Polish Academy of Sciences
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Abstracts

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ABSTRACTS

Paleotemperature and paleodiet reconstruction on the base of oxygen and carbon isotopes from mammoth tusk dentine and horse teeth enamel during Late Paleolith and Mesolith

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The use of stable isotopes has proven to be one of the most effective methods in reconstructing paleoenvironments and paleodiet through the upper Pleistocene period (e.g. Fricke et al. 1998; Genoni et al. 1998; Bocherens 2003). This study demonstrates how isotopic data can be employed alongside other forms of evidence to inform on past at great time depths, making it especially relevant to the Palaeolithic where there is a wealth of material potentially available for study.

The basic aim of this study is to recover the climatic signal recorded in the oxygen isotope composition of *Mammuthus primigenius* tusks and *Equus* sp. teeth remains. Second aim represents the reconstruction of the paleodiet and paleovegetation on the base of carbon isotope analyses.

The samples come from the *Mamuthus primigenius* tusks (Slovak Republic: Slaninová cave 32 300 ± 268 cal. BP, Trenčianske Bohuslavice 30 053 ± 258 cal. BP, Dzeravá skala cave 27 793 cal. BP; Czech Republic: Předmostí – Přerov II. 31 142 ± 374 to 31 620 ± 240 cal. BP., Kůlna cave 27 568 ± 445 cal. BP., Brno – Vídeňská street 17 588 ± 257 cal. BP, Pekárna cave 15 701 ± 662 cal. BP.) and from tooth enamel of *Equus* sp. (Czech Republic: Balcarka cave 17 186 ± 223 cal. BP, Býčí skála cave 15 652 ±336 cal. BP, Pekárna cave 15 701 ± 662 cal. BP, Kolíbky cave 15 053 ± 339 cal. BP, Smolín 9 330 ± 82 cal. BP).

For determination of $^{13}C/^{12}C$ and $^{18}O/^{16}O$ ratios we used the metodology after McCrea (1950). All analyses were performed at the Czech Geological Survey (Prague, Czech Republic).

The range of calculated $\delta^{18}O_p$ in the *Mammuthus primigenius* tusk samples from Gravettian varied from 14.3‰ to 16.6‰; $\delta^{18}O_p$ in the *Mammuthus primigenius* tusks and *Equus* sp. enamel samples from Magdalenian varied from 13.5‰ to 15.5‰, and $\delta^{18}O_p$ in the *Equus* sp. enamel sample from Boreal varied around 14.7‰. Calculated mean annual temperature moved from 5.8°C to 10.4°C during Gravettian, from 2.6°C to 7.5°C during Magdalenian and around 5.4°C during Boreal on the base of these isotope analyses.

The range of $\delta^{13}C$ in the *Mammuthus primigenius* tusk samples from Gravettian varied from -8.7‰ do -5.7‰; $\delta^{13}C$ in the *Mammuthus primigenius* tusks and *Equus* sp.

enamel samples from Magdalenian varied from -7.6‰ to -10.7‰ and $\delta^{13}C$ in the *Equus* sp. enamel sample from Boreal varied around -10.5‰.

Calculated mean annual temperature during Gravettian on the base of our isotope analyses (5.8 to 10°C) was not so low as supposed by some analyses on the base of malacology, flora or simulations. We have to take into account rapid climatic oscilations and adaptations of flora and fauna to these changes and also possible migrations of studied mammoths from southern warmer areas.

Calculated mean annual temperature during Magdalenian varied from 2.6°C to 7.5°C. Our analyses confirm that climatic development during late glacial was not uniform, but displayed many climatic oscilations. This conclusion is confirmed also by the isotope results from Greenland ice cores.

Calculated mean annual temperature during Boreal varied around 5.4°C. This temperature analysis documents cold period, which represent one of the cold events of post glacial, so called 8.2 ka cold event. This event is registered in many profiles and also correlated with considerable cooling registered in ice cores.

During Gravettian environment has a character of steppe and meadow, in some cases with light groves around the rivers. This conclusion could be confirmed by sympatric occurrence of typical large grazing animals such as *Rangifer tarandus*, *Equus* sp., *Bos/Bison* sp. or *Coelodonta antiquitatis* on the studied localities. During mammoths life comes to changes in ingesting of different plant food on the base of our carbon isotope analyses. The results could be interpreted as year climatic periodicity and reaction of the plant cover to changing climatic conditions and also as possible migration of mammoths within long distances.

Environment during Magdalenian could be interpreted as gradual transition from open grasslands to more closed. Our analyses confirm also alternating of colder and warmer oscillations. Plant cover were richer during the Mesolith with comparison to Gravettian one.

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Palaeoenvironmental reconstruction based on the morphology of the Devonian stromatoporoid at Słopiec (Holy Cross Mountains, Poland)

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Słopiec is a small outcrop in the western part of the Holy Cross Mountains, about 25 km south from Kielce. It is one of the several localities in the Holy Cross Mountains, where the Devonian stromatoporoid-coral limestones are exposed. Słopiec biostromal limestones present a part of the Dyminy reef complex (*sensu* Racki 1992) and are dated as the Late Givetian–Frasnian. This reef complex has emerged on the shallow carbonate platform in the Early Frasnian (Szulczewski 1995).

Stromatoporoids dominate macro-fossils in the Słopiec limestones. They are represented by various massive forms always accompanied by numerous, dendroid amphiporoids forming “submarine meadows”. Apart from these fauna the bedded complex contains also relatively rare branching corals and brachiopods.

Stromatoporoids with massive skeletons (coenosteum) commonly show different shapes, which reflect the palaeoenvironmental conditions (e.g. Broadhurst 1966; Kaźmierczak 1971; Kobluk 1978; Kershaw 1998; Łuczyński 1998 a, b, 2003). The most important environmental factors influencing not only on the stromatoporoids’ growth-form, but also on its external morphometric features, were the following: deposition’s rate, bottom currents, water turbulence and substrate consistency.

In Słopiec outcrop, the most common are high domical shaped forms (71% of specimens) and variously shaped bulbous forms (26%), mainly with flat base. Only 33% of stromatoporoids are preserved in the growth position. Most of them are overturned, but generally they display no external damage, thus we may assume that they were transported over a short distance. Stromatoporoids thrived in a shallow, relatively calm water, where the specimens with high profiles, could expand upwards and sometimes achieve large sizes. Sporadically, the short-lasting turbulent episodes (probably storms) occurred and then, highly extended domical shaped and bulbous forms with narrow base were easily pulled out from the sediment. These suggest that the rate of sedimentation was very slow or even stagnated during the stromatoporids’ growth. Consequently, stromatoporoids could form continuous skeletal layers across the entire surface and they may acquire the enveloping arrangement of latilamine, as well as smooth external surface. Substrate on which they settled were not solid, but firm enough to allow the high forms with a narrow bases to grow on.

Słopiec stromatoporoid assemblage occurs in fine-grained (mudstone/wackestone) carbonate sediment and may be interpreted as growing in a shallow water, isolated back-reef lagoon environment, situated in the central part of the Dyminy reef complex. Such interpretation is supported by the microfacies analysis that revealed considerable amount of calcispheres, single-chambered foraminifers and oncoids with thick microbial coatings.

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Archaeocyaths of the Kaczawa Complex, W Sudetes, Poland – preliminary data

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The Kaczawa Complex in the West Sudetes (NE part of the Bohemian Massif) consists of volcano-sedimentary sequences of Neoproterozoic to Early Carboniferous age and mélange bodies of assumed Late Devonian to Early Carboniferous age (Baranowski et al. 1990; Kryza et al. 2007). Due to intensive deformation, scarcity of good quality outcrops and lack of biostratigraphic markers, a detailed stratigraphic scheme of the Kaczawa Complex still remains a matter of controversy. A part of this volcano-sedimentary infillings of an extensional basin are thick bodies of carbonate rocks, known as Wojcieszów Limestones in the regional literature. The wide spectrum of lithotypes recognized in the Wojcieszów Limestones indicates variable conditions of their deposition – from very shallow to deeper water marine environments (Lorenc 1983). Gürich (1882) considered them as Ordovician. Schwarzbach (1933) suggested that the Wojcieszów Limestones may be correlated with the limestones of Lusatian

Massif. The age of this Lusatian limestones from the Görlitz Synclinorium was established, based on archaeocyaths, by Schwarzbach (1933) as Lower Cambrian. However those dubious archaeocyaths described by Schwarzbach were revised some times later (vide Elicki & Debrenne 1993; Elicki – personal communication, 2008). In paper by Gunia (1967) the Lower Cambrian age was called back due to the newly discovered remains of an alleged coral named *Cambrotrypa sudetica*, but character of this finding remains still uncertain. The last effort to establish the age of the Wojcieszów Limestones has been done by Skowronek & Steffahn (2000). They described foraminifera, sponge spicules and vertebrate remains excluding Cambrian age and pointing to Silurian or even younger. After more than 120 years of controversies our finding of undoubted archaeocyaths finally proves Early Cambrian age of these rocks.

Archaeocyaths of the Wojcieszów Limestones occur in archaeocyath-calcimicrobe boundstones. Both regular and irregular, as well solitary and branching forms have been found. Over one thousand specimens have been found. Largest cups of solitary archaeocyaths are 40 mm high and 35 mm in diameter. In some of specimens skeleton has been partly dissolved and replaced by sparry calcite, thus the actual appearance and sizes of skeletal elements are modified. This incompleteness of the material makes precise specific or even generic determination difficult.

We distinguish 10 forms of archaeocyathas in our preliminary study. Based on identified specimens of *Dokidocyatella*, *Erisacoscinus*, *Aficyathus*, *Leptosocyathus*, *Protopharetra* (Debrenne et al. 2002) the Wojcieszów Limestones is Early Botoman in age, precisely they represent arrcheocyathan zone *squamosus–zelenovi* (Debrenne et al. 2002). Archeocyath assembalge found in the Wojcieszów Limestone is similar to that described by Elicki & Debrenne (1993) from Doberlung-Torgau Synclinorium in the Lusatian Massif.

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New flora and fauna associated with fishes in the Oligocene of the Menilite-Krosno Series from the Outer Carpathians of Poland

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Oligocene deposits included in the Menilite-Krosno Series of the Outer Carpathians contain a remarkable ubiquity of fish remains. Flora and fauna associated with them have been recently collected at eight localities in Poland: Błażowa, Babice-Połanki, Jamna Dolna 1, Jamna Dolna 2, Krępak, Rudawka Rymanowska, Wola Czudecka. The fishes are preserved here as variably articulated skeletons, and they represent the majority of marine macrofauna of the Menilite-Krosno Series. New finds include both the marine biota, such as algae, crabs, and amphipods, as well as terrestrial elements, primarily plant detritus, dragonflies, and birds (feathers). They are associated with the fishes ascribed to pelagic, near-bottom, and bottom marine waters (e.g. Clupeidae, Bathylagidae, Gonostomatidae, Phosichthyidae, Sternoptychidae, Paralepididae, Myctophidae, Merlucciidae, Zeidae, Serranidae, Gempylidae, Trichiuridae). All these fossils occur in pelagic deposits represented by thin-bedded shales (e.g. Menilite Shales), marls, and limestones.

Algae are represented by vegetative parts, such as fragments of filamentous thalli either narrow (1–5 mm in width) or wide (5–30 mm in width). They occur frequently at localities Błażowa and Jamna Dolna 2. A few specimens were found at locality Rudawka Rymanowska. Some specimens, from locality Jamna Dolna 2, include remains of gas bladders typical of the kelp. High abundance of algae at localities Jamna Dolna 2 and Błażowa allows to recognize algal communities in the northernmost part of Carpathian basins, which is distinguished as the Skole Basin.

Terrestrial plant detritus include fragments of wood (usually rounded), leaves, and fragments of twigs. They are quite frequent in localities which are situated in the external part of Carpathians. Fragments of wood and leaves occur at Błażowa. Fragments of wood, leaves and fragments of twigs occur also at Jamna Dolna 2. Some specimens of wood occur also at Rudawka Rymanowska and Wola Czudecka.

Marine crabs are represented by a single large carapace (4.5 cm wide) with first pair of pereopods, found at Krępak. Amphipods include carapaces of three specimens from Błażowa and Babice-Połanki. Dragonflies are represented by a single, nearly complete specimen, although lacking one wing. It was found at Rudawka Rymanowska. Birds are represented by four feathers, that were found at Jamna Dolna 1 and Rogi.

Fossils bearing rocks are fine-grained, with disarticulated skeletal fish elements in spatial proximity to articulated portion of skeleton, random orientation of skeletons on bedding planes, suggesting stagnant (calm) bottom conditions during sedimentation.

However, the presence of terrestrial elements within these deposits clearly indicates influence of offshore winds and surface offshore currents, which transported terrestrial biota over long distances from the shore and distributed them all over deeper parts of the of Carpathian (Tethyan) Basin.

The newly recorded fossils enrich considerably the list of organisms associated with fishes of the Menilite-Krosno Series not only in Poland, but also in Czech Republic, Slovakia, Ukraine, and Romania.

Silurian brachiopods from boreholes in eastern Poland

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The described material comes from four boreholes in eastern Poland (Białystok region): Tyniewicze IG-1 (major part), Proniewicze IG-1, Widowo IG-1, and Sobótka IG-1. It can be provisorily dated as the Wenlockian.

The most characteristic taxa identified up to now are: *Leptaena rhomboidalis*, *Skenidioides levisii*, *Resserella canalis*, *Leangella* sp., *Gotatrypa* sp., *Plectatrypa lamellosa*, *Cyrtia trapezoidalis*, *Eospirifer* sp.

Two features of the described fauna require particular attention: first, absence of rhynchonellids and chonetids common in coeval strata in Gothland; second, lack of common species (and even genera) with the fauna of nearby boreholes in Lithuania (Musteikis & Modzalevskaya 2002).

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Brachiopods from the Upper Cretaceous white chalk of Chełm, south-eastern Poland

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The brachiopod assemblage from the Upper Cretaceous white chalk of Chełm is characterised by the dominance of micromorphic species. The investigated brachiopods are of low diversity when compared with other assemblages from the Upper Cretaceous chalk facies in Europe (e.g. Steinich 1965; Surlyk 1972, 1982; Bitner & Pisera 1979;

Johansen 1987a, b; Johansen & Surlyk 1990; Simon 1998, 2000, 2005). Fourteen species have been recognised in the material from Chełm while the Maastrichtian brachiopod fauna of Denmark consists of about 50 species (Surlyk 1972; Johansen 1987a). One of the most common species in the assemblage from Chełm is a rhynchonellide *Cryptoporella antiqua* Bitner et Pisera, occurring also in the Upper Cretaceous white chalk of Mielnik, another Polish locality (Bitner & Pisera 1979). There are two genera of the superfamily Cancellothyridoidea, *Terebratulina* and *Gissilina*. *Terebratulina* species dominate in the studied material, among them *T. longicollis* Steinich and *T. chrysalis* (Schlotheim) are the most common. Two inarticulate species, *Lingula cretacea* Lundgren and *Isocrania costata* (Sowerby), and a megathyrid *Bronnothyris bronnii* (Roemer) are relatively common. Among micromorphic brachiopods very rare are *Magas chitoniformis* (Schlotheim), *Leptothyrellopsis polonicus* Bitner & Pisera, and ?*Aemula* sp. The macromorphic brachiopods are represented by only one specimen of *Neoliothyrina* and four specimens of *Carneithyris*.

The species from Chełm belong to all four ecological groups distinguished by Surlyk (1972) based on the mode of life. The most common are brachiopods attached to the substrate by means of a pedicle. Among them there are minute forms using very small substrates as *Cryptoporella antiqua*, most *Terebratulina* species, *Gissilina* sp., *Bronnothyris bronnii*, and *Leptothyrellopsis polonicus*. Such large-sized form as *Neoliothyrina* belongs to that attached to a large hard substrate, and *Terebratulina chrysalis* is interpreted as attached directly to the sediment. The second group comprises secondarily free-living forms and is represented by *Carneithyris* sp. and *Magas chitoniformis*. *Lingula cretacea* belongs to the third group of burrowing forms, while *Isocrania costata* to forms that live attached to the substrate by cementation of the ventral valve.

The uppermost Campanian–Maastrichtian of NW Europe was divided into twelve brachiopod zones by Surlyk (1984). Unfortunately all the species occurring in Chełm have a very wide stratigraphical range. There are any of *Rugia* index species. *Terebratulina longicollis* which appearance indicates the *longicollis–jasmundi* Zone (latest Campanian) occurs in the whole section.

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Foraminifers from the Treskelodden Formation (Late Carboniferous–Early Permian) of south Spitsbergen

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Palaeozoic rocks of southern Spitsbergen, including the Treskelodden Formation, are exposed between Hornsund and Bellsund along a 5–10 km wide, NNW-SSE oriented belt. The formation consists of a sequence of fresh-water and shallow-marine clastics and subordinate biogenic limestone intercalations with well preserved fossils (Birkenmajer 1979; Harland 1997; Dallmann 1999).

The foraminifers from these rocks are abundant and diverse, but they have not been documented up to date. Fifty-nine species of twenty-two genera, including three new species (*Globivalvulina treskelenensis*, *Hemigordius arcticus*, and *Hemigordius hyrnensis*) have been identified (Błażejowski et al. 2006; Błażejowski & Gaździcki 2007; Błażejowski 2008).

The associated fusulinaceans provide an independent time framework when evaluating stratigraphic importance of the smaller foraminifers. Information derived from this study has been integrated with that from previous investigations to produce a smaller foraminiferal biostratigraphic model for High Arctic.

Detailed analysis of taxonomically and stratigraphically differentiated microfauna, allowed to establish the age of the Treskelodden Formation as Gzhelian–Artinskian (Błażejowski 2008).

The biota show a significant Permo-Carboniferous cooling. Highly diversified, tropical-like associations dominated by dasycladacean algae and small benthic and epibiotic foraminifers (Chloroforam Association) prevailed during the Gzhelian to Sakmarian time. Poorly diversified, temperate-like associations, dominated by bryozoans, brachiopods and foraminiferans characterizing cooler climatic settings developed during the Artinskian (Bryonoderm-extended) – see Błażejowski (2008). The cooling trend is evidence for a dramatic climatic deterioration in northern Pangaea at the end of the Palaeozoic (Beauchamp & Baud 2002).

The results of this study add significantly to known occurrences of late Palaeozoic foraminifers in the High Arctic, complementing of previous studies (Sosipatrova 1967). The foraminifer assemblage is correlated with similar coeval association in the Sverdrup Basin of Arctic Canada, Timan-Pechora Basin and Wandel Sea Basin.

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Discovery of the first, nearly complete starfish from the Upper Cretaceous of Miechów Trough, southern Poland

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Complete and nearly complete asteroids of Poland are known only from the Miocene deposits (e.g. Bałuk & Radwański 1968; Nosowska 1997). Up till now, starfishes and their remains occurring in the Cretaceous strata in Poland were negelcted and only one single ossicle has been illustrated so far (Maryańska & Popiel-Barczyk 1969).

In 2007, a nearly complete asteroid representing a juvenile form (smaller than 1 cm in diameter) and assigned to the genus *Crateraster* Spencer (see details in Gale

1987), was discovered in a residue from a bulk sample collected at Glanów (Miechów Upland). The Middle and Late Cenomanian to Early Turonian deposits are exposed in the section at Glanów (see Marcinowski 1974; Walaszczyk 1992; Borszcz et al. 2008, for details). Apart of the articulated specimen, a few hundred of isolated skeletal ossicles have also been found.

Complete specimens are extremely rare in the fossil record (e.g. Villier 1999; Jagt 2000; Villier et al. 2004), and that such a preservation needs exceptional depositional conditions, e.g. storm and rapid burial quickly after dead without transport (see e.g., Donovan 1991; Brett et al. 1997; Jagt 2000; Ausich 2001).

Taphonomic study of our material (i.e. evident signs of abrasion of the whole specimen and the lack of one arm) suggests that it was quickly buried after the death and post-mortem transport. However, the absence of any epibionts on the preserved skeleton suggests a short residence time on the sea-floor.

One century long research of the Glanów deposits gave neither such an articulated starfish nor any evidence of obrution that is critical for complete starfish preservation. Therefore, at the moment the finding is assumed to be an incidental phenomenon and more sedimentological and palaeontological investigations are needed.

The data presented above are only preliminary and many problems concerning biostratinomy and burial environment will hopefuly be resolved during the ongoing investigation by the present author.

I would like express thank to my friend, Artur Gajerski, M.Sc. (Faculty of Earth Sciences, Sosnowiec), for providing the starfish material for further study, which is now housed at the Department of Paleontology and Biostratigraphy, Faculty of Earth Sciences in Sosnowiec, Poland under catalogue acronyms GIUS 9-3497.

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Palaeogeoecological research of the sediments in a former lake Stará jímka (Bohemian/Bavarian Forest)

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Geological, geomorphological and palaeoecological study of Quaternary sediments was conducted in connection with the geological mapping of the map sheet 22-333 Srní at a scale of 1: 25 000 (Babůrek et al. 2006). Modern geomorphological research has been carried out for four years in the vicinity of the Prášilské Lake. The results of the research were summarized in a hypothesis about the geomorphological origin of the landscape (Břízová et al. 2006). Although the hypothesis provides a lot of information about the morphochronology, it is necessary to find some other exact information to confirm or disprove the statement. The Prášilské Lake is a lake of a glacial origin. The lake is near Prášily village, below the east slope of the Poledník Mt. (1,315 m a.s.l.). The Stará Jímka area lies approximately 1,500 m to the north of the Prášilské Lake. Both localities belong to the same basin of the Jezerní Potok stream. The Stará Jímka area itself is an approximately 900 m long depression with N–S direction which is extended along the steep slope with the east exposition. The depression is dammed by some long accumulation of glacial origin on the East. We can delimit two main parts of the area. The first part, which is in the north, is covered by a spruce forest. The second part (in the south) is almost without tree cover and is very wet. There is a man-made dam approximately at the border between the two described parts. It is obvious that the north part used to be a water reservoir. A small quarry lies to the east from which material for the dam was extracted.

The organic sediments were analysed for pollen and algae. The peatbog sediments on the map sheet Srní (22-333) are the subject of palynological investigation and Quaternary-geological mapping. Several samples of the localities (Stará Jímka Lake-Pod Poledníkem) were radiocarbon dated (Gd-, GdA-: code numbers of the data obtained using gas proportional dating techniques and accelerator mass spectrometry, dependently, from Gliwice Radiocarbon Laboratory of the Silesian University of Technology, Gliwice, Poland, Table 1).

Table 1. Radiocarbon dating results

Locality	Number of sample	Laboratory number	Depth (m)	^{14}C - BP	Range of Calendar Age
Stará jímka SJ	SJ 4	Gd-30097	0.20–0.30	2660±250	1050-350, 1400-100 BC
	SJ 5	Gd-15745	2.00–2.10	3850±170	2600-2000, 2900-1850 BC
	SJ 2	GdA-520	3.10–3.20	7730±90	8590-8420, 8770-8360 BP
	SJ 1	GdA-514	3.94–4.00	7890±90	8980-8590, 9050-8450 BP
	SJ 3	GdA-516	4.50–4.60	10470±120	12650-12170, 12800-12000 BP

Results of pollen analysis are used for the reconstruction of vegetational evolution in the Bohemian/Bavarian Forest.

Preliminary results of pollen analysis:

1.50 m	*Abies*, *Fagus*, *Picea*, Polypodiaceae
2.00 m	*Pinus*, *Picea*, *Sphagnum*
2.70 m	*Corylus*, Polypodiaceae, g. *Pediastrum* and g. *Botryococcus*
3.75 m	*Pinus*, *Betula*, *Corylus*, g. *Pediastrum* and *Botryococcus*, *P. angulosum* var. *angulosum* and *P. boryanum* var. *brevicorne*
4.00 m	*Pinus*, *Betula*, *Ulmus*, g. *Pediastrum* and *Botryococcus*
4.90 m	*Pinus*, *Betula*, *Corylus*, *Picea*, *Salix*, Polypodiaceae, *Botryococcus*, *Pediastrum*
5.05 m	*Salix*, *Juniperus*, *Betula* and *Pinus*, NAP – Poaceae and Cyperaceae, g. *Pediastrum* and *Botryococcus*
5.10 m	*Salix*, *Juniperus*, *Betula*, *Pinus*, *Hippophaë*, *Ephedra*.

The important and interesting sediments of the glacial lake Stará Jímka have been found near the Prášilské Lake. They were used for the new interpretation in relation to the geological setting of the area. Lake deposits and peat-bog sediments contained pollen and algal assemblages, that indicate the Late Glacial (15,000–10,250 BP) and the Holocene (10,250 BP– recent).

Glacial sediments also represent very important evidence of past geomorphological processes and could be used for the reconstruction of the chronological development of the landscape (Mentlík & Břízová 2005, 2006; Mentlík et al. 2005, 2006).

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A contribution to the study of the Lower Palaeozoic fossils of the Mongolian Altai

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Between Mongolian Altai and Gobi Altai Ranges, Lower Palaeozoic fossils were investigated during the joint geological mapping of the Chandmani somon (Zamtyn Nuruu) area in the 1:50,000 scale made by the Czech Geological Survey, Mineral Resources and Petroleum Authority of Mongolia (MRPAM), and the Geological Investigation Centre (GIC) in 2004–2007 (see Hanžl & Aichler 2007). The mapping has been realized in the frame of the project "Geological mapping of selected parts of Mongolia at a scale of 1:50,000", as an integral part of the Czech Development Cooperation.

Lake Terrane. Only questionable fossils were found in silty, often silicified and mostly re-crystallized carbonates of the Neoproterozoic?–Cambrian Maykhan Tsakhir Formation. The robust tube-shaped remains, entirely recrystallized, resemble archaeocyathids. Locally very common, determinable fossil remains (including fragments of stromatolites and algal crusts) were found in the grey-white limestones of the Lower Cambrian Tsahkir-Uul Fm. Locally rich and well-preserved (although low-grade metamorphosed) archaeocyathids asspocited with microbialites form biostromes to bioherms. The genera *Inessocyathus*? sp., *Urcyathus*? sp., *Coscinocyathus*? sp., *Eris-*

matocoscinus? sp., *Nochroicyathus*? sp. and *Degeletticyathus*? sp. indicate Tommotian to Botomian age (Lower Cambrian). The fossils indicate marine shallow-water of the quiet (protected shelf) to medium-dynamic environment in the photic zone.

Gobi Altai Terrane. Middle Ordovician (?Darriwilian) age of the Bayan Tsagan Fm. was supported by locally rich brachiopods *Orthidiella* sp., *Productorthis* sp., *Orthambonites* sp. and *Strophomenida* div. sp., and trilobites Asaphacea indet. (Budil et al. 2008), crinoids *Iocrinus* sp. and *Ramseyocrinus* sp., and bivalves found in the chlorite shales to metasiltstones with intercalations of slightly re-crystallized, originally biodetritic limestones at the Gichiginey Nuruu Mt. Range. The marine, relatively deep-water and rather quiet environment, however with periodic influx of bioclastic material from the elevations of the sea floor is supposed.

Rauzer & Zhanchiv (1987) suggested the Silurian age for the Khutag Nuur Fm. in the mapped territory. Common Corals Lykophyllinae incert., tabulates. cf. *Subalveolitella–Microalveolites*? sp., cf. *Halysites*?, *Shortlites cf. psedoorthopteroides*, *Favosites lichenarioides*, *Favosites* sp., indeterminable solitary Rugosa, amphiporids and stromatoporoids indicate Wenlock to Ludlow. The crinoids *Cyclomischus* sp. and *Baryschir* sp., ostracods and bryozoans confirm this age. This association indicates marine, relatively shallow-water environment with proximity of carbonate buildups.

1. The Lower Devonian (Upper Lochkovian to Emsian) age has been proved at least for part of the Gichigenii Fm. Light grey, white and pink-grey biosparitic limestones are locally rich in crinoids, corals, and brachiopods. Although the fossils were mostly affected by slight re-crystallization, the columnals of crinoids *Trybliocrinus* sp., *Cyclocaudax* sp., *Mediocrinus* sp., *Salairocrinus* sp., and brachiopods *Atrypa* sp., *Sieberella* sp., *Leptaenopyxis* sp., athyrids and rhynchonellids occur together with corals *Lecomptia*? sp., *Favosites* div sp., algal structures, cephalopods, gastropod *Praenatica*? sp., and trepostomate bryozoans. These rich associations indicate shallow-water marine environment in the photic zone, with biostromes and biohermes.

2. Pink, white and grey biosparitic to biomicritic, slightly re-crystallised limestones with crinoids belonging to the Lochkovian–Emsian Takhilt Fm. Extremely rich fauna consists of crinoids *Asperocrinus* sp., *Trybliocrinus* sp., *Mediocrinus* sp., *Salairocrinus* sp., *Pentamerocystella* sp., *Mydodactylus* sp., *Pandocrinus* sp., corals and stromatoporoids *Sutherlandinia* sp., rugosans, *Parastriatopora* sp., *Striatopora–Taouzia*?, *Bainbridgia*? sp., cf. *Cladochonus* sp., syringoporids, and *Laccophyllum*, gastropods *Orthonychia* sp., *Cyrtocyclonema* sp., brachiopods *Rugosatrypa*? sp., *Cymostrophia* sp., and trilobites (Budil et al. 2008) *Gerastos* sp., *Crotalocephalina* aff. *cordai*, *Reedops*? sp., "*Scutellum*"? sp. Branching bryozoans and nautiloids *Kopaninoceras* sp. have been also found. The dacryoconarid tentaculites *Guerichina* sp. support attribution to the Lochkovian–Pragian. This fauna indicates shallow-water marine environment in the photic zone, with biostromes and bioherms or even small reefs.

3. Rauser & Zhanchiv (1987) inferred the Middle Devonian age for the part of Togootin Fm. The layers and lenses of dark grey, fine biosparitic to locally biomicritic limestone contain mostly indeterminable (slight metamorphism) large crinoid columnals and pluricolumnals accompanied by brachiopods and rugose corals. The presence of *Lyrielasma*? sp. and strophomenid brachiopods indicates early to middle Devonian (up to the Emsian–Givetian). Rhynchonellids and fenestrate bryozoans are common

but have no biostratigraphical value, while *Pentacauliscus* sp. suggests the Lochkovian. The dacryoconarid tentaculites *Viriatelina* sp. and *Styliolina* sp., and crinoids *Cyclocaudax* sp. and *Melocrinites* sp., indicate Pragian to Givetian age. Palynological analysis offered poorly preserved remains, suggesting roughly the Devonian age. The fossils indicate deep-water, quiet dysoxic conditions, but the frequent large bioclasts suggest proximity of elevations covered by crinoids.

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Study of testate amoeba ecology by confocal and two photon microscopy

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Testate amoebae (Protozoa: Rhizopoda) are a group of unicellular animals (20–400 µm), protected with the shell (SiO_2, $CaCO_3$, proteins), living in fresh water habitats. They are used as model organisms in population ecology, ecotoxicology, paleoecology – thanks to their cosmopolitan distribution and species-specific ecological preferences together with low ecological valence to the changes of the environmental surroundings. Testate amoebae are usually examined using scanning electron microscopy (SEM) and environmental SEM (E-SEM). Scanning electron microscope allows for much better resolution than confocal laser scanning microscopy CLSM (far sufficient for recognizing taxonomically important features), but is limited to viewing surface of the specimen. Moreover, for species determination using morphology features, the shell often needs to be examined from all sides and the interior structures need to be visible. For this reason, we use CLSM and two-photon excitation (TPE) fluorescence microscopy to visualize the shell and inner structures of testate amoebae. We tried as many as fluorescent 15 dyes. We also performed checks for autofluorescence, acquired the z-stack through the whole animal and made 3D reconstructions of testate amoebae. We applied the CLSM and TPE to visualize a cytoplasm inside the shell of a living organism, which is not possible by SEM. CLSM enables us to acquire images from depths up to 40 µm, whereas TPE is able to penetrate to 60 µm. We successfully used fluorescent dyes acid fuchsine to visualize the shell; BCECF, DIOC$_3$(3), FITC, and propidium iodide to label inner structures. Mixotrophic species show autofluorescence of the chlorophyll a, membranes and the shell; heterotrophic species show autofluorescence of the shell only. These results contribute to morphological characteristics including taxonomical and ecophysiological research on testate amoebae. As far as we know, it is for the first time the CLSM, TPE and 3D reconstruction are used for studying inner organization of testate amoebae as well as for the first time acid fuchsine is used for their shell visualization.

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Mazuelloids from the Kacak Member (?uppermost Eifelian) of the Barrandian, Czechia

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A rich and diverse association of three-dimensionally preserved mazuelloids was etched from a single sample of black, fine-grained limestone nodule derived from the Eifelian/Givetian Kacak Member from Hostim locality (Prague Basin, Barrandian Area, Czechia), WGS-84: 49°57’46.657”N, 14°8’1.745”E. This is the first finding of mazuelloids in this stratigraphic position. However, the lack of biostratigraphically significant conodonts, and general scarcity of conodont elements in the Kacak Member does not allow to precise the exact position of Eifelian/Givetian boundary in the Barrandian. The most plausible hypothesis is that the level with mazuelloids still belongs to the Eifelian uppermost *kockelianus* Zone, very close to the E/G boundary.

These microfossils were probably previously reported as Foraminifera in thin sections of limestone nodules from the neighborhood of the present locality (Svoboda & Prantl 1953, p. 225). Although neither organic layer, nor calcium phosphate has been found in our material, the microfossils are now regarded as mazuelloids due to their morphology. They possess a spherical test typically about 100–200 micrometers in diameter, with hollow, usually conical, or cyllindrical processes projecting radially. The fossils are usually somewhat crushed due to transport before diagenesis, so that the spines come with broken tips, mimicking tube-like projections of some foraminifers, e.g., *Parathurammina*. Also the characteristic double-layer appearance of the test wall with layers separated by a thin seam, or organic layer, was probably destroyed by recrystallization during diagenesis in our material.

Mazuelloids have been etched out of the ca. 200 g sample of carbonate rock with 10% acetic acid, and the residuum washed and sieved between 315 and 100 μm sieves. Optical stereomicroscope was used to pick the fossils. Images were taken with SEM at the 7 degrees angular difference between images, to make anaglyphs (for software see: http://cm.bell-labs.com/sources/contrib/pac/sys/ src/cmd/img/anaglyph-1.01.tbz).

Our discovery complements stratigraphical and palaeogeographical occurrences of mazuelloids, being reported so far from the Neoproterozoic of China, Ordovician of Tasmania, Sweden and Estonia, Silurian of Greenland, Germany, Austria, Hungary, France, Bohemia, Canada, Wales, Sardinia, and Poland, Devonian of Germany, United States, and Hungary. The lack of mazuelloids from the Cambrian strata indicates a possibility that the Neoproterozoic forms belong to other group than the true Paleozoic mazuelloids. We agree with other authors (e.g., Eisenack 1934; Kremer 2005) that mazuelloids are large acanthomorphic acritarchs close to *Baltisphaeridium* that have been subject to post-mortem, early diagenetic phosphatization. The most plausible hypothesis about their phylogenetic relationship is that of Le Hérissé et al. (1997), Porębska & Koszowska (2001), and Kremer (2005), who presume close relationship to the cysts of deep-water dinoflagellates. Hypertrophic conditions, which are thought to be the cause of mazuelloids' enormous size (Kremer 2005) compared to other acritarchs, are indicated by sharp increase of dispersed organic matter in the black shale sediment at the onset of the Kacak Member.

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Alnus kefersteinii (Goeppert) Unger and its in situ pollen (Bechlejovice, Tertiary, Czech Republic)

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Pollen grains of *Alnipollenites verus* (Potonié) Potonié have been isolated from two well preserved catkins from the locality Bechlejovice. It represents important verification of the taxonomical classification of frequently found male alder inflorescences in this locality. The plant remains are preserved in laminated diatomite as compressions/impressions with small amount of carbonized substance. Macroscopical remains of the mail catkins are assigned to *Alnus kefersteinii* (Goeppert). Pollen grains are pentaporate with pores having vestibulum, they are 15–20 μm in size having granulate microstructure on the surface. Isolated pollen grains verify the taxonomical classification of catkins assigned to *Alnus kefersteinii* (Goeppert) Unger occurring in Bechlejovice locality. This conclusion is in agreement with previous determinations based on gross morphology.

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Direct evidence for carnivory of bradoriid arthropods on echinoderms in Cambrian of the Příbram-Jince Basin (Barrandian area, Czech Republic)

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To distinguish between different types of carnivorous behaviour, namely to separate hunting from scavenging, is complicated in Recent material. The situation is even more complicated in the fossil record by the fact that carnivorous arthropods capable of hunting could be also opportunistic scavengers (Babcock 2003).

There is only sparse information on feeding strategies of Cambrian non-trilobite bivalved arthropods: recently published evaluation of functional morphology, taphonomy and distribution of the poorly mineralized genera *Isoxys* and *Tuzoia* fit well with free-swimming life habit for both genera (Vannier et al. 2008). However direct evidence for such a life habit is still missing from Cambrian assemblages. Indirect exidence could be seen in fossil agregates filled by skeletal debris of different invertebrates, including bradoriid valves (Vannier & Chen 2005). The pattern of distribution of bradoriids shows that members of this group required a well-oxygenated sea bottom above the oxygen minimum zone, being only rarely adapted to a probably pelagic life. Similarly *Konicekion* is obviously restricted to levels of fine, comparatively shallow clastic shelf deposits in the Příbram-Jince Basin.

The edrioasteroid echinoderm *Stromatocystites* (type species *S. pentangularis* Pompeckj, 1895; Skryje-Týřovice Basin; Barrandian area) is the most widely and taxonomically diverse Cambrian edrioasteroid genus. The five known species have been described from the late second and third unnamed series of Cambrian of Gondwana (Australia), peri-Gondwana (Czech Republic), Baltica (Sweden) and Laurentia. All established species are strictly restricted to siliciclastic rocks with no evidence for hard substrate attachment. Dornbos (2006) supposed that *Stromatocystites* was well adapted to an attached mode of life on relatively firm Proterozoic-type soft substrates characterized by absence of the well-developed mixed layer. Consequently, *Stromatocystites* has been classified as a suctorial sediment attacher by Dornbos (2006).

The locally common but obviously stratigraphically and geographically restricted occurrence of hundreds of more or less completely preserved thecae of *S. pentangilaris* on the southern slope of the Vystrkov Hill locality was established for the first time by Želízko (1911). Six more or less entirely preserved thecae of *Stromatocystites pentangularis* contain from six to about fifty valves of the tiny bradoriid arthropod *Konicekion* Šnajdr, 1975. The bradoriids are preserved in the space between oral and aboral surfaces of the flattened echinoderms thecae, e.g. lying inside of the echinoderm body. All echinoderm individuals with the entombed bradoriid arthropods were collected from only one outcrop at Vystrkov Hill and are deposited in collections of the Czech Geological Survey, Klárov 3, Praha 1, CZ-18 21, Czech Republic under numbers YA 1031 and p 3394a–c.

Another find preserves more than twenty five individuals of *Konicekion* accumulated inside a large coprolite. These examples demonstrate that *Konicekion* represents not only an important recycler on the Cambrian seabed, as earlier supposed, but that its life strategy included also opportunistic scavenging and/or even predation on much larger animals, e.g. edrioasteroid echinoderms. The findings provide new data for reconstruction of the complex benthic food web of the Cambrian.

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New data on the Middle Badenian sediments of the western Part of the Malé Karpaty Mountains

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At the beginning of the Middle Badenian (corresponding to the zone Spiroplectamina carinata, Grill 1941) the Vienna Basin experienced an extensive regression and deposition of the lagoonal sediments of the Žižkov Member in the northern part of the Basin and alluvial fans of the Devínska Nová Ves Formation at the western margin of the Malé Karpaty Mountains. Later on, due to successive transgression the marginal areas were flooded and shallow-marine sandy sediments of the Stupava Member (Fordinál in Fordinál et al. 2005), Jakubov Formation were deposited and at places the bioherms of lithothamnian limestones were formed.

The sediments of the Devínska Nová Ves Formation, and marginal as well as basin sediments of the Jakubov Formation, were investigated at the western margin of the Malé Karpaty Mountains tracing the line between Záhorská Bystrica and Rohožník. The Devínska Nová Ves Formation contains abundant breccias, gravels and sands, and to a lesser extent clays, coal-bearing clays and lignites.

The breccias are made of chaotically deposited sharp-edged granitoid blocks, reaching up to 95% of the total mass. The matrix is aleuritic-psammitic with high muscovite content, non-calcareous, sometimes weakly calcareous. This material originated from fossil weathering crusts of granitoid rocks, transported towards the basin by detritic cones and debris-flows (Vass et al. 1988). Well-rounded pebbles of granitoids, quartzite and metamorphites are less abundant. They represent sediments of alluvial fans. Lithotype very frequently occurring within the Devínska Nová Ves Formation are yellow and yellow-brown medium- to coarse-grained sands with thin layers of fine gravel, occasionally with intercalations of clays. The sands are mostly non-calcareous and no-fossiliferous. Sporadically there were identified in the Devínska Nová Ves Formation pale-grey-green rusty-mottled non-calcareous clays with sandy fraction content. In the clays there were observed palinomorphs originating from hydrophilic and terrestial plants of the genera *Betula, Nuphar*, *Osmunda*, *Salix*, *Sphagnum*, and families Ranunculaceae, Selaginellaceae, and remnants of fungi and moss conides. Their presence indicates humid environment along streams or lakes. Obviously the above sediments are flood-plain deposits.

Atop the Devínska Nová Ves Formation sediments there are layers of shallow marine deposits of the Stupava Member and deep-sea clays of the Jakubov Formation. The Stupava Member are made of yellow- and greyish-yellowish-coloured fine- and medium-grained sands with layers and lenses of sandstones, mudstones and lithothamnian limestones.

Apart from a rich molluscan fauna found in the sands at Vrchná hora near Stupava (Buday 1939), a foraminifer fauna of low diversity was also found, with the most abundant *Elphidium* [*E. crispum* (L.), *E. macellum* (F.-M.), *E. fichtelianum*, *E. rugosum* (Orb.)] and species *Ammonia beccarii* (L.), less common are *Asterigerinata planorbis* (Orb.), *Uvigerina semiornata semiornata* Orb.

The lithothamnian limestones (algal foramiferal microfacies) in the Stupava Member are of pale-grey-yellow colour; when weathered they become grey. Quartz grains, mainly in psammitic, less commonly in aleuritic fraction, are a typical feature of these limestones. They are typically rich in allochems of dominatly biogenic origic. Among red algae *Lithothamnion* and *Ethelia alba* (Pfender) have been identified; among foraminifers *Amphistegina* sp., *Borelis mello* Fichtel & Moll, *Anomalina* sp. *Planorbulina* sp., miliolidic (*Quinqueloculina* sp., *Triloculina* sp.) there are also gastropods and bryozoans. Other biogenic grains are represented by fragments of the thick-shelled bivalves, echinoderm ossicles, smooth ostracods, serpulid tubes.

The basin sediments of the Jakubov Formation consist of grey-green and blue-grey calcareous clays. These sediments contain rich foraminifer assemblages, in which *Spiroplectinella carinata* (Orb.), *Uvigerina semiornata* Orb., *U. brunensis* Karrer, *Nonion commune* (Orb.), *Sphaeroidina bulloides* Orb. were identified.

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Problematic determination of ribbed Cretaceous nautioloids, example of *Eutrephoceras columbinum* (Fritsch, 1872) vs. *Cymatoceras atlas* (Whiteaves, 1876)

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In agreement with the surface morphology of shell, two basic groups of Cretaceous nautiloids could be distinguished. The first group is characterized by smooth shells (e.g., *Eutrephoceras* (Hyatt, 1894)), while the second group is represented by forms with radially ribbed surface (e.g. *Cymatoceras* (Hyatt, 1884)). Because of problems in taxonomy at suprageneric level (e.g. Kummel 1964; Shimansky 1975; Tintant & Kabamba 1985), genera and species are discussed here. Features such as character of suture, umbilicus, position of siphuncle, shape of the shell and also the surface of shell are very important for classification (Teichert 1964). Due to generally insufficient preservation, fewer features could have been used and consequently classification starts to be even more complicated. Thus, determination of specimens with poorly preserved taxonomical features is commonly wrong.

Taxonomical features can be variable. Specimens with smooth or ribbed surface of the shell could be classified as belonging to the first group or to the second one. The ribbing is well preserved on the authentic or recrystalized shell, on the impression of the shell and also on the core surface of the shell. The ribbings can be preserved on the core just like a relict often in umbilicus and aperture areas, or it can be completely absent because of the secondary abrasion or transport. In such case, a specimen with a smooth surface is at disposal, but still could be classified as belonging to the second group.

Such a complication could be documented for example in several specimens of *Eutrephoceras columbinum* (Fritsch, 1872) (see Fritsch & Schlönbach 1872; Frank 2006), with completely smooth shells and the species *Cymatoceras atlas* (Whiteaves, 1876) (see Whiteaves 1876) characterized by radially ribbed shells. All taxonomical features of these two species are the same and also the stratigraphic range is comparable. Just the ribbing on all specimens of *E. columbinum* is missing because of the preservation. It is very probable that they represent the same species. Absence of ribbing caused by poor preservation of juveniles is very common. This knowledge was gained by revision of Cretaceous nautiloids in the Natural History Museum in London.

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Diversity, distribution and taxonomy of the family Pectinidae Wilkes, 1810 in the Upper Triassic and Lower Jurassic deposits of the Western Carpathians

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Pectinid bivalves belong to typical and worldwide distributed Upper Triassic and Jurassic mollusks. The literature data of 19th–20th centuries concerning bivalves contain large amount of described species and this sometimes caused misinterpretations, ambiguity and inaccuracy of the various (e.g. systematical, paleobiogeographical and extinctional) analyses. In the uppermost Triassic (Rhaetian) deposits of the Western Carpathians six species “*Chlamys (Chlamys)*” *valoniensis*, “*Chlamys (Chl.)*” *mayeri*, “*Chlamys (Chl.)*” *simkovicsi*, *Chlamys* cf. *falgeri*, *Camptonectes (Camptochlamys)* sp. n. and “*Entolium*” sp. were recognized. After the Triassic/Jurassic mass exctinction event in the Lower Liassic (Hettangian) deposits only three species “*Chlamys (Chl.)*” *valoniensis*, “*Chlamys (Chl.)*” *punctatissima,* “*Entolium*” sp. occur. The species richness begins from the Lower Sinemurian where six species “*Chlamys (Chl.)*” *textoria*, *Agerchlamys subreticulata*, *Camptonectes (Camptochlamys) subulata*, “*Praechlamys*” *pallosus*, “*Praechlamys*” *rollei*, *Entolium (Entolium) corneolum* are known. In the Pliensbachian the species composition is the same as in Sinemurian, additionally typical species of this stage *Pseudopecten (Pseudopecten) equivalvis* is present. For the first time antimarginal microsculpture on the shells of *“Chlamys (Chl.)*” *simkovicsi* and “*Chlamys (Ch.)*” *valoniensis* was observed.

Climatic changes and the breakup of the European shelf at the end of the Triassic period had drastically changed the environments (reef biostromes and bioherms, lagoonar and tidal areas) of the most bivalve species. Successive Liassic transgressions opened new life habits, epicontinental seas, on the platform where these opportu-

nistic and ecologically tolerant species immigrated in westward direction. That is the reason why the Hettangian sediments (with abundant terrigenous input) of the Western Carpathians have very depleted the faunal composition. In contrast abundance of "*Chlamys (Chl.)*" *valoniensis*, *Chlamys (Chl.) pollux* (the ancestor is "*Chlamys (Chl.)*" *simkovicsi*) and other bivalve species is well documented from the Lower Liassic platform deposits. On the other side of Pangea (in present North and South America) *Agerchlamys boelingi* (older ancestor *Agerchlamys inspecta* was found in the Upper Triassic deposits of northeast Russia and New Zealand) lived since the lowermost Hettangian. It is known in the Alpine-Carpathian region since Lower Sinemurian under the name *Agerchlamys subreticulata*. Also new onset of carbonate deposition in the Tethyan realm since Sinemurian indicated favourable life conditions. Origin of bivalve species found in these beds can be traced in the boreal and platform region.

Revision of Cretaceous leaf floras of Poland – preliminary report

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Cretaceous leaf floras have been described from Poland in several dispersed contributions, some of them being not even written by palaeobotanists. The revision of this material is attempted by the present author.

The following collections are being studied:

1. Lower Upper Cretaceous (Cenomanian to Coniacian) flora of the Nysa Kłodzka (Sudeten Mountains, Glatzer Neisse graben) that contains e.g., *Credneria*, *Dewalquea*, *Flabellaria* (Goeppert 1842) – collections of the Wrocław University and Humboldt University in Berlin.

2. Upper Upper Cretaceous flora of the central and eastern Poland: a. Campanian? to Maastrichtian flora of the Roztocze region – collections of the Museum of the Earth in Warsaw (ten angiosperm taxa, e.g., *Dryophyllum*, *Dewalquea*, *Eulirion*; nine gymnosperms – Kohlman-Adamska 1975) and private collections in the Roztocze region, and collections of the Institute of Botany in Cracow; b. Maastrichtian flora of the Middle Vistula valley – collections of the Natural History Museum at Kazimierz Dolny.

The flora is in major part rather poorly preserved.

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Biostratigraphical and paleoecological interpretation of the Veľké Kršteňany borehole (Upper Nitra region) based on the calcareous nannofossils and foraminifers

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Veľké Kršteňany borehole is situated in the Upper Nitra Paleogene basin of the Inner Carpathians. The studied assemblage of the calcareous nannofosils is rich both quantitatively and qualitatively and indicative of nannoplankton zones NP 12–NP 16 (sensu Martini 1971) of the Middle and Upper Eocene.

In the basalmost part of the borehole the Nannoplankton Zone NP 12 – *Tribrachiatus orthostylus* was recognized, basing on the presence of the species *Ellipsolithus macellus* and *Tribrachiatus orthostylu*s. This species has its last occurrence at the top of this zone. The Zone NP 13 – *Discoaster lodoensis* was recognized in the interval between samples VK 013 and VK 08 basing on the absence of *Tribrachiatus orthostylus*. This species has its last occurrence at the top of the zone NP 12. The Zone NP 14 – *Discoaster sublodoensis* was recognized basing on the appearance of *Laneternithus minutus*, which has its first occurence at the base of the Zone NP 14. In this zone bloom of the family Discoasteraceae, with more than 10% share in the assemblage, is observed indicating EECO (Early Eocene Climatic Optimum, Agnini et al. 2006). The most common species in this zone are *Discoaster barbadiensis* and *D. saipanensis.* The top of Discoasteraceae-bloom was recognized in the samples VK 08–VK 05. In the higher samples their number decreased. The Zone NP 15 – *Chiphragmalithus alatus* was recognized as a very poor nannofosil assemblage in the interval between samples VK 4–VK10. In this zone, discoasters are very rare, replaced by placoliths, such as *Dictyococites bisectus*, *Coccolithus pelagicus*, *Cyclicargolithus floridanus*, *Reticulofenestra* sp. The Zone NP 16 – *Discoaster tani nodifer* was assigned basing on the presence of *Helicosphaera compacta*, which is characteristic of upper part of the Zone NP 16. This zone was recognized in the interval VK 11–VK 15.

Foraminiferes were also studied with comparable results. In the interval VK 015–VK 02 Soták recognized Middle Eocene–Ypresian, foraminiferal biozone P9 with species *Subbotina (T) boweri.* The interval VK 02–VK 08 was assigned to Lower–Middle Lutetian with foraminiferal zones P10–P11, with characteristic species *Acarinina cuneicamerata*, *A. bullbrooki*, *A. interposita*, *A. matthewsae*, Upper Lutetian – foraminiferal biozones P11–P12 with *Morozovella aragonensis*, *M. crater*, *M. spinulosa* and the Upper Lutetian–Bartonian, foraminiferal biozones P 13–P14, with *Acarinina (T.) topilensis* and *Morozovelloides crassata*.

The nannofossil assemblage from the Veľké Kršteňany borehole characterize the period before EECO (interval between samples VK 015–VK 08) characterized by the Discoasteraceae – bloom (interval between samples VK 08–VK 04) and period of cooling (samples VK 5).

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The Antarctic Paleogene–Neogene bryozoans and their diversity and biogeographical links

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The Antarctic Cenozoic bryozoan faunas provide important biogeographical data on the composition of the oldest known Early Eocene bryozoan assemblage, following the Neogene (i.e. Miocene and Pliocene) bryozoans which mark the transitional time in evolutionary history of this fauna – up to the present day cheilostome-dominated bryofaunas which is a major component of the benthic assemblages in the Antarctic and sub-Antarctic waters.

Taxonomic and palaeoenvironmental analyses of the bryozoan assemblages from the shallow-marine-estuarine sediments of the Eocene La Meseta Formation, Seymour Island, the glacio-marine Lower Miocene Cape Melville Formation, King George Island and the Pliocene Cockburn Island Formation, Cockburn Island show different taxonomic composition what proves their development in a differentiated paleoclimatic conditions and is consistent with the other macro- and microfaunas together with sedimentological indicators (Gaździcki 1996; Hara & Crame 2004).

The La Meseta Formation bryozoan fauna shows a spectacular diversity of cheilostomes and cyclostomes of the higher taxonomical levels (20 families and 30 genera) enhanced by a significant proportion of a new species of Macroporidae, Smittinidae, Celleporidae, Bitectiporidae, Philodoporidae and Sclerodomidae, what indicates a short episode in the history of the early Paleogene Antarctic bryozoans faunas connected with the global Paleocene–Eocene turnover, that marks a significant radiation of cheilostome ascophorans (Hara 2001, 2002, 2003). Others families such as Catenicellidae, Aspidostomatidae, Cellaridae and Adeonidae started to radiate from the Mid- or Late Cretaceous and they are well-represented in the La Meseta bryozoan faunas. Aspidostomatidae, Cellaridae, Romancheinidae and Lepralielidae reported from the Early Paleogene of New Zealand predate the Antarctic records on Seymour Island and subsequently occur in the younger Late Eocene sediments of the St. Vincent Basin.

The preliminary taxonomic analyses of the Early Tertiary bryozoan material of the southern South America provide the possibility of the faunistic comparision with the Early Eocene La Meseta bryozoan fauna, as well as with the Paleocene–Eocene New

Zealand bryozoans. The recently studied Canu collection presents a valuable data on the taxonomy and the closest biogeographical Magellanic-Antarctic connection, showing its evolutionary importance for the evolution of many bryozoan cheilostomes between the Late Cretaceous–Early Paleocene (Hara 2008). Insight into a Cenozoic geological history of the austral genera i.e. *Aspidostoma* is important for the reconstruction of the biogeographical links between South America and West Antarctica. *Aspidostoma* Hincks, 1888, being commonly widespread throughout the Tertiary in the triangle of Antarctica-South America-Australia-New Zealand, reaches its maximum diversity in the late Early Eocene of the La Meseta Formation on Seymour Island and has its earlier fossil record in the Lower Danian (Roca Formation) of Patagonia (Hara 2008).

The moderately rich Pliocene bryofauna from the Cockburn Island Formation in terms of the higher taxa is dominated by cheilostomes comprising umbonulomorphs represented by the family Romancheinidae Jullien, 1888 as well as the the lepraliomorhps comprising family Smittinidae Levinsen, 1909; Microporellidae Hincks, 1872; Lacernidae Jullien, 1888, and Celleporidae Johnston, 1838 (Hara & Crame in prep.).

The Pliocene bryozoans and their Recent counterparts have a key biogeographical significance. Cheilostomes such as Calloporidae, Chaperiidae, Microporidae, Cribrilinidae, Arachnopusiidae, and Romancheinidae known from the Mid-Cretaceous are well-represented in the Late Pliocene of the Cockburn Island Formation (CIF). Other families such as Smittinidae, Bitectiporidae and Schizoporellidae may be considered to have originated in the Early Eocene, evolving in the Antarctic region and then becoming widespread through the Neogene to the Recent. The evolution of the other families present in the Pliocene sequences of the CIF, such as Inversiulidae, Microporellidae and Lacernidae, started in the late Neogene and these families are well-represented among the studied fauna (Hara & Crame in prep.).

At the present day, bryozoans, with a preponderence of Cheilostomata, are among the most significant components of the marine benthic community. They exhibit a high degree of endemism to the Antarctic continent, they also clearly expanded in numbers and range through the cooler conditions of the Cenozoic (Gaździcki et al. 2004).

The Recent Antarctic Cheilostomata are taxonomically diverse among which Schizoporelloidea is the most richly represented superfamily with 58 endemic species, among these the Smittinidae is the largest family with 34 species (33 endemic), and followed by the Buguloidea, Umbonuloidea and Celleporoidea which are also the most diverse superfamilies among the Recent Antarctic faunas.

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Miocene invertebrates from the Palaeolithic (Gravettian – Pavlovian, Kostenkian) archaeological sites of Pavlovian Hills (Southern Moravia, Czech Republic)

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During the last 15 years, a detailed study of Miocene (Badenian, Sarmatian, Pannonian) invertebrates discovered at the Palaeolithic archaeological sites of Southern Moravia (Czech Republic), particularly at the Gravettian localities of the Pavlovian Hills (Dolní Věstonice, Pavlov, Milovice), is in progress. As confirmed by numerous traces of artificial human adaptations, these macrofossils were collected by the inhabitants of the mentioned sites and used mostly as decorative objects.

Within the broader area of Pavlovian Hills, the Gravettian sites of Pavlov, Dolní Věstonice (Pavlovian, about 29–25,000 B.P.), and Milovice (Kostenkian, about 25–21,000 B.P.) are the most important. So far, complex elaboration of the Miocene fossils from Pavlov I (excavation seasons 1952–58), Pavlov VI, and Milovice sites have been recently done (Hladilová 1994, 2005; Svoboda et al. submitted), and the older material from Dolní Věstonice I (deposited in the Anthropos Institute of the Moravian Museum in Brno) has been revised (Hladilová 1997).

At Pavlov I 9 bivalve species (*Cardites partschi* predominates significantly), 46 gastropod species (pirenells dominate, and various species and subspecies of the genera *Conus*, *Melanopsis*, *Terebralia*, as well as *Lemintina arenaria* are relatively frequent), 3 scaphopod species (*Dentalium badense* dominates), 2 polychaete species (*Serpula* sp. prevails), and 1 shark tooth (*Carcharocles megalodon*) have been found. In specimen numbers, scaphopods and gastropods predominate unequivocally over bivalves and worms. The fossils are mostly of Badenian age, the younger elements (Sarmatian – pirenells, Pannonian – melanopsids) are less frequent.

The Pavlov VI site represents a new locality (discovered only in 2007). In total 129 specimens of Miocene molluscs were collected, that are dominated by scaphopods (*Dentalium badense*) and gastropods (*Pirenella, Melanopsis*, *Turritella*, *Conus* and *Terebralia*), while the bivalves are represented by two small fragments only. The molluscs are of Badenian, Sarmatian, and Pannonian ages.

In the revised material (53 specimens) coming from the older excavations at the site of Dolní Věstonice I (Hladilová 1997) the bivalves are entirely missing. Scaphopods *Dentalium badense* are most frequent. Among gastropods, the melanopsids (*Melanopsis impressa bonellii* and *Melanopsis fossilis fossilis*) and *Lemintina arenaria* are frequent. Even shells of sessile polychaetes were relatively numerous (*Serpula cornea*, *Serpula* sp.). The Badenian material conspicuously predominates over the Sarmatian and Pannonian elements.

At Milovice (Hladilová 1994), 67 specimens of Miocene fossils were found – 10 bivalve species, 17 gastropod species, 2 scaphopod species, and 1 solitary coral (*Caryophyllia* cf. *vindobonensis*). Among molluscs, gastropods significantly dominate over bivalves, scaphopods occur only exceptionally. Among gastropods, various species of the genus *Semicassis* and *Terebralia* prevail. The majority of molluscs and the coral are of Badenian age; the Sarmatian and Pannonian elements occur only sporadically.

The fossils found belong mostly to known species. Their source areas can be situated near or more distant vicinity of the above mentioned Palaeolithic sites as the Badenian sediments comprise a part of the sedimentary infilling of the Carpathian Foredeep, and the sediments of the Badenian, Sarmatian, and Pannonian ages can be found in the Vienna Basin. The good state of preservation of fossils fully corresponds to the hypothesis that they have been collected on natural outcrops.

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Foraminifera as environmental proxies of the Middle Miocene "Bryozoan event" in the Central Paratethys in Czech Republic

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To improve the reliability of bryozoans as a palaeoenvironment indicator, a detailed study of the Middle Miocene foraminifera, calcareous nannoplankton and oxygen and carbon stable isotopes from the rocks of bryozoan event was carried out. Abundant occurrence of bryozoans in the Middle Miocene of the Central Paratethys is an isochronous event which can be correlated with M6 Zone between FO of *Orbulina suturalis* and LO of *Praeorbulina circularis* (14.8–14.58 Ma).

The Middle Miocene ecosystems of the Central Paratethys Sea developed during the climatic optimum and the large transgression of tropical-subtropical waters. Those factors triggered the expansion of Bryozoa in the narrow shallow-water zone accompanied by epiphytic foraminifera such as *Asterigerinata*, *Lobatula* and *Elphidium*, and larger foraminifera *Amphistegina*, rarely cibicidoids. Although foraminiferal assemblages indicate only small palaeoenvironmental variations, bryozoan species composition is remarkably variable suggesting equally variable palaeoenvironment. In this study, four different bryozoan associations can be distinguished in shallow water zone:

1. *Reteporella–Hornera verrucosa* association, indicative of a high-energy environment.
2. *Buffonellodes–Rhynchozoon* association, typical of carbonate substrate with seagrass meadows.
3. *Smittina–Metrarabdotos* association, indicative of suboxic zone in sediment.
4. *Schizomavella tenella–Schizoporella tetragona* association, recorded almost in all shallow water environments. This may suggest that it consists of most eurytopic forms.

Only exceptionally deeper-water conditions were inferred at one section, and *Tervia irregularis* dominated association has been found. This assemblage was only present for a short period of time.

Early Paleozoic palynology of Brunovistulicum

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The Brunovistulicum is a tectonic unit developed in the Precambrian. It consists of crystalline and anchimetamorphic rocks which underlie Palaeozoic sediments in the Upper and Lower Silesia in Poland and Moravia in Czech Republic.

From the north and east Bruno-vistulicum is separated from Małopolska Block by fault zones Odra and Kraków-Lubliniec – which are parts of much larger transcontinental dislocation zone Hamburg-Kraków and which is parallel to TTZ. Western boundary is delimited by Moravian-Silesian tectonic zone which separates Brunovistulicum from the overthrusted from the west crystalline complexes of Western Sudeten, represented in this area by rock series of Moldanubicum units. From the south, crystalline basement of Brunovistulicum is cut by Perypieniny (dislocation) zone. It seems that it does not represent a boundary of the terrane, which crystalline basement probably spreads out south under the overthrusted towards the north complexes of Inner Carpathians. Crystalline basement of Brunovistulicum consists of two parts: Upper Silesian Block (USB) and Brno (Moravian) Block (BB), which are divided by Hana fault zone representing SE continuation of Elbe fault zone.

The Brunovistulicum Precambrian basement is overlain by Paleozoic sedimentary cover which comprises lithologically diverse deposits, of the Cambrian, Ordovician, Devonian and Carboniferous with flysch and the coal-bearing Carboniferous sediments.

The development of Early Palaeozoic sediment cover in Brunovistulicum area is still an open problem. The investigations of this problem are more advanced in Polish part of Brunovistulicum (USB). Four lithostratigraphical units are distinguished within the Lower Palaeozoic section. In ascending stratigraphic order, these are: the Borzęta Formation (Lower Cambrian, Sub-Holmia Zone), Goczałkowice Formation (Lower Cambrian, Holmia Zone), Sosnowiec Formation (Middle Cambrian), Bibiela Formation (Ordovician). Owing to litholigic and facies variations, the Lower Cambrian lithostratigraphical units are subdivided into members (Mb).

The stratigraphy of these rocks is based mainly on acritarchs. The trilobite fauna (*Holmia* Zone) was documented only in the upper part of the Lower Cambrian profile in the Goczałkowice IG 1 borehole.

In Moravia (BB), clastic sediments which occur between metamorphic Precambrain rocks and Middle Devonian carbonates are called Lower Devonian Basal Clastics. The palynological investigations of clastic rocks recognized under Devonian carbonates in boreholes located south of Brno, proved their Lower Cambrian age.

The acritarchs recovered from the Early Paleozoic deposits of Brunovistulicum are morphologically distinctive and taxonomically diverse. They allow to establish characteristic palynozones that can be recognized throughout the entire Brunovistulicum area.

Palynology as a tool for the difficult stratigraphic problems – an example from the Cambrian and Devonian of the Brno and Upper Silesia Blocks

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The main palynological objects are small, acid-resistant, usually of plant origin (but not only) fossils. Their concentration in sediments varies, but in some cases even a few thousand of fossils per one gram of rock can be retrieved. They are rather cosmopolitan and in the case when other macro- or microfossils are absent, they are especially very useful and valuable for biostratigraphy.

In the Silesian-Cracow (Upper Silesian Block) and Moravia (Brno Block) areas the Lower Cambrian and Lower Devonian sediments are similarly developed as clastic sequences. They are laying just below the carbonate rocks (mainly dolomites) of the Middle Devonian. Thanks to palynological investigations, it is possible to differentiate stratigraphically these lithologically similar clastic rocks. The palynological analyses of samples from the Měnín 1 borehole (Moravia, Czech Republic) from the depth 473–477.5 m has rich Lower Cambrian *Acritarcha* microflora. The assemblage contains biostratigraphically important species: *Skiagia ornata*, *S. compressa*, *Archeodiscina umbonulata*, *Heliosphaeridium dissimilare* or *Dictyodidium priscum* (Jachowicz & Přichystal 1997).

The palynological content of samples from 470.3–470.4 m and 468.8–469.1 m depth is also rich in diverse microfloral remains. In both samples the microflora is very well-preserved, but consisting of taxonomically different miospores and large amount of fragments of higher plant (Purkyňová et al. 2004). Single acritarchs assigned to the genus *Micrhystridium* were observed, as well. Based on the presence of such species as *Calyptosporites velatus* and *Rhabdosporites langii* the age of the samples was established as the *velatus–langii* miospore zone. Chronostratigraphically, this zone indicates the Lower Eifelian and is correlated with the *Polygnathus costatus costatus* conodont horizon. According to Richardson & McGregor (1986) this zone is characterized by the first appearance of both index species *Calyptosporites velatus* and *Rhabdosporites langii*. Other typical for this zone species like *Dibolisporites echinaceus, Samarisporites eximius, Apiculiretusispora brandtii*, and other species of *Ancyrospora, Grandispora* and *Dibolisporites* are also abundant.

Previously, similarly palynologically dated rocks were also recognized in Poland from the Andrychów region (Turnau 1974), Radom-Lublin area (Turnau 1986) and lately from the Trojanowice 2 borehole (north to Cracow) and the Zbrza outcrop (the Holy Cross Mountains; current research, not published yet). Generally, a Late Emsian and Early Eifelian was recorded in the regions mentioned above.

Similarly in Poland, thanks to palynological research in the Trojanowice 2 borehole lower (519–602 m) lithologically undivided part of the section has been successfully divided into two different stratigraphical parts. According to the very well-preserved and identifiable microflora, they belong to the lowermost Lower Cambrian (*Sabellidites* and *Platysolenites*) and the upper part of the Lower Devonian (*annulatus–sextantii* and *douglastownense–eurypterota* miospore zones) respectively.

Investigations of samples from the depth interval 558–602 m revealed the presence of microfossils characteristic for the lower part of the Lower Cambrian. In dark-grey claystones intercalated or laminated with siltstones, rich and well-preserved acritarchs were documented. They are represented by the following genera: *Leiosphaeridia*, *Tasmanites*, *Leiovalia*, *Granomarginata* and *Ceratophyton*. Very abundant cyanobacteria are other characteristic constituents. Assemblages of organic microfossils of similar composition have been described in the East-European Platform (Jankauskas & Lendzion 1992) from the sub-Holmia sediments (*Sabellidites* and *Platysolenites* Zones).

The lithostratigraphic study of the interval investigated proved that in Trojanowice 2 borehole the lower parts of Borzęta Formation were reached (Buła & Jachowicz 1996; Buła 2000).

In the sample from a 557 m depth-interval, there is a sharp change of microflora. Very common are rather small miospores that are rich in index and characteristic species for the *annulatus–sextantii* Emsian miospore zone (Richardson & McGregor 1982). The microfloral assemblage consists of *Emphanisporites annulatus*, *E. schultzii, Acinosporites lindlarensis*, *Apiculiretusispora plicata*, *A. brandtii, Dibolisporites echinaceus*, *D. eifeliensis*, *Dictyotriletes subgranifer* and *D. emsiensis*. Another change in the land microflora assemblage appears just above, in light in color, palinomorph-barren quartzite sandstone. Above this unit the mudstones appear again; however, this time the miospores are represented by large forms belonging to various *Grandispora* species, and accompanied by miospores possessing anchor appendages classified to *Ancyrospora* and *Hystricosporites. Grandispora douglastownense* and *Ancyrospora eurypterota* were found among the others, indicating the *douglastownense–eurypterota* miospore zone (Richardson & McGregor 1982).

It is interesting that just below the carbonates (519 m) single miospores similar (?) to *Rhabdosporites langii* and *Calyptosporites velatus* were observed. It may indicate still another miospore zone, namely *velatus–langii* of the Eifelian, but more research is needed to confirm these observations.

Our research proves again that in the Upper Silesian region and in the Moravia region palynological studies are extremely useful in the establishment of stratigraphic position of the Lower Palaeozoic sediments.

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The earliest Antarctic penguins

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The earliest penguin remains were found in New Zealand, and they are late Early Paleocene in age. The oldest fossils belonging to Antarctic sphenisciforms were recovered from the upper third of the Late Paleocene Cross Valley Formation (Seymour Island, Antarctic Peninsula). They are represented by three incomplete bones, which became the basis for erecting a new genus and species, *Crossvallia unienvillia*. One of the most extensive collections of fossil penguins (amounting to several thousand specimens, mainly isolated bones, grouped into at least six, scattered throughout the world, sets) was found in the Eocene La Meseta Formation of Seymour Island. More than a century of research resulted in description of 15 species from that formation, though only ten of them (grouped into six genera) seem to be taxonomically distinct. These are: *Anthropornis nordenskjoeldi*, *A. grandis*, *Palaeeudyptes klekowskii*, *P. gunnari*, *Archaeospheniscus wimani*, *Delphinornis larseni*, *D. gracilis*, *D. arctowskii*, *Mesetaornis polaris* and *Marambiornis exilis*; the first four being clearly larger (in terms of body size) than extant *Aptenodytes forsteri* (emperor penguin). All of them may have co-existed in the West Antarctic during the Late Eocene epoch, i.e. just prior to the final break-up of Gondawana. Recent analyses strongly support earlier conclusions that the numbers above are nothing more than just a minimal reliable estimate of the Eocene Antarctic penguin diversity. The oldest bones from the La Meseta Formation are probably Early Eocene in age, and some of them bear very close resemblance to just-mentioned species that are known from younger strata of the formation. Interestingly, one line of evidence suggests that the common ancestor of extant penguins lived in the Antarctic during Eocene.

Development of Mid- and Late Cretaceous ammonite faunas from the Russian Pacific: some palaeobiogeographic and extinction/migratory patterns

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Based on detailed revisions of ammonite faunas from the Russian Pacific, an attempt is made to determine the palaeobiogeographic affinities of Mid- and Late Cretaceous ammonite assemblages from this area. Comparisons with other continents are based on patterns of migration/extinction, palaeoecology and palaeobiogeography which characterize the evolutionary development of Pacific taxa.

A major obstacle encountered in correlation with the type areas of the various Mid- and Upper Cretaceous stages is the high degree of faunal endemism which is typical of the Pacific Cretaceous fauna in general and the Late Cretaceous one in particular, which means that most of the recently proposed criteria for the recognition of stage boundaries cannot be applied. Moreover, macrofaunal complexes from the Russian coast of the Pacific are easily subdivided into endemic taxonomic groups: northern (Chukotka and Kamchatka), southern (Sakhalin and the Kuril Islands) and Priamurje including Sikhote Alin. Following this, I consider the area of Priamurje and Sikhote Alin, Sakhalin and the Kuril Islands plus Japan to form the Northwest Pacific Province (NWP), and Koryak Upland, Chukotka and Kamchatka Peninsula, plus Alaska, Arctic Canada and British Columbia as the Arctic Province (A). Both provinces belonged to the Boreal Palaeobiogeographic Realm. However, on the basis of tectonic reconstructions, during Late Cretaceous time Sakhalin Island gradually moved towards the Arctic Province, whereas the Japanese Islands remained within the Northwest Pacific Province.

Palaeoecological patterns documented for Sakhalin and other sections in adjacent territories rely on ammonite shell morphologies and links with lithofacies types. In spite of that fact that, as noted above, the Cretaceous of the Pacific Realm shows a high degree of faunal endemism and provinciality, the general trend in ammonite evolution in the Boreal Pacific is the same as elsewhere. Despite the predominance of endemic forms in Far East Russia, stage-by-stage changes in morphotypes are closely comparable to those observed in other regions; yet, at the same time, Pacific heteromorph ammonite development shows a very specific character. Correlation problems both within the Pacific Realm and between this region and elsewhere in the world might be resolved by refined studies of bioevents.

Thus, an abrupt faunal turnover is suggestive of the placement of the Albian/Cenomanian boundary in the Russian Pacific. The Cenomanian/Turonian boundary remains one of the best-studied mass extinctions in the world; no Cenomanian taxa survived this crisis in the Russian Pacific either. Correlation with Europe is based on such features as the extinction of the family Acanthoceratidae at the end of the Cenomanian and the wide distribution of heteromorph ammonites, particularly the development of

Scaphites facies in the Turonian. The Turonian/Coniacian boundary faunal turnover in Sakhalin was marked by the entry of new ammonite morphotypes and by a slight reduction in taxonomic diversity, with a decrease in total origination rate. Moreover, the base of the Coniacian is marked by the occurrence of a new *Scaphites* assemblage in Sakhalin as well as in Europe. The exact position of the Coniacian/Santonian boundary is still very problematic in the Russian Far East as well as in Japan. However, the faunal turnover across this boundary interval, characterised by the same evolutionary trends, has been documented from many places across the globe. The local position of the Santonian/Campanian boundary is based on a regional faunal turnover during the boundary interval in Sakhalin. The Campanian/Maastrichtian boundary in the Russian Pacific is defined by few biotic and abiotic events. The Cretaceous/Paleogene boundary is easily identified on account of the demise of all Maastrichtian ammonites and inoceramid bivalves, and marked taxonomic changes in foraminiferal assemblages.

Vegetation conditions of Slovakia, Moravia and Bohemia during the Last Glacial – palaeobotanical records and speculations

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Several localities with sediment containing palaeobotanical information on vegetation in the Last Glacial Period on the territory of the past Czechoslovakia have been found recently. The greatest time segment is covered by the profile “Šafárka“ in the proximity of Spišská Nová Ves in NE Slovakia (Jankovská et al. 2002). The oldest radiocarbon data are older than over 52,000 uncal. BP. The pollen diagram represents very well the vegetation changes in the course of the whole considered period. Stands with *Larix* prevailed on the territory during the coldest initial period. They were interspersed with *Pinus cembra*, *Betula* cf. *alba*/*pubescens* and probably also *Pinus mugo*. An improvement of climatic conditions in second phase of vegetation development became evident by the expansion of birch into rather well closed larch stands. The third developmental phase, i.e. an intense expansion of *Picea* and *Alnus*, as well as of *Pinus* (*sylvestris*?) was conditioned by a rapid increase of temperature and improvement of hydrological conditions. Despite of such changes, *Larix* and *Pinus cembra* further remained stable components of stands of coniferous taiga character. Spruce stands, containing all previously mentioned woody species, prevailed in the whole area in the next stage. The last recognized stage was marked by the retreat of *Picea* and *Alnus*, and by the spreading of *Pinus* (*sylvestris*?, *mugo*?). Such activities probably denote the onset of the Late Glacial temperature minimum. As a drawback of this profile can be considered the fact that most radiocarbon data within the span of 48,000 to about 16,000 uncal. BP have been obtained from the material of cones and wood collected beyond the profile proper. Thus, the data cannot be exactly allocated to individual layers of the profile.

Approximately from the same period of the Last Glacial as the medium part of the "Šafárka" profile comes also the sediment of the profile "Jablůnka" from the western border of the Moravian Carpathians (Jankovská 2006). Stands of taiga character, with *Larix* and *Pinus cembra*, prevail here around radiocarbon data from about 39.000 and 45.000 uncal. BP. A sample of peat taken accidentally from a borehole on the locality "Týn n. Bečvou" (Jankovská et al. 2007) has also supported results from the locality "Jablůnka". A great amount of *Larix* and *Pinus cembra* pollen grains have been found here in a sample dated around 44.200 ± 1.400 uncal. BP.

Pollen analytical results allow for the conclusion that the landscape of Slovak and Moravian Carpathians was covered by a forest vegetation during the Last Glacial and, decisively so, in the Last Interpleniglacial. In stands of the taiga type prevailed the stands with *Larix* and *Pinus cembra* in the cool periods with a distinct continental climate. *Picea* and *Alnus* prevailed during the warmer climatic fluctuations at hydrologically favourable sites. Larch and larch-stone pine stands prevailed in Slovak Carpathians till to the onset of Holocene (Jankovská 2007a). No evidence on the existence of similar stone pine-larch stands are available at present from the Moravian Carpathians for the same time period, since no corresponding sediments from Late Glacial are at hand. However, a similar situation as in Slovakia can be assumed. Forest communities with larch have crossed the Moravian Gate (Moravská brána) during the Last Glacial, as evidenced by the present-day presence of *Larix* in the Nízký Jeseník Mountains, where it has its relict occurrence. The pollen of *Larix* was found northward from Hrubý Jeseník Mountains in the sediment of Late Glacial.

Until recently the occurrence of *Larix* in the area of the Czech Massif during the Last Glacial was doubted. The attempts of pollen analysts to find pollen grains of larch in the sediment of Late Glacial in this region were unsuccessfull or, at least, insignificant. However, *Larix* pollen was found in the peat sediment collected by P. Pokorný from a Praha-Podbaba profile (Jankovská & Pokorný 2008). The radiocarbon dating provided the value 31,012 ± 1,810 uncal. BP. So far the stands with *Larix* were present in some areas of the Czech Massif during the Last Glacial, their character was probably different from that of the Carpathian stands. They were rather like a forest steppe with larch as it is known today from the continental southern Siberia. A similar character of the landscape "the mammoths steppe-tundra" has been also documented by pollenanalytical results from the settlement of mammoth hunters Oporów (Kuszell 2003) with the date around 35,000 uncal. BP. Close to this type of landscape are also vegetation conditions reconstructed from palaeobotanical analyses of the profile "Bulhary" in South Moravia (Rybníčková & Rybníček 1991) with the radiocarbon date 25,675 ± 2,750 uncal. BP.

Although we have from Krkonoše Mountains sediment with the radiocarbon date about 25,000 BP, we can say nothing about vegetation situation here in that time. Is this sediment are only palynomorphs from Tertiary – consequence of redeposition by wind long distant transport during the periglacial conditiones (Jankovská 2007b).

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The Ammolagenidae, a new family of agglutinated foraminifera

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The first organism currently assigned to the genus *Ammolagena* was described by Jones & Parker (1860) as benthic foraminiferal species *Trochammina irregularis* var. *clavata* from sea-floor samples collected off Malta in the Mediterranean. Eimer & Fickert (1899) placed this species in to their new genus *Ammolagena.* In classic foraminiferal systematics (e.g., Cushman 1918; Loeblich & Tappan 1987) the genus *Ammolagena* has always been placed in the suborder Ammodiscina, whose representatives are two-chambered, with a globular proloculus and a long coiled second chamber. Detailed observations of type specimens of *Ammolagena* housed in the Natural History

Museum, London provided a new insight into the systematics of this genus. Kaminski & Gradstein (2005) noted the occurrence of a second aperture situated at the base of the globular initial chamber (opposite the tubular long chamber) in *Ammolagena*. The specimens from Cretaceous and Palaeogene of the Flysch Carpathians possess the same features. Additionally, a second aperture was noted on previous illustrations of *Ammolagena clavata* (Wright 1891; Rhumbler 1913). Some authors (Cushman 1918; Collins 1958) even reported occasionally finding two-chambered specimens.

The presence of a second supplementary opening and the absence of any regular mode of coiling were reasons for removing the genus *Ammolagena* from the Ammodiscina, and placing it into the new family Ammolagenidae [the suborder Hormosinina, superfamily Hormosinellacea (Kaminski et al. 2008)].

The new family Ammolagenidae has the test commonly attached to shell fragments or to other foraminifers, up to 2 mm in length, large ovoid proloculus followed by narrower tubular rectilinear chamber, rarely linked to form a pseudo-multichambered chain. The wall is finely agglutinated on an inner proteinaceous layer, originally reddish-brown in colour, turning grey or white in fossil forms, surface smoothly finished and glossy. The main aperture is terminal, rounded, at the open end of the tube. A smaller secondary opening may be present at the base of the proloculus. This opening may serve as a connection between chambers in multichambered specimens. *Trochammina irregularis* (d'Orbigny) var. *clavata* Jones & Parker, 1860 is the type species. Type specimens are housed in the Natural History Museum (London), in the Jones & Parker collection.

The stratigraphic range of the family Ammolagenidae is from Ordovician to Holocene. The oldest known representative of the genus is *Ammolagena silurica* Eisenack (1954) described from limestones of early Middle Ordovician age (Estonia area). The genus *Ammolagena contorta* Waters (1927) occurs in Pennsylvanian deposits of the Ardmore basin, Oklahoma; and *Ammolagena clavata* (Jones & Parker) is observed in the uppermost Jurassic (Tithonian) deposits of the Argo Abyssal Plain (Indian Ocean). This species is commonly recorded from Upper Cretaceous, Paleogene, and Neogene strata (Carpathians, Trinidad, Norwegian Sea), as well as from Holocene (North and South Atlantic, Mediterranean, South Pacific – deep from 180 m to 3,400 m).

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Phenotypic plasticity of *Asphinctites–Polysphinctites* polymorphic group from Faustianka clay pit (upper lower Bathonian), south-central Poland

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In middle Jurassic silty clays (late early Bathonian – *Tenuiplicatus* Zone) of the Faustianka clay pit (south-central Poland), representatives of Morphoceratidae – *Asphinctites tenuiplicatus* (Brauns) and *Asphinctites* (*Polysphinctites*) *secundus* (Wetzel) commonly regarded as a dimorphic pair, are abundant. Rich paleontological material (246 specimens), well located on the Faustianka profile, allowed detailed observations of mutual relations of conceptual macroconch (M) and microconch (m) of *Asphinctites–Polysphinctites* group, numerously co-occurring in the discussed silty clays sequence including two horizons of ironstone nodules. Representatives of *A. tenuiplicatus* (M) are characterized by poorly differentiated ornamentation of body chambers and variably ornamented inner whorls. Among mature specimens three classes characterized by differentiated shape and size were identified: specimens up to 90 mm (38%); specimens 90 mm to 110 mm (60%), and large to very large forms with sizes significantly greater than 110 mm (2 %). Representatives of *A.* (*P.*) *secundus* (m) show even greater diversity in diameters of mature shells (with comparison of *A. tenuiplicatus*) and types of apertural constructions, which shape and size considerably decreases with growing diameter of shell – four classes characterized by differentiated shape and size were identified: specimens up to 25 mm (30%); specimens up 25 to 30 mm (45%); specimens with diameter up 30 to 50 mm (22%) and forms with final diameters up 50 mm (3%). On the basis of analyzed material it is assumed, that morphometric variability among those two taxa suggests the occurrence of ornamental polymorphism phenomenon (Reyment 1988). Moreover, the occurrence of seven morpho-classes among *Asphinctites– Polysphinctites* polymorphic group, may be the result of the phenotypic plasticity phenomenon caused by diverse environmental factors (e.g. nutrient changes or periodically pressure of specialized predators).

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Trimerocephalus life-position files from the Famennian of Kowala Quarry (Holy Cross Mountains, Central Poland)

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Numerous specimens of blind phacopid trilobites of the genus *Trimerocephalus* McCoy 1849, belonging potentially to a new species, were found in the light-grey marly shales of Early Famennian age, exposed in the western part of the northern wall of the Kowala Quarry. All specimens are completely preserved and of similar final sizes (i.e. mature growth stages: 18–24 mm). These trilobites are positioned "one by one" on upper surfaces of the strata, forming files composed of a few to several specimens (the maximum number was 13), the files length being limited by the size of the joint-cracked stratum surface. Particular trilobites are positioned within small distances to each other (1–5 mm), or there is a direct contact between them, sometimes they even overlap each other. The occurrence of *Trimerocephalus* life-position files is limited to two horizons of marly shales; and a few pathways were also found on the surface of spherical marly-calcareous concretions, which irregularly appear within those two horizons. The origin of *Trimerocephalus* life-position files is thought to have been related to the behavioral phenomenon which has so-far been unknown among trilobites. This could be involved by hierarchy-based groups determined by conceptual chemical signals (i.e. urine dispersal). The so-called "chemosensory pathways" phenomenon commonly occurs among modern decapod crustaceans, for example among various lobster species. Moreover, taking into consideration the fact that the studied *Trimerocephalus* are destitute of any optic apparatus, the advantage of chemical signals over electromagnetic signals seems to be a convincing argument, supporting such interpretation of the *Trimerocephalus* life-positioning files.

Sabellid and serpulid worms from the Lower Turonian of Kaňk – Na Vrších.(Bohemian Cretaceous Basin, Czech Republic)

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The revision of sabellid and serpulid worms of the nearshore sediments of BCB in the locality Kaňk – Na Vrších has been carried out based on material collected between 2002–2008 by the author and the old collection of V. Ziegler (1984) kept in NM of Prague. Ziegler (1984) described 14 species from the same locality. The present studies show that *Glomerula gordialis* and *Serpula prolifera* described by Ziegler belong in fact to one species *G. serpentina*; *Glomerula scitula* in Ziegler (1984) belongs to *Glomerula lombricus*; *Sarcinella plexus* and *Sarcinella minor* (O5373) in Ziegler (1984) belong to *Filograna socialis*; *Serpula antiquata* and *Proliserpula ampullacea* belong to *Neovermilia ampullacea*; *Eoplacostegus dentatus* belongs to *Placostegus* sp.; *Pomatoceros ares* belongs to *Pyrgopolon (Septenaria)* sp.; *Pomatoceros biplicatus* belongs to *Neovermilia* ex. gr. *ampullacea*; *Spirorbis asper, S. milada* and *S. subrugosus* represent *Neomicrorbis crenatostriatus subrugosus*; *Neomicrorbis knobi* belongs to *N. crenatostriatus crenatostriatus*. New finds are: *Pyrgopolon* sp. C, *Pyrgopolon* (*Septenaria*) *tricostata*, ?*Pyrgopolon* (*Septenaria*) *macropus*, *Pyrgopolon* sp., *Laqueoserpula reussi*, *Placostegus velimensis*, *Placostegus* cf. *zbyslavus*, *Dorsoserpula gamigensis*, *Dorsoserpula* cf. *conjuncta*?, *Neovermilia* ex. gr. *ampullacea*, *Filograna socialis*. Some taxonomic problems are still unsolved: *Laqueoserpula reussi* was described by Weinzettl (1910; O3537–O3539) as gastropod, *Neovermilia* ex. gr. *ampullacea* may in fact belong to the genus *Pyrgopolon*. As suggested by the presence of *Filograna socialis*, *Pyrgopolon* cf. *macropus* deeper sea can be inferred for Kaňk – Na Vrších than for classical nearshore localities such as Velim, Nová Ves near Kolín, Radim and Kněžívka.

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Taxonomic value of dental characters in Temnospondyli

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Dental features have played a major role in taxonomic and phylogenetic studies of Temnospondyli. However, detailed studies of dentition are very scant (Bystrow 1938; Schultze 1959; Chase 1963; Warren & Davey 1992). This lack of in-depth research may be attributed to the fact that completely preserved dentitions of these amphibians are rarely encountered, which severely limits opportunities for analysing patterns of variation in dentition and determining its potential taxonomic significance. A large accumulation of Triassic vertebrate fossils offers quite a few new possibilities to perform a complete analysis of changes in dental features within such taxa.

In the present work, a detailed analysis of individual teeth and of the distribution along the tooth row in *Metoposaurus diagnosticus krasiejowensis* Sulej, 2002 is presented. It appears that isolated teeth are not species specifics, but it has turned out that distribution along the tooth row is more important. In general, the distribution of teeth in the lower and upper jaws is comparable to the arrangement described by Chase (1963) and Warren & Davey (1992). The latter also noted that metoposaurids are unique amongst temnospondyls in having a dentary tusk included in the marginal tooth row of the dentary, an observation subsequently confirmed by Hunt (1993). Schoch & Milner (2000) described this as a synapomorphy for the Metoposauridae. However, in the present material, deviations in the configuration of tooth rows between specimens have been observed. In mandibles, there are two patterns in the structure of the mesial portion; in three specimens dentary tusks are included in the marginal dentary tooth row. In others, this tusk is not part of the dentary row and has smaller teeth external to it. Moreover, a parasymphyseal tooth row on the inner side of the lower jaw has been noted, perpendicular to its lingual face. Only in a single specimen this is not seen.

The distribution of tooth rows in upper jaw appears to be highly conservative; major differences have only been observed in the inner, pleurodont tooth row. In smaller skulls, near the palatine-ectopterygoid suture, teeth become smaller and a concave triangular arrangement in the inner tooth row can be seen. In the largest skull available for the present study, the tooth row on the palatine merges gradually into the ectopterygoid row. My analysis of variation in tooth arrangement indicates that inclusion of a dentary tusk in the marginal tooth row is not a conservative feature and has no taxonomic significance. How can this changeability be accounted for? In my opinion, differences in tooth distribution in the lower and upper jaws of *M. diagnosticus krasiejowensis* are rather the result of ontogenetic processes.

A new feature in tooth row distribution seems to be important for taxonomic analysis. The palatine part of parachoanal tooth row varies within the Metoposauridae. In *Buettneria* these teeth form an agglomeration, in *Metoposaurus* a regular series.

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Some thoughts on retiolitids (Graptolithina) and their evolutionary history from the perspective of Poland (Baltica)

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The retiolitids are an extraordinary group of late-appearing diplograptids having unique skeleton built of thecal and ancora sleeve walls, both represented by lists. Studies of retiolitids progressed slowly during the 19th to mid-20th century based on flattened material.

The nature of the retiolitid skeletal structure has long been misunderstood. The skeleton was traditionally regarded as a normal diplograptid one in which the periderm was reduced to lists. Early authors lacked the ability to recognize the real nature of retiolitid skeleton in the absence of ultrastructure studies.

The turning point of these studies came with the recognition of the double-layer nature of the skeleton; i.e., diplograptid thecae, outside of which was an additional layer, the ancora sleeve, a structure developed from the bifurcation and subsequent distal development of the virgella (e.g., Bates 1990; Bates & Kirk 1992). Continuous fusellar membranes that form the thecal walls and ancora sleeve are extremely thin and only rarely preserved, whereas the much thicker and multi-layered cortical periderm forming lists built of bandages is typically well preserved. As a consequence, the only consistently preserved element of the rhabdosome is the cortex. The retiolitid research has accelerated in recent years with the scanning electron microscope observations as well as the discovery of the new well preserved forms from Poland, Baltica and the Arctic Canada. Thus the history of retiolitids is better recognized as a result of the study of the new isolated forms from Poland (Kozłowska-Dawidziuk 1995, 1997, 2001, 2004; Kozłowska & Bates 2008), and the Arctic Canada (Lenz & Kozłowska-Dawidziuk 2004, 2007).

According to the recent studies we can say that the evolutionary history of retiolitids was complex, a common tendency toward reduction of rhabdosome size in most lineages is observed. The greatest reduction in both number and volume of thecae, and in skeletal elements is demonstrated in the *Gothograptus* and *Plectograptus* faunas. Contrary to the thecal decrease, a distinctive increase of sicula size is observed. Two types of colonies are distinguished: stratigraphycally old colonies with a small sicula and numerous thecae of similar size, and young colonies with a long sicula and a few, small thecae. These changes imply modification of the soft body: increase of siculozooid length and decrease in the size of the zooids. In consequence, the colony reduction is observed. The most extreme stages of rhabdosome reduction in Ludlow retiolitids can be seen in forms from Poland: *Plectodinemagraptus gracilis* and in the *Holoretiolites helenaewitoldi*. They possibly represent the last stage of rhabdosome reduction, the next hypothetical stage would be its total loss.

During the fifteen million years of retiolitid evolutionary history, the most severe was the Silurian *Cyrtograptus lundgreni* Event. It had a profound effect on both retiolitids and monograptids, resulting in the extinction of more than 90% of the species (Lenz & Kozłowska-Dawidziuk 2001). The event was also studied in detail in Poland (Porębska et al. 2004). This was followed by recovery and expansion during the subsequent late Wenlock and early Ludlow and, finally, the retiolitids became extinct during the *leintwardinensis* Event (Urbanek 1993; Kozłowska-Dawidziuk 1995, 2004).

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Fossil record of marine blooms: a testimony of past seas productivity

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Formation of post-bloom aggregates is a common event in many modern eutrophized shelf areas. The episodes of large macroaggregate formation are reported regularly and its formation and degradation have been observed and described in detail from its early stage. Periodic algal/cyanobacterial blooms and/or standing crops are mass scale events that occur regularly each year and are responsible for a giant production of organic matter forming so called post-bloom macroaggregates.

Although macroaggregate formation is a common phenomenon in modern seas, well-documented examples of fossil macroaggregates (algal and cyanobacterial) are thus far unknown. Low fossilization potential and mucilaginous consistency excludes post-bloom biomass from the fossil record. Structures interpreted as fossil post-bloom aggregates have been recognized in early Silurian black radiolarian cherts cropping out in the Bardzkie Mountains (southwestern Poland) and the Holy Cross Mountains (central Poland). The macroaggregates are visible in the blackish cherts as whitish lenses and nodules of various thickness and horizontal extension. They occur at certain levels of the profiles and are separated from the surrounding black chert. The aggregates contain fragments of variously degraded acritarchs, rare radiolarians, fragmented graptolites, grains of various minerals, mainly detrital quartz, and highly degraded unidentifiable organic matter. The acritarchs from the early Silurian blooms are bigger than those from the surrounding black chert. Some are phosphatized forming microfossils known as mazuelloids (Kremer 2005). EDS spectra of the whitish nodules have shown higher content of phosphates in the nodules and their proximity.

The early Silurian macroaggregates are unique structures in the fossil record. Their preservation as nodules or lenses in the radiolarian cherts were possible due to favorable geochemical condition at the bottom. The presence of cyanobacterial mats developing at the bottom (Kremer and Kaźmierczak 2005) seem to be the crucial factor enabling the conservation and preservation of the delicate mucilage aggregations. The abundance of macroaggregates is a good testimony of high primary productivity of the early Silurian sea caused by periodically hypertrophic conditions driven probably by nutrient-rich upwelling currents.

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Lithiotis-facies – stratigraphy, palaeoenvironment and palaeobiogeography

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The separation of Laurusia and Gondwana, which was initiated by the Triassic break-up of Pangaea, continued during Early–Middle Jurassic time (Golonka 2007). The Early Triassic continental rifting was magnified at the Triassic/Jurassic boundary and the Atlantic Ocean originated as a consequence of this break-up. In effect, the origin of the narrow sea strait, so-called "Hispanic Corridor", took place between these two continents and connection of the Panthalassa Ocean (Proto-Pacific) and western (Alpine) Tethys gradually started in Early Jurassic, most probably in Sinemurian–Pliensbachian times. Therefore the widespread distribution of numerous fossil invertebrate groups took place during these times (Hallam 1983; Damborenea 2000; Arias 2006). Continental clastics and volcanics prevailed in the area between Africa and North America near Triassic/Jurassic boundary. The earliest Jurassic was the time of complete assembly of eastern Pangea and of onset of the break-up of the supercontinent and separation of Gondwana and North America. The color of these rocks changed from red to gray along the Triassic–Jurassic boundary due to increased humidity and global transition from oxic to anoxic conditions.

The huge, up to 40 cm long, *Lithiotis*, *Cochlearites* and *Lithioperna* bivalves, which dominated within "*Lithiotis*" facies (*sensu* – Fraser et al. 2004, with literature cited therein), are most significant representatives of buildup-maker of shallow marine/lagoonal bivalve mounds (reefs) in numerous places of Tethyan–Panthalassa margins during Pliensbachian–Early Toarcian times. One of the best known *Lithiotis*/*Cochlearites*-bearing buildups occur in numerous localities in Morocco (High Atlas Mountains), and Jebel Azourki region is most important to study of this facies (especially Assemsouk section – the northern part of Jebel Azourki) (Lee 1983). Full sequence of the Lower Jurassic (Pliensbachian to Lower Toarcian), lagoonal-paralic deposits is well exposed in this region. These deposits contain magnificent buildup constructed by bivalves such as: *Lithiotis*, *Cochlearites*, *Lithioperna* or *Opisoma*. Most of these organisms are in a vertical life position – buried alive in muddy sediment. Sedimentological analysis proved features typical for reef environments with well-developed core of the reef and its surroundings ("reef tallus"). Carbonate bivalve buildup is located in clastic deposits (sandstones and mudstones with abundance of fauna and flora).

Carbonate sedimentation predominated along the Neotethyan margins (Leinfelder et al. 2002). The northwestern Neotethys region consisted of numerous horst blocks capped by carbonate platforms with adjacent grabens filled with deeper-water black mudstone and organic-rich shale facies. Reef communities were rare at that time. The time around the Triassic–Jurassic boundary marked the very important extinction event (Hallam & Wignall 1999). The distribution of *Lithiotis*-facies bivalves from Western (Spain, Italy) and Middle Europe (Slovenia, Croatia, Albania) trough north Africa (Morocco) and Arabian Peninsula (Oman, Arabian Emirates) up to Timor Island and western margin of both Americas (USA, Peru) indicates worldwide, rapid expansion of such *Lithiotis*-type bivalves (Leinfelder et al. 2002; Fraser et al. 2004). The Early Jurassic migration routes were connected both with break-up of Pangaea and oceanic circulation, which facilitated high speed of distribution of larva's of such oyster-like bivalves. Early Jurassic migration direction was demonstrated by distribution of these reef-building Early Jurassic (Pliensbachian–Toarcian) oyster-like bivalves (*Lithiotis*- and *Cochlearites*-type). Previously, in Triassic times, the migration of sea fauna (Late Triassic crinoids, mollusks, crustaceans and so on) was going through the vast eastern Tethys branch of the Panthalassa Ocean, which is perfectly visible in the distribution of the typical "Alpine" fauna of the western Tethys found in the numerous terranes along the western coasts of South and North America (Kristan-Tollmann & Tollman 1985).

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Bivalves from the Neogene deposits in the Ostróda region

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In Lidzbark borehole, situated 6 km south-east from Ostróda Miocene fossil bearing deposits have been encountered below the 242.8 m thick (113.8 m below sea level) Pleistocene. Directly below the Pleistocene deposits there are rather weakly compact, noncalcareous, fine-grained sandstones gray and sometimes brown and red in colour that are 2.8 m thick. Below, 1.1 m of dark gray fine-grained sands with marine bivalve accumulation were encountered. The bivalves have shells 2 cm and larger, and are well preserved, but extremely fragile. Cartographical drill hole Rabaty, situated 10 km north-east from Lidzbark, gray-green sandy silts without visible sedimentary structures were drilled below Quarternary deposits at the depth of about 100 m below sea level.

It is generally believed, based on earlier investigations, that in this region the Miocene deposits that occur below the Pleistocene at the depth of more than 105 m below sea level, are generally represented by classical sandy-silt facies of brown coal. They are underlain by Oligocene galuconitic sands.

The studied marine bivalve fauna occurs at the depth of 246.0–246.1, 246.1–246.2, 246.2–246.3 and 246.3–246.4 m. The assemblage consists of such marine bivalves as: *Glycymeris deshayesi* (Mayer), *Glans (Centrocardia) subrudista* (Friedberg), *Mytilaster* sp. and *Venus* (*Ventricoloidea) multilamella marginalis* Eichwald.

These bivalve species indicate the shallow water marine sedimentation of normal salinity in this region during the Miocene. Occurrence of marine bivalves in this area proves the need of revision of earlier paleogeographical reconstructions of the Neogene, placing the region within the terrestial sedimentation of sandy and sandy-silt deposits with brown coal layers.

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Therizinosauroid theropods: *In ovo* development

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Therizinosauroids are one of the rarest and most enigmatic groups of theropod dinosaurs. They had a bizzare skeletal construction, walked on four digits of their hindfeet, and have often been interpreted as herbivores. Embryos of these peculiar creatures came from the Upper Cretaceous (Cenomanian–Maastrichtian; about 75–85 million years ago) Nanchao Formation of Henan Province, China. The embryos are prepared by a master work of Mr. Terry W. Manning inside of the subspherical dendroolithid eggs (9×7×7 cm), collected from unilayered clutches, of which a cluster-like arrangement lacks any sophisticated regular pattern. The developmental stages of the embryos are shown by 1) taphonomic patterns, based on whether the embryonic bones are either concentrated on the inner surface of an egg bottom or clustered in a lower spheric part of the egg; and 2) ossification patterns of the vertebral centra, based on distinct levels of bone porosity. These embryonic specimens offer a more detailed insight into the development of the dinosaur embryonic period than any other known dinosaur embryos. They display successive patterns of skeletogenesis, and a post-eruption sequence of teeth. Preserved *in ovo* embryonic bones have provided much evidence about the development of skeletal morphologies that are recognized as theropodan diagnostic features. Among theropods, remarkable similarities with the adult oviraptorosaurs have been identified on the examined embryonic skeletons. Furthermore, the embryos show considerable affinity to the therizinosauroid phenotype, and represent the most complete fossil assemblage of any therizinosauroid dinosaurs ever found. These embryos were assigned to the Therizinosauroidea with confidence on account of the following cranial and postcranial autapomorphies: 1) an edentulous premaxilla with a sharp downturned edge lying below the subhorizontaly elongated external naris; 2) a dentary with the lateral surface forming a horizontal shelf; 3) teeth with fan-shaped crowns that have a few marginal cusps and are labio-lingually compressed, basally constricted, and followed below by the root with a larger antero-posterior diameter; 4) a humerus with a massive deltopectoral crest extending proximally and with a pointed medial tuberosity on its proximal end; 5) an ilium with an expanded and hooked preacetabular and shorter postacetabular processes; 6) strongly curved hypertrofied manual unguals that are deep proximally, but taper to sharp points. Among known Asian therizinosauroids, the therizinosauroid embryos show skeletal similarities closest to two Chinese therizinosauroids discovered recently in the Upper Cretaceous beds of the Iren Dabasu Formation of Nei Mongol, *Neimongosaurus yangi* and *Erliansaurus bellamanus*. Fusion of cervical and caudal neural arches and centra, complete ossification of thoracic ribs and ilium, possible co-ossification of tibia and fibula, fused pubes, complete meta- and acropodial elements, together with small portions of unossified epiphyses of long bones suggest an advanced precociality of therizinosauroid embryos. Considering these advanced precocial traits, I assume that corresponding therizinosauroid hatchlings were capable of locomotor activity, allowing them to leave the nest shortly after hatching and begin to search for food and feed alone. The proposed scenario of independence from their parents may be supported by the fact that the therizinosauroid hatchlings possessed dentition compatible with an omnivorous type of diet, and their skeleton was considerably adapted to mechanical resistance associated with immediate posthatching locomotion.

Pseudoasterophyllites cretacea – herbaceous angiosperm

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Pseudoasterophyllites cretacea O. Feistmantel ex Velenovský, originally described as a pteridophyte, is reinterpreted here as an angiosperm. The fossil occurs in the Peruc Korycany Formation (Cenomanian) of the Bohemian Cretaceous Basin. It shows twigs bearing decussate leaves. Always two pairs of leaves are closely placed forming a seemingly whorled arrangement. Leaf cuticle is thick, amphistomatic, showing paracytic stomata and isodiametric ordinary cells. In the same layer there are found stamens showing the same cuticle pattern as *Pseudoasterophyllites cretacea* and we interprete them as an associated organ of *P. cretacea*. The stamens are massive (1 × 2–3 mm), dithecate, tetrasporangiate, with a small triangular apical expansion of the connective. The stamens are aggregated in composed structures. Another dehiscence is by longitudinal slits. Pollen grains found in situ are of *Tucanopollis* type, sulcate, oblate to spheroidal, in polar view elliptic to circular, 18–24 µm in diameter. Aperture broad and short, membrane thin often covered by echinate Ubisch-bodies. Sculpture psilate (in LM), microechinate, perforate (in SEM). Exine thick (1.5–2 µm), nexine 0.8–1 µm, short columellae, tectum 1–1.2 µm. Stamens associated with the foliage are known from two sites: Pecínov quarry (Cenomanian, Peruc-Korycany Formation) in the Bohemian Cretaceous Basin (Czech Republic) and Les Renardičres (Cenomanian) in France.

Rhaetian echinoderms and their life activity from the Western Carpathians

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The Rhaetian Fatra- and Hybe formations (in the Krížna and the Choč Nappe of the Western Carpathians, respectively) consist of gray shallow marine limestones with dark marlstone intercalations. Like the isochronous Kössen Fm in the Alpine region both formations are famous by numerous brachiopods and bivalves On the contrary, echinoderms are much less diversified and preserved mostly by test fragments and disarticulated ossicles. Crinoid ossicles are most frequent. Despite their abundance in some layers, they never form classical crinoidal limestones. All crinoid remains belong to a single isocrinid species *Isocrinus bavaricus* Winkler. Echinoid remains are also abundant. Except of few well preserved specimens of the *Paracidaris jeanneti* Lambert, black marls yielded a wide spectrum of echinoid spines which can be assigned to Diadematacea. Echinoid grazing traces with a typical pentamerous shape were recorded on surface of brachiopod shells in the Hybe Fm. These Rhaetian echinoids probably had massive jaws used for rasping of algal and bryozoan epibionts. Although the presence of fully developed latern is also known in older echinoids, echinoid rasping traces were not recognized until Rhaetian. These echinoid grazing traces were described as the *Gnathichnus pentax* Bromley. Only few elements of asteroids and ophiuroids were found, but their poor preservation did not allowe for precise determination. Holothurian remains have not been studied in detail yet.

Benthic foraminifera as indicators of the last millennium environmental changes in Hornsund fjord, SW Svalbard

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Benthic foraminifera are broadly researched in the area of Svalbard archipelago (European Arctic). The general distribution pattern of near-shore species is expressed by the succession of *Cribroelphidium excavatum clavatum*, as the most near-shore, followed by the more distant *Spiroplectammina earlandi*, *Ammotium crassis*, *Labrospira crassimargo*, and *Recurvoides turbinatus*. Due to variability of environmental data available for the 20th century, some foraminiferal assemblage changes could be linked to local conditions, especially summer precipitation in the area, indicating high sensitivity and usefulness of foraminiferal-based proxies for paleoclimatic studies.

Southwestern Spitsbergen neighbors the polar front, separating warm water-masses flowing into the Arctic from cold Arctic water. In this unique setting, even small displacements of the polar front may produce a pronounced signal in the paleoclimatic record, which reflect intensity of the North Atlantic thermohaline circulation. Core HR-3, located in outer fjord basin of the Hornsund fjord, was especially suitable to record coastal and shelf hydrological and water-mass changes, due to the stability of the depositional environment and reasonably high accumulation rates.

Despite a lack of clear foraminiferal assemblage trends, the three major features of climatic changes of the last millennium are well expressed by *Cibicides lobatulus* $\delta^{18}O$ and are supported by other proxies, including grain size, and IRD. These periods are the Medieval Warm Period, the Little Ice Age (~1600–1900 AD), and 20th century warming; however, the boundary between the two older periods remains in question. The colder periods seemed to stay in phase with invasions of less saline and cold Arctic water due to westward displacement of the polar front. Our data clearly indicate that tidewater glaciers were present in SW Spitsbergen throughout the last millennium. They were most active from the late 16th century until the end of the 19th century.

Cambrian pseudofossils from the Holy Cross Mountains (Poland) from the collection of Włodzimierz Sedlak

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In 1967–1993 Włodzimierz Sedlak Publisher several dozen papers dedicated to the Cambrian fossils in the Holy Cross Mountains. Numerous samples, more or less 12 000 specimens, were collected from the Cambrian deposits of the Łysogóry – the highest range of the Holy Cross Mountains, mostly in its eastern part located nearby the Holy Cross. Fossils were sampled from the thick-bedded quartzitic sandstones, which in the earlier times were considered paleontologicaly mute. According to those papers Sedlak's collection includes algae, archaeocyaths, gastropods and, medusae *Corallicyathida*, showing features of both archaeocyathus and corals, and fungi. The specimens of *Corallicyathida* are dominating in the collection. He presented results of his stuides during international symposia (Sedlak 1975, 1980). Some of these fossils are described and illustrated in *Atlas of Key and Characteristic Fossils* published in 1990, volume III dedicated to fossils of the Lowe Palaeozoic and Proterozoic of Poland (Sedlak 1990).

According to Sedlak, the fossils occur on sedimentary bedding planes and perpendicularly oriented joint planes as well as within intra-sedimentary and tectonic breccias. It is noteworthy that the considered fauna is better preserved within the breccia horizons.

The scientific significance of *Corallicyathida* from Sedlak's collection was questioned lately by Bodzioch (2000), who proved that ribbons of this form resulted from radial crystallization of quartz upon the fissures.

Most specimens in the Sedlak's collection (up to a few thousand), donated to the Polish Geological Institute in Kielce, belong to *Corallicyathida* and occur mostly within the fragments of tectonic breccias. Reinvestigation of this collection has shown that numerous specimens of the *Corallicyathida* occur on surfaces oriented perpendicularly to bedding planes, which, in some cases, reveal tectonic striaes. Thus, these forms and algae in the quartzitic sandstones from the Łysogóry Range can not be considered as the organic structures but rather inorganic precipitates crystallized from fluids migrating along the tectonic fissures. The only one specimen, where numerous well preserved and undoubted molds of crinod ossicles occur on bedding plane of the quartzitic sandstone is probably of different (Devonian?) age.

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Contribution to the systematic of Lower Cretaceous ribbed aptychi

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Aptychi are a specific group of fossils related to ammonites. They are represented by thick, calcite valve-shaped elements that are not direct parts of ammonite shells. Aptychi, with negligible exceptions, cannot be classified within natural ammonite genera and species. Nevertheless, their system uses common nomenclature rules.

Aptychi form symmetric pair systems of valves and thus are also designated as diaptychi. However, both valves are found together in sediments relatively rarely. They are usually found separately as right and left valves.

Aptychi have been studied for about 200 years. Of many authors concerned with them, four authors who brought relatively the largest amount of basic knowledge should be mentioned here. On the first place, Trauth (1927–1938) developed morphological terminology and laid foundations for the artificial classification of aptychi. His successor was Gąsiorowski with the most significant contributions in the years

1959–1962. Other experts in the problems of aptychi were Renz (1972–1983) and also Renz & Habicht (1985), who described, above all in connection with “the Deep Sea Drilling Project”, many new taxa. New taxonomic opinions and proposals were brought by Turculet (1994) as well.

With reference to the considerable diversity of ribbed aptychi in the uppermost Jurassic and Lower Cretaceous, the hitherto used principles of classification of aptychi have recently proved unsatisfactory because they begin to make the introduction of new taxa in accord with nomenclature rules impossible.

The older system of ribbed Lower Cretaceous aptychi used two genera: *Punctaptychus* and *Lamellaptychus*. Turculet (1994) divided the genus *Lamellaptychus* into several subgenera. In the framework of both genera, species and subspecies were distinguished, which resulted in binominal and trinominal nomenclature. With regard to the richness of newly described species and subspecies in recent years, Renz (e.g. 1972) and Turculet with Avram (1995) were not able to continue using the introduced system. This manifested itself sometimes in even quadrinominal nomenclature, sometimes in combination with a hyphen or without it.

On the basis of our revision of Lower Cretaceous aptychi according to data in the literature, but especially thanks to our own collections in the Lower Cretaceous of the Western Carpathians and Eastern Alps, we have arrived to some significant findings that are suitable for application in the systematic of aptychi.

First, on some valves a so-called sigmoidal bend occurs on ribs. Trauth (1935, 1938) introduced the systematic name “*fractocosta*”, or “*fractocostata*” for this bend. The rank of this taxon in Trauth’s systematic was variety, later the term acquired the position of a subspecies. As shown by some findings of diaptychi, a sigmoidal bend in the pair arrangement of valves of aptychi can develop only on one of the valves, whereas on the other it is missing.

A similar situation may be observed in the case of occurrence of so-called radial lines. Trauth (1938) named the aptychi possessing “*radiata*”, with a rank of variety. But in some localities, on the same bedding plane valves ribbed similarly can occur with radial lines or without them.

For the above-mentioned reasons we propose to abandon the subspecies names “*fractocostatus*” and “*radiatus*” because, in our opinion, they lack systematic importance. It is the basic ribbing that plays the decisive role in the generic and subgeneric systematic of the ribbed aptychi. In the case of subspecies classification, all details on valve surface are used with the exception of the presented sigmoidal bend and radial lines.

For the systematic of Lower Cretaceous ribbed diaptychi with calcite valves we propose the systematic hierarchy given below. The ribbed aptychi are newly divided into the following two new families: Punctaptychidae and Lamellaptychidae.

In the family Punctaptychidae, the valves of which consist of 4 calcareous layers, we are able to distinguish two genera: *Punctaptychus* Trauth, 1927 and *Cinctpunctaptychus* gen. n. (type species *Punctaptychus cinctus* Trauth, 1935).

The family Lamellaptychidae, the valves of which are formed by three layers, includes 5 genera differing in the basic arrangement of ribs: *Lamellaptychus* Trauth, 1927, *Beyrichilamellaptychus* Turculet, 1994, *Mortilletilamellaptychus* gen. n. (type species *Aptychus Mortilleti* Pictet et Loriol, 1858), *Thorolamellaptychus* Turculet, 1994 and *Didayilamellaptychus* Turculet, 1994.

The genera are divided into species. In justifiable cases, the category of subspecies can be used. The category of subgenus remains open to be available for other possibilities.

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Fossil wood record of the Krkonose-piedmont and the Intra-Sudetic Basins

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Silicified stems of Permo-Carboniferous plants are very abundant in the Krkonose – Piedmont and Intra-Sudetic Basins in the Czech Republic. Stems belong to cordaites and/or Walchian Voltziales (*Dadoxylon*-type wood), tree ferns of *Psaronius* type, seed ferns of *Medullosa* type, sphenopsids and ?lycopsids. In the Czech part of the Intra Sudetic Basin, the occurence of fossil wood is proved in one fossiliferous horizon (Jívka Member of the Odolov Formation, Barruelian) and belongs to the *Dadoxylon*-

type wood only. On the other hand, there are at least four different levels of the Kumburk, Semily and Vrchlabi Formation (Late Pennsylvanian to Early Permian) of the Krkonose-piedmont Basin having a richer systematical composition. Fossils are permineralized mostly by highly crystalline SiO2 often with allochthonous material. The recrystallization is obvious and reflects a multiphase process of silicification which took place most probably under different mechanisms, related to various original palaeoenvironmental conditions.

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Rhaetian fish remains from the Fatra Formation, Western Carpathians (Kardolína locality in the Tatra Mountains)

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Rhaetian fish remains (single shark and actinopterygian teeth and scales) were previously reported from the Polish slopes of the Tatra Mountains by Gaździcki (1974) and by Duffin & Gaździcki (1977). In Slovakia, indetermined Rhaetian fish remains were mentioned by Michalík (1977, 1979), and by Gaździcki et al. (1979).

The Kardolína section is situated on steep slope of the Mt Pálenica (NNE of the Tatranská Kotlina village) in eastern part of the Belianske Tatry Mountains. It represents the most complete profile of the Fatra Formation (Michalík et al. 2007), rich in mollusks, brachiopods, corals, echinoderms, foraminifers, ostracods and algae. The fishes (single teeth and vertebrae) were collected in its lower part (beds 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4, 4.2, 5.1, 5.2, 5.4, 13/14, 14/15 and 15/16) and are housed in the Geological Institute of SAS in Bratislava.

The most apparent forms belong to chisel-like anterior teeth of the *Sargodon tomicus* Plieninger, 1847. This very deep-bodied fish (its maximum depth being slightly less than the standard length: less than 30 cm to more than one meter) was recorded from the Norian–Rhaetian sediments of Europe, especially from bone-beds of England, France and Germany. Conical teeth in the study material belong to *Saurichthys longidens* Agassiz, 1834 and *Birgeria acuminata* (Agassiz, 1839). *Saurichthys longidens* and *Birgeria acuminata* were predators, while the highest trophic level was occupied by “primitive” basal actinopterygians. The morphological variability of these two forms (with reduced scale cover in order to diminish the body weight) is rather high (the former being long and narrow, with an elongated snout, the latter being large and massive, with a powerful skull), depending on their mode of preying upon other fishes. *Saurichthys* was probably able to catch its prey with quick and sudden darts, owing to the strong forward push given by the median and caudal fins; on the contrary, in *Birgeria*, a slow chaser living near the bottom, the large and mobile mouth allowed this fish to expand quickly the oral cavity engulfing water and preys, just as happens in extant groups. In both taxa the dentition consists of large and striated conical teeth alternating with much smaller ones, typically adapted to hold and shear preys (Lombardo & Tintori 2005).

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The Berriasian ammonite *Riasanites* from the Polish basin and the Russian Platform – palaeobiogeographical implications

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The Polish basin developed along the margin of the East European Platform and occupied a unique palaeogeographic position between the two major palaeogeographic provinces – Tethyan and Boreal – resulting in interfering influences of both provinces. Studies of ammonites from the Polish basin could be crucial for analysis of migration routes and occurrence of particular species in other basins. The find of *Riasanites*, very important for Boreal–Tethyan correlation, in the Polish basin could allow verification of some hypothesys about its migration routes. Revision of *Riasanites* from the Russian Platform, based on material from the *Riazanites rjasanensis*

Zone of the Moscow and Ryazan outcrops (Mitta 2008) was the main step in this verification. Berriasian ammonites from borehole cores of the Polish basin are housed in the Geological Museum of the Polish Geological Institute (collection of S. Marek). Two informal stratigraphical units were distinguished in the Berriasian of the Polish basin: "Beds with *Riasanites*, *Himalayites* and *Picteticeras*" and "Beds with *Surites*, *Euthymiceras* and *Neocosmoceras*" (Marek & Rajska 1997, and many others). The lower unit – "Beds with *Riasanites*, *Himalayites* and *Picteticeras*" – corresponds to the Tethyan *occitanica* Zone and to the lower part of the *boissieri* Zone. Baraboszkin (1999) questioned this scheme because *Riasanites riasanensis* (Nikitin) on the Russian Platform occurs in the Late Berriasian and it could not be correlated with the Tethyan *occitanica* Zone, including the middle and higher parts of the Lower Berriasian. New revision and comparison with *Riasanites* from their type region brought new data for the discussion on the origin and migration of this genus.

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Dinosaur tracks in the Late Triassic of the Tatra Mountains

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The first dinosaur tracks were found in the Late Triassic of the Tatra Mountains by Professor Jozef Michalík and described by Michalík et al. in 1976. In this paper the authors proposed a new Late Triassic dinosaur ichnospecies *Coelurosaurichnus tatricus* Michalík et Sýkora, 1976 for those three discovered tridactyl ichnites. Later, Michalík & Kundrát (1998) redescribed these ichnites and suggested their similarity to ichnites from the ichnogenus *Eubrontes* Hitchcock, 1845, ichnotaxa very characteristic for the Early Jurassic dinosaur ichnoassemblages.

In the last four years new Late Triassic (?Norian–Rhaetian) material of dinosaur tracks has been found in the fluvial deposits of the Tatra Mountains, Poland and Slovakia (Niedźwiedzki 2005). New finds came from the two sites (Czerwone Żlebki and Cerevny Uplaz, Western Tatra Mountains), where the strata of Tomanová Formation are well exposed. Interestingly, vertebrate ichnites are numerous in the Upper Triassic of the Tatra Mountains, but are usually very poorly preserved or eroded. New footprints represent pedal ichnites of theropod (cf. *Kayentapus* isp., *Anchisauripus* isp.), ornithischian (cf. *Anomoepus* isp., ?cf. *Moyenisauropus* isp.) dinosaurs. Enigmatic large circular or oval structures, probably made by sauropodomorph and large tridactyl ichnite, probably theropod in origin were also identified.

These new paleoichnological finds are very important for the understanding of the ichnodiversity and ichnotaxonomy of the latest Triassic (?Norian–Rhaetian) vertebrate assemblages (especially dinosaur assemblages). This is the third reported record of dinosaur footprints in the Tatra Mountains.

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Seasonality, palaeoecology and migration of fauna from the Gravettian sites

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Seasonal or perennial occupancy of the prominent Central European Gravettian localities is one of the hottest Palaeolithic research topics, where zooarchaeological, palaeontological and geochemical methods may be employed. The application of these methods could also reavel data about palaeoecology and migration of hunted animals, thus gaining further details for wider geoarchaeological interpretations.

The seasonality of the Gravettian sites could be studied by using the animal dental cement microstructures. This method also enables estimation of the accurate animal age and the season of its death, and allows determination of not only the palaeoecological conditions of archaeological situation, but also to reveal the economical-social relationships of the hunting-gatherer cultures. The spectrum of individual animal species and their ages revealed from dental increments show different hunting preferences across the studied Gravettian sites. The settlement strategies, i.e. when and why the specific site was settled, may be traced by using the known animal death season. Dolní Věstonice, Přerov-Předmostí and Moravany-Lopata II Gravettian sites were full-year settlements. The sites Jarošov, Spytihněv, Lubná I, Trenčianské Bohuslavice, Willendorf II (layer 8 and 9) and Kraków-Spadzista were on the other hand occupied only seasonally (from spring to autumn). Exceptional cases are the Polish cave sites (Deszczowa and Mamutowa cave), where much more studies will be necessary to prove the perennial occupancy of Gravettian hunters. The other sites, which will say us more about the Gravettian occupancy, are Krems-Hundsteig a Krems-Altensdorf.

Based on the strontium ($^{86}Sr/^{87}Sr$) isotopes ratio it was found out that the large gregarious animals, such as reindeers or horses did not migrate in the north-south direction and that they moved around the Gravettian sites in the proximity of less than ~10 km. These findings are in contradiction to previous hypotheses (Musil 2002). The determination of migration of Palaeolithic animals (reindeers, horses, foxes and wolves) and the strontium isotope ratio of animal bones were compared with data originating from the site sediments, recent mollusc shells and rodent bones. Stable isotope values ($^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratios) of the Palaeolithic animal bones showed the floral change close to the OIS 3-2 transition, when the expansion of grass initiated, i.e. to the extension of tundra. These results are in agreement with those of Richards & Hedges (2003) and Pryor (2006). Application of these analyses have proved to be good tools to solve archaeological and palaeoecological issues.

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Calcareous micro-concretions in Recent and fossil myodocopid shells

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Myodocopid ostracods are today very diverse and abundant in various marine environments. However, they are very rare as fossils even in the subrecent samples. The unstable material (amorphous? or fine grained calcium carbonate) of their carapaces, also the post mortem forming of micro-concretions (nodules), were probable the reasons of poor potential for their fossilization and scarcity in the fossil record.

The calcareous nodules were described by Sohn & Kornicker (1969, 1988) as artifacts, which form after death of animal (rarely *in vivo*) in carapaces of recent myodocopid shells. According to these authors the nodules are a source of calcareous particles in marine sediments. These nodules were also described as unique form of calcification of shells by Bate & Sheppard (1982), Smith & Bate (1983) and in Silurian myodocipids by Siveter et al. (1987).

The calcareous micro-concretions were studied in some specimens of Recent myodocopid ostracods from the Admiralty Bay, King George Island, West Antarctica (see Majewski & Olempska 2005) and also in the myodocopid shells from the Devonian deep-sea hydrothermal venting systems of the Hamar Laghdad (Anti-Atlas, Morocco).

Calcareous micro-concretions are common component of myodocopid shells collected in the Admiralty Bay (Antarctica). In myodocopid shells from the Emsian of Marocco (Bełka 1998; Olempska & Bełka 2005), the structures very similar to those in recent shells also occur.

The formation of nodules is interpreted by the present author, as a result of fluctuation and recrystallisation of unstable, fine grained calcium carbonate after animal death. The decomposition of the protein and chitin framework of the shell probably play a leading role in the control of chemical reactions including those leading to the concretion formation.

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The phosphatized sponges from the Upper Santonian deposits of Kraków and Miechów Uplands (southern Poland)

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The phosphatized sponges that occur in the bottom part of the Santonian deposit are known from the four outcrops of the Kraków and Miechów Uplands: from marly glauconitic clays at Korzkiew "Above the Castle", from glauconitic marls at Korzkiew "U Krzywdy" and at Zabierzów, and also from marly glauconitic limestone at Wielkanoc. The sponge- bearing layer does not exceed 30 cm in thickness.

Most studied sponges represent Lychniscosida and Hexactinosida. Only four fragments belong to lithistids. The composition of sponge fauna is similar in all four outcrops. The difference in sponge diversity is associated with different number of specimens found in particular outcrops: Korzkiew "Above the Castle" – 30 species (96 specimens from own material and 182 from collection of the late Professor Małecki), Korzkiew "U Krzywdy" – 30 species (402 specimens); Zabierzów – 14 species (28 specimens); Wielkanoc – 27 species (130 specimens). The most common species are: *Periphragella plicata* Schrammen, *Laocoetis fittoni* (Mantell), *Polyopesia angustata* Schrammen, *Rhizopoterion cribrosum* (Phillips), *Coscinopora infundibuliformis* Goldfuss and *Etheridgia miriabilis* Tate.

The sponge preservations vary and three groups can be distinguished differing in colour: white, beige, and dark. The interspicular spaces and spongocoels of all specimens are infilled with phosphatized foraminiferal or foraminiferal-calcisphere wackestone. The XRD analysis shows the difference in the mineralogical composition of these three groups. The white sponges comprise the lowest amount of francolite (marine variety of carbonate fluorapatite – CFA) and the highest amount of calcite. In the beige sponges the amount of francolite increases, while amount of calcite decreases. The dark sponges comprise the largest amount of francolite, while the amount of calcite is low. All three groups occur only in Wielkanoc, whereas, in other studied outcrops, only beige and dark sponges appear.

All sponges were phosphatized shortly after its burying in sediment. SEM investigations show that precipitation of CFA (as the hexagonal plates) took place in free spaces between the particles of calcareous ooze. The shape and space occupied by the sponge were the factors controlling the processes of phosphatization.

All investigated sponges lived on soft bottom at the water depth more than 100 m. The well preserved white and beige sponges from Wielkanoc represent lag deposit. The slightly abraded beige sponges were transported for short distance. The strongly abraded, crumbled and more than once phosphatized dark sponges were transported for longer time and/or distance. The most crumbled and abraded dark sponges occur in Wielkanoc, and relatively better preserved occur in Korzkiew "Above the Castle".

At the start of the Middle/Late Santonian due to tectonic uplift associated with Subhercynian movements (principal factor) and eustatic decrease of sea level (secondary factor) the areas of previously deeper water became the alimentation areas for other regions. All sponges in the four outcrops were redeposited. The Korzkiew and Zabierzów areas were closer to the dark sponge alimentation area/areas than Wielkanoc region.

Badenian microfauna of the evaporite sequences from the borehole Zbudza P-7 (the East Slovakian Basin)

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The borehole of Zbudza P-7 is situated in the Trebisov Depression part of the East Slovakian Basin. In the studied section the majority of the Badenian deposits represented by the Zbudza Formation, developed during the Badenian salinity crisis in the Parathetys Sea. The evaporitic sedimentation took place not only in the East Slovakian Basin but also in the Carpathian Foredeep (Wieliczka), Transcarpathian Ukraina and Romanian Transylvania Basin (Vass et al. 2000; Kováč et al. 2007). The Zbudza Formation in the P-7 borehole consists of pure and clayey halites, with interbeds of siliciclastics (conglomerates, fine sandstones and laminated silit/claystones), and nodular clayey anhydrites (Bukowski et al. 2003).

Previous micropaleontological investi-gations of this formation, near the village of Zbudza, have shown the presence of the benthic foraminiferal assemblages, typical for the Middle Badenian – Zona *Spiroplectammina carinata* (Zlinská 2004) and Upper Badenian – Zona *Bulimina–Bolivina* (Gašpariková 1963), *sens*u Grill (1943).

The present micropaleontological investigations in the laminated silt/claystones of the evaporite sequences from the borehole of Zbudza P-7 encountered benthic and planktic Badenian microfossils. In the lower part of the evaporite sequence the assamblage is represented by the benthic foraminifers: *Borelis melo*, *Borelis* sp., *Cibicides* sp., *Pararotalia* sp., *Valvulineria complanata*, *Pullenia bulloides*, *Elphidium crispum*, *E. fichtellianum, Quinqueloculina* sp., *Spiroloculina canaliculata*, *Fursenkoina acuta*, *Globigerina* sp. and ostracods. In the upper part of the evaporite sequence the foraminifera assemblage contains index species of the zone *Orbulina suturalis–Gl. peripheroronda* (*sensu* Berggren 1995) accompanied by *O. universa*, *Praeorbulina glomerosa*, *P. circularis*, *P. curva*, *P. sicana*, *Globigerinoides bisphericus*, *G. quadrilobatus*, *G. trilobus*, *Globigerina bulloides*. In the uppermost part of the evaporite sequence occur *Globoturborotalita drury*, *G. decoraperta*, *Globigernella regularis*, *Globigerina bulloides*, *G. falconensis*, *Globoquadrina atispira, Globorotalia bykove*, *G. scitula* and *G. transylvanica.*

In spite of the several studies the age of the Zbudza Formation is questionable both in the light of the biostratigraphical research (Gašpariková 1963; Zlinská 2004; Paruch-Kulczycka 2004) as well as the paleomagnetic results (Túnyi et al. 2005; Kováč et al. 2007). In the later studies there are two different stratigraphical interpretations, first that the Zbudza Formation originated in a short interval (15.034–15.155 Ma), Zone M 6: *Orbulina suturalis–Gl. peripheroronda*; the second one is that the age of Zbudza Formation time interval is about 14.7–13.3 Ma, Zone M 7 – *Gl. peripheroacuta*.

The present micropaleontological investigations of the Zbudza P-7 microfauna suggest that the first interpretation (15.034–15.155 Ma, Zone M 6) is correct due to the presence of the foraminifera taxa characteristic for the Zone M 6 *Orbulina suturalis–Gl. peripheroronda*.

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Foraminifers and ostracods from the Campanian of the Jeżówka quarry, the Miechów Trough, southern Poland: paleoecological implications

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Campanian foraminifers and ostracods from the Jeżówka quarry were analyzed. Both groups are good bioindicators of changes in marine environments. They are used as proxies of paleodepth, organic flux and paleooxygenation.

The studied area is situated in the south-western part of the Miechów Trough, which represents the southeasterly segment of the Szczecin-Łódź-Miechów Synclinorium. The section at Jeżówka comprises 8-m-thick sequence of calcareous strata separated by a hardground into two complexes. At the bottom there is 1.5-m-thick sequence of grey siliceous limestones (opoka) with cherts, overlain by a 1-m-thick grey opoka. Higher up in the section there is 1-m-thick opoka with glauconite terminated by 0.3-m-thick green-brownish layer of the hardground. The sequence is overlain by 4.5-m-thick complex of light grey opoka.

Foraminiferal assemblages in the studied interval are moderately to highly diverse. More than 80 taxa were identified at the generic or specific level. The identified taxa represent 4 suborders: Globigerinina, Textulariina, Lagenina, Rotaliina. Representatives of Globigerinina and Rotaliina dominate foraminiferal assemblages.

In the studied interval P/B ratio values vary from 40 to 70%; keeled forms make 40 to 70% of planktonic foraminiferal assemblages; H(S), the Shannon-Weaver heterogeneity index is generally high: 2.6–3.2; number of benthic species in the assemblages exceeds 20 and the proportion of agglutinated tests vary from 3 to 25%. Benthic foraminiferal assemblages are dominated by epifaunal morphogroups.

Ostracod assemblages are represented by 2 suborders: Platycopida and Podocopida. More than 50 species were identified. Platycopids form 30 to 55% of the assemblages.

The studied interval represents the upper part of the planktonic foraminifer *Globotruncana ventricosa* Interval Zone and *Globotruncana arca* and *Globotruncana ventricosa* Partial Range Subzones. The boundary between the two subzones is located at the top of the hardground.

High contribution of keeled forms to planktonic foraminiferal assemblages, high share of epifaunal morphogroups in benthic foraminiferal assemblages and low to moderate contribution of platycopids to the ostracod assemblages indicate mesotrophic to oligotrophic surface waters and generally aerobic bottom-water conditions with a few short episodes of less oxygenated bottom-waters.

High proportion of planktonic foraminifera, high values of the H(S) diversity index of benthic foraminiferal assemblages and predominance intermediate – deep water species of *Cytherella, Cytherelloidea, Krithe, Argilloecia, Macrocypris, Cythereis, Bairdia* and *Bairdiopapillata* within ostracod assemblages indicate an outer shelf environment with a shallowing episode during formation of the hardground at the boundary between *Globotruncana arca* and *Globotruncana ventricosa* Subzones.

Jagt et al. (2004) included the sequence of opoka from below the hardground to the *papillosa* and *conica/papillosa* zones. Based on the absence of species of *Hoplitoplacenticeras* in the Jeżówka section they concluded that the hardground possibly represents equivalent of *gracilis/mucronata* and *conica/mucronata* zones and that its formation was largely controlled by the latest Early Campanian "Peine Phase" and resulted from sediment winnowing around the sequence boundary and during the following transgressive systems tract of the *mucronata* Transgression (Jagt et al. 2004).

Our study indicates that the hardground at the boundary between *Globotruncana arca* and *Globotruncana ventricosa* Partial Range Subzones may reflect short but abrupt sea level fall that can be correlated with the sea level fall and positive $\delta^{13}C$ excursion documented by Jarvis et al. (2002) from Europe and Tunisia as the Mid-Campanian Event.

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Middle Eocene fresh-water sponges from Canada: preliminary report

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Fresh-water sponges are today a significant element of biota in all terrestrial water bodies and are well studied worldwide (Pronzato & Manconi 2002). They are, however, much less common and studied in the fossils record. Sponges as such are among oldest Metazoa and known since Precambrian but from marine settings. The first fresh-water sponges are known from the Mesozoic from singular reports from the Late Jurassic of the USA and Lower Cretaceous of Europe and Patagonia; they are more commonly observed in deposits since Eocene (Pisera 2006; Pisera & Saez 2003, and references therein). Recently sediments of the Middle Eocene lake developed in the kimberlitic crater in northern Canada known as Giraffe Pipe have been discovered (Wolfe et al. 2006) that contain rich biota of siliceous microfossils, including sponge spicules. Apart from sponges, there are rich and diversified diatoms (Bacillariophyta), chrysophytes (cysts, scales and bristles), testate amoebe scales (Euglyphidae); many forms have pronounced modern affinities (Siver & Wolfe 2005, 2007). Sponges are represented by loose spicules: mega and microscleres and gemmuloscleres that belong to the family Spongillidae Gray, 1867 and perhaps Potamolepidae Brien, 1967. Based on morphology of gemmuloscleres and mega/microslceres at least 5 (probably much more, because only small fraction of samples has been investigated) species, most of them probably new, and 2 or 3 genera are present (some new). There is a clear differentiation in species composition in various samples that contain usually more than one species. This diversity is the highest known in the fossil record and indicates that already in the Middle Eocene fresh-water sponges were highly diversified, thus most of their evolution happened before that time. This unique fauna of sponges is crucial in understanding the evolution of fresh-water sponges and their Recent distribution characterized by numerous cosmopolitan species and genera.

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New fossiliferous locality in the Pieniny Klippen Belt in Myjava vicinity (Western Carpathians, Slovakia)

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During the excavation works at the southern periphery of the Myjava town a part of a large klippe was outcropped. Greenish-grey limestones-marlstones with dark spotty bioturbations are cropping out along 20 m at the northern end of the visible section. The southern part of the section is build by the grey-green and dark grey marly shales and marls. At the excavation we have found fragments of grey silty and limy shales with abundant ammonite shells on the lamination surfaces.

The position of the ammonitic shales is not well documented in the outcrop, because of the strong tectonic deformations and local reductions of softer horizons. However, few cm thick lens with several poorly preserved ammonites have been found in the middle part of the section. We collected fossils from the shale clasts dispersed around this horizon. The whole visible section was sampled at intervals of approximately 1–6 m. Samples for biostratigraphic, microfacies and nannoplankton studies were taken from the marlstone section below, and from shaly part from above the horizon with ammonites.

The underlying spotty marlstones are defined as intrabiopelmicrites to intrabiopelmictosparites (wackestone-packestone). The samples from this part yielded planktonic foraminifera *Blefuscuiana infracretacea* (Glaessner), *Blowiella blowi* (Bolli), *Hedbergella planispira* (Tappan), *H.* cf. *delrioensis* (Carsey), *Globigerinelloides ferreolensis* (Moullade), *Ticinella bejaouaensis* Sigal, and *T. roberti* (Gandolfi). Such an association indicates the age latest Aptian.

Nearly 450 cm above the base of measured sequence there is 20 cm thick layer of pale calcarenite with cherty nodules. Locally the structure of wackestone-packestone continually pass into grainstone, forming irregular patches. In this part of section *G. ferreolensis* and *Blowiella blowi* are missing, and *Favusella* sp. with *Ticinella primula* Luterbacher appear for the first time. The latter is the index microfossil of the upper part of the Early Albian to mid-Albian biozone Ticinella primula (cf. Robaszynski & Caron 1995; Maamouri et al. 1994). In this bed also *Didemnoides moreti* (Durand Delga) and *Gemeridella minuta* Borza and Mišík were identified, together with some miliolid foraminifera.

Practically in all the samples occur radiolarians, sponge spicules, fragments of echinoderms, algae, and inoceramid shells, calcareous dinoflagellata and ostracods. Few benthic foraminifers are represented by *Dorothia oxycona* (Reuss), *Lenticulina* sp., *Spirillina* sp., *Anomalina* sp., *Gavelinella* sp., cf. *Lingulogavelinella* sp., *Gyroidinoides* sp. and nodosariid and textulariid forms.

The middle part of the section is extremely tectonized, but the change of the lithology is clear. In the 70 cm thick grey marls we found several small ammonite shells. However, the bulk of about 50 determinable specimens are from laminated marls of the scree dispersed around. Ammonite shells are flattened and some of them also laterally deformed. We determined four species: *Leymeriella tardefurcata* (d'Orbigny, 1841), *L.* cf. *acuticostata* Brinkmann, 1937 (only few specimens), *Protetragonites* ex gr. *aeolus* (d'Orbigny, 1850) and *Metahamites* sp. Several valves of the inoceramids and fish scales were found together with the ammonites.

The *Leymeriella tardefurcata* is the index taxon of the zone Leymeriella tardefurcata of the Early Albian. If we apply the subdivision of the zone L. tardefurcata to the three subzones of Owen (1999), it is possible to precise the age of the horizon with ammonites at Myjava as the lower part of the Early Albian, zone L. tardefurcata. The age of the middle part of the section as defined on the ammonite fauna corresponds to the age determined from microfaunal content.

The upper part of the section consists mostly of dark grey silty claystones and slaty marls. The nannoplankton assemblages in all samples are very poor, containing *Cyclagelosphaera* sp., *Watznaueria barnesae* (Black), *Watznaueria fossacincta* Black, *Zeugrhabdotus embergeri* (Noel), *Nannoconus kamptneri* Brönnimann, *N. globulus* Brönnimann and *N. steinmannii* Kamptner. The age of such an impoverished association can be only roughly estimated as the Early Cretaceous (Barremian) according to the presence of nannoconids, but the redeposition of all the microfossils cannot be excluded.

Another known locality with *L. tardefurcata* in the Pieniny Klippen Belt is at the Orava region (Andrusov 1959). *Leymeriella* fauna is widespread in both the Mediterranean and Subboreal realms.

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New insights in venation pattern morphology of Paleozoic insects

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Paleozoic insect fauna greatly differs from Mesozoic and Cenozoic ones. Insects are known either as compression fossils or three-dimensional siderite nodules. Wing venation is the structure most commonly preserved on Paleozoic insect fossils. Morphological limitations due to various adaptations and pattern stability within groups make that the venation pattern remains crucial structure for systematic of Paleozoic insects. Unfortunately many fossil taxa described by some authors are based on fragmentary material of different body structures those are usually misguided. Such enthusiasm caused noise in systematic and generates further difficulties to make any serious comparison with other taxa. The aim of this study is finding of significant venation characters on newly discovered material and revision of selected Paleozoic fossils.

Current research in several institutional and private collections enabled study of new Upper Carboniferous material of paleopterous and neopterous insects from several localities in Euro-America and China. The first results of comparative studies mainly based on wing venation pattern morphology revealed new significant characters for taxonomy and phylogeny of different insect groups (e.g., Ephemeroptera: Syntonopteridae, Palaeodi-ctyopterida: Homoipteridae, Namuroning-xiidae, Odonatoptera: Meganeuridae and others). Contemporary studies extend our knowledge on past insect diversity and display variability of venation pattern in evolution. Moreover, those results provide support for paleogeography, such as evidence for a Euro-American connection during the Late Carboniferous.

Early and Late Tithonian nannoconid assemblages from the Stare Bystre and Grajcarek sections (Pieniny Klippen Belt, Poland)

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A new *Nannoconus*-based zonal scheme was recently proposed for the Tithonian (Pszczółkowski 2006). In the present contribution, the nannoconid assemblages recorded from the Tithonian–earliest Berriasian limestones are correlated with microfossil zones in the Stare Bystre (Branisko Succession) and Grajcarek (Magura Succession) sections of the Pieniny Klippen Belt in Poland. In the Stare Bystre section, red nodular limestones of the Czorsztyn Limestone Formation are Kimmeridgian–Early Tithonian in age. The exposed lower part of the Pieniny Limestone Formation (Birkenmajer 1979) belongs to the Lower Tithonian (Malmica Zone) – lowermost Berriasian (Alpina Subzone). The Early Tithonian ammonites collected from the nodular limestone (Myczyński in Pszczółkowski & Myczyński 2008) constrain location of the Kimmeridgian/Tithonian boundary in this section In the Stare Bystre section, four nannoconid biozones were identified. First occurrence of *Nannoconus* was recorded from the Lower Tithonian limestone, slightly below the base of the Malmica Zone (*sensu* Reháková 2000).

In the Grajcarek section (= Zabaniszcze hamlet), the Palenica Marl Member of the Czorsztyn Limestone Formation (Birkenmajer 1977) was assigned to the Early Tithonian Malmica Zone (Nowak 1971, 1976). The *Nannoconus infans* and *N. wintereri* Zones are represented in the upper part of this Member and also in the lower interval of the Pieniny Limestone Formation.

In the studied sections, specimens referred here provisionally to *Nannoconus* sp. A occur in the *N. infans* and *N. wintereri* Zones. These specimens differ from published description of species *N. compressus*, *N. infans* and *N. wintereri* (Bralower et al. 1989; see also Table 1).

Table 1. Dimensions and outline of some Tithonian nannoconid taxa.

Taxon	Dimensions			Outline	Source of data
	Length (μm)	Width (μm)	Axial canal		
Nannoconus compressus Bralower and Thierstein	3–8	2–4	Narrow (common lack of axial canal)	Rectangular to elongate oval	Bralower et al. (1989)
Nannoconus infans Bralower	1–6	Less than 3	Very narrow	Variable (square, elongate or sausage shaped)	Bralower et al. (1989)
Nannoconus wintereri Bralower and Thierstein	4–8	4–8	Bowl-shaped	Cone shaped	Bralower et al. (1989)
Nannoconus sp. A	4.5–6.5	4.5–6	Very narrow	Cone shaped	This work

The results of this study show that (1) the *N. compressus* Zone correlates with the Early Tithonian (uppermost) Pulla-Tithonica and (lower) Malmica Zones and (2) the *N. infans* Zone is equivalent to the upper part of the Malmica Zone and the lower part of the *Chitinoidella* Zone (including the lower interval of the Boneti Subzone). The *N. wintereri* Zone corresponds with the upper part of the *Chitinoidella* Zone, entire *Crassicollaria* Zone and the basal interval of the Berriasian Alpina Subzone.

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Lower Carboniferous trilobites (Tournaisian–Visean boundary) from Mokrá quarry near Brno (Czech Republic)

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The active quarry-complex of Mokrá is situated in the southern part of the Moravian Karst, approximately 15 km SNS from Brno. Studied sequence of the Mokrá quarry is developed in the allochtonous Horakov development of containing sediments from the Frasnian until the Viséan (Kalvoda & Ondrackova 2003). It documents transition between the platform carbonate sedimentation in Frasnian, via sedimentation from calciturbidite during deepening of basin and its extension in the Famennian, to the basin inversion and gradual transition to the sedimentation in Upper Tournaisian. The Brezina Formation consists of reddish and olive greenish shales with calciturbidites and siliciclastic turbidites. It falls from Upper Tournaisian to Middle Viséan (Crha 1987). There has been no systematical study on the Lower Carboniferous trilobites from Moravia till 60's of the last century. Just a few papers on occurrence of sporadic fragments of trilobites were published.

Chlupáč (1966) found a trilobite assemblage in the vicinity of Mokrá near Brno which came from several sporadic pits. All these trilobites were found only in the Hady-Ricka limestones. No work has been ever written on occurrence of Lower Carboniferous trilobites from the Brezina shales.

During a few last years Lower Carboniferous shales of the Brezina Formation with very common fragments of trilobites were collected in the Mokrá quarry. Sixteen trilobite taxa were established (see Hahn & Hahn 1988; Hahn 1990; Hahn et al. 1996), extending our knowledge on Lower Carboniferous trilobites. The occurence of stratigraphically important conodont and foraminifer taxa dated trilobites from the Middle Tournaisian, Upper crenulata – Zone, CU I ß. There are three main goals of our study: the study of the systematic evaluation of the new trilobite assemblage from shales of the Brezina Formation, their biostritigraphy and interpretation of their autecology and feeding habits.

In Czech Republic, all studies on trilobite autecology have been focused just on the Prague Basin (Barrandian area). Chlupáč (1983) studied the trilobite assemblage, including their ecology from the Chýnice Limestone, while Chlupáč et al. (1985) studied the trilobite assemblage from the Lochkovian–Pragian boundary interval. Havlíček & Vanek (1998) concentrated on brachiopode-trilobite assemblage and their main biofacies in the Pragian. Surprisingly, there has been no study focusing on autecology of Lower Carboniferous trilobites from Moravia. Based on specific functional morphology features of taxa, author divided trilobites found in the Mokrá quarry into four groups according to their probable life style and feeding habits.

Based on analyses of exoskeletal functional morphology, four main morphotypes of trilobite life strategy and feeding habits have been distinguished: (1) *Archegonus* morphotype, (2) *Liobole* morphotype, (3) *Bollandia* morphotype, and (4) *Tawstockia* morphotype.

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Epibionts on cephalopod shells – Upper Famennian (Devonian) examples from the Holy Cross Mountains (Poland)

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Many invertebrates encrusting modern and ancient cephalopod shells have been documented by numerous authors (e.g. Seilacher 1960; Landman et al. 1987; Braid et al. 1989; Donovan 1989; Frey 1989; Wignall & Simms 1990; Klug & Korn 2001). In this preliminary report epibionts on Devonian cephalopods from Poland are reported for the first time. The material analysed was collected in 2003–2007 in the active

Kowala Quarry, situated in the southern limb of the Gałęzice-Kowala syncline, southern part of the Kielce region of the Holy Cross Mountains.

Only 30 of about 850 cephalopod shells collected from uppermost Famennian, display encrustation by diverse epibionts (episkeletozoans *sensu* Taylor & Wilson 2002). These infested cephalopods are represented mostly by clymeniids, as well as goniatitids and nautiloids. Most of the infestation appears on internal moulds, because unstable aragonitic shell material of cephalopods has been dissolved during diagenesis. Crinoids (represented by holdfasts – about 62%) dominate as epibionts on cephalopod shells, less common are serpulids (about 15%), and single bryozoans, microconchids, possibly cornulitids and other organisms of uncertain affinities. Bryozoans are represented by two taxa: indeterminate juvenile bryozoans (too young to be identified the order) and trepostomes, probably the genus *Paleschara* (Paul D. Taylor, inf. e-mail, 2008).

Preliminary observations indicate, that probably all of the epibionts utilized dead cephalopods shells as a hard substrate. It is supported by the facts that 1) nearly all of the epibionts are attached to only one, lateral side of the cephalopod shells, 2) none of them are observed on a ventral side, and 3) none of epibionts caused modification of the cephalopod conch (see Klug & Korn 2001; Maeda & Seilacher 1996). Therefore, isolated cephalopod shells certainly served as benthic islands for various encrusters on a Devonian muddy sea-floor (see Taylor & Wilson 2003).

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First Mesozoic turnover of coral fauna

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Middle Anisian corals, first Mesozoic corals that appeared after the Permian/ Triassic extinction, were differentiated morphologically and microstructurally (Roniewicz & Morycowa 1989). The range of this original microstructural differentiation persisted to the Late Mesozoic (Roniewicz & Morycowa 1993).

From four stages of the history of post-Paleozoic corals (early Mesozoic: Anisian–Pliensbachian; middle Mesozoic: Toarcian–Valanginian; late Mesozoic: Hauterivian–Maastrichtian, and Cenozoic: Paleocene–Recent), the most interesting is the early Mesozoic one with its second, Ladinian–Early Norian phase when the most differentiated taxonomically Triassic faunas developed (Roniewicz & Morycowa 1989, 1993). This phase ended with the faunistic turnover that took place early in the Norian.

Recently, a new taxonomically rich Early Norian corals have been discovered in the Dachstein plateau in the Northern Calcareous Alps (Roniewicz et al. 2007); its age is documented by conodonts at the early Lacian (*Epigondolella primitia*, *E. triangularis* and *Norigondolella navicula*) to early Alaunian (*E.* cf. *multidentata*). The equivalents of this fauna are known from the neighbouring Julian Alps (Turnšek & Ramovš 1987; Ramovš & Turnšek 1991), as well as from the Taurus Mountains in Anatolia, Turkey (Cuif 1977, here additional literature) originating on the south-western border of the Tethys, and from the Pamirs in the central Asian Tethys (Melnikova 2001). In the Northern Tethys, the richest early Norian coral fauna is that from the Dachstein plateau (31 genera). The Anatolian fauna does not surpass it in terms of taxonomical diversity (25 genera) but it displays very well preserved skeletons. Late Norian and Rhaetian coral fauna, taxonomically different from that characterized above, is broadly distributed in the world and its taxonomical composition is well documented; the change is taxonomically significant as it concerns not only generic but even the family level (Anisian–Early Norinan 25 families: Upper Norian–Rhaetian 14 families). This turnover belongs to small-scale Late Triassic turnovers (preceding the Triassic–Jurassic extinction), observed in different groups of organisms (compare Benton 1986; Stanley 1988); some organisms show taxonomical changes at the end of the Carnian (compare Hallam 1995).

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New palaeontological data from the Triassic of the Tatra Mountains

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The Triassic of High-Tatric and Lower Sub-Tatric (Křížna) units in the Western Tatra Mountains is characterised by the paucity of skeletal organisms. Recently we discovered fossils in the Lower Triassic clastics and the Middle–Upper Triassic carbonates of the Křížna Unit, and the Middle Triassic carbonates of the Wierchowa Unit. These are gastropods, calcareous algae, echinoderms, benthic foraminifers and sponges earlier known from the Triassic of the Tatra Mountains (Kotański 1967; Bełka & Gaździcki 1976; Gaździcki & Lipiec 1995; Jaglarz & Szulc 2003; Niedźwiedzki & Salamon 2006). Unfortunately, the index fossils are rare.

The gastropod *Werfenella rectecostata* (Hauer) was found in the brown mudstones of the Suchy Wierch section in the Křížna Unit, indicating their Early Triassic age (Nützel 2005).

The thick complex of Middle Triassic carbonates yielded numerous foraminifers, calcareous algae and echinoderms. It is worth to note that up till now no foraminifers have been described from the Křížna Unit of the Polish Tatra Mountains. Within the limestones of the Łysanki section foraminifers *Glomospirella grandis* (Salaj), *Ophthalmidium* sp. and *Glomospira* sp., and crinoid of *Dadocrinus* sp. were found. These crinoids were also found in the Anisian limestones of the Skoruśniak section, where they occur together with foraminifer *Hoyenella* gr. *sinensis* (Ho). Anisian dolomites of the Żleb pod Czerwieniec section comprise foraminifers of *Gaudryina* sp., *Agathammina* sp. and *Hoyenella* gr. *sinensis* (Ho).

Ladinian dolomites of the Skupniów Upłaz section comprise calcareous algae *Kantia* sp. and foraminifers *Aulotortus praegaschei* (Koehn-Zaninetti). Ladinian dolomites of the Hlúpy section comprise foraminifers such as *Turriglommina* cf. *mesotriasica*, *Glomospira articulosa* Plummer, *Dentalina* cf. *zlambachensis* Kristan-Tollmann and *Hoyenella* gr. *sinensis* (Ho).

Dolomites of the Żleb pod Czerwoną Przełęcz section yielded foraminifer assemblages of Carnian–Norian age. The assemblage includes *Nodosaria nitidana* Brand, *Gsollbergella spiroloculiformis* (Oravecz-Scheffer), *Miliolipora cuvillieri* Broennimann et Zaninetti, *Aulotortus friedli* Kristan-Tollmann, *Ophthalmidium* cf. *lucidum* (Trifonova), *Hoyenella inconstans* (Michalík, Jendrejáková et Borza), *Trochammina* sp. and *Turriglommina* sp.

The Middle Triassic of the Wierchowa Unit is composed of interbedded limestones and dolomites (Jaglarz & Szulc 2003). Fauna and flora are restricted to lower part of the succession. The fossils occur mostly in calcarenitic intervals in limestones or dolomites. Gastropods are represented by *Omphaloptycha* sp. in the Anisian of the Giewont section. Crinoids are represented by *Dadocrinus* sp. and *Holocrinus* ?*acutangulus* (Meyer). Apart from crinoids, the ophiuroid *Aspiduriella* sp. also appears in the same part of the Giewont section.

Calcareous algae occurring in the Stoły pod Ciemniakiem section are represented by *Oligoporella pilosa* Pia, ?*Kantia* sp. and poorly preserved diplopores.

Several species of benthic foraminifera were found in Kominiarski Wierch, Stoły pod Ciemniakiem and Giewont sections. Foraminifers *Krikoumbilica pileiformis* He occur in the Kominiarski Wierch section, *Nodosaria hoae* (Trifonova) in the Stoły pod Ciemniakiem section, and *Glomospira* gr. *sinensis* (Ho) in Stoły pod Ciemniakiem and Giewont sections. Beside the above mentioned fossils some sponges and sessile gastropods have been found in the Kominiarski Wierch section (Jaglarz & Szulc 2003).

Stratigraphically important species from the Middle Triassic of the High-Tatric Unit are only *Dadocrinus* sp. and *Holocrinus acutangulus* indicating Bithynian–early Pelsonian age (see Hagdorn & Głuchowski 1993). Among the dasycladacean only *Oligoporella pilosa* has stratigraphical significance and indicates Bithynian?–Early Illyrian (Bystrický 1986). *Glomospira* gr. *sinensis* characterizes Olenekian–Anisian (Rettori 1995).

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Lower Cretaceous ichnoassemblage from the Polomec (Zliechov Basin, Krížna Nappe, Western Carpathians, Slovakia)

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The Polomec section of "Pseudothurmannia Beds" contains rich trace fossils assemblage. The Ladce Formation, the Mráznica Formation, the Kališčo Formation, the Lúčkovská Formation and the Podhorie Formation are distinguished in the Lower Cretaceous of the Western Carpathians. The Polomec sequence is situated in the Krížna Nappe and consists of the spotted limestone of the Mráznica Formation. The Hauterivian to Barremian "Pseudothurmannia beds" originated on the continental edge and slope of the Zliechov Basin. The trace fossils assemblage contains *Thalassinoides*, *Zoophycos*, *Palaeophycus*, *Planolites*, *Hormosiroidea*, *Chondrites* and other undetermined trace fossils. *Thalassinoides* (domichnion) was found in the basal part of the studied section only. *Zoophycos* and *Chondrites* are the most common trace fossils. Limestone is well bioturbated and ammonite shells were frequently destroyed by tracemakers. Preservation of fossils was influenced by relatively high bioturbation activity and infaunal colonization was clearly not interrupted but substrate oxygen contents probably altered periodically.

Brachiopod *Gyrosoria lata* (Etheridge) from the Saxo-Bohemian Cretaceous Basin

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The micromorphic brachiopod species *Gyrosoria lata* (Etheridge, 1881) is a well known traditional marker of so called *lata* Zone within the Anglo-Paris Basin. However the species has not been revised since the time it was designed by Etheridge (1881) as a variety of "*Terebratulina gracilis*". It is almost certain by now that nobody has officially changed status of the Etheridge's variety to the species-level.

Stratigraphic range of the species is rather narrow in the Anglo-Paris Basin – Middle Chalk to lowermost Upper Chalk (see Mortimore 1986) in terms of traditional lithostratigraphy. The high abundance of these brachiopods led to erection of "Zone ŕ *Terebratulina gracilis*" (Barrois 1876). Much later after Etheridge's description of the new lata-variety (1881) term "*Terebratulina lata* Zone" (or just "*lata* Zone") became common practice that continue to the recent times. This zone ranges from the top of *Mytiloides labiatus* up to the base of *Sternotaxis plana* Zone, i.e. Middle to lower Upper Turonian.

These tiny brachiopods have been reported from many localities in Europe, but erroneously under names of distinct species as *Terebratulina gracilis* v. Schlotheim(e.g. d'Orbigny 1847) or *Terebratulina rigida* Sowerby by Schloenbach (1866). Moreover also new names have been probably created for this species (*Terebratula ornata* Roemer or *Terebratulina subgracilis* d'Orbigny). Although these names could act as older synonyms thus having priority they should be rejected for different reasons (Sklenář & Simon, in prep.).

Gyrosoria lata is a widely geographically distributed species. It occurs throughout Middle to Upper Turonian of South England, France, Belgium, Germany, Czech Republic and it has been also recognized from south-western Russia (Sklenář & Simon, unpublished). The easternmost appearance is in Turkmenistan (Titova 1977). There is a clear diachronisms of the stratigraphic range of this species in Europe to Asia. The species has been reported from Middle to lowermost Upper Turonian of Anglo-Paris Basin, from the Upper Turonian of Bohemian Cretaceous Basin (BCB) and from the (?Upper) Turonian to Coniacian from Turkmenistan (Titova 1977). This could indicate migration of *G. lata* to eastern parts of the North European Province during Turonian.

The first report of this species from BCB is by Wiese et al. (2004) from the Úpohlavy quarry near Lovosice in north-western Bohemia. Occurrence of *G. lata* is associated with hemipelagical facies characterised by more or less marly sedimentation. This species became (either primarily or secondarily) highly abundant in some layers. The secondary abundance (caused by taphonomic factors) has been proved statistically in Ohře district (NW Bohemia). This species displays high intra- as and interpopulation variability.

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Dinoflagellate cyst biostratigraphy of the Jurassic/Cretaceous boundary

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The latest Jurassic and earliest Cretaceous were marked globally by low sea-levels and consequent provincialism of marine biota. North hemisphere biotas are divided biogeographically into the southern Tethyan province and the northern Boreal province. The distinctive nature of the biota in these provinces has necessitated the establishment of independent zonations and stage nomenclature.

Jurassic/Cretaceous boundary sediments were studied in two totally different regions, Tethyan and Boreal. Tethyan studies are situated in the Outer Western Carpathians (Brodno section – Slovakia, Skalice section – Czech Republic) and Northern Calcareous Alps (Leube quarry – Austria). Jurassic/Cretaceous boundary beds (Upper Volgian and Ryazanian) in the Nordvik Peninsula (North Siberia) were studied from Boreal region.

As for the Western Carpathians samples, dinocysts *Amphorula metaelliptica, Systematophora penicillata* and *S. scoriacea* occur in the Late Tithonian. The base of the

Berriasian was defined on the occurrence of *Endoscrinium campanula*; *Circulodinium distinctum, Ctenidodinium elegantulum*, and *Prolixosphaeridium* sp. A occur for the first time in the Early Berriasian of the calpionellid Calpionella biozone, Alpina Subzone. In the uppermost part of Early Berriasian non-calcareous dinoflagellates were successfully correlated with the calpionellid Elliptica subzone. As for dinocysts, the presence of the species *Achomosphaera neptunii* that does not confirm Leereveld's conclusions (1995), i.e. the first occurrence of the species in the Mediterranean area from the Middle Berriasian, is the most important. Data from the Silesian Unit confirm its occurrence already in the uppermost part of Early Berriasian as stated by Monteil (1992, 1993).

The palynological assemblages of the studied part of the Northern Calcareous Alps are mainly composed of dinocysts, only in few samples representatives of sporomorphs and foraminifera linings were found. Samples from the Tithonian contain dinocysts, such as *Ctenidodinium ornatum*, *Occisucysta balois*, *Prolixosphaeridium mixtispinosum*, *Senoniasphaera jurassica*, *Systematophora areolata*, *Tehamadinium evittii*, which are typical of Tithonian to Lower Berriasian age (Monteil 1992; Stover et al. 1996). Stratigraphically the most important species *Muderongia tabulata* and *Achomosphaera neptunii* occur first in the Early Berriasian. The first appearance of these species was reported from the early Berriasian (Jacobi ammonite Zone) of southeastern France (Monteil 1992). Simultaneously this interval includes *Amphorula delicata*, *Circulodinium distinctum*, *Ctenidodinium elegantulum*, *Endoscrinium campanula*, *Systematophora areolata*, *S. complicata, S. scoriacea*, species well known from the Berriasian. Then stratigraphically important species *Biorbifera johnewingii* occurs too. Jardine et al. (1984) found the first occurrence of *B. johnewingii* at the base of the Occitanica Zone of the middle Berriasian.

The palynomorph associations from the Nordvik Peninsula comprise abundant spores and pollens of terrestrial plants as well as diverse microphytoplankton (dinocysts, green algae, acritarch, foraminifera linings). The characteristic feature of dinoflagellate cyst assemblages is low abundance and diversity of chorate and proximochorate type. Samples were dominated by dinocysts, such as *Cassiculosphaeridia magna*, *Endoscrinium campanula*, *Paragonyaulacysta borealis*, *Pareodinia asperata*, *P. ceratophora*, *Senoniasphaera jurassica*, *Sirmiodinium grossii*, *S. orbis*, *Trichodinium*, *Tubotuberella apatela*, *T. rhombiformis*. They are typical for *Paragonyaulacysta borealis* dinocyst zone (Pestchevitskaya 2006). The presence of *Bourkidinium, Endoscrinium campanula*, and *Spiniferites* in the Upper Volgian is interesting. They are known from the Early Berriasian of the Tethyan region.

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Conodont faunas from the Barrandian area – their potential for detail biostratigraphic subdivision of the Lower Devonian

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Conodonts are tiny phosphatic microfossils from extinct primitive marine chordates. They are in fact fundamental tools of Palaeozoic biostratigraphy. Due to very rapid evolution, conodonts can characterize relatively short intervals of time for biostratigraphy, and wide horizontal distribution of many pelagic taxa allows for worldwide correlations. There are, however, still significant problems concerning the stratigraphical distribution and global correlation of faunas. The problems were mostly caused by natural constraints (e.g., dearth of biostratigraphic information, environmental aspects), but also by various approaches to taxonomy and nomenclature of critical conodont taxa. Application of unsuitable chronostratigraphic units seriously distorted the global correlation. An especially complicated situation in this aspect is in the late Silurian and the early Devonian. Previous studies showed that the strata and faunas in the Prague Synform (Barrandian area, Czech Republic) provide the most promising means to resolve many complications and to contribute to accurate control of geological dating.

Long-time study of conodont faunas in the past years enabled detailed biostratigraphic subdivision of the Lochkovian and Pragian in the Barrandian area. Refined conodont biozonations were partly developed in cooperation with P. Carls (Braunschweig, Germany) and J.I. Valenzuela-Ríos (Valencia, Spain). The Lochkovian in the Prague Synform is subdivided into three parts: the lower, the middle and the upper, which are further refined and subdivided into (three or four) small-scale units using the binominal system (it is not an ancestor-descendent sequence). The boundaries between units of both orders correspond well to the boundaries between distinct parts of depositional sequences in the Požáry sections (Požáry section is a standard for biostratigraphic correlation of the Lochkovian in the Prague Synform). We chiefly follow the initial three-fold subdivision of the Lochkovian proposed by Murphy & Valenzuela-Ríos (1999). The proportional discrepancy is seen in the upper parts of the proposed scale. The upper interval, characterized by the entry of *Masaraella pandora* beta, is proportionally very short and forms less than 10% of the Lochkovian succession. Detailed microfacies study of the Požáry section supported by geochemical data, MS and GRS logging did not reveal any indication of strong condensation or larger gap in sedimentation. Moreover, the same situation can be observed also in other sections (e.g., Čertovy schody, Branžovy), where the last taxa of *Ancyrodelloides* disappear close below the base of the Praha Fm. Conodonts in the Praha Fm. are relatively scarce and most species are largely confined to peri-Gondwana. The Pragian in the original sense (= Praha Formation) in the Prague Synform is subdivided into three parts (the lower, the middle and the upper), that are characterized by conodont biozones (Slavík 2004). Conodont stratigraphy of the Zlichovian is still very complicated due to difficulties with the Pragian/Emsian GSSP and different taxonomical concepts of index taxa; it is a subject of further studies and international discussion. The upper Emsian (Dalejan) conodont biozonation in the sense of Klapper (1977) remains unchanged.

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New data on the stratigraphy of the Jurassic–Cretaceous boundary in the Polish Lowlands

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Up to now, the Jurassic–Cretaceous boundary in the Polish Lowlands was established according to schemes of the Boreal Realm and it placed between the Volgian stage and Riazanian stage (Dembowska & Marek 1976; Marek 1997). The International Commission on Stratigraphy accepts the Tethyan divisions of this boundary as the obligatory for all Realms. This boundary is located between the Tithonin and Berriasian stages and it corresponds to the boundary between the Middle and the Upper Volgian in the Boreal Realm.

The study presents the summary of the micropaleontological investigation of the Lower Cretaceous deposits in wells from central Poland in the Warsaw Trough (Gostynin IG 1, Łowicz IG 1, and Żychlin IG 3) and in the Łódź Trough (Sarnów IG 1, Koło IG 3, Banachów IG1) but also the northwestern Poland (Szczecin Trough, Strzelno IG1 and Oświno IG1). This concerns the older Berriasian deposits in the "Purbeckian facies". This sequence includes the lower parts of the Kcynia Formation, developed as sulphate-calcareous (Wieniec Member) and marly-calcareous sediments (Skotniki Member).

The biostratigraphic boundary between the Tithonian and Berriasian sedimentary sequences in the studied areas is based on the inverstigations of the ostracod genus *Cypridea* that allowed for its more precise definition, and in some cases revision of the sedimentary sequences. This microfauna allowed to distinguished English ostracods Zone of the Berriasian: *Cypridea dunkeri* Zone correlated with the ammonite *jacobi/grandis* Zone of the Lower Berriasian. The *Cypridea granulosa* Zone is equivalent to the Middle Berriasian *occitanica* Zone, while the sediments with ostracods of the *Cypridea vidrana* and *Cypridea setina* zones have been correlated with the Upper Berriasian *boissieri* Zone (Hoedemaeker 2002).

The ostracod *Cypridea dunke*ri Zone of the Lower Berriasian has been identified in the deposits of the Warsaw Trough (Gostynin IG 1 and Żychlin IG 3) in the region of Łódź Trough (Koło IG 3) and in the Szczecin Trough (Strzelno IG1). This zone can be correlated with Polish local ostracod zones E, D, and C *sensu* Bielecka & Sztejn (1966), because of common species occurring both in the Purbeckian of Poland and England, that are *Cypridea inversa* Martin, *C. tumescens praecursor* Oertli, *C. peltoides peltoides* Anderson and *Cypridea dunkeri carinata* Martin.

The *Cypridea granulosa* Zone has been distinguished in the Middle Berriasian "Purbeckian facies" of the study areas. The correlation with the English zonation is difficult because of the different nature of the ostracod fauna and due to lithological discontinuities in the studied sections. In this paper, the B Zone of Bielecka & Sztejn (1966) with appearance of the index species *Klieana kujaviana* Bielecka et Sztejn is correlated with the English *Cypridea granulosa* Zone and is included to the Middle Berriasian. These parts of the Middle Berriasian sediments containing ostracods from genera *Klieana*, *Rhinocypris*, *Darwinula* and *Bisculocypris* represent probably the marine phase of the *Cypridea granulosa* Zone, characteristic of the "Cinder Beds" in the Purbeckian of England. The *Cypridea granulosa* Zone was recognized in the sediments of the Warsaw Trough (Gostynin IG 1 and Żychlin IG 3) and in the Szczecin Trough (Oświno IG1).

The *Cypridea vidrana* Zone was established for the lowermost part of the Upper Berriasian in the study sections. These sediments contain ostracods of the A Zone *sensu* Bielecka & Sztejn (1966) with the index species *Cypridea obliqua polonica* Sztejn and are correlated with the lowermost part of the English *Cypridea vidrana* Zone because of the presence of species *Cypridea obliqua* Wolburg, common in the Purbeckian strata of Poland and England (in Poland subspecies *C. obliqua polonica* Sztejn). The *Cypridea vidrana* Zone was recognized in the Warsaw Trough (Żychlin IG 3).

On the basis of the ostracods studies in the areas of the Polish Lowlands the new stratigraphic interpretation of the boundary of the Lower Cretaceous sedimentary sequence is proposed. The sediments with ostracods of zones E through B, included hitherto in the Upper Tithonian (Marek 1997) are assumed to represent the Berriasian. These deposits include lower parts of the Kcynia Formation, developed as sulphate-calcareous (Wieniec Member) and marly-calcareous sediments (Skotniki Member). The Jurrasic/Cretaceous boundary in the Warsaw Trough was also defined in terms of sequence stratigraphy (Dziadzio et al. 2004). In result, the biostratigraphic boundary between the Tithonian and Berriasian is largely equivalent to a sequence boundary and has been put at the carbonate-sulphate deposits of the Wieniec Member.

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Nuculoids (Bivalvia) from the Sarka formation (Ordovician, Darriwilian) in the Prague Basin

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Nuculoids are a group of bivalves with simple shell, taxodont teeth, protobranch gills and enlarged foot. They are evolutionary and phylogenetically very important because they represent one of the root lineages of the bivalves. Several groups evolved from them. They have very simple shell and their systematics is extremely complicated. The specimens are often poorly preserved, some of the features are underestimated (teeth, muscle) while another overestimated (the shape of shell). There are also problems with orientation of shell. Sometimes anterior part is considered as posterior part and vice versa.

Nuculoids are quite abundant in the Sarka Formation (Ordovician, Darriwilian) in the Prague Basin. Barrande (1881) described from that unit the following species: *Leda bohemica*, *L. ala*, *L. incolata*, *Nucula applanans*, *N. dispar*, *N. faba*. Pfab (1934) assigned some of them to the genus *Ctenodonta* and described new genera such as *Praeleda*, *Praenucula*, *Pseudocyrtodonta*. The genus *Ctenodonta* is the most problematic among them because it is a "waste basket" for most of Paleozoic nuculids in fact. The complete revision of this genus was done by Pojeta (1988). In the Sarka Formation there are three species: *Ctenodonta bohemica*, *C. ponderata* and *C. applanans*. *C. bohemica* and *C. applanans* are very similar to each other while *C. ponderarata* differs from both. However, Pojeta (1988) assigned none of them to the genus *Ctenodonta.* Pojeta (1977) synonymized the genera *Praeleda* and *Praenucula* with *Deceptrix*. On the other hand the genus *Praenucula* was estimated to be valide by Tunnicliff (1982) and Babin & Gutiérrez-Marco (1991). Distinctions between *Praenucula* and *Deceptrix* are the following: the posterior teeth in *Deceptrix* are smaller and more numerous than the anterior ones, while in *Praenucula* the anterior and posterior teeth are similar in size and number. Umbo is situated in the posterior portion in *Praenucula* while in *Deceptrix* in the anterior part. Two subspecies of *Praenucula* have been described from the Sarka Formation: *P. dispar dispar* and *P. dispar expansa.* The latter one is the type species of the genus. Those two subspecies are so similar, that there is no reason to separate them. *Praeleda* has been placed in synonymy with *Deceptrix* for a long time. The differences between them are: *Praeleda* is longer than *Deceptrix*, the height of the *Praeleda* shell is similar to its length, and anterior adductor is more prominent. However, *Praeleda* and *Deceptrix* have the same type of the hinge (cardiolarid). Although it is very significant these two genera are considered now as independent. The reason for it is their stratigraphic ranges. *Praeleda* occurs in the Ordovician, *Deceptrix* is Devonian. Thus, the former is considered as ancestor of the latter genus. In the Sarka Formation there are three species of *Praeleda: P. compar*, *P. amica*, *P. pulchra.* The hinges of *P. compar* and *P. amica* correspond with the definition of hinge by Cope (1999). The hinge of *P. compar* is different and does not fit the definition. That is why this species apparently does not belong to the genus *Praeleda*. All the species mentioned above were most probably infaunal deposit feeders.

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Evolution of the Triassic temnospondyl *Gerrothorax*

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Although the *Gerrothorax* specimens from the Ladinian of Kupferzell were identified as *G. pustuloglomeratus*, some differences from the lectotype clavicle of that species may appear significant in establishing the course of evolution within the lineage. The *Gerrothorax* material from Kupferzell is abundant (150 individuals), almost each bone being represented by at several specimens of various sizes, including an almost complete articulated skeleton. The locality is younger than that of the type of *G. pustuloglomeratus*, which is the oldest known species of the genus and apparently represents the most primitive state in morphology of the posterior part of the clavicle. There seems to be a trend to widen this part in stratigraphic succession of *Gerrothorax* species from Europe. Some changes towards posteriorward elongation of the occiput in the skull, narrowing of the anterior lateral process of the interclavicle, shortening of the contact with clavicle in cleithrum (as compared with scapula) are also observable in the post-Ladinian part of the lineage. The material from Kupferzell may deserve separation in a new chrono(sub)species in the lineage: *G. pustuloglomeratus* (Ladinian), the Kupferzell species (Ladinian), *G. striopustulatus* (Carnian), *G. franconicus* (Norian), *G. pulcherrimus* (Norian), and *G. rhaeticus* (Rhaetian).

Overview of macrofloras from the Most Basin (Czech Republic) and their phytostratigraphical correlation within Central and Boreal Europe

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Floras from the Staré Sedlo Formation are not well documented in the Most Basin. Sediments of the Střezov Formation contain plant macrofossil assemblages from cores Bz 372, GÚ 111 and KV 15 that were related to the volcanic complex of the České středohoří Mountains and have been correlated with the floristic assemblages of Seifhennersdorf-Kundratice and/or Nerchau-Flörsheim. The lowermost part of the Most Formation, i.e. the Duchcov Member, is represented by relatively hete-rogeneous floras (i.e., Tuchořice, core JZ 44, Marianna Mine) containing no important phytostratigraphical markers. However, palynological data and analogous macrofossils from extrabasinal area (the Hlavačov Gravel and Sand) show affinity to the Late Oligocene floristic assemblage of Thierbach and/or the Early Miocene floristic assemblage of Witznitz. On the contrary, floras of the Holešice Member are distinctly richer and match coal facies and sandy delta facies. Floras assigned to the Upper Inter-Seam Beds (Čermníky, Holedeč, Nástup-Tušimice Mine) correspond to the floristic assemblage of Bitterfeld. Floras bound to the Libkovice Member (floras from the Břešťany Clay and the micaceous facies of the Krušné Hory Mountains) are correlated with the floristic assemblage of Bílina-Brandis on the basis of the occurrence of *Schenkiella credneri*. Floras from the sediments closely underlying the Lom Coal Seam still within the Libkovice Member are noteworthy in a distinct increase of thermophilous elements and thus may indicate the Early Miocene Climate Optimum that can be correlated with floras of the floristic assemblage of Eichelskopf-Wiesa. The floras of the Lom Seam (lowermost part of the Lom Member) contain only aquatic herbs associated with woody elements. The floristic character shows affinity to floras of the floristic assemblage of Františkovy Lázně-Kleinleipisch.

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Early Miocene conifer macrofossils from the Most Basin (Czech Republic)

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A systematic overview of the conifer macrofossils (leaves, cones, seeds and wood) from the Lower Miocene of the Most Basin (Czech Republic) is presented and nine natural units (botanical species) are defined, namely three species of *Pinus* (i.e., *P. engelhardtii* Menzel, *P. ornata* (Sternberg) Brongniart and *Pinus urani* (Unger) Schimper), as well as *Pseudolarix schmidtgenii* Kräusel, *Quasisequoia couttsiae* (Heer) Kunzmann, *Taxodium dubium* (Sternberg) Heer, *Glyptostrobus europaeus* (Brongniart) Unger, *Tetraclinis salicornioides* (Unger) Kvaček, and *Cupressospermum saxonicum* (Mai) Kunzmann. This is the first evidence of seeds of *C. saxonicum* in the Most Basin. Organs are rarely directly attached (pollen/seed cones attached to a twig, a cone scale with seeds), but rather found in direct (close) or indirect (distant) association. The conifers are also characterized in environmental context as elements of several different vegetation types, i.e. temperate riparian forest, mixed swamp forest and mesophytic forest (for fluvial and/or delta environments), and coniferous peat-forming swamp forest, mixed swamp forest and evergreen broad-leaved forest (for basin environment).

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Revision of Silurian scolecodonts from the Prague Basin (Czech Republic): a preliminary report

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Polychaete annelids represent a diverse group of animals that live in all Recent oceans. Species differ in appearance, life habit and other characters. Their role in the Recent benthic food chain is quite important and supposedly it was so in the past. The main significance is in recycling of the organic matter from the sediment, disintegration of the plant matter, preying on other animals and their body may represent an important source of nutrients for other organisms. Representatives of these worms live in fresh, brackish and sea-water being tolerant to changes in salinity. Classical subdivision of polychaetes into errant and sedentary families expresses two major modes of life (e.g. Ruppert et al. 2004).

Specimens of the errant and especially eunicemorph polychaetes are the most important in the fossil record, because of their jaws that have been called scolecodonts. These marine worms are usually freely moving predators, mostly living in a shallow environment (e.g. Michel & De Villez 1978). They first appear in the latest Cambrian. However, the main diversification of the group proceeded from Early to Middle Ordovician (Hints & Eriksson 2004) and in the Silurian this group was already diverse (Bergman 1989).

The size of scolecodonts, the most resistant part of the body, ranges from about 50 µm to several millimetres. These elements form a quite complicated jaw apparatus composed of a pair of ventral mandibles and several pairs of dorsal maxillae. Most probably, the maxillae are shed during the life because no growing structures have been observed (Olive 1980). That is one of the reasons why they are quite common in sedimentary rocks. Moreover, they are resistant to oxidation, thermal changes and to acids (Jansonius & Craig 1974).

The first reports on the fossil scolecodonts were published by Eichwald (1854), Massalongo (1855) and others. However, the term "scolecodont" was proposed later by Croneis & Scott (1933). In the Czech Republic, Kodym et al. (1931) confirmed first the presence of scolecodonts from the quarry "pod Koledníkem", Barrandian area. Afterwards, Žebera (1935) published a review of this group from the Czech Silurian and assigned the majority of them to *Arabellites perneri* Žebera, 1935. Šnajdr (1951) transferred this species to the genus *Kettnerites* Žebera, 1935.

Šnajdr (1951) collected thousands of elements of polychaete jaws from several Silurian localities. The most common species is *Kettnerites kosoviensis* Žebera, 1935. In addition, specimens of *Pernerites* cf. *giganteus* Žebera, 1935 and *Ildraites* (?) *budňanenisis* Šnajdr, 1951 were recognized. The main goal of the present research is to revise Šnajdr's and Žebera's scolecodont collections comprising specimens preserved on rock surface, which are housed in the National Museum in Prague and in the collections of the Institute of Geology and Palaeontology at the Charles University. The revision concerns also with new sampling at similar localities and comparison of the old and recently collected specimens.

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Caddisfly (Trichoptera) cases and associated trace fossils from the Oligocene lacustrine strata of King George Island, West Antarctica

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Cases of caddisflies, and associated trace fossils occur in the Oligocene Mount Wawel Formation (Point Hennequin Group *sensu* Birkenmajer 2001) of King George Island (South Shetlands, West Antarctica). The Mount Wawel Formation is composed of volcanoclastic yellow and gray tuffaceous sandstones and tuffs, which show mud cracks and ripple marks. They contain also fossil leaves of the *Nothofagus*-Podocarpaceae assemblage (Birkenmajer & Zastawniak 1989).

Several slabs of very fine-grained sandstones collected during the austral summer of 2006–2007 from the Dragon Glacier plant beds (informal unit introduced by Birkenmajer 1981; GPS co-ordinates: S 62°06.638; W 58°22.571) contain oblique, slightly curved, slightly tapering down, longitudinally striated open tubes, which lined with thin, brownish organic substance. The tubes are 1–3 mm wide and 20–30 mm long. They occur irregularly or in patches, locally only a few millimeters apart when crowded. Extrapolated density fluctuates around 500 tubes/m^2. In some bedding planes, top of the tubes is surrounded by crescentic marks pointing to a consistent direction of water flow. The tubes are interpreted as *in situ* preserved caddisfly larvae cases. Wall of the tubes contains very fine clastic grains and dark amorphic substance. Therefore, they can be ascribed to the ichnogenus *Terrindusia* Vialov & Sukatsheva (1976).

The bedding and parting surfaces of the beds with *Terrindusia* contain variable preserved, horizontal, winding trackways small invertebrates. They are 6–7 mm wide. Numerous leg imprints and undertracks point to arthropods. The leg imprints are oblique in respect to the trackway axis and located about 2 mm apart. Some of the trackways are dissected by a narrow median furrow.

Some surfaces are densely covered by smaller, winding trace fossils, which are seen mostly as a 2–3 mm wide double furrows. In better preserved, rare specimens, oblique, long leg impressions can be seen. They are located in alternated position about 8 mm apart. This points again to arthropods as the tracemakers. The trackway is about 10 mm wide.

A resting trace (undertrack) produced probably by the same tracemaker as for the former trace fossil is observed. The trace is 15 mm wide and 23 mm long. It displays imprints of three pairs of legs preserved as positive epireliefs, probably due to compactional pressure. In the rear part, an imprint of a forked body termination can be seen. Probably, this part of the body is responsible for formation of the double furrow. This suggest an insect, probably in a larvae stage.

There are also semi-circular, winding furrows, which are 2 mm wide. The can be ascribed to the ichnogenus *Helminthoidichnites* Fitch (1850), which can be produced by insect larvae or annelids in many environments.

Generally, the trace fossil assemblage belongs to the Mermia ichnofacies, which is typical of lacustrine sediments under permanent cover of water. The trace fossil assemblage point to a presence of caddisfly larvae living in stationary cases, probably filtering water for food, and to activity of moving benthic arthropods, probably insect larvae. It is not excluded that they belong also to caddisflies larvae going out of their cases. In any case, they require well oxygenated, fresh waters.

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Preliminary report on new finds of mesofossils of the Upper Cretaceous Klikov Formation (Southern Bohemia, Czech Republic)

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New mesofossil material comes from the Klikov Formation, which is a basal part of the South Bohemian Basins. The basins consist of two elongated depressions, the Třeboň Basin and the Budějovice Basin separated by the Lišov horst. Both subbasins extend south from Soběslav and Vodňany to Velenice (Czech-Austrian border) and they together occupy area of 2300 km^2. They are developed on the Moldanubian crystalline complex of the Bohemian massif. Sedimentation in both basins began in Upper Cretaceous and continued intermittently until Pliocene. The Upper Cretaceous (Coniacian–Santonian) deposits of the Klikov Formation are present in both basins with mean thickness 100–150 m. Sediments form irregular cycles consisting of three lithological types: A – light grey sandstone beds, B – red beds (sandy mudstone and sandy claystone), C – grey beds (sandstone and claystone) (Slánská 1976). Most plant fossils were found in grey beds. Fossil leaves from the Klikov Formation were described by Němejc (1961), Knobloch (1964), and Němejc & Kvaček (1975). Mesofossils (fossil flowers, fruits and seed) were described by Knobloch & Mai (1986), and the pollen by Pacltová (1961, 1981).

Mesofossils of the Klikov Formation are preserved as charcoal. Most species recognised so far can be assigned to taxa established by Knobloch and Mai (1986). The new fossils found in the Klikov Formation were identified as *Budvaricarpus serialis* Knobloch et Mai, *Caryanthus triaseris* Friis, *Caryanthus deltoides* (Knobloch) Knobloch et Mai, members of genera *Visnea*, *Eurya* and families Nymphaeaceae and Ericaceae. Preliminary studies using SEM have already allowed some reinterpretations of the original descriptions. In the case of the genus *Budvaricarpus* the reinterpretation shows the structure as an aggregation of fruits borne within a common bract. Each fruit is derived from a single epigynous flower with a distinct hypanthium and tepals. The individual flowers/fruits of *Budvaricarpus* are similar to flowers/fruits of *Caryanthus*.

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Stratigraphic position and age of the Mutne Sandstone Member of the Jaworzynka Formation (Magura Nappe, Outer Carpathians)

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The Mutne sandstones are typical for the western marginal Siary subunit of the Magura Nappe. They were first described under this name by Sikora & Żytko (1956) from the Mutne village. Similar rocks in the same lithostratigraphical position from the western part Siary Subunit were described by Buratan et al. (1959) as "the Łyska sandstones", and by Książkiewicz (1974) as the "Ropianka beds with the intercalations of arcose sandstones". Formalized lithostratigraphy of these deposits was proposed by Cieszkowski et al. (2007). Currently they have member status and are a part of the Jaworzynka Formation placed at the top of that formation. The Mutne Sandstone Member is the lithosom dominated by thick-bedded (average 0.5–1.2m), medium- and coarse-grained sandstones. The shales associated with the sandstones form thin layers of several centimeters thick.

The age of Mutne Sandstone Member was dated by foraminiferal assemblages from the shale intercalations. They are described by Geroch et al. (1967), Sikora & Żytko (1960), Golonka & Wójcik (1978) as taxonomically poor, containing long-ranging species, typical for the Senonian–Paleocene interval. Finally, the Mutne Sandstone Member was attributed to the Paleocene based on both foraminiferal assemblages and the lithostratigraphic position within sedimentary sequence of the Magura Nappe profile (Chodyń 2002; Ryłko 2004, and references).

During 2006–2007 field-work the outcrops of the Mutne Sandstone Member was sampled in the type section, as well as the profiles from reference sections situated in Jaworzynka (Krężelka creek, a tributary of the Lachowka river) and in Kóków-Rzyczki hamlet. As a rule the samples contain well preserved agglutinated flysch-type foraminifera. In most cases the assemblages were taxonomically poor, thus difficult to use for age determination, but several samples in each case delivered more diversified assemblage of foraminifera. In these assemblages, apart from the dominate cosmopolitan forms, there were also biostratigraphically important taxa. These are typical Late Cretaceous–Paleocene interval forms, e.g.: *Glomospira diffundens* Cushman et Renz, *Annectina grzybowskii* (Jurkiewicz), *Caudammina ovula* (Grzybowski), *Hormosina velascoensis* (Cushman), *Remesella varians* (Glaessner), *Spiroplectammina spectabilis* (Grzybowski), *Rzehakina epigona* (Rzehak), *Rzehakina minima* Cushamn et Renz. The first occurrence of the most mentioned above species was in the Maastrichtian in the deep water Carpathian basins (Olszewska 1997; Kaminski & Gradstein 2005, and references therein). Sporadically, the assemblages contained the specimens of *Rzehakina inclusa,* (Grzybowski), which in this taxonomical configuration, characterizes the latest Cretaceous–Maastrichtian age. *Rzehakina inclusa* (Grzybowski) belongs to the biostratigraphic markers in the Carpathian flysch deposits (Olszewska 1997).

Very similar taxonomical composition of foraminiferal assemblages is known from the Jaworzynka Formation, situated just below the Mutne Sandstone Member. The sample from the bottom part of the Łabowa Shale Formation contains a typical Paleocene assemblage of the agglutinated foraminifera with *Caudammina ovula* (Grzybowski), *Hormosina velascoensis* (Cushman), *Rzehakina fissistomata* (Grzybowski), *Haplophragmoides mjatliukae* Maslakova and relatively numerous *Spiroplectammina spectabilis* (Grzybowski). Some samples contain numerous small specimens of *Glomospira charoides* (Jones et Parker).

The investigated foraminiferal assemblages indicate the Maastrichtian age of the Mutne Sandstone Member. It represents the upper part of the *Rzehakina inclusa* zone, *sensu* Olszewska (1997). It is possible that the uppermost part of the Mutne Sandstone

Member belongs to the Paleocene but there is no explicit paleontological evidence for this so far. The opinion that the Mutne Sandstones Member is partly Paleocene in age is thus based only on its position in the section and the above quoted references.

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Late Famennian Prionoceratidae (Ammonoidea) from Kowala (Holy Cross Mountains)

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The base of the present study are collections of prionoceratids from Kowala by Czarnocki, stored at the Museum of the Polish Geological Institute, Warsaw. The older collection (collection no.163.II. from 1949), has never been studied before, while the second one (collection no. 284.II.) was elaborated by Czarnocki in 1952. According to labels, all studied specimens were gathered from "gonioclymenia and wocklumeria layers". Because they have no precise stratigraphical position, the conodonts derived from the embedding sediment were studied.

Close to end of the Late Devonian the prionoceratids were represented by only four genera: *Prionoceras*, *Mimimitoceras*, *Rectimitoceras* and *Balvia*. The genus *Prionoceras* is represented in the studied material (coll. 163.II.70–74) by *P. divisum*

(Münster) and *P. sulcatum* (Münster), the species with discoidal or globose conchs. In *Mimimitoceras*, which has the same form of a conch, the shell constrictions are accompanied by an apertural shell thickening (Korn 1992). This genus is represented in both collections by: *M. fuerstenbergi* Korn, *M. lentum* Korn, *M. liratum* (Schmidt) and *M. varicosum* (Schindewolf), for the first time are described from the studied collections. The genus *Rectimitoceras*, in which "median and adult stage without shell constrictions and internal shell thickenings do not cause a regular shell tripartition" (Becker 1996) is represented by *R. substriatum* (Münster).

None *Balvia* species have been found in the Holy Cross Mountains until Dzik (2006) described two species: *B. prima* Dzik and *B. minutula* Korn from Ostrówka. Four species of *Balvia* from Kowala (coll. 284.II.), i.e. *B. lens* Korn, *B. minutula* Korn, *B. nucleus* (Schmidt), and *B. biformis* (Schindewolf) have been recognized here for the first time. The appearance of *Balvia lens* and related early *Balvia*-species without ventrolateral furrows marks the beginning of the international zones UD VI-B and *B. nucleus* – the beginning of the UD VI-C2 (Becker et al. 2002).

Except *B. prima*, all species of *Balvia* are known from *Wocklumeria* Genozone. The mentioned above prionoceratid ammonoids as well as clymeniids (coll. 284.II.) such as *Kalloclymenia pessoides* Bush, *Kosmoclymenia undulata* (Münster) from "gonioclymenia layers" indicate *Wocklumeria* Genozone. "The gonioclymenia layers" were erroneously named by Czarnocki in his original notes and later some remarks about this problem was given in Czarnocki (1989). Further, among the specimens labeled *Balvia lens, Epiwocklumeria applanata* Wedekind (284.II.385) was distinguished which is characteristic of the UD VI D of German ammonoid succession.

The conodont fauna from coll. 163.II. is poor and indicates the Upper *expansa*–Lower *praesulcata* Zones [*Tripodellus sigmoidalis* (Ziegler), *Tr. gonioclymeniae* (Müller), *Branmehla inornata* (Branson et Mehl) and *Neopolygnathus communis* (Branson et Mehl)]. *Tr. gonioclymeniae* as well as *Tolypammina rotula* Gutschick et Treckman are known also from the Jabłonna IG 1 borehole from the Midlle *Bispathodus costatus* Zone (Jurkiewicz & Żakowa 1967).

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Chitinozoa of the Silurian–Devonian transition in the Dnestrove section (Podolia, Ukraine)

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Chitinozoans (organic-walled palynomorphs) have proved to be most effective microfossils (together with conodonts, trilobites and graptolites) for biostratigraphy of lower Palaeozoic strata (Paris et al. 2000; Verniers et al. 1995). Based on rich, newly collected chitinozoans, I have examined the potential of these palynomorphs for precise biostratigraphy of the well documented Silurian–Devonian boundary sequences of the Dnestr River sections in Podolia, southwestern Ukraine (Nikiforova et al. 1972; Drygant 1984, 1994; Tsegelnjuk et al. 1983). Chitinozoan species reported previously by Obut 1973, Tsegelnjuk 1982, and Paris & Grahn 1996 from the same sections have now been re-examined in scanning electron microscope. Special attention has been paid to study the most complete and undisturbed Silurian–Devonian boundary sediments of the Dnestrove (formerly Volkovtsy) section (section no. 64, in: Nikiforova et al. 1972), which have been discussed and proposed as a candidate for the GSSP (Nikiforova 1977; Abushik et al. 1985; Koren' et al. 1989). Diverse and abundant assemblages of chitinozoans including *Urnochitina urna*, *Calpichitina annulata,* and *C. velata*, *Linochitina* cf. *klonkensis*, *Eisenackitina* aff. *E. krizi, Eisenackitina* sp., *Vinnalochitina* cf. *suchomastensis*, *Cingulochitina* sp., *Ancyrochitina* cf. *ancyrea*, *Ancyrochitina* sp., allow the recognition of the upper part of the Přidoli in the uppermost Skala horizon (Dzvenygorod beds) of the Dnestrove section. The chitinozoan data also indicate that the upper part of the Dnestrove section can be attributed to the lower Lochkovian. Lochkovian chitinozoan assemblage recovered in the Borshchiv horizon (Khudykivtsi and Mytkiv beds) includes: *Eisenackitina bohemica*, *E. elongata*, *Cingulochitina* sp., *Calpichitina annulata*, *Margachitina catenaria*. *Ancyrochitina lemniscata*, *Ancyrochitina* sp. aff. *A. aurita*, *Ancyrochitina* sp., *Pterochitina megavelata*, *Linochitina* ex. gr. *ervensis*, *Angochitina tsegelnjuki*, *Anthochitina* ex. gr. *superba*, *Anthochitina radiata*. In the Dnestrove section, the Silurian–Devonian boundary were established on the base of the FAD (First Appearance Datum) of the index species *M. uniformis angustidens* within the greenish-gray argillaceous shales and marls containing dark-gray limestone nodules of the Dzvenygorod and Khudykivtsy beds. This boundary can also be fixed by the FAD of the index species *Eisenackitina bohemica*, and *Margachitina catenaria*, and the LAD (Last Appearance Datum) of *Urnochitina urna*, and *Linochitina* cf. *klonkensis*. The occurrence of characteristic species such as *Calpichitina annulata, C. velata*, and *Eisenackitina bohemica*, *E. elongata*, *Margachitina catenaria*, *Anthochitina* ex. gr. *superba*, and *Anthochitina radiata* represent a clear accumulation zone within the Silurian–Devonian boundary interval. Diverse chitinozoan assemblages recognized in this study provide potential for the accurate correlation of the Silurian–Devonian sequences in Podolia with the international stratotype (GSSP section) at Klonk, Barrandian area, Czech Republic (Chlupač &

Hladil 2000), and comparable with sequences in Poland (Wrona 1980) and Estonia (Nestor 1994), as well as in other localities worldwide.

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Palaeontological modeling – classical recognition of genera and species in rugose corals vs. self-organizing Kohonen networks classification

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In the present study we analyze part of probably most extensive data base of mostly Frasnian massive phillipsastreid rugose corals. The data base, prepared by one of us (TW), contains specimens from different areas of the world in total number of about nine hundred specimens (Wrzołek 2007). Every single specimen is characterized by 27 features (about 24.000 biometric records). The current study has been aimed at (1) distinguishing of the genus *Frechastraea* Scrutton, 1968 from *Phillipsastrea* d'Orbigny, 1849 and *Scruttonia* Cherepnina, 1974; (2) distinguishing of species within the genus *Frechastraea*.

The classical taxonomy (TW): the database is analyzed to reveal any inhomogeities in distribution of its numerical and/or ordinal data, allowing for recognition of genera and species groups in the material studied, and then distinguishing of species within the genera or species groups. This sort of classification seeks for a few simple numerical and/or ordinal criteria, allowing to distinguish taxa from each other. The procedures outlined here have been employed recently for the *Phillipsastrea hennahii* species group and for the genus *Smithicyathus* (Wrzołek 2005, 2007). In case of the genus *Frechastraea* the distinguishing criteria, as found in the literature, are scarcity of horseshoe dissepiments and the pseudocerioid intercorallite wall. The use of these criteria alone (PP<0.4 and MUe3.5) allows for selection of over two hundred colonies; included are here also the representatives of *Phillipsastrea ananas* (Goldfuss, 1826) and some other, similar species with large corallites and spindle-shaped septa, rarely if ever assigned in the literature to *Frechastraea*. Additional criterion – DIC<6 restricts this number to 115 colonies, representing mostly the Upper Frasnian material most similar to *Frechastraea pentagona* (Goldfuss, 1826), the type species of the genus. Mixed with this material are the colonies described as species of the genus *Scruttonia*. In some cases various types of intercorallite wall can be observed in a single colony, so the MU criterion not always can be used to distinguish these two genera. As for the species of the genus *Frechastraea* there are numerous species names available for this material, possibly large part of these names has been used to denote variants within the broadly variable species; careful study of the present database (hopefully the ANN approach described below) can reveal some inhomogeneities of distribution of features studied, allowing for more objective distinction of species within the material established as *Frechastraea*.

The Artificial Neural Networks approach (ZR): the analytical procedure has been twofold. In the first step *k-means clustering* has been used to differentiate the data set (mostly the Upper Frasnian records) into two or three clusters that might represent the genera *Phillipsastrea*, *Frechastraea* and *Scruttonia*. In principle, the *k-means method* produces clusters of greatest possible distinction. Additionally, this method gives opportunity to see which of the features are taxonomically important and, conversely, which features can be rejected without changing the final results of classification. In our data set two clusters (I and II) were obtained, contrary to the previous generic classifications suggesting abandonment of the generic name *Scruttonia*. The cluster I contains 255 specimens, with representatives of *Phillipsastrea* dominating (220 specimens), there are also 30 specimens previously recognized as *Frechastraea* and 4 as *Scruttonia*. The cluster II contains 274 specimens, with representatives of *Frechastraea* dominating (177 specimens), there are also 74 specimens previously recognized as *Phillipsastrea* and 23 as *Scruttonia*.

Second step of analysis concerns recognition of species within *Frechastraea* (cluster II). In this step were used the artificial neural networks (ANNs) – software or systems that are able to "learn" on collected input data sets. ANNs give also opportunity to know and follow the real morphological closeness and relationship of distinguished morphogroups (?species) in analyzed multidimensional morphospace. That kind of relationships could be the base of evolutionary interpretations. The exploration of the self organized map, (an output layer of ANN) allowed to distinguish 13 concentrations of colonies. The previous species classification gave total number of 29 species. Consequently, the 13 morphogroups recognized herein consist of representatives of various species, with some of the morphogroups including types of different species.

ANNs together with other statistical methods are proposed here, as a tool in more objective palaeontological and taxonomical modeling, especially in classification problems. Initially ANNs arose form research on artificial intelligence and possess couple of very important features formerly recognized only in natural neural systems: (1) ANNs learn on examples; (2) ANNs are resistant to incompleteness of input data, and (3) ANNs are able to generalize the knowledge. They are commonly used in physics, geophysics, chemistry, biology, applied ecology etc; recently, one of us (ZR) successfully applied ANNs to classification of Late Cretaceous belemnites (Remin 2008).

Synthesys of classical and ANN classification (TW & ZR): let us consider a question which if any classification is more objective and as such should be given priority in settling taxonomical questions. Should we follow ANN classification, with its assumption of general equality of features, or should we follow classical taxonomy, with notion of rank of features, some being more important for classification, then the others. At the moment we are of the opinion that some balanced synthesys of these approaches can be the best solution. If we can give a general explanation for this, let it be as follows: the taxonomical procedures aim at reconstruction of phylogeny, which in itself can be composed of two major groups of processes: directional and predictable and chaotic and unpredictable. Possibly the classical taxonomy is most suitable to ordered and predictable phylogenies, which rarely if ever can be traced for longer time intervals. As for the history of our group, of the family Phillipsastreidae and particularly of the genus *Frechastraea*: it seems to be very short (its acme restricted to the Late Frasnian), and we do not see here any clear directional component, with apparently chaotic distribution of species and features.

By synthesys we mean reciprocal verification of results of the two taxonomies. There is a big chance that Kohonen networks can help the natural Remin's (or Wrzołek's) networks in detecting patterns in apparently chaotic matrices of numbers and symbols.

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Middle Miocene bryozoan event in the Carpathian Foredeep

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Middle Miocene bryozoan event represents massive accumulations of bryozoans which were described from different stratigraphical horizons of the Tertiary sediments in the Carpathian Foredeep and in the Vienna Basin. Middle Miocene calcareous rocks consist usually of corallinacean algae, larger foraminifera and in places also hermatypic corals. Laterally they may be replaced by bryozoans. Later molluscs dominated over bryozoans.

The Middle Miocene bryozoan event is characterized by short duration (usually between the FO of *Orbulina suturalis* and LO of *Praeorbulina circularis* it mean about 14.8–14.58 Ma). The beginning of the event is always marked by a very similar bryozoan association that consists mainly of erect cyclostomatous forms like *Tervia, Idmidronea* or *Eximonea,* sometimes with reteporids. The terminal bryozoan association is also similar everywhere and usually is characterized by cheilostomatous bryozoan like *Smittina, Metrarabdotos* and/or celleporids. The basal bryozoan associations are accompanied by foraminifera assemblage dominated by *Cibicidoides* spp. which are later replaced by epiphytic or large foraminifera.

Two factors could control the bryozoan event. Commonly it is believed that short-time climate deterioration is responsible for such bryozoan accumulations. More probable interpretation is that they may result from changes in trophic condition. Algae and corals are adapted to oligotrophic conditions, while bryozoans prefer mesotrophic or eutrophic conditions.

Bajocian–Bathonian (Middle Jurassic) bryozoans from the Polish Jura

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The Jurassic bryozoans of the Order Cyclostomata are poorly known. This is partly due to their patchy geological and geographical distribution, as well as the small size of many colonies meaning that they are often overlooked. In addition, the frequent absence of gonozooids (larval brood chambers) in Jurassic cyclostomes makes genus-level taxonomy very difficult. Thus, every new Jurassic bryozoan fauna is important because it may bring new data about their taxonomic composition in particular regions and environments. Here we present a preliminary investigation of Bajocian–Bathonian (Middle Jurassic) cyclostome bryozoans from Poland. These are particularly interesting because the Bathonian was the time of cyclostome peak of diversity in the Jurassic period. The highest assemblage diversities occur in the Bathonian of Normandy, France, which serves as a reference point for other Jurassic localities.

Middle Jurassic bryozoans from Bajocian–Bathonian ore-bearing clays of the Polish Jura (south-central Poland) are one of a few fossil groups that have never been investigated. A rich bryozoan fauna has been found encrusting hiatus concretions. These concretions occur at several horizons within the clay sequence and mark distinct pauses in sedimentation and/or episodes of erosion, during which various epi- and endolithozoans colonized the concretions. Nearly one hundred bryozoan colonies have been collected on hiatus concretions from the Upper Bajocian (Mokrsko locality) and Middle to Upper Bathonian (Ogrodzieniec, Żarki, Bugaj and Krzyworzeka localities). One-third of these colonies, however, are strongly abraded and/or devoid of gonozooids, preventing precise identification. Many of the sheet- or spot-like colonies of this type could be assigned only to the form-genus "*Berenicea*". The most abundant genus with 31 colonies was *Ceriocava*, occurring in the form of so-called "flabellotrypiform" and dome-shaped colonies. The Polish *Ceriocava* colonies, however, differ from the ubiqitous French species *Ceriocava corymbosa* and may in fact represent a new species. The second most numerous genus is *Microeciella*, characterized by sheet-like colonies and ovoidal gonozooids. This genus is represented by at least four species, differing in gonozooid shape, position of the ooeciopore, pseudopore shape and size, and autozooid size. Some are probably new species. Another genus with sheet-like colonies is *Hyporosopora*, characterized by broad, subtriangular gonozooids. Four species of *Hyporosopora*, one of which is new, are represented by six colonies. *Reptomultisparsa*, characterized by its elongate gonozooids, is represented by at least four species, one of which is new. Runner-like colonies occur in two species of *Stomatopora* that differ in the robustness of their zooids. The number of *Stomatopora* colonies, considered as fugitive opportunists, is low (seven colonies were found) in comparison with the sheet-like colonies that adopt a confrontational strategy in competition for substrate space. Only one fragmentary ribbon-like colony could be assigned to ?*Proboscinopora*.

The overall diversity of cyclostome bryozoans encrusting the Bajocian–Bathonian hiatus concretions from Poland is relatively high. Unfortunately, few examples of bryozoan-encrusted hiatus concretions are known from elsewhere for direct comparison. Repeated overturning of the concretions by high-energy events is evident in the abrasion of the bryozoan colonies, as well as in truncation of bivalve borings *Gastrochaenolites*. However, this disturbance does not explain the scarcity of gonozooids which are also infrequent in Jurassic cyclostomes from other depositional environments.

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Micrasterids (Echinoidea) in siliciclastic sediments of the Upper Turonian (Bohemian Cretaceous Basin): taxonomy, taphonomy, sedimentary environment, biostratigraphy

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In the northern part of the Bohemian Cretaceous Basin, the Late Cretaceous sedimentation was highly influenced by the northerly situated extensive Western Sudetic Island. This deeply weathered area were supplying huge amounts of sand to feed the deltas prograding southwards to the basin. The sand bodies laterally passed into clayey sand and, farther offshore, to marls and carbonate sediments, locally with abundant echinoderms. The hemipelagic marl and carbonate sedimentation was studied at Úpohlavy near Lovosice, west of the sandstone area. The more proximal clayey sand facies with echinoderms is best accessible at the eastern margin of the sandstone area, in the northern vicinity of the town of Jičín (Železnice-Těšín and Kněžnice sections). The correlation of strata in these two lithofacies is based mainly on ammonites and inoceramids, suggesting early Late Turonian age for the roughly isochronous strata with micrasterid echinoids. Comparing the macrofaunal taphocoenoses of the two areas, distinctive differences are apparent. Brachiopods, sponges, ophiuroids and crinoids are abundant in the western marl-dominated area but practically absent in the eastern area. Important ammonites shared by both areas belong to the upper part of the *Subprionocyclus neptuni* Zone. In the inoceramid zonation, they belong to the *perplexus*/*lamarcki* and *stuemckei*/*inaequivalvis* Zones. Regular echinoids with prevailing *Gauthieria radiata* (Sorignet) are rare everywhere, much like the cidarids. On the contrary, irregular echinoids are very important components of the taphocoenoses in both areas, even though they are fundamentally more abundant in the east. The hemiasterids are very abundant in the east but completely missing in the west. The micrasterids are more rare than hemiasterids in the eastern siliciclastic sediments, with occasional occurrence of the *Epiaster*-like species so far determined as *Micraster michelini* (Agassiz) accompanied by other, as yet poorly known micrasterid forms. In the marl-dominated western area, *M. leskei* Desmoulins occurs in an isochronous horizon (lower part of Hundorf limestones). The species *M. michelini* was probably better adapted to coarser substrates and more agitated environment. On the other hand, morphologically more advanced *M. leskei* inhabited the fine chalk-like bottom substrate. In the clayey sand areas, the echinoderm species diversity as a whole is apparently lower and the individual abundance is higher than in the marl-dominated areas. The species diversity may be, however, largely biased due to the unfavourable preservation conditions. The taphonomy of micrasterids differs substantially in the two areas. Palaeoenvironmental parameters are supplemented by foraminiferal and palynological data.

Investigations are still in progress (project 205/06/0842 of the Czech Science Foundation and project Z 30130516 of the Institute of Geology ASCR, v.v.i.).

Taphocoenoses of the Cenomanian/Turonian boundary interval: the case study of Plaňany, Bohemian Cretaceous Basin

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Marine faunal taphocoenoses of the Cenomanian/Turonian boundary interval (Bohemian Cretaceous Basin) have been studied for the last two decades. The studied localities are mostly situated at, or close to, the southern basin margin. They frequently represent the exhumed former rocky bottom elevations which, due to post-Cretaceous denudation, are isolated from one another and from the main basin. Cretaceous sediments partly fill rocky bottom depressions, and also cover elevated parts as thin relics. Although the hitherto studied outcrops always share common features, the age of the preserved sedimentary successions and faunal taphocoenoses is often different and may belong to different phases of transgressive-regressive events. A detailed study of each individual site is therefore necessary to give a realistic geomorphological, palaeoceanographic and even biotic development of a wider area. The case study at Plaňany, a large working quarry west of Kolín, central Bohemia, brought new data on this phenomenon. Considering mostly very complex palaeocommunity record, the taphocoenose approach was used to character-rize the preserved fossil assemblages.

The quarry at Plaňany is located in the centre of a crystalline rock elevation, originally completely covered by Cretaceous sediments. After the post-Cretaceous denudation, the remains of at least 2 transgressive-regressive events could have been distinguished based on sedimentological, macrofaunal, foraminiferal and palynological data. Seven well defined taphocoenoses have been preliminarily distinguished. Older (probably Late Cenomanian) taphocoenoses are as follows: 1) taphocoenose with oysters and rudists (*Rastellum diluvianum*, *Radiolites saxoniae*) in conglomeratic sand-dominated rocks; 2) taphocoenose with gastropods in hard micritic limestones. Early Turonian macrofauna occurs in the following well defined taphocoenoses; 3) taphocoenose with large oysters (*Hyotissa semiplana*, *R.* cf. *diluvianum,* etc.) in conglomerates, conglomeratic sandstones and sandy claystones; 4) taphocoenose with small oysters [*Ostrea* cf. *operculata*, *Amphidonte (Amphidonte) sigmoideum*], sponges (with abundant *Guettardiscyphia* sp.) and shark teeth and coprolites in dark grey claystones with glauconite; 5) taphocoenose with *Pycnogyra* in glauconitic coprolitic sediment (invertebrate coprolites); 6) taphocoenose with diversified sponges in light siltstones; 7) taphocoenose with *Atreta* and *Bdelloidina* – epifaunas cemented to the crystalline rock substrates adjoined to phosphatic crusts.

Some lateral differences do exist within most macrofaunal taphocoenoses and litho-logies, reflecting a special position in the sedimentary area, e.g., the distance of the exposed basement rocks, the presence of some type of local barriers etc. For example, taphocoenose 5 is locally enriched with roveacrinid crinoids and ichthyolits, taphocoenose 6 with brachiopods and small oysters [e.g., *Amphidonte (A.) reticulatum*].

Investigations are still in progress (project Z 30130516 of the Institute of Geology ASCR, v.v.i.).

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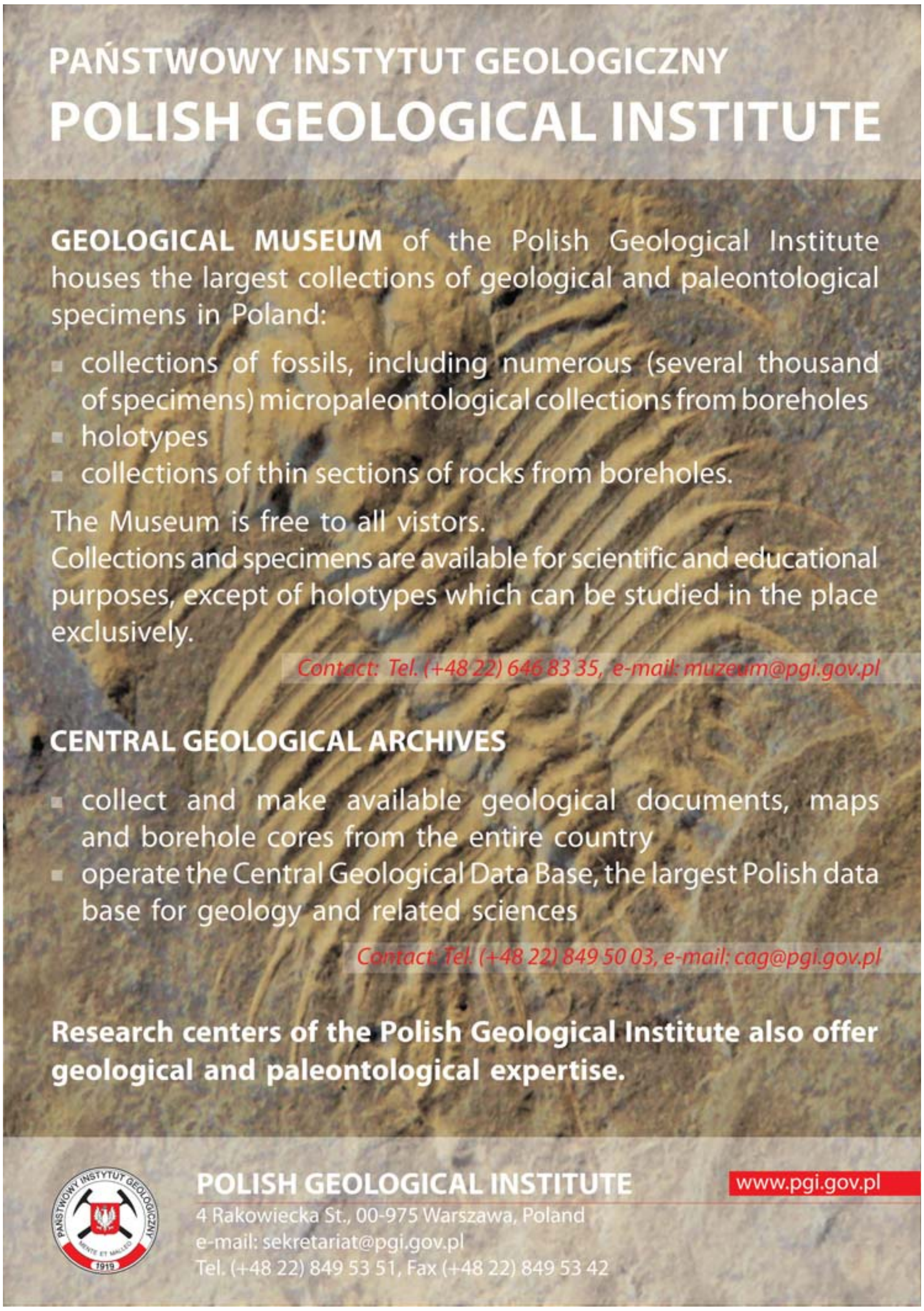

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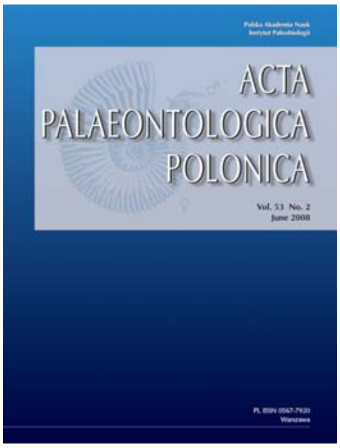

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