia accompanying these phenomena had input on foraminiferal populations and also for their state of preservation in the sediment. A decrease in number and diversity characterized the microfauna inhabiting the sea floor as well as surface waters at that time. Moreover, the collected agglutinated benthic (*Caudammina, Glomospira, Rzehakina, Bolivinopsis*) and calcareous planktonic taxa (globigerinids), like most microorganisms during the biotic crisis at that time (KTBE), display small size under the influence of environmental stress (Keller & Abramovich 2009). In contrast to agglutinated foraminifers new opportunistic plankton taxa occurred with some delay in part of the basin. More numerous and diversified assemblages including calcareous taxa occur in variegated marls and shales accumulated in the shallower (Subsilesian) zone while impoverished and monospecific assemblages including agglutinated foraminifers or single specimens of calcareous plankton and benthos occurred in turbidities which were transported into the deeper (Silesian) zone of the basin. The renewal of the biotopes that took place at the end of the Paleocene during the thermal maximum (LPTE, Bains *et al.* 2000) was associated with an increase in plankton variation (assemblages with *Morozovella* and *Acarinina*). This plankton and also benthos including *Nuttalides trumpyi* which reflect the reactivation of the circulation in the deeper part of the basin (Friedrich *et al.* 2006) were also noted in studied deposits.

Because of the nature of studied deposits the determination of the K-Pg boundary based on microfauna studies was often impossible. It was caused by rather poor preservation of foraminifers and their very long stratigraphical ranges, as well as due to erosion and lack of deposition at this time.

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HELICODROMITES–DOMINATED TRACE FOSSIL ASSEMBLAGE FROM THE BADENIAN SEDIMENTS OF KRÁLOVO POLE (BRNO, SOUTH MORAVIA, CZECH REPUBLIC)

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The brickyard in Královo Pole was situated in the place of the present shopping centre "Královo Pole". Badenian sediments are there represented as monotonous grey, calcareous clays which turn to brownish and green-grey, fine-sandy calcareous clays with gypsum in upper parts of the profile. The sediments belong to NN5 zone of lower Badenian (Langhian stage of the global scale) (Brestenská *et al.* 1983). Previous research indicates very slow-moving waters with poor aeration and low nutrient income and depth more than 400 m (e.g., Brzobohatý 1997).

During the July 2001, an approx. 60 cm thick layer with frequently occurring but rarely overcrossing specimens of large *Helicodromites* isp. was found. Three specimens were collected; less than 10 were observed in situ. The layer contains also tunnel systems of *Pilichnus* isp.

Helicodromites-like burrows have been reported mostly but not exclusively from shallow marine environments. Berger (1957) described *H. mobilis* from outer shelf to passive slope. Furthermore, Baldwin & Mccave (1999) described recent helicoidal structures from the depth of 4000 meters. The relatively wide range of occurrences doesn't make *Helicodromites* isp. suitable for potential assignment to depth-related "Seilacherian" ichnofacies; however low wave-current energy can preliminarily be considered typical for *Helicodromites*.

Pilichnus isp. was described from deep-sea environments, sometimes with poor aeration (e.g., Baraboshkin *et al.* 2015). Mikuláš (1997) proposed that *Pilichnus* isp. represents burrows developed to absorb CH_4 and H_2S from the sediment.

In conclusion, the studied material represents lower Badenian deep-sea marine sedimentation. Recognised trace fossils were most likely caused by polychaete worms: *P. dichotomus* as a chemical feeding trace (chemichnion), *H. mobilis* as a grazing trace.

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SUMMARY OF THE RECENT STATE OF KNOWLEDGE IN THE PERMIAN PALAEOBOTANY OF THE INTRASUDETIC BASIN

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Systematical research of the Permian flora begun in the half of the 20th century. Němejc (1953) mentioned 10 plant species from the Broumov localities. Rieger (1966) studied geologically explored outcrops with regard to fauna and flora.

The fossiliferous Broumov Formation (Pešek *et al.* 2001) is divided into 3 members. The oldest Nowa Ruda Member is unfossiliferous. The Olivětín Member contains Ruprechtice and Otovice limestones and the so-called „Walchia shales“. In the „Walchia shale“ facies near Olivětín, Rieger (1966) found and described the following species: *Autunia naumannii*, *Rhachyphyllum* cf. *lyratifolia*, *Sphenopteris germanica*, *Odontopteris subcrenulata*, *Linopteris germarii*, *Taeniopteris* cf. *abnormis* and *Ernestiodendron filiciforme*; and near Otovice also *Neurodontopteris auriculata*. „Walchia shales“ are characterised by dominance of conifers that were not determined by Rieger (1966), who only cited Florin (1938–1945). Bors (1988) focussed in identification of conifers in his thesis and determined the following species from the “Walchia shales“: *Culmitzschia angustifolia, C. parvifolia*, *C. intermedia*, *C. speciosa*, *Hermitia goeppertiana*, *H. hirmeri*, *Otovicia hypnoides* and *Walchia piniformis*; and important callipterid *Arnhardtia scheibei*.

Otovice limestone contains *Sigillaria brardii*, *Calamites gigas*, *Pecopteris cyathea*, *P. thuringiaca*, *Odontopteris subcrenulata*, *Autunia conferta* and *Culmitzschia speciosa* (Rieger, 1966) and Ruprechtice limestone only *Autunia conferta*. The youngest flora represented by *Autunia conferta* comes from the Martínkovice Member, Hejtmánkovice limestone.

Rieger (1966) mentioned 21 plant species from the Olivětín Member, whereas Bors (1988) determined 24 species. However, some species as *Sphenobaiera* sp. and *Pseudovoltzia* sp. are dubious.

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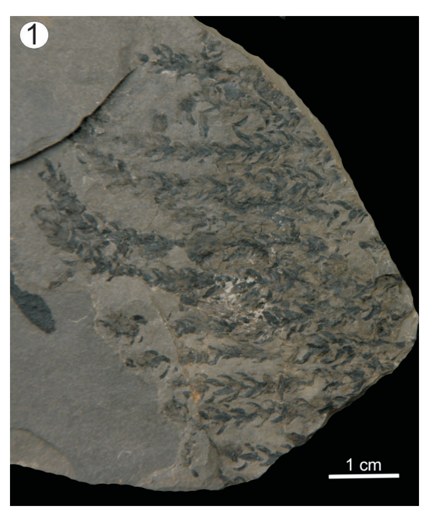

Plate 1. Conifer *Otovicia hypnoides* (Brongniart) Kerp, a typical representative of walchia-shale flora, Otovice near Broumov, Broumov Formation, Olivětín Member, Permian.

ACTINOPTERYGIANS OF THE FAMILY AEDUELLIDAE IN THE PERMO-CARBONIFEROUS BASINS OF THE CZECH REPUBLIC

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Aeduellidae are important representatives of actinopterygian fishes in the Permo-Carboniferous sediments of Europe and North America. They bear conspicuous features that reliably distinguish them from other co-occurring actinopterygians. Aeduellidae were first described from the Permo-Carboniferous basins of the French Massif Central, where they occur in several genera and species, and are very abundant (Heyler 1969). Subsequently, they were also discovered in the Saar Basin in Germany, in the Puertollano Basin in Spain, in Northern Switzerland and in New Mexico, USA. They were unknown in the Bohemian basins until the year 1986, although numerous species of other fish-like fauna are common in the Bohemian, French and German basins. Extensive new collections of actinopterygians from the Krkonoše Piedmont Basin and Boskovice Graben, together with the studies of old collections in the National Museum, Prague have provided a fairly wide range of aeduellid species (Štamberg 2007, 2014). The first aeduellid *Spinarichthys dispersus* was described from the Stephanian C of Central Bohemia (Štamberg 1986). The Permian sediments (Padochov Formation) of the Boskovice Graben provided *Neslovicella rzehaki* Štamberg, 2007, which occurs in large quantities in the Neslovice Fish Rock. The somewhat younger sediments of the Letovice Formation in the northern part of the Boskovice Graben hold another aeduellid, *Bourbonnella hirsuta* Štamberg, 2007. The oldest Permian fossiliferous Rudník Member (Asselian) of the Krkonoše Piedmont Basin is characterized by *Neslovicella elongata* Štamberg, 2010. Aeduellidae are also found in the younger fossiliferous horizons of the Krkonoše Piedmont Basin. The Kalná Horizon (Prosečné Formation, Asselian) has produced bones and parts of bodies of *Aeduella* and *Bourbonnella* (Štamberg 2014), and isolated bones of *Aeduella* also occasionally occur in the Chotěvice Formation (Asselian).

The relatively abundant occurrence of Actinopterygians of the family Aeduellidae in the Permo-Carboniferous basins of the Czech Republic is another indication of the interconnection of our former lakes with lakes in France and Germany.

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BOHEMIAN GOTHIC PAINTINGS: PROVENANCE OF NATURAL CHALK USED IN GROUND LAYERS DETERMINED BY CALCAREOUS NANNOFOSSILS

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Nannofossil content found in the chalk ground layers on Bohemian panel paintings created from the 14th to the 16th century was studied from the collection of National Gallery Prague. The work was focused on markers that offered information about the place of origin of natural chalk. Pieces of painting were disintegrated in a drop of H_2O_2 and studied by light microscope.

Nannofossils proved that sediments did not come from Bohemia. Most of samples, for example from paintings of the Master of the Vyšší Brod Cycle (ca 1345) or Master of the Litoměřice Altarpiece (ca 1515) contained similar assemblages (Švábenická *et al.* 2017). *Arkhangelskiella maastrichtiana* and *Cribrosphaerella daniae* indicate Maastrichtian, *Prediscosphaera stoveri* gives evidence for high latitudes, Boreal province, and genus *Lucianorhabdus* shows on a shallow sea. So, the chalk was deposited during Maastrichtian in the epicontinental sea of North European Platform. In Middle Ages, it had to be imported along the Elbe from N and NW Europe, nowadays N Germany or Denmark. Restores of artworks call it Rügen chalk. Scarce *Micula murus*, low latitude species found in chalk ground layer under silvering (Master of the Puchner Arc) indicates the influence from the Tethyan realm and may demonstrate region located more southwards. This natural chalk was probably imported from SW France over the Alps and restores call it Champagne chalk.

The source of natural chalk considerably influences the property of the chalk thus playing an important role for the choice of the particular material for its use in the ground layers under gilding or under color layers painting even within one artwork or in one workshop. The practice of using the different sediments of natural chalk may be characteristic for the workshop practice.

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TAXONOMY AND PALAEOECOLOGICAL IMPLICATIONS OF THE J/K INTERVAL BELEMNITES (OUTER WESTERN CARPATHIANS, CZECH REPUBLIC)

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The Jurassic-Cretaceous belemnites are commonly found in the eastern part of Czech Republic only. Their records are exclusively known from tectonically affected complexes, palaeogeographically belonging to the Outer Western Carpathians. For the Upper Jurassic – Lower Cretaceous interval (Tithonian – Hauterivian?), a highly diversified assemblage appears here. Belemnites are represented by family Mesohibolitidae (*Hibolithes*, *Mesohibolites*, *Conohibolites*) and Duvaliidae (*Duvalia*, *Berriasibelus*, *Conobelus*, *Pseudobelus*, *Castellanibelus*).

The exact stratigraphic correlation of rostra with individual layers is almost impossible, belemnites are oftenly reworked from older strata and accumulated in pocket fillings. In the Kurovice quarry, macrofauna including belemnites has been recorded in a slump structure (the bed 105, uppermost *Crassicollaria* through *Calpionella* Zones) in the lowermost Berriasian (Košťák *et al.* 2018). In Štramberk area (Kotouč quarry) the belemnites were studied in two sequences – Lower Berriasian (*Jacobi* Zone, confirmed by ammonites Vašíček & Skupien 2016) and from filling of the pocket "Š-12" (Upper Tithonian to Lower Hauterivian; Svobodová *et al.* 2011).

All taxa described herein belong to the classic Tethyan belemnite fauna whose extension is known from the shelf areas throughout NE Tethys and in the Mediterranean province. Material from the Lower Berriasian sequence was also subjected to geochemical analyzes. Strontium isotopes of belemnite rostra exceed values 0,707232 – 0,707312, which corresponds to the Berriasian strontium values following results of Price & Gröcke (2002). Oxygen and carbon isotopes of belemnites show the classically reverse trend than the $\delta^{13}C$ and the $\delta^{18}O$ values obtained from the bulk-rock in the Tethys region (Price *et al.* 2016).

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HAPLOCERATIDS OF THE ŠTRAMBERK LIMESTONE (TITHONIAN, SILESIAN UNIT, OUTER WESTERN CARPATHIANS)

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In the Štramberk Limestone ammonites of the family Haploceratidae are abundant. At present, these ammonites occur frequently in the Kotouč Quarry; they are richly deposited in Moravian-Silesian museums. In the past years the given family has been studied in foreign localities many times. In represented species, sexual dimorphism is observed based on different shape of mouth on microconchs and macroconchs. Summary of previous knowledge is presented aptly by Zeiss (2001).

Based on the study of original material in Munich processed by Zittel (1868, 1870), specimens deposited in above-mentioned museums and our collection, 6 species in the Štramberk Limestone at Štramberk area have been revised so far. One of them represents probably a new species or a macroconch unknown yet.

The most abundant species in the Štramberk Limestone is *Haploceras elimatum*. As far as this species is concerned, microconchs have not been found yet. With regard to size of adult shells, it is clear that aptychi, i.e. the lower element of the jaw apparatus, occurring in body chambers of this species, belong to the genus *Punctaptychus*.

Other representatives of haploceratids of the Štramberk Limestone belong especially to the genus *Hypolissoceras*. The typical representative of them is *H. carachtheis*. Aptychi of this genus, the shells of which reach medium size, belong to the genus *Beyrichilamellaptychus*.

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THE KONKIAN / SARMATIAN BOUNDARY IN THE EASTERN PARATETHYS BASED ON FORAMINIFERA

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The Konkian/Sarmatian boundary were studied in deposits of several sections (outcrops and wells) of the Northern Black Sea Region, Kerch Peninsula (the Southern Ukraine) and Ciscaucasia (the Southern Russia) (e.g., Vernigorova *et al.* 2006, Vernigorova 2008, Golovina *et al.* 2009). In most cases, studied deposits are characterized by dark-gray laminated calcareous clays.

The upper part of the Konkian deposits contains euryhaline foraminifera assemblage with special species composition. This is the Konkian typical species (e.g., *Quinqueloculina guriana*, *Varidentella reussi sartaganica*, *Elphidium kudakoense*, *E. jukov*i) and a small amount of species that are characteristic for the lower Sarmatian (e.g., *Elphidium horridum*, *Porosononion martkobi*, *Nonion bogdanowichi* (e.g., Vernigorova 2008, Golovina *et al.* 2009, Popov *et al.* 2016). The Konkian age of these deposits is confirmed by the Konkian species of mollusks, ostracoda, nannoplankton (e.g., Vernigorova 2008, Golovina *et al.* 2009).

The lower part of the lower Sarmatian deposits of the Eastern Paratethys has two type of foraminifera assemblages. The first is a Nonionidae – Elphidiidae assemblage (Bogdanovich 1965). Such species as *Porosononion subgranosus*, *P. martkobi*, *Nonion bogdanowichi*, *Elphidium horridum*, *E. macellum*, *E. regnum* are dominate in it. The second is a Miliolidae assemblage (Bogdanovich 1965). It is characterized by the dominance such species as *Quinqueloculina reussi reussi*, *Q. consobrina nitens*, *Q. consobrina sarmatica*, *Q. collaris*, *Articulina sarmatica*, *A. problema* etc.

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REACTION OF CHITINOZOA FROM THE PRAGUE BASIN TO THE MID-HOMERIAN GRAPTOLITE EXTINCTION (SILURIAN, CZECH REPUBLIC)

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The *lundgreni* Event is a major graptolite extinction described from numerous mid-Homerian localities world-wide. This event has been associated with an extinction of conodonts, other faunal groups (including chitinozoa), sea-level changes and excursion of δ13C detected in limestone sediments. Mutual correlation of the two major biostratigraphically important groups, graptolites and conodonts, is obscured due to their facial restriction. Recently, new data suggest, that the effect of conodont extinction is magnified by facial changes during the mid-Homerian (Jarochowska & Munnecke 2016). Chitinozoa represent the third group widely used in Silurian biostratigraphy, with a high potential to correlate graptolite and conodont record. Only a few studies deal with the dynamics of chitinozoan faunas across the mid-Homerian (Steeman *et al.* 2015).

The Vykočilka locality of the Prague Basin represents a complete section through the mid-Homerian, well-controlled by graptolites. It has been sampled to examine the presence of chitinozoans. Most of the samples were productive, although the preservation varied from bad to moderate. The dominant genera are *Ancyrochitina* and *Conochitina*, followed by *Cingulochitina*, *Linochitina* and others. The majority of species continues through the graptolite extinction level, or are known from higher stratigraphic levels in the Prague Basin. Among the species, that disappear at, or close to the graptolite extinction level are *Cingulochitina cingulata*, *Margachitina margaritana* and ?*Urnochitina* sp. A. The genera *Ancyrochitina* and *Conochitina* show a mutual alternation in relative abundance. This pattern becomes more apparent in the upper part of the studied section, close to the graptolite extinction level, implying different ecological requirements of both genera. This must be taken into account when evaluating the dynamics of chitinozoan fauna. The overall effect of environmental changes on chitinozoans through the mid--Homerian can be therefore interpreted as clear but not severe.

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A NEW AGGLUTINATED FORAMINIFER FROM THE GENUS *AMMOPEMPHIX* IN THE PLEISTOCENE OF THE ARCTIC OCEAN

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In the course of investigating the agglutinated foraminiferal assemblages from the Pleistocene of the Lomonosov Ridge in the Central Arctic Ocean, we recovered numerous individuals belonging to the genus *Ammopemphix* Loeblich, 1952. The morphological features of this taxon do not allow us to place it in any of the previously described species such as *A. arctica* (Cushman 1948) or *A. quadrupla* (Wiesner 1931), and we threfore regard it to be a new species.

The species is an attached form, with delicate chambers that are hemispherical and flattened on the basal attachment surface. Its aperture is simple, rounded, and situated on the top of the chamber. A short neck may be present. The wall is made of fine mineral grains held together by a yellowish-brown organic cement. The size of the agglutinated grains varies – smaller grains are used on the attachment surface, on the interior of the chamber, and in the vicinity of the neck. The diameter of the chambers ranges from 20 μm to 155 μm.

Individuals of this species may occur as single individuals or as pseudocolonies in which specimens are attached to one other, however, there appears to be no connection between individual chambers. Pseudocolonies may consist of several to dozens of individuals in different stages of development. Juvenile specimens are often observed among adult specimens. We do not observe any symmetry in the positioning of individuals in pseudocolonies. Individuals of *Ammopemphix* may be attached in crevices on mineral grains, on the inner surface of larger fragments of agglutinated foraminiferal, or more rarely on calcareous foraminifera. In larger colonies, some individuals may be found colonizing previous generations of *Ammopemphix* specimens.

Until now the genus *Ammopemphix* has only been reported from the modern ocean. Our finding in the middle Pleistocene of the Lomonosov Ridge is the first report of the genus from the fossil record.

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PLANKTONIC FORAMINIFERA FROM THE LOWER BERRIASIAN OF THE RUSSIAN PLATFORM (CRIMEA): BIOSTRATIGRAPHY AND EVOLUTION

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The subject of our current research is the paleontological record of the earliest Cretaceous planktonic foraminifera. The main purpose is to determinate taxonomical diversity, biostratigraphy and planktonic foraminifera evolution.

We studied the Dvuyakornaya Formation in the Tonas River Basin (Eastern Crimea) representing a deep neritic - upper bathyal paleodepth facies of the Russian Platform. A Berriasian age was determinated using nannofossils (CC2 Zone) and ammonites (*Jacobi* Zone).

Relatively numerous, small sized (60–150 micron) planktonic foraminiferal tests were obtained from the disintegrated and washed marls. Six species belonging to five genera were distinguished. All of these taxa have a Tethyan or sub-Tethyan origin. The most common taxon is *Favusella hoterivica* (Subbotina), next most common species are *Lilliputinella eocretacea* (Neagu) and *Conoglobigerina gulekhensis* (Gorbachik and Poroshina). *Lilliputinella* aff. *similis* (Longoria), ?*Favusella* sp., *Hedbergella handousi* Salaj and *Gorbachikella grandiapertura* Boudacher *et al.* are rare.

All taxa of planktonic foraminifers have their first occurrences in Cretaceous, we do not find any taxa that survived from the Jurassic. Only *Conoglobigerina gulekhensis* (Gorbatchik & Poroshina) and *Favusella hoterivica* (Subbotina) were reported from earlier than the Berriasian interval. The other four taxa were only prior known from younger Cretaceous strata. Now they are also documented from Berriasian, 10 for 20 million years earlier.

Taking into account the structure of the test walls and morphological features of the chambers and aperture we postulate two evolutionary lines between Jurassic and Cretacous planktonic foraminifera. The first is *Globuligerina oxfordiana* (Grigelis)-*Favusella hoterivica* (Subbotina) connected with the transformation from rugulose to reticulate wall, and the second is *Globuligerina balakhmatovae* (Morozova)-*Lilliputinella eocretacea* (Neagu) connected with the flattening of the coil and chambers and displacement of the aperture.

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CALCAREOUS ALGAE, CYANOBACTERIA, MICROPROBLEMATICA AND MICROBIALITES FROM THE FRASNIAN-FAMENNIAN BOUNDARY INTERVAL AT THE ŠUMBERA SECTION, MORAVIAN KARST, CZECH REPUBLIC

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The Frasnian-Famennian boundary interval is connected with one of the most severe biotic perturbations in Earth's history, known as Kellwasser Crisis (e.g., Walliser 1996). The decimation of metazoan reef-builders in the upper Frasnian lead to the expansion of microbial structures which were considered as disaster-forms in the aftermath of the Kellwasser Crisis by some authors (e.g., Rakociński & Racki 2016).

The Šumbera section in the Moravian Karst (Moravo-Silesian Basin) corresponds to the Upper *rhenana* to *Pa. minuta minuta* or younger Zones (see Weiner *et al.* 2017) and represents upper ramp environment (Hladil *et al.* 1991) with material redeposited from the shallower water areas. Calibration by conodont biostratigraphy enables to track in detail changes of facies and biota through the Frasnian-Famennian boundary interval at this section. Several features, which are often discussed in the context of "anachronistic" facies (sensu Woods 2014) were recorded: flat pebble conglomerates, enhanced early marine cementation and abundant microbial structures.

The section was studied also for Upper Devonian algae/cyanobacteria/microproblematica association, whose diversity is comparable to coeval occurrences in Belgium, Australia, Canada, China and Russia (see Rakociński & Racki 2016 for references). The Moravian association from the Šumbera section comprises: renalcids (*Izhella* Antropov, 1955); *Girvanella* Nicholson & Etheridge, 1878; *Rectangulina* Antropov, 1959; two morphotypes of *Rothpletzella* Wood, 1948; solenoporaceans; *Keega*-like microfossils; *Paralitanaia* Mamet & Préat, 1985; volvocean and radiospherid calcispheres; palaeoberesellids; *Umbellina* Loeblich & Tappan, 1961; and *Wetheredella* Wood, 1948. *Girvanella*, *Rothpletzella* and *Wetheredella* together with microconchids and ?stromatoporoids occur also in oncoid cortexes. The Frasnian-Famennian boundary in the Šumbera section is characterized by abundance of renalcids which became a rock-forming component in the lower Famennian part of the section.

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NEW FINDINGS OF SARCOPTERYGIAN FISH FROM THE MORAVIAN KARST (UPPER DEVONIAN, CZECH REPUBLIC)

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The evidence of sarcopterygian fish from the Devonian and Lower Carboniferous sequences of the Moravian Karst (Moravo-Silesian Basin) is poor. Beside teeth of onychodontiform fish obtained from insoluble residues (Ginter 1991 in Hladil *et al.* 1991, Smutná 1994, 1996, Kumpan 2013), a unique finding of cosmine-covered right lateral extrascapular of "osteolepiform" tetrapodomorph was described (Poukarová & Weiner 2016).

Recently, a new material of sarcopterygian fish was obtained from small outcrops of the Líšeň Formation, which are situated in a forested area near the Habrůvka village. In these sections, three 15–35 cm thick beds of fossiliferous calcirudite containing fish remains were recognized. These beds are Famennian in age and correspond to the *Palmatolepis minuta minuta* to *Palmatolepis rhomboidea* conodont zones.

Except common closely indeterminable fragments, the locality yielded also well preserved material of fossil fish including acanthodian spines and remains of sarcopterygians such as dipnoans and actinistians.

Actinistian material include, e.g., incomplete lower jaw, gular plates, opercular bones and urohyal belonging to the genus *Diplocercides* Stensiö, 1922. This genus was previously described from the Frasnian of Germany and Iran, and the Famennian of Poland (see Szrek 2007 for references).

A unique finding of incomplete dipnoan skull in palatal view will be subject of further detail study.

ACKNOWLEDGEMENTS

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THE UPPER DEVONIAN CONODONT ASSEMBLAGES FROM THE CEPHALOPOD LIMESTONE OF THE AREA NEAR ŁAGÓV (HOLY CROSS MTS.)

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The conodont fauna and conodont-based stratigraphy of middle part of Upper Devonian succession of the Łagów region (Holy Cross Mountains, about 34 km SSE of Kielce) are discussed. The Łagów region has a unique meaning for recognition of the Devonian history in the aspect of the Frasnian / Famennian Event as well in recognition of biostratigraphy and in identifying of geodynamic phenomena in the region. The oldest Frasnian cephalopod limestone was identified in Płucki section by Czarnocki in the beginning of the 20th century, while the oldest of the Famennian cephalopod limestone was identified in Łagów-Dule by Gürich (1896), Sobolew (1912) and Czarnocki (1989).

The Płucki section near Łagów was studied to establish the effect of the global Kellwasser Event on faunal diversity and content. At Płucki in the late Frasnian there are two horizons of black cephalopod limestone, which may represent the German Lower and Upper Kellwasser Horizons. They contain similar conodont and ammonoid assemblages, although there are some differences in their composition from bed to bed (Racki *et al*. 2002, Dzik 2002, Woroncowa-Marcinowska 2006).

Łagów-Dule section crops out near the mouth of the ravine on it's both sides. More than 6 m thick succession of intercalated black limestone and shale are exposed. Sobolew (1912) divided it in two parts: Lower and Upper Łagów Beds and respectively attributed it to the lower and upper part of the *Cheiloceras* Stage. In the uppermost part of the valley's left slope he separated *Clymenia* Bed. The studied interval yields a conodont assemblage, which indicates the Lower and Upper *rhomboidea,* Lower, Upper and Uppermost *marginifera* and Lower *trachytera* zones. The mixed conodont fauna are observed in Early *marginifera* Zone. Earlier, the conodonts were studied here by Wolska (1967), Dzik (2006) and Woroncowa-Marcinowska (2006).

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THE UPPERMOST DEVONIAN AMMONOID AND CONODONT STRATIGRAPHY IN KOWALA QARRY (HOLY CROSS MTS.)

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Goniatites and clymeniids from the Devonian/Carboniferous (D/C) boundary interval were reviewed to provide more precise correlation of this interval from Kowala Quarry with the biostratigraphic divisions of outer shelf deposits of Renish Masif (Becker *et al*. 2016). Strata with the D/C boundary interval located in the southern part of the Kielce Region have been recognized by Czarnocki (1989). He noted the presence of black shale with "*Imitoceras"* lying on marly limestone of the *Wocklumeria* Genozone. The last unit he divided into the lower and upper subgenozones. His numerous collection of ammonoids, which is the base of the present study, is stored in PGI-NRI Geological Museum, Warsaw. The investigated interval is approximately 10 m thick and consists of rhythmic succession of nodular marly limestone and shale. In the upper part of succession, black shale horizon (Hangenberg Black Shale – HBS) is about 1 m thick, overlays about 8 m thick nodular marly limestone and shale. The studied interval yields a conodont assemblages, which indicate the Upper *expansa* and Lower-Middle *praesulcata* zones. To ensure more detailed inter-regional correlation, Becker *et al*. (2016) proposed to establish parallel D/C boundary ammonoid zones based on the evolution within the Prionoceratidae, Kosmoclymeniidae or on a succession of other marker clymeniids. In Kowala section, within the Prionoceratidae *Mayneoceras nucleus* and *Effenbergia lens* are very important and easily recognizable alternative marker species (Woroncowa-Marcinowska 2011). Within clymeniids *Glatziella*, *Wocklumeria sphaeroides* and *Epiwocklumeria applanata* are also easily recognizable and important for correlation. The *Postclymenia evoluta* Zone of Becker *et al*. (2016) begins at the base of the HBS. It is not defined by the entry of the index species, but by the sudden extinction of almost all ammonoids, notably of almost all clymeniids. Exceptions are some cymaclymeniids and one or two mimimitoceratids. Very similar taxonomical composition was studied from HBS of Kowala Quarry. Dzik (1997) and Malec (2014) noted *Acutimitoceras* about 0,5 m above HBS horizon.

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INTERNAL STRUCTURE OF SOME ACANTHODIAN FIN SPINES

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The inner structure of acanthodian fin spines (especially pectoral ones) was studied based on both natural and artificial cross sections and thin sections. Numerous specimens of the Late Pennsylvanian genus *Acanthodes* were studied in detail by the author (e.g., Zajíc 1998). Sections of fin spines of various Devonian taxa were occasionally figured (e.g., spines of the Early Devonian genus *Machaeracanthus* in Burrow *et al*. 2010). The figured inner structures on the cross sections of Devonian and Pennsylvanian specimens seem different at a first glance. The present study aims at combining classic methods with computer tomography. The differences between the two families (Acanthodidae and Machaeracanthidae) will be discussed in the light of recent papers concerning acanthodian monophyletic vs. polyphyletic nature (Brazeau 2009, Davis *et al*. 2012).

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NEW INFORMATION ON THE MIOCENE PALEONTOLOGICAL LOCALITY TALIÁNSKÁ SKÁLA NEAR KELČICE (CARPATHIAN FOREDEEP, CZECH REPUBLIC)

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Taliánská skála, the locality only sporadically mentioned in older geological and paleontological literature (Ovečka 1949, 1953, Kalabis 1961, Jašková 2002, among others), is situated near Prostějov, about 1 km SE from Kelčice village (Czech Republic). It is an old abandoned quarry in Miocene (Lower Badenian) sediments generally belonging to the facies with red-algal limestones and representing the sedimentary infill of the westernmost part of the Carpathian Foredeep. The new paleontological study of the locality, carried out in 2014-2016 as a part of a bachelor thesis at the Department of Biology, Faculty of Education, Palacky University in Olomouc (Zapletal 2016), confirmed this locality to be relatively rich in fossils, namely with regard to both amount and number of species. The following species of macrofossils were found: the serpulid worm *Ditrupa cornea* (Linnaeus), bivalves *Aequipecten macrotis* (Sowerby in Smith), *Corbula* cf. *gibba* (Olivi), *Panopea* (*Panopea*) *menardi* (Deshayes), *Tellina* sp. and *?Ervilia* sp., the gastropods *Turritella* cf. *badensis* Sacco and *Turritella* sp., one undeterminable bryozoan and the ichnofossil *Ophiomorpha* isp. In the two thin-sections from the rocks collected at the locality there were recorded foraminifers, ostracods, echinoderms (echinoids) and worms. Macroscopic study of rocks from Taliánská skála indicated that they are represented by sandy limestones to calcareous sandstones, similarly the microscopic study of two thin-sections confirmed that these rocks can be classified as calcareous sandstones rather than typical algal limestones. The presence of red algae has not been proved either macroscopically or microscopically.

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PALEOECOLOGY OF CALCAREOUS NANNOFOSSILS FROM PALEOGENE FORMATIONS OF THE MAGURA UNIT IN THE SLOVAK PART OF WESTERN CARPATHIANS

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The main objective of this presentation is to reveal how the calcareous nannofossils react to environmental changes at changed paleoecological conditions, which occurred during the Eocene/Oligocene transitional period. The calcareous nannofossils were identified and statistically evaluated in the time span from the Late Eocene to Early Oligocene.

The research results have demonstrated that the species *Coccolithus pelagicus* (Wallich) Schiller*, Coccolithus eopelagicus* (Bramlette & Riedel) Bramlette & Sullivan*, Reticulofenestra umbilica* (Levin) Martini & Ritzkowski and *Dictyococcites bisectus* (Hay, Mohler & Wade) Bukry et Percival enlarged their body dimensions as a response to changed paleoecological conditions. The reason for this effect was not just the cooling trend during the Late Eocene to Early Oligocene, but also eutrophication of the environment, supply of continental material, volcanic activity, as well as the presence of half-separated basin.

Based on evaluated biostratigraphic data, the relationships between the cold-water and warm-water species, as well as species present in the moderate tempered water were statistically processed.

FIELD TRIP: STRATIGRAPHY AND TECTONICS OF THE NE-CLOSURE OF THE PRAGUE BASIN

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National Museum, Prague, Czech Republic

This one-day field trip will be focused on the stratigraphy and tectonics of the NE-closure of the Prague Basin, an area known world-wide for its Early Palaeozoic stratigraphy and palaeontology. The Prague Basin occupies a central position within the Teplá-Barrandian

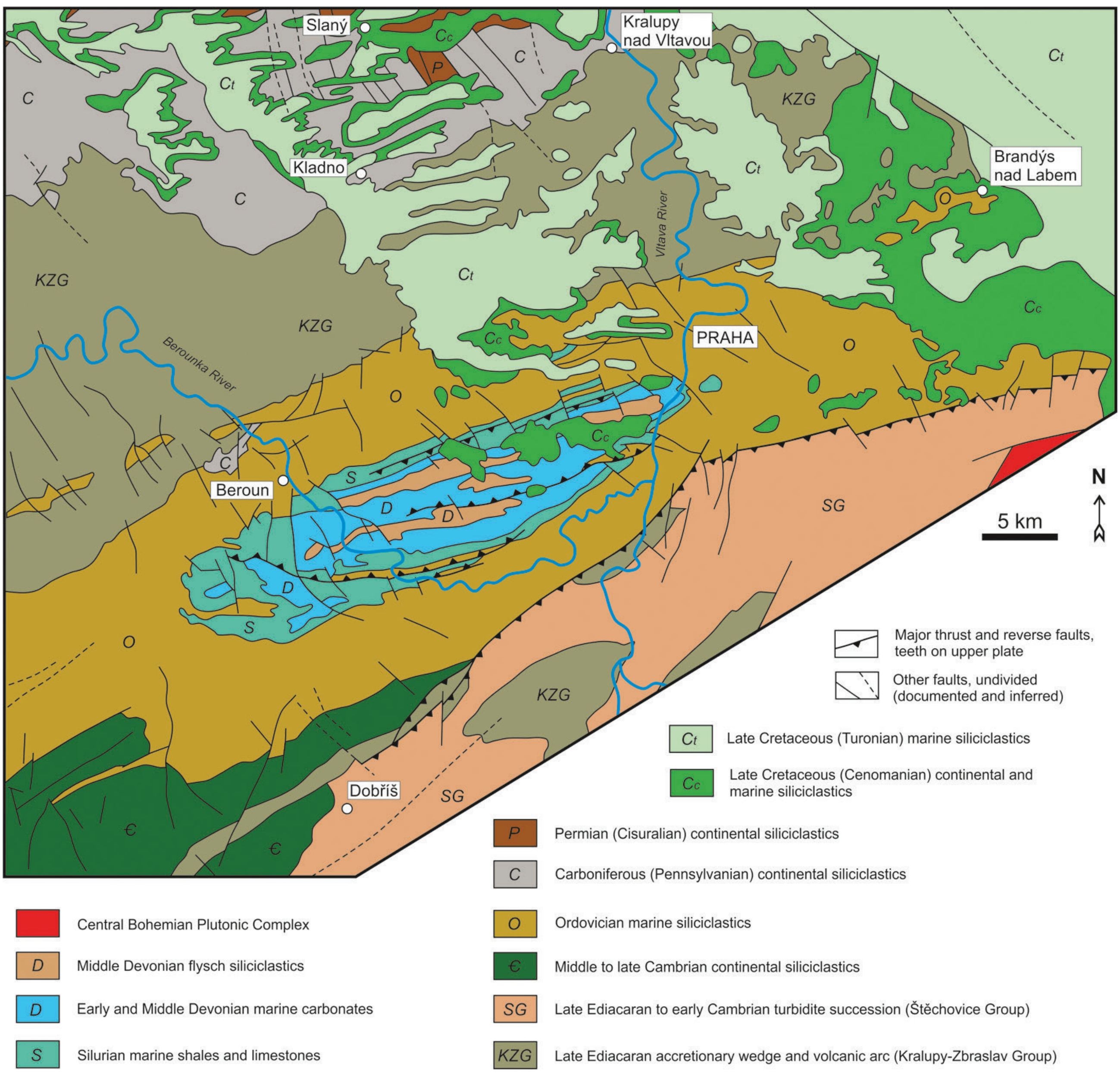

Figure 1. Simplified geological map of the NE part of the Prague Basin.

Unit, Bohemian Massif. It presumably initiated as a narrow fault-bounded graben, and has been interpreted as part of the extensive peri-Gondwana passive margin in the southern realms of the Rheic Ocean (e.g., Patočka *et al.* 2003, Aifa *et al.* 2007). Its sedimentary sequence overlaps the pervasively deformed Cadomian (late Neoproterozoic to early Cambrian) accretionary wedge, middle to late Cambrian continental–marine basins and late Cambrian volcanic complexes (Fig. 1; Havlíček 1980, 1981; Chlupáč *et al.* 1998; Fatka & Mergl, 2009; Hajná *et al.* 2011, 2017 and references therein).

The basin is filled with a continuous volcano-sedimentary marine succession ranging from the earliest Ordovician (Tremadocian) to Middle Devonian (Givetian), with a minimum and maximum cumulative thicknesses of about 1,200 and 5,100 m (Fig. 2; Chlupáč *et al.* 1998). The succession consists of: (1) Ordovician siliciclastic rocks (shales, siltstones, sandstones; up to ~3,700 m thick in total) interpreted as cold-water passive-margin, continental shelf deposits (e.g., Havlíček 1982). Dropstone horizons in the uppermost stratigraphic levels indicate that the Prague Basin was within the reach of peri-Gondwana continental glaciers during the Late Ordovician (Brenchley and Štorch 1989). (2) The Ordovician siliciclastics are conformably overlain by Silurian tuffitic and graptolite black shales, they were deposited in an oxygen-poor environment, and they pass upward into warm-water carbonates (maximum total thickness of the Silurian is ~630 m; (e.g., Kříž 1991, 1992). (3) The carbonate deposition continued across the Silurian–Devonian boundary and resulted in a package of Lower to Middle Devonian warm-water carbonates, including reef and carbonate platform facies (e.g., Chlupáč 2003), up to ~570 m thick (in total). (4) Finally, the carbonate succession is capped by ~250 m thick Givetian flysch siliciclastics (shales, siltstones, sandstones), which mark the onset of basin inversion during the initial stages of the Variscan orogeny (Fig. 1; Kukal & Jäger 1988; Strnad & Mihaljevič 2005). Moreover, the entire Ordovician to Middle Devonian succession is interfingered with submarine basaltic volcanic complexes and sills (Fig. 8a), with the main peaks of volcanic activity in the Middle Ordovician (Floian–Sandbian) and early to late Silurian (Wenlock–Ludlow;

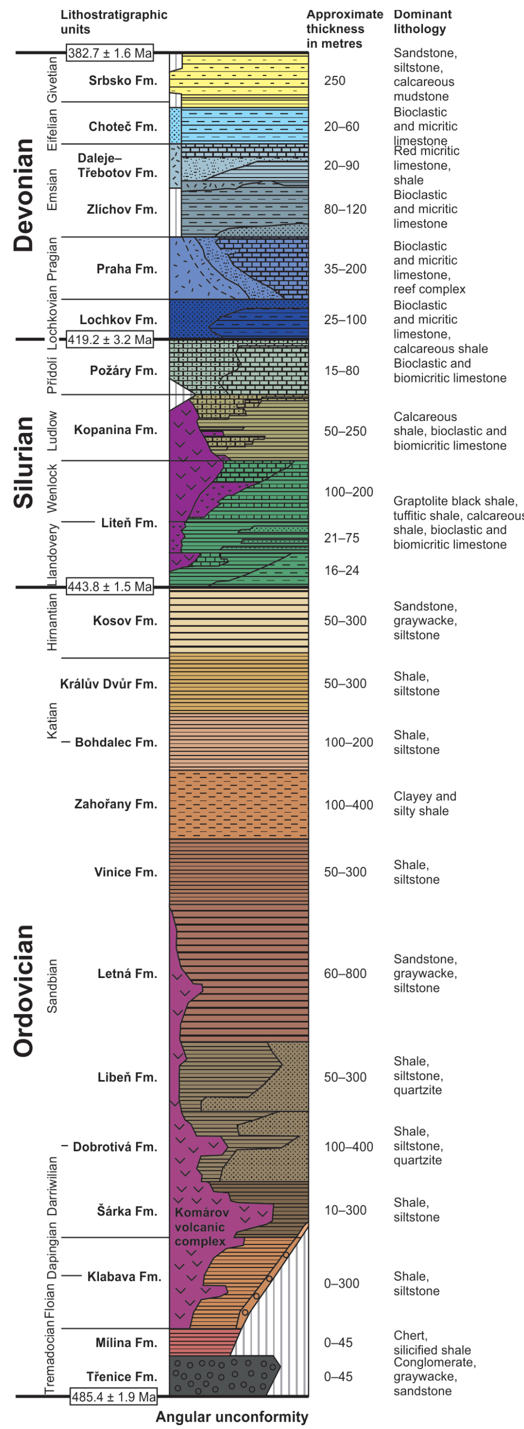

Figure 2. Stratigraphic chart summarizing lithostratigraphy of the Ordovician to Middle Devonian successions of the Prague Basin (Vacek & Žák, in press, compiled from Chlupáč *et al.* 1998). Numerical ages of chronostratigraphic boundaries are according to the International Chronostratigraphic Chart published in 2016 (www.stratigraphy.org).

Figure 3. Map showing position of the field trip stops (modified from www.mapy.idnes.cz).

Fig. 2). Their geochemical composition indicates that they formed in a continental rift setting (Patočka *et al.* 1993). However, Silurian rifting never developed to an oceanic stage. Cessation of the Silurian volcanic activity is explained by far-field forces, specifically, a rift failure in response to slab-pull relaxation due to closure of the Iapetus Ocean (Tasáryová *et al.* 2017). Palaeomagnetic data record a northward drift of the Prague Basin from a latitude of about 40°S in the late Cambrian to subtropical latitudes (c. 10–20°S) in the Middle Devonian (e.g., Krs *et al.* 1987, 2001; Tait *et al.* 1994, 1995; Aifa *et al.* 2007; Tasáryová *et al.* 2014). It remains a matter of debate whether the Teplá–Barrandian Unit, including the Prague Basin, remained attached to Gondwana as a part of its extended passive margin, or whether it was completely detached and became a far-travelled continental terrane isolated within the Rheic Ocean during the Early Palaeozoic (see, e.g., Paris & Robardet 1990; Robardet 2003; Fatka & Mergl 2009; Žák & Sláma 2018 for discussions).

During the Variscan plate convergence, the northwesterly oceanic domain (Saxothuringian Ocean) followed by the Saxothuringian continental margin were progressively subducted beneath the Teplá–Barrandian (from >380 Ma to ~340 Ma), resulting in overall ~NW–SE to ~WNW–ESE horizontal shortening of the overriding Teplá–Barrandian upper crust (e.g., Zulauf 1997, 2001). The Prague Basin was inverted, uplifted, and multiply deformed in response to this crustal shortening (e.g., Havlíček 1963, 1981; Chlupáč *et al.* 1998; Melichar 2004; Röhlich 2007; Vacek & Žák, in press and references therein).

Importantly, the style and intensity of the Variscan deformation varies along strike of the Prague Basin, which, as a result, is divided into two contrasting segments. The southwestern segment is made up of Ordovician siliciclastics and is dismembered into a mosaic of fault-bounded blocks. In contrast, the northeastern segment forms a ~36 km long and ~16 km wide (at the present-day erosional level) ~NW–SE-trending syncline, with Ordovician siliciclastics in the periphery, and Silurian–Devonian predominantly carbonate successions in the core (Fig. 1). It is a simple structure, defined by buckle folds of up to several kilometres wavelength cross-cut by major reverse/thrust faults, both recording horizontal ~NW–SE shortening (c. 5–30 %) and coeval ~NE–SW extension. Due to this deformation, the syncline evolved into a doubly vergent compressional fan associated with significant crustal thickening. Subsequently, these Late Devonian/early Carboniferous structures were overprinted by vertical shortening, accommodated by localized recumbent folds and normal faults. This deformation event can be correlated with normal displacement along ductile shear zones that juxtaposed the Teplá–Barrandian upper crust against the deep middle and lower crust (Moldanubian Unit) at around 346–337 Ma. Even younger is a newly recognized deformation phase represented by ~N–S shortening, affecting both ends of the syncline (Vacek & Žák, in press).

Our field trip will cover various aspects of depositional and post-depositional history of the Prague Basin in its NE part between Praha-Butovice and Praha-Hlubočepy. Six major stops are planned with several possible alternate stops on the way (Fig. 3).

Stop 1
Hemrovy skály (50.0429081N, 14.3536717E) and **Ostruha near Praha-Nová Ves** (50.0429081N, 14.3536717E)
Topic: Lower Silurian submarine volcanism

Extensive outcrops provide an insight into the structure of the Lower Silurian Nová Ves volcanic centre. It belongs to a system of several volcanic centres that developed during the Early Silurian along the ENE-WSW trending faults. The main phase of volcanic activity dates to the Homerian and Gorstian (Wenclock/Ludlow). These volcanoes produced predominantly submarine highly altered basalts and various volcanoclastics (hyaloclastites, tuffs, agglomerates), as well as subvolcanic dikes and sills. Their composition is characterized by transition from alkali to tholeiitic, corresponding to continental rift setting.

The Hemrovy skály exposure is characterized by alternation of basaltic pillow lavas (Fig. 4) with basaltic volcanoclastics. A nice example of brecciated lava flow is exposed at Ostruha to the south of Hemrovy skály.

Stop 2
Butovické hradiště (50.0391086N, 14.3551831E)
Topic: Shallow-water carbonate platform deposits

An extensive exposure of the Upper Silurian (Přídolí) and Lower Devonian (Lochkovian) carbonates is located on the western slope of the Hradiště Hill. Various bioclastic limestones were deposited in the shallow-water carbonate platform. We will observe e.g., sedimentary structures documenting storm-affected deposition.

Stop 3
Jezírko quarry, Praha-Hlubočepy
(50.0418700N, 14.3852694E)
Topic: Vertical shortening as a result of the Variscan orogen collapse

The exposure on the right hand side of the access road-cut provides a fine example of the localized vertical shortening resulting from the collapse of the Variscan orogeny (Vacek & Žák, in press). This is exemplified by the S-vergent recumbent folds that developed in thinly-bedded limestones of the Choteč Formation (Eifelian; Fig. 5). A small--scale detachment can be seen at the contact with

Figure 4. Stop 1: Ostruha. Lower Silurian basaltic pillow lavas of the Nová Ves volcanic centre.

underlying nodular limestones of the Daleje-Třebotov Formation (Emsian).

Stop 4

Railway-cut, Praha-Hlubočepy (50.0388933N, 14.3957678E)

Topic: Onset of basin inversion during initial stages of the Variscan orogeny

The railway-cut exposes the topmost part of the Prague Basin's sedimentary sequence (Fig. 6). The lower part of the section consists of the thinly-bedded nodular limestones with thin shale interbeds (Choteč Formation, Eifelian). It is sharply overlain by dark shales and silicites of the Kačák Member (Srbsko Formation, Eifelian/Givetian). The prominent lithological change reflects a sea-level rise and drowning of the carbonate platform in the Prague Basin. This event has been recognized globally (Kačák Event). Dark shales are overlain by siliciclastics of the Roblín Member (Srbsko Formation – fine-grained sandstones and siltstones) with common terrestrial plant remains (e.g., *Relimia, Pseudosporochnus* or *Protolepidodendron*). It reflects the onset of basin inversion during the initial stages of the Variscan orogeny, accompanied by increased erosion rates and a supply of terrestrial detrital material to the marine basins.

Stop 5

Kaplička Quarry (50.0388831N, 14.4044581E)

Topic: Sedimentary processes on the carbonate platform slope

The section to north of the disused Kaplička quarry exposes the transition from hemipelagic nodular Dvorce-Prokop Limestone (Praha Formation, Pragian/Emsian) to the Zlíchov Formation (Emsian; Fig. 7). Its base consists of carbonate breccia with rich coral debris (in local stratigraphy referred to as Kaplička coral horizon). It has been interpreted as gravity-flow deposits initiated by increased subsidence of the sea-floor. Interestingly, the supposed transport direction is predominantly

Figure 5. Stop 3: Jezírko quarry. Recumbent folds in thinly-bedded Choteč Limestone document vertical shortening related to the Variscan orogeny collapse.

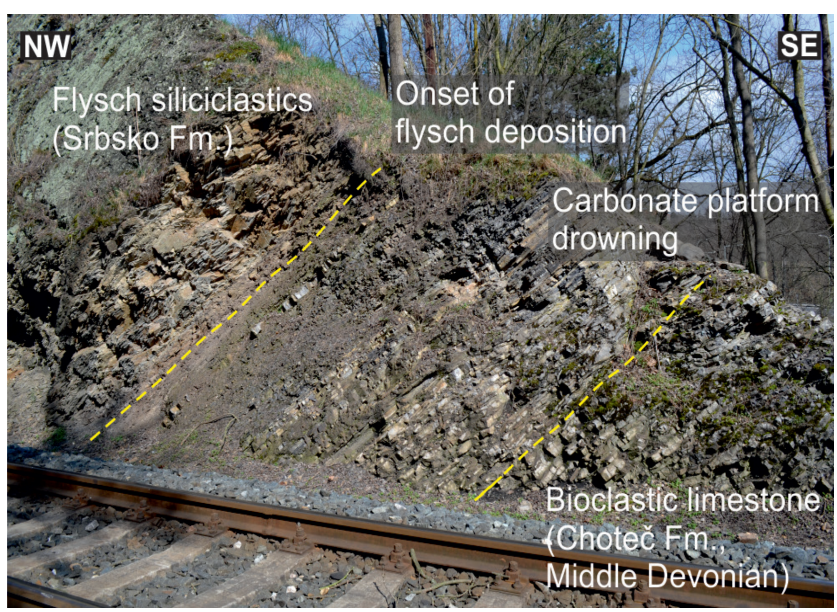

Figure 6. Stop 4: Praha-Hlubočepy, railway-cut section. Eifelian/Givetian transition characterized by carbonate platform drowning followed by onset of basin inversion and deposition of flysch siliciclastics.

Figure 7. Stop 5: Kaplička quarry. Transition from hemipelagic nodular limestones to massive carbonate breccia.

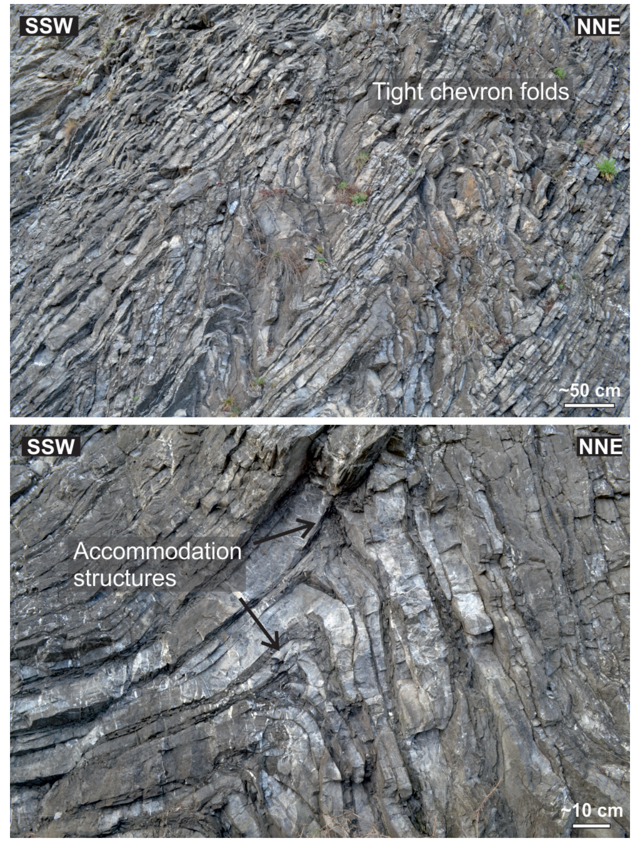

Figure 8. Stop 6: Barrandov cliffs. Close-up on various folds developed in limestone/shale sequence and associated accommodation structures (hinge thrusts).

from SE to NW and SW, i.e. completely opposite to all remaining Devonian formations. The source areas must have therefore been located in the parts of the basin that were not preserved to present day. A small-scale detachment can be seen at the base of the massive breccia layer.

Stop 6
Barrandov Cliffs (50.0347553N, 14.4018200E)
Topic: Complex Variscan deformation of the Prague Basin

The steep cliffs of the well-known 'Barrande's Rock' provide a fine example of complex deformation of the Prague Basin (Fig. 8). The cliffs were named after the French palaeontologist Joachim Barrande (1799–1883; memorial plaque placed in 1884). The exposure consists of Lower Devonian (Lochkovian) limestones thinly interbedded with calcareous shales deposited as carbonate slope calciturbidites, alternating with background hemipelagic sediment. This lithology (i.e. dm-scale alternation of shale and limestone beds) defines a horizon several tens of metres thick, which significantly differs from successions below and above, composed of mostly competent, thick, and uniformly NW-dipping strata. The mechanically weak horizon of the Lochkovian limestones is spectacularly disharmonically folded into asymmetric meter-scale buckle folds, locally associated with small-scale thrusts.

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