M. JAMRICH: **Vápnité nanofosílie sarmatu (vrchného seravalu) Dunajskej a Viedenskej panvy Západných Karpát "state of art"**

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Vápnité nanofosílie, zvyšky morských rias, veľmi citlivo odrážajú klimatické a paleoceánografické zmeny a sú dôležité pri určovaní veku sedimentov. V rámci Západných Karpát boli študované vápnité nanofosílie sarmatského veku z oblasti Dunajskej a Viedenskej panvy. Sarmat je korelovaný s vrchnou časťou zóny NN6 *Discoaster exilis* a spodnou NN7 zónou *Discoaster kugleri* (Martini, 1971). Sarmat v centrálnej Paratetýde korešponduje s vrchným seravalom v mediteránnej oblasti; konkom a spodným besarabom východnej Paratetýdy. K primárnym biostratigrafickým charakteristikám spoločenstiev vápnitých nanofosílií patrí absencia *Sphenolithus heteromorphus*, čo umožňuje vyčlenenie biozóny vápnitých nanofosílií NN6 a prvý objav *Discoaster kugleri*, ktorý indikuje biozónu NN7. Spodná hranica sarmatu je určená na základe posledného výskytu *Calcidiscus premacintyrei* a prvého výskytu *Calcidiscus macintyrei* a *C. pataecus*. Spodnosarmatský vek spoločenstiev vápnitých nanofosílií potvrdzujú prvé výskyty bentickej foraminifery *Anomalinoides badeniensis*.

Z hľadiska vápnitých nanofosílií sú indíciou sarmatského veku študovaných sedimentov západokarpatského neogénneho záznamu biohorizonty s dominanciou *Calcidiscus* spp. *(Calcidiscus macintyrei*, *C. tropicus*, *C. leptoporus)*, *Perforocalcinella fusiformis*; *Reticulofenestra pseudoumbilicus* (veľké variety); *Holodiscolithus macroporus*; *Braarudosphaera bigelowii bigelowii*, *B. bigelowii parvula*, *Sphenolithus abies*. Hranica sarmat/panón je datovaná na 11,6 mil. rokov, korelovaná s hranicou seraval/tortón v mediteránnej oblasti (Kováč et al., 2005). Sarmatské nanofosílie západokarpatského regiónu boli prvýkrát detailne preštudované vo vrte ŠVM-1 Tajná, v Dunajskej panve (Kováč et al., 2008). Na báze sarmatu bola určená zóna Calcidiscus macintyrei s. l., s podzónami: Calcidiscus macintyrei s. s.; paraakmé Calcidiscus macintyrei; Calcidiscus macintyrei s Perforocalcinella fusiformis. Vo vrchnom sarmate boli stanovené podzóny: Braarudosphaera bigelowii parvula a Sphenolithus abies. Prvý rozsiahly výskum vápnitých nanofosílií sarmatského veku Viedenskej panvy bol uskutočnený v rámci multidisciplinárneho štúdia sedimentov vrtov situovaných v oblasti Malacky a Jakubov. Koreláciou definovaných spoločenstiev vápnitých nanofosílií s foraminiferami bolo možné stanoviť predbežnú stratigrafickú pozíciu a paleoekologické interpretácie. Doteraz boli identifikované biohorizonty s dominanciou: *Calcidiscus* spp. *(Calcidiscus macintyrei*, *C. tropicus*, *C. leptoporus)*; *Reticulofenestra pseudoumbilicus*; *Perforocalcinella fusiformis*; *Braarudosphaera bigelowii parvula*; *Holodiscolithus macroporus*. Niektoré biohorizonty boli určené aj v oblasti východnej Paratetýdy, čo poukazuje na možné krátkodobé spojenie paniev centrálnej a východnej Paratetýdy v tomto období.

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Environmental, Structural and Stratigraphical Evolution of the Western Carpathians

WECA CONFERENCE

Environmentálny, štruktúrny a stratigrafický vývoj Západných Karpát

Bratislava, 2. – 3. 12. 2010

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Abstract: *The article reports about the ESSE WECA conference held in Comenius Univ. Bratislava on 2. – 3. 12. 2010 and presents 40 abstracts of lectures and posters.*

Key words: *International conference ESSE WECA, Western Carpathians, Bratislava, Slovakia*

The traditional international conference ESSE WECA with biennial periodicity was organized by the Department of Geology and Paleontology in the Faculty of Natural Sciences together with the Geological Club in Comenius University Bratislava. Both, oral and poster presentations were held in the AMOS room of Comenius Univ., Mlynská dolina, on 2. – 3.

Tradičnú medzinárodnú konferenciu ESSE WECA s dvojročnou periodicitou zorganizovala Katedra geológie a paleontológie spolu s Geologickým klubom na Prírodovedeckej fakulte UK v Bratislave. Prednášky i posterové prezentácie boli v miestnosti AMOS na PriF UK v Mlynskej doline 2. a 3. decembra 2010. Zaregistrovaných bolo 51 účastníkov

December 2010. Altogether 51 participants from Slovakia, Czech Republic and Poland were registered for the conference. Presentations were divided into four thematic groups:

1. New knowledge about the geology and tectonic evolution of the Pieniny klippen belt and the Flysch belt

2. New knowledge about the geology and evolution of the Carpathian Neogene basins and the Foredeep

3. Paleontology, sedimentology and stratigraphy of the Western Carpathian sedimentary sequences

4. New knowledge about the crystalline basement of the Western Carpathians

The foreign and Slovak participants evaluated the conference with 28 lectures and 20 posters very positively, concerning the logistics and the high scientific level of presentations. The event took place in a friendly, partially already the pre-Christmas atmosphere.

konferencie zo Slovenska, Českej Republiky a Poľska. Prezentácie boli zaradené do štyroch tematických okruhov:

1. Nové poznatky v geologickom a tektonickom vývoji Pieninského bradlového pásma a flyšového pásma

2. Nové poznatky o geológii a vývoji karpatských neogénnych bazénov a čelnej karpatskej predhlbne

3. Paleontológia, sedimentológia a stratigrafia sedimentárnych sekvencií Západných Karpát

4. Nové poznatky o kryštalinickom podloží Západných Karpát

Na konferencii bolo odprezentovaných 28 prednášok a 20 posterov. Zahraniční aj domáci účastníci hodnotili konferenciu veľmi kladne po organizačnej stránke, ocenili aj vysokú vedeckú úroveň prezentácií. Podujatie prebiehalo v priateľskej, sčasti už príjemnej predvianočnej atmosfére.

Fig. 1. Participants of the ESSE WECA conference in the AMOS room of Faculty on Natural Sciences. Photo E. Halásová.

Obr. 1. Účastníci konferencie ESSE WECA počas prednášky v miestnosti AMOS na PriF UK. Foto E. Halásová.

Fig. 2. Part of the participants of ESSE WECA conference during the reception in the hotel Družba. From the right: J. Michalík, Š. Hladilová, E. Halásová, D. Reháková, M. Smrečková, V. Némethová, Z. Keblovská, S. Ozdínová. Photo M. Gregáňová.

Obr. 2. Časť účastníkov konferencie ESSE WECA počas recepcie v zariadení hotela Družba. Sprava: J. Michalík, Š. Hladilová, E. Halásová, D. Reháková, M. Smrečková, V. Némethová, Z. Keblovská, S. Ozdínová. Foto M. Gregáňová.

ESSE WECA
Abstracts/Abstrakty

M. BĄBEL[1], D. OLSZEWSKA-NEJBERT[1], A. BOGUCKI[2] and A. YATSYSHYN[2]: **The unique record of the Badenian salinity crisis in the northern margin of the Carpathian Foredeep**

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The Badenian (= Wielician) salinity crisis in the Central Paratethys was a time of transformation during which several formerly marine basins and subbasins of the Carpathian and circum-Carpathian regions became evaporite basins due to restriction of their connection with the Mediterranean Sea. The evaporite deposition was usually preceded and followed by the Badenian marine sedimentation. The record of the Badenian salinity crisis in the basin of the Carpathian Foredeep (in Ukraine and Poland) consists of gypsum and halite deposits, and is particularly well exposed along the northern margin of these basins, where the gypsum beds (less than 60 m in thickness) outcrop on the surface. The areal extent of these sulphates to the north is remarkably smaller than of both the under- and overlying marine Badenian deposits. It is clearly a result of evaporitic water/brine level fall in the marine basin followed by the rapid post-evaporitic marine transgression or flooding. The basin was presumably a saline-type basin, i.e. it was entirely cut-off from the ocean, and its water/brine level was situated lower than the global sealevel. The exposed gypsum deposits are mostly unaltered by the diagenesis (e.g. modifications by dehydration-rehydration processes) during burial and show exceptionally well-preserved primary sedimentary structures. These include: (1) crusts of bottom-grown grass-like gypsum (= selenite) crystals (some up to 3.5 m in length), (2) variants of gypsum microbialite and selenite domes (some several meters in size), (3) oriented structures produced by the growth of selenite crystals in the up-current direction of inflowing brine, and others. Certain beds within the layer-cake stratigraphy, interpreted to be isochronous or near-isochronous, are traceable in the outcrops over a distance of a few hundred kilometers, proving that these deposits formed in the entire basin at the same time. The presence of such aerially-extensive, well-preserved primary gypsum deposits makes the northern margin of Carpathian Foredeep unique among the other Badenian Paratethyan evaporite basins, the deposits of which are commonly poorly exposed, diagenetically modified, and unavailable for the direct study. Even in comparison with the famous Messinian gypsum evaporites of the Mediterranean, this basin is unique. It is much larger than any peripheral gypsum basin exposed along the margin of the Mediterranean and is practically undeformed by tectonics, as is usually the case of Messinian basins and subbasins.

M. BĄK: **Radiolarian records and environmental changes in the Western Tethys during the 1.8 Ma interval including the Cenomanian – Turonian oceanic anoxic event**

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The radiolarian fauna from the deep-water settings in the Umbria--Marche and the Outer Carpathian basins of the Western Tethys is used for interpretation of environmental changes during the late Cenomanian through the Early Turonian time interval. The frequency of 184 recognized species, thirteen of them newly described, has been processed and analysed.

The whole radiolarian set has been subdivided into six super groups, including 25 groups related to specific water masses. The assembled species represented various feeding preferences and ecological strategies. An increase of the radiolarian total number in the sediments related to the Bonarelli Level (BL) displays a positive correlation with an increase of phosphorus (P) content, and with a significant decrease in radiolarian diversity. Most of radiolarian species avoided levels with the high P content, in contrast to some species as *H. barbui* and *C. conara* increased significantly in the number of specimens. On the contrary, diversified radiolarian assemblages appeared at levels, directly preceded by a notable P increase, marking a period when the water system was saturated in relation to nitrogen.

The radiolarian abundance in the sediments was strongly related to their preservation during sinking in the water column and at the water/sediment interface, increasing significantly at levels, marked by the high pellet production. Thus, pelletization played an important role in the transport of radiolarian skeletons and their further preservation, irrespective to conditions of their growth.

Radiolarians experienced and responded to environmental changes during the 1.8 Ma around the Bonarelli Interval (BI). The Cenomanian – Turonian press extinction event – a period of unquestionable eutrophication represented by the BI, did not result in the great radiolarian extinction and turnovers. The radiolarian radiation preceded the BI by over 330 kyr. The extinction, directly connected with the OAE2 started *ca* 240 kyr before the end of the organic-rich sedimentation, coinciding with the onset of enhanced diatom frustules, recorded in the siliceous part of the BI. Since this period, a step-wise radiolarian extinction continued through the Early Turonian. Many of the radiolarian species previously considered as terminating during the BI, in fact outlived up to "post-Bonarelli" times, having their last occurrence above the BI or even in the Early Turonian. In the case of the radiolarian fauna, the Bonarelli period caused the disappearance of many Lazarus taxa, which returned in almost their initial state during 940 ky after the BI.

The current radiolarian study sheds light on the biological effects of anoxic events, indicating the role of the mesopelagic zone and oceanic circulation in nutrient exchange, which modulates and controls the OAE2. The mesopelagic zone played an important role in P sequestration and was responsible for the release of the most of P, leading to enhanced eutrophication of water column.

M. BARSKI, B. A. MATYJA and A. WIERZBOWSKI: **On the age of "black flysch" (Szlachtowa Formation) in the Podubocze sections near Czorsztyn, Pieniny Klippen Belt of Poland**

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The studied deposits of the dark coloured calcareous shales with the subordinate intercalations of micaceous sandstones are exposed in two unnamed creeks at Czorsztyn Dam Lake at Podubocze near Czorsztyn. These deposits have been studied by Birkenmajer (1957, 1963) who used the term "flysch Aalenian" for all these strata (replaced later by the Szlachtowa Fm., Birkenmajer, 1977) and included them into the Upper Toarcian and/or lowermost Aalenian; he attributed the deposits from the sections studied to the Branisko Succession of the Klippen successions. Recently, the organic-walled dinoflagellate cysts from this section have been studied by Gedl (2008) who recognized two dinoflagellate cyst assemblages: the Upper Toarcian and the Lower Bajocian ones.

The lithology of the sandstones in thin-sections and composition of the organic-walled dinoflagellate cyst assemblages in the shale samples were analysed by us to make clear the stratigraphical position of the deposits in question, and their relation to deposits of the Branisko Succession. The sandstones show a large content of mica flakes as well as abundant lithoclasts, especially carbonates: the latter consist mostly of micritic limestones and dolostones possibly of Triassic age. There have not been encountered any clasts with microfossils or microfacies indicative of late Middle Jurassic to Early Cretaceous age. On the other hand, the shales yielded abundant dinoflagellate cysts including *Dissiliodinium giganteum* and *D. lichenoides* commonly occurring in almost all samples and indicative of the Lower Bajocian. Other cysts recognized, either show a wider stratigraphical range, or are evidently redeposited from older deposits (*Rhaetogonyaulax rhaetica* of Triassic age, *Wittnadinium minutum* of Early Jurassic age, *Parvocysta nasuta* of Toarcian to earliest Aalenian age). Some of the studied samples are markedly enriched in cysts of the genus *Nannoceratopsis*, such as *N. gracilis* – the species known from the Upper Pliensbachian to Bathonian – but represented by specimens which differ markedly in maturity of the organic matter as evidenced under the UV light. This may suggest that *Nannoceratopsis* cysts are partly also redeposited. It may be concluded that the Szlachtowa Formation in the Podubocze section yields dinoflagellate cyst assemblages with an age-indicative forms proving Early Bajocian age of the deposits in question, but with a marked admixture of older redeposited forms (from Triassic to Aalenian). Gedl´s (2008) concept on Toarcian age of some deposits in the studied sections has been based thus possibly on redeposited material.

It should be remembered, however, that the deposits in the studied section differ markedly from coeval, the Early Bajocian deposits of the Branisko Succession in the Pieniny Klippen Basin – i.e. the Harcygrund Shale Fm., which does not show any features of the flysch sedimentation. It stay thus an open question – whether the deposits studied in the Podubocze section represent really the Pieniny Klippen Basin succession or they belong to the Magura Basin succession?

M. CIESZKOWSKI, T. KYSIAK, A. ŚLĄCZKA and A. WOLSKA: **Olistoliths of gabbro from Osielec (Magura nappe, Outer Carpathians, Poland)**

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In the Rača Subunit of the Magura nappe a gabbro block has been found by prof. M. Książkiewicz in Osielec village. This block occurred there close to outcrops of the Osielec Sandstones. It was later described by prof. T. Wieser (1952) as "the ophiolite from Osielec" (*Annales Societatis Geologorum Poloniae*, 21, 319 – 327). Several years ago Wieser tried to revise his petrological investigations of this gabbro, but the described block has disappeared from its previous placement, probably completely exploited by the local farmers. Authors studied the geology of the Magura nappe in Osielec and its surroundings, and in 2009 during detailed field investigations new outcrops of the Osielec Sandstones were discovered and within these sandstones there was an olistostrome. It is represented by the debris flow deposits with pebbles of different exotic rocks as well huge olistoliths representing the older Magura flysch deposits, e.g. Eocene variegated shales. Within the exotic rocks there are blocks of gabbro (1 – 4 m in diameter). In Osielec section, the Osielec Sandstone Member intercalates the Beloveža Formation (Hieroglyphic beds) being Middle and Late Eocene in age. This formation is stratigraphically underlain by the Łabowa Shales Formation (Early and Middle Eocene) the Ropianka Formation (Senonian-Paleocene) and is overlaid by the thick-bedded sandstones of the Magura Formation (Late Eocene – Oligocene).

The gabbro is metamorphosed; therefore its structure is partly granoblastic. The rock is green or dark-green with macroscopically visible grains of light-green feldspar and dark-green amphibole. Preliminary petrological research indicates that the studied gabbro blocks are composed of albite (ca 65 %), epidote, chlorite and hornblende as main minerals; titanite, calcite, clinozoisite, zoisite and quartz as subordinate; as well as ilmenite, leucoxene, hematite and zircon as accessoric.

Discovery of the gabbro olistoliths within the Magura nappe is important for the paleoreconstructions of the Magura Basin. It is supposed that the basement of the basin consisted of oceanic crust. However this idea is not yet sufficiently proved. Investigated gabbro could represent ophiolitic succession, the presence of which may confirm existence of oceanic crust in general. The determination of the absolute age of this gabbro has been done. If the age of gabbro would correspond to Alpine Orogeny, it could be an important proof of the existence of the oceanic crust in the basement of the Magura Basin. If not, the gabbro could be attributed to the Variscan basement of the Pre-Carpathian paleogeographic area where the Carpathians basins were later formed.

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M. CIESZKOWSKI[1], A. ŚLĄCZKA[2] and A. WAŚKOWSKA[3]: **Eocene olistostrome in the Silesian nappe at the shore of Rożnów Lake, Outer Carpathians, Poland**

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One of the big olistostromes that occur within the Silesian nappe is well cropped out at the cliff of eastern shore of the Rożnów Lake, between the villages Sienna and Lipie. The olistostrome placed within the Hieroglyphic Beds (thin- and medium-bedded sandstones and shales of the Middle and Late Eocene) of the Silesian Series is more than 100 m thick. In the lithostratigraphic section, just below the Hieroglyphic Beds, lie thick-bedded Ciężkowice Sandstones and Variegated Shales (Early and Middle Eocene), and above them the Green Shales, the Globigerina Marls (higher Late Eocene), the Menilite and Krosno beds (Oligocene). The olistostrome is built up of pebbly sandstone debris-flow with scattered exotic rocks 2 – 15 cm of diameter, occasionally up to 30 cm, that are represented by the grains and blocks of quartz, gneisses, granitogneisses, lydites, sandstones, conglomerates as well as of Jurassic limestones and Cretaceous marls. Calcareous armed balls occur there also. Within the debris-flow there are frequent clusters of chaotically arranged clasts of shales separated by thin layers of coarse sandy matrix and these clusters look from the distance like shaly packets. Additionally there occur olistoliths from a few up to several tens of meters long and up to several meters thick. These olistoliths are represented by the Hieroglyphic Beds-like packets, blocks of the Ciężkowice Sandstones and variegated shales. Variegated shales form an olistoplaque a few hundreds meters long. There also occur soft Eocene marls, and light, middle-bedded, quartzitic sandstones and thin- and medium--bedded sandstones rich of carbonate detritus. Especially interesting are the blocks of grey-greenish soft marls with foraminiferal assemblages including *Miliolidae*, which are characteristic for the upper slope and even outer shelf environment. Near the top of the olistostrome the deposits become very chaotic. Some of the shaly-sandstone olistoliths display plastic fold deformations (submarine slumping folds). Studies of paleocurrent directions and the vergence of slumped folds show that material of the olistostrome has been derived generally from the south from tectonically active northern slope of the Silesian Ridge.

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M. CIESZKOWSKI[1], J. GOLONKA[2], J. KOWAL[3], M. MIKA[4] and A. WAŚKOWSKA[5]: **Ostravice Sandstones in Poland (Outer West Carpathians, Silesian nappe)**

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The Ostravice Sandstones were described in the Czech and Czechoslovak literature as a lithostratigraphic unit occurring in the Silesian Series profile above the Lhoty Formation and below the Godula Formation in the Silesian-Moravian Beskidy (presently Czech Republic). They were not mentioned in the Polish literature to this time. According to the present authors they occur also in the Polish sector of the Outer Carpathians. They spread out on the distance 200 km in the Silesian nappe between Ustroń (near the Poland-Czech Republic border) and Tuchow areas, where they were encountered east of Biała River in the Brzanka range.

Their presence was noted by the presented authors in the northern Silesian Beskid foothill, in Ustroń-Poniwiec quarry among the others, as well as in the Rożnów Foothills area, in Czhów among the others. These sandstones commence the Godula Formation, forming thick complex within lower Godula Beds. According to the presented authors, this complex containing thick-bedded sandstones, represents lithostratigraphic unit – member in the lowermost part of the Godula Formation. In Silesian Beskid, it is built of thick- and very thick-bedded amalgamated sandstones, almost entirely without shakes intercalations. The sandstones are mostly massive, coarse-grained or conglomeratic, sometimes with conglomerate layers or lenses. The complex thickness decreases eastwards and shales intercalations occur more frequently within the trick-bedded sandstones. The olistoliths of Lhoty and Verovice formations were encountered within the described complex in the Ustroń area. The size of these olistoliths varies from dozen to 200 meters. The occurrence of numerous carbonate clasts, mainly pelitic limestones, and few millimeters to dozen or so centimeters in size is characteristic feature of Ostravice Sandstones. The sandstones´ age was estimated as Coniacian-Santonian. The microscopic observations revealed quartz as main component, glauconite is also abundant, with less frequent micas (muscovite and biotite) and quite rare feldspars and heavy minerals.

Besides the monomineral grains, there occur clasts of magmatic rocks (mainly granitoids, sometimes rocks of rhyolite and basalt types), as well as carbonates and scarce sandstone, siltstone, cherts, siliceous limestones clasts with relics of fauna. This composition is not really different from the typical composition of the

Godula Sandstones. The limestones within clasts in the Ostravice Sandstones are represented by grainstones and wackestones, rarely packstones (pelbiosparites, biomicrites, biopelmicrites, oosparites, and intrabiosparites). These limestones partly contain more or less recognizable microfossils, which enable defining the limestone age as latest Jurassic and earliest Cretaceous. Foraminifers, *Protopeneroplis ultragranulata* and *Scythiloculina confusa* among the others occur here, together with the abundant calpionellids, mainly *Calpionella alpina*, less frequently *Crassicolaria sp.* and other fossils. The calcareous dinocysts *Schizosphaerella minutissima* and *Colomisphaera heliosphaera* were observed in the clasts. Peloids, and coated grains, like ooids and cortoids occur frequently in the limestones.

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M. CIESZKOWSKI[1], J. GOLONKA[2], A. ŚLĄCZKA[3] and A. WAŚKOWSKA[4]: **Geological attractions of the Melsztyn Castle hill (Silesian nappe, Outer Carpathians, Poland)**

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The Medieval Melsztyn Castle is located on the hill above the Dunajec River valley, on the northern margin of Zakliczyn Depression. This fortification served as a home for powerful nobles as well as watchtower on the merchant´s route along the Dunajec River valley.

The castle hill provides interesting geological and geotouristical values. It is situated within the Silesian nappe, major tectonic unit of the Polish sector of the Outer Carpathians. The sedimentary succession of this nappe, on the hills surrounding Zakliczyn Depression, is represented by the continuous profile of the flysch deposits, encompassing the Early Cretaceous – Oligocene age interval. The Istebna Beds form the stratigraphic basement of the Ciężkowice Sandstones. The Campanian-Maastrichtian Lower Istebna Beds are represented by the thick-bedded, coarse-grained and conglomeratic sandstones. The Paleocene Upper Istebna Beds developed as lower and upper Istebna shales separated by the upper Istebna sandstones. The Middle Eocene variegated shales, Upper Eocene Hieroglyphic Beds and green shales as well as Oligocene Menilite and Krosno Beds cover the Ciężkowice Sandstones. The Melsztyn Castle was built on the Ciężkowice Sandstones. These coarse-grained and conglomeratic sandstones form thick, massive amalgamated beds. They display sometimes a large-scale cross--bedding. This complex contains lenses or layers of conglomerates as well as debris-flow sandy-silty deposits with numerous conglomeratic pebbles and large exotic boulders. The sandstones from Melsztyn are unique, because they contain numerous limestone clasts and rhodoids. These rhodoids are scattered in the sandstone beds, or form layers and lenses thick to 30 centimeters. The limestone clasts, corals, molluscs, gastropods are associated with rhodoids. The older geological-cartographic papers assigned the sandstones from Melsztyn to Campanian-Maastrichtian upper Istebna sandstones. The occurrence of rhodoids, with typical Paleogene red algae assemblages as well as Paleocene assemblages of foraminifers with taxa typical for Rzehakina fissistomata *sensu* Olszewska, 1997, stratigraphic horizon, in the underlying Istebna shales contradicts these statements. The sandstones, which build the Melsztyn hill, were used in the castle construction therefore their numerous fragments can be observed in the walls of present-day castle ruin. Several imbricated tectonic scales occur within the Silesian nappe in the Zakliczyn Depression area. The Cieżkowice Sandstones of the Melsztyn area were included in the Jorków-Zakiczyn scale structure.

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M. GAŽI a R. AUBRECHT: **Geologická stavba oravského úseku bradlového pásma v okolí obce Istebné**

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Jurské a kriedové vápencové bradlá západnej časti oravského úseku pieninského bradlového pásma tvoria typický bradlový reliéf. Svoju dnešnú pozíciu nadobudli po tom, ako prešlo bradlové pásmo viacerými deformačnými fázami. Vzhľadom na vykonané práce je pravdepodobné, že bradlá sú nasunuté na pieskovce magurského príkrovu a jednotlivé bradlá sú len erózne zvyšky. V horninách bradlového pásma bola zistená SSV – JJZ až SV – JZ tenzia, SZ – JV kompresia a pole definované SV – JZ kompresiou a na ňu kolmou tenziou. Časová sukcesia nebola pozorovaná. V magurskej jednotke bola pozorovaná kliváž, ktorá pri vzniku zvierala s vrstvovitosťou 30°. Vrásy so subhorizontálnymi osami smeru SZ – JV sú preukázateľne mladšie ako kliváž. Poukazujú na SV – JZ smer kompresie. V sedimentoch podtatranskej skupiny možno pozorovať SV – JZ tenziu nasledovanú SZ – JV tenziou. Skúmané boli dva sedimentologické profily. Analýza profilu Revišné 1 poukazuje na zvláštny vývoj v kysuckej jednotke. Zvyčajná titón--beriaská kalpionelová mikrofácia je zastúpená rádioláriovou a rádioláriovo-špongiovou mikrofáciou bez výskytu kalpionel. Vek hornín v profile Revišné 1 bol určený podľa spoločenstiev cýst. Súvrstvia profilu Revišné 2 sú v prevrátenom vrstevnatom slede a vekovo siahajú od titónu až po apt, pričom tento vekový rozsah v ostatných lokalitách czorsztynskej sukcesie chýba. Druhý profil je neobyčajný aj prítomnosťou krasínskej brekcie, ktorá bola doteraz opísaná len v púchovskom úseku bradlového pásma.

J. GOLONKA and J. RAJCHEL: **Neogene algae-bearing sediments in the Polish Outer Carpathians**

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During Badenian (Serravallian – Langhian) times, the Carpathian foreland basin continued its development partly on the top of the thrust front with mainly terrestrial deposits forming the clastic wedge. This clastic wedge along the Carpathians could be comparable with the lower, freshwater molasse of the Alpine Foreland Basin. During the Serravallian the marine transgression flooded the foreland basin – Fore-Carpathian Trough, the adjacent platform and the Outer Carpathian thrust units.

The calcareous algae played an important role as the rock--forming organisms in Serravallian of the Fore-Carpathian Trough, forming limestones consisting mostly of the red algae (with bryozoans and other organisms), so-called *Lithothamnium* limestones. The limestones occur in large areas of Upper Silesia, in Nida Trough, along the southern margin of Świętokrzyskie Mts., in Roztocze, and in separated lobes on the Carpathian Flysch. Several erosionally isolated lobes have been found along the northern margin of the Skole Unit of the Polish Outer Carpathians. They rest with the angular unconformity on the deformed and eroded flysch deposits. The red algae of littoral and sublittoral zone occur in the reef, fore--reef and back-reef facies, and in the extremely shallow, near-shore facies. The *Lithothamnium* limestones on the Carpathian flysch contain red algae belonging to family *Corallinaceae*. Their thalusses are built of cells with calcite or magnesium calcite walls. These cells are very small, some μm to several tens of μm in size. They form encrustments, often with branches. The genera and species of the fossils Miocene red algae were distinguished according to cell size, arrangement and spores, single or gather in sporangia or conceptacles. The calcareous algae play a major role in ecological and paleogeographic reconstructions. They determine shallow and littoral zones. The character of algal assemblages closely determines the facies environment – reef, lagoon, bahamite or others.

U. HARA and M. JASIONOWSKI: **Geochemistry and mineralogy of the bryozoans in the Sarmatian serpulid--microbialite reefs of the Carpathian Foredeep (SE Poland – W Ukraine)**

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Bryozoans constitute a significant component of the benthic assemblage of the Middle Miocene (Lower Sarmatian) serpulid--microbialite reefs of the Medobory and Roztocze regions (Paratethys, western Ukraine and SE Poland), occupying various ecological niches.

Their occurrence is attached to the facially different sediments such as microbialites, marly and silty facies as well as organodetritic sequences. Bryozoans contribute to the reef-framework, giving a privilege to two taxa of the *Fasciculipora sp.* and *Schizoporella tetragona*, as the frame builders, but their distribution in the reef is confined to some places, only. They are also common encrusters and important component of bioclastic or marly deposits within the reefs. Altogether 18 bryozoan species belonging to cyclostomes and cheilostomes were found. Cyclostomes are dominant taxa among which 8 genera have been distinguished such as *Crisia* Lamx. 1812, *Tubulipora* Lamarck, 1816, *Anguisia* Jullien, 1882, *Tervia* Jullien, 1883, *Entalophoroecia* Hermelin, 1976, *Ybselosoecia* Canu and Lecointre, 1933, *Fasciculipora* d´Orbigny and tubuliporine cyclostomes. The cheilostomes represented by three genera of *Schizoporella* Hincks, *Cryptosula* Canu & Bassler, and *Celleporina* Gray are characteristic component of the Sarmatian biota including 5 species where two of them are new for the science. Colonies of the *Schizoporella* genus form either large multilamellar and small, nodular encrustations within the Sarmatian reefs, but *Cryptosula* is a ubiquitous genus, facially independent, met in the marly, bioclastic and organodetritic limestones and it forms either incrusting or branched colonies.

The geochemical and mineralogical studies comprise the Sarmatian bryozoans composed of only the cheilostome taxa such as multilamellar and unilamellar ascophoran lepraliomorphs represented by the *Schizoporella* and *Cryptosula*. For the comparative purpose there have been analysed two specimens of the *Schizoporella* derived from the Adriatic Sea: *S. errata* from Venice Lagoon (Italy) and *S. dunkeri* from the waters off the Brusnik Island (Central Dalmatia, Croatia).

The Sarmatian cheilostome bryozoans are characterized by the medium-Mg calcite mineralogy. Skeletons of the *Schizoporella* genus show variable concentration of Mg (from 3 000 to 10 000 ppm) but *Cryptosula* contains medium admixture of Mg (4 000 – 6 000 ppm). It is generally slightly less than in the inorganic precipitates building the Sarmatian serpulid-microbialite reefs (8 000 – 12 000 ppm) – see Jasionowski (2006), but comparable to some recent calcite cheilostome bryozoans (Kukliński and Taylor, 2009). Sr concentration is usually quite high reaching from 200 to 2 500 ppm similarly as in the reef microbial precipitates. Skeletons of the Recent *Schizoporella* both from the brackish Venice as well from the normal--marine waters off the Brusnik Island show very high concentrations of Sr (7 000 – 9 000 ppm) and simultaneously low – Mg (300 to 1 000 ppm) what indicates prevailing aragonite mineralogy, frequent among the modern cheilostomes (see Kukliński and Taylor, 2009). Only some single analyses with very high Mg contents (like 30 000 ppm) prove a presence of the high-Mg calcite in some parts of the skeletons.

It is known that the Recent marine cheilostome bryozoans produce skeletons with varied mineralogy (calcite, aragonite or bimineral – see Taylor et al., 2009) controlled probably by such environmental factor as temperature. More variable mineralogy (with more aragonite) is typical of the warm low-latitude waters whereas in the colder circum-polar waters the skeletons are usually calcitic. The studied Sarmatian bryozoans exhibit medium Mg-calcite mineralogy similar to the recent colder-water analogues. It is unclear, however, if temperature alone influenced their mineralogical composition; it could be speculated that some other environmental parameters (such as the water supersaturation or increased alkalinity) played also a part. As it was proved in this study, salinity seems to exert no influence on the mineralogy and geochemistry of the Recent *Schizoporella*.

U. HARA: **Bryozoans in the Sarmatian reef of the NE part the Central Paratethys: Their paleobiology and distribution pattern**

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The Lower Sarmatian bryozoans represent an important constituent of the biologically-originated accumulations of the northern Carpathian Foredeep of SE Poland and the western Ukraine. The bryozoan biocenosis, their spatial distribution, and the colony growth pattern are very differentiated within the reefs. 18 species of cyclostomes and cheilostomes belonging to 9 families and 10 genera were recognized among the microbialite, organodetritic, silty, and marly facies. The bryozoans in the Sarmatian carbonate buildups show the patchy distribution pattern and their constructional role as frame-builders is limited. However, the most conspicuous element in the reefs contributes to the frame builders, mainly among the algae-dominated cryptic microhabits, formed by sequences of a densely packed algal laminae acting as a baffler and binder, where the bryozoans, serpulids and vermetids occur as the overgrowing organisms. Schizoporellids in the Medobory ecosystem perform the main constructional role and the multilamellar bioconstructions are evidently formed by the *Schizoporella tetragona* Reuss, 1847, recognized in the northern and central parts of the Medobory Ridge. The multilamellar constructions variable in shape and dimensions are often composed of many growth layers forming the hemispherical, spherical or large, irregularly-shaped 3-dimentional lumps. Within the colonies there are a few sequences of laminae of a length varying from 1.4 cm to 0.36 cm which may mark the sedimentological cycles, probably connected with the fluctuations of the sedimentary environment of the Sarmatian basin. In the internal structure of the colonies the horizontal, superposed, slightly bended laminar sheets are seen and the sequences of loosely packed concentric sheets with the rather rare associated organisms, confined to the interlaminar spaces, are observed. The small, dome--shaped colonies and laminar structures of *Schizoporella tetragona* up to 1 – 2 cm in length, were recognized in the Roztocze area and in the marginal part of the Medobory Ridge.

Two morphotypes of multilamellar schizoporellids, such as similar to crustones, which contribute to the frame construction, and small dome-shaped, similar to globstone type, are connected with environmental factors such as currents intensity and the availability of the substratum.

In contrast, the main frame-builder role in the Roztocze area is performed by the fasciculiporids, accompanied by the other branched colonies of the different taxa such as *Entalophoroecia* sp. and *Ybselosoecia typica* as well as the spherical dweller of *Celleporina rostrata* (Małecki). *Cryptosula terebrata* in the Sarmatian biota of Roztocze commonly occurs and acts as a binder, forming small, incrusting, unilamellar flat-shaped colonies of a length of zoaria up to 2 – 4 mm.

The morphology of bryozoan colonies (laminar, peat-shaped, mushroom-shaped, plate-like) seems to depend on their location in the Sarmatian basin and the hydrodynamic regime where the colonies grew. The development of schizoporellid and the celleporid bryozoan morphotypes within the Sarmatian reefs are subjected to specific physical and biological factors which control their distribution. Usually, these colony growth-patterns occur in the spatially restricted, transitional, geologically short-term settings, where the most of the bryozoans are not able to cope (see also Hageman et al., 2003).

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N. HUDÁČKOVÁ[1] and A. ZLINSKÁ[2]: **Lower Sarmatian foraminifers from marginal marine environments in the Malacky vicinity (Vienna Basin)**

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In the middle western part of the Slovak part of the Vienna Basin, the area of Malacky surroundings was studied for the reevaluation of the oil prospecting wells. In the paper we present results of foraminiferal assemblage separated from the Sarmatian (Upper Serravallian – 12.7 to 11.6 Ma) part of the well core sediments, focused on paleoecological interpretations of its lower part. Material was obtained from the well cores MZ 93, MZ 34, MZ 68, MZ 26, MZ 55, M1, MZ 87, drilled by Nafta a.s. oil company, the ZNV 11, ZNV 12, drilled by the State Geological Institute of Dionýz Štúr and JV5, JV19, JV8, drilled by EQUIS Ltd. The studied wells are situated in the centre of mentioned area in the Malacky town vicinity and two wells are situated in the Malé Karpaty foothill near the Pernek village. Sediments consist of clays, and silts with sandy layers, the sediments are sometimes bioturbated. Standard laboratory methods were used for the fossil separation. Foraminiferal tests were determined under stereoscope microscope and scanned by SEM microscope for the detail study of the test wall. For the paleoecological interpretations the dominance diagrams, equitability, counting of diversity indices (Simpson´s, Fisher α) was used. The multidimensional statistical methods as Cluster analysis and PCA analysis were also employed.

The studied sediments contained foraminiferal shells typical for the Lower Sarmatian. One of the most abundant species was the leading one for the Lower Sarmatian, *Elphidium reginum* d´Orbigny accompanied by *Anomalinoides dividens* Lucz., *Articulina sarmatica* (Karrer) and *Sarmatiella moldaviensis* Bogd. as well. The assemblages here generally dominated by elphidiids and ammonias, which are opportunistic and generally live in sediment as epifaunal or infaunal dwellers (Murray, 1991; Hayward et al., 1997). Based on statistical methods we could identify foraminiferal assemblages being typical by the dominance of species *Ammonia*/*Elphidium* (A/E), *Ammonia*/*Haynesina* (A/Hy), *Ammonia* (A), large elphidia (LE), *Anomalinoides badenensis*/*dividens* (Ab) and the assemblage dominated by small miliolids (sM). The most conspicuous assemblages are those with the highest dominance of *Ammonia* and *Elphidium* genera. The most dominant species herein, ammonias, are mostly detritivorous, living in eutrophic conditions, and sometimes even surviving short dysoxic events (Murray, 2006). The elphidiids are herbivores but they may be in some cases detritivorous also. In the studied assemblages, the keeled morphotypes (herbivorous, epifaunal) highly prevail in the lower parts of the studied well cores; the rounded elphidiids (detritivorous) prevail in their upper parts. Other dominant genus in some samples is *Anomalinoides*, presupposed the adaptation to the planktic or pseudoplanktic way of life, which requires a certain depth of water (Filipescu, 2004). The last identified assemblage consists of small miliolid taxa, which obviously live in the sandy to silty marginal environs, preferring climbing on algae and mostly tolerate hypersaline water (Gandhi, 2004; Murray, 2006). Foraminiferal associations identified in the sediments of the studied wells are typical for the shallow water environment of the various salinities. The mentioned assemblages more than stratigraphy mirror changes of the environmental factors. The alternating foraminiferal assemblages of the lowermost Sarmatian: *Ammonia*/*Elphidium* (A/E) and *Ammonia*/*Haynesina* (A/Hy) document very shallow water lagoon of nearly marine salinity. The association of the large elphidia (LE) documents deeper water well aerated of meio-oligotrophic environs. In the more central part of the studied area, the deeper water (more than 10 m) with sea floor probably with oxygen deficit was documented by the foraminiferal oligoassociations of the genus *Anomalinoides* and *Bolivina*. The upper part of the Lower Sarmatian sediments studied in the scope of this paper contains foraminiferal association with small miliolids (sM), typical for very shallow water environment of the normal marine or hyper saline lower marshes. The associations of *Ammonia*, *Ammonia*/*Elphidium* and small miliolids are alternating in the marginal parts depending of the nutrient and water supply.

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Š. JÓZSA[1], D. REHÁKOVÁ[1], E. HALÁSOVÁ[1] and M. SMREČKOVÁ[2]: **Late Barremian – Early Aptian microfauna and microflora from Podbielsky Cickov quarry (Orava sector of the Pieniny Klippen Belt), Kysuca Unit, Western Carpathians**

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Deep water sediments of the Kysuca Unit have been exposed recently in the Podbielsky Cickov valley near the Podbiel village. Microfaunal assemblages of foraminifers, dinocysts, calcareous nannoplankton, scarce radiolaria, sponge spicules and ostracods have been separated and documented from intercalations of dark to black marlstones, between frequently bioturbated majolica type limestone layers of Mráznica Formation. Scarce planktonic assemblage of foraminifers with the first occurrence in Late Barremian, containing small few chambered representatives of the genus *Globigerinelloides* (*Globigerinelloides* cf. *blowi* (Bolli) and *Hedbergella* (*Hedbergella aptiana* Bartenstein, *Hedbergella occulta* Longoria) is present. Some samples contained deep water agglutinated foraminifers *(Nothia, Glomospirella, Glomospira, Hormosina, Reophax, Subreophax, Pseudoreophax, Trochamminoides)* and scarce poorly preserved calcareous foraminifers *(Lenticulina, Laevidentalina, Gavelinella)*.

Events of the flourishing of calcareous dinoflagellates were identified in the samples as well. The cysts were studied by the optical microscope (Leica DM 2500 P) and SEM (Hitachi-S 800). The first observation confirms the presence of the cyst association in which *Colomisphaera vogleri* (Borza) dominated over the very seldom stomiosphaerid species *Stomiosphaera wanneri* (Borza), *Stomiosphaera* cf. *echinata* Nowak. Most of the washed samples are filled with the pyrite sometimes with calcite. In the micrite marly matrix (mudstones) average abundance of the dinocysts is from 1 to maximum 2 percents.

The study under the SEM revealed the pirumellid type of the ultrastructure of the cyst walls which is different from the radially oriented crystals of *Colomisphaera vogleri* described by Borza (1969). The preliminary results show two different cyst species belonging to *Pirumella multistrata patriciagreeleyae* (Bolli) and *Pirumella sp*.

Calcareous nannoplankton association is represented by the forms rather more resistant to the dissolution in most cases by *Watznaueria barnesae* (Black) Bukry and *Cyclagelosphaera margerelii* Noël and scarce *Rucinolithus sp*., *Nannoconus steinmannii steinmannii*, *Zeugrhabdothus embergeri* (Noël) Perch--Nielsen, *Cruciellipsis cuvillieri* (Manivit) Thierstein.

Some of the samples contained poorly preserved radiolaria represented by the genera of *Cryptamphorella*, *Archaeodictyomitra*, *Dictyomitra*. These radiolarians and most of the observed benthic foraminifers are of the deep water origin. The character of these associations indicates rather eutrophic environment.

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M. HYŽNÝ: **Eocene decapod crustaceans deposited in the Liptovské múzeum Čierny Orol in Liptovský Mikuláš (northern Slovakia)**

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The Borové Formation (Gross et al.,1984) of the Subtatric Group is known by the several crab genera (order Decapoda: infraorder Brachyura) coming from the several different localities, where the rocks of the Middle and Late Eocene are exposed. Remains of the decapod crustaceans from the Middle Eocene strata of Borové Fm. in the Liptovská kotlina Depression have been known since the work by Dornyay (1913) who reported the presence of *Harpactoxanthopsis quadrilobata* (Desmarest, 1822) at the locality Mních near the town of Ružomberok (Rózsahegy). Later, the presence of the species was confirmed by Lőrenthey and Beurlen (1929) as well as Papšová (1970). Lőrenthey and Beurlen (1929) mentioned two more species from the same area: *Raninoides fabianii* (Lőrenthey in Lőrenthey and Beurlen, 1929) and *Harpactocarcinus punctulatus* A. Milne-Edwards, 1862. Dornyay (1913) also reported decapods from the Upper Eocene strata of the Ružomberok area. He identified *Lophoranina bittneri* (Lőrenthey, 1902) and *L. reussi* (Woodward, 1866). However, the re-examination of the material presented here revealed the presence of *L. reussi* only. Additional indeterminate decapod remains at several other localities of presumed Middle to Late Eocene age of the Liptovská kotlina Depression were reported by Papšová (1970, 1975 and 1978).

Material presented here is that which was originally described by Dornyay (1913). Today it is deposited in the Liptovské Múzeum – Čierny Orol in Liptovský Mikuláš. One specimen of *H. quadrilobata* is deposited in Prírodovedné múzeum of SNM in Bratislava (SNM Z-277) which actually represents a near-complete female individual figured by Dornyay (1913, Pl. 2, Fig. 7) and later re-figured by Lőrenthey and Beurlen (1929, Pl. 9, Fig. 4).

The studied collection deposited in Liptovský Mikuláš consists of up to 30 specimens coming from several localities close to Ružomberok in the Liptovská kotlina Depression, namely Mních, Klein´s quarry and Kubala´s quarry. The material represents two taxa, *Lophoranina reussi* (Raninidae) and *Harpactoxanthopsis quadrilobata* (Zanthopsidae). In the latter, the sexual dimorphism is observable in the nature of abdomina. Both species represent the well-known European Eocene taxa. The present contribution gives new data on the material from Slovakia, which has until now been insufficiently described (Dornyay, 1913). As indicated by Lőrenthey and Beurlen (1929), the decapod crustacean association from the Eocene strata of Liptovská kotlina Depression consists of at least four different taxa (see above). Additional field works in the studied area may provide more data on the already known decapod association. This contribution should be considered as a part of the revision of the fossil decapod crustaceans deposited in Slovak museums, conducted by the author.

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M. KANIA: **Microstructural analysis of the shear zones from the crystalline core of the Western Tatra Mountains: Preliminary results**

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In order to improve knowledge about the Alpine age deformations of the Western Tatra Mountains crystalline core, the structural, microstructural and petrotectonic studies have started. The subject of the studies were the outcrops of faulted rocks developed during the multistage deformation processes in the brittle, brittle-ductile and ductile conditions.

Zones of these rocks were previously observed in the upper parts of the Chochołowska Valley by Skupiński (1975) and described as zones of tectonic greisenization. Cymerman (2009) points out their key role in the Alpine age evolution of the Western Tatra Mountains crystalline core.

Fault zones in the following, most important areas, were sampled: Długi Upłaz range – Rakoń hill – Wołowiec hill, Zabrat Pass, Trzydniowiański Wierch hill – Jarząbczy Wierch hill, Ornak ridge and Kopa Kondracka hill. Observations of structures were carried out in the outcrops and by the optical microscope as well as scanning electron microscope.

Analysis of structures and textures, especially of porphyroclast sizes, shapes and porphyroclast/matrix ratio allowed to describe not only various stages of brittle and ductile deformations, but also transition zones between these two shearing regimes in the collected material.

The obtained data allowed the determining of the presence of localized zones of mesocataclasites with a high proportion of the matrix in relation to the porphyroclasts at the top part of Ornak ridge. In the region of Rakoń and Wołowiec mountains the granitoids with the initial cataclasis and cohesive fault breccias were found. There are common contact zones between the different types of brittle fault rocks, i.e. cataclastic breccias and mesocataclasites. In many cases the polygenical deformed rocks with heterogeneous deformation traces were deformed. Structures show the brittle, brittle-ductile as well as ductile conditions of these deformations. In some cases structures of dynamic recrystallization by the subgrain rotation in the ductile conditions were observed, such as mylonitic S – C foliation, C´ shear bands and rotated porphyroclasts. These structures, as well as Riedel shears in the cataclasites, were applied as the shear sense indicators what allowed to determine variable directions of movement of structural domains.

J. KOWAL: **The Klęczany–Limanowa tectonic window (Outer Carpathians, Poland): New stratigraphical, mineralogical and paleontological data**

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Within the Klęczany–Limanowa tectonic window (Polish Outer Carpathians) the deposits of the Grybów Unit crop out. They are surrounded by the flysch deposits of the Rača Subunit of the Magura nappe, which thrust over the Grybów Unit here. Differences of lithostratigraphic development in this area enabled to distinguish northern and southern facial zones of the Grybów Unit (Cieszkowski, 1992). The southern zone of the Grybów nappe thrusts over the northern. Detail mapping of the investigated eastern part of the Klęczany–Limanowa tectonic window and its surroundings distinguished a few local tectonic structures: folds, thrust–sheets and transversal faults, occuring in this window especially in the southern zone of the Grybów Unit, which is tectonically more complicated. Four small thrust–sheets were distinguished there.

The deposits of the northern facial zone are partly similar to deposits of the Dukla nappe, but there is also a supposition, that it is the innermost thrust-sheet of the Silesian nappe. The lithostratigraphic section of the southern zone of the Grybów Unit is represented by the Hieroglyphic Beds (Eocene), the Subgrybów Beds with one level of the Wola Łużańska Limestones (Oligocene), the Grybów Beds (Oligocene), the Krosno Beds (Oligocene) and the Klęczany Beds (?Miocene) with not clear stratigraphical position. In the section of the northern zone there were divided the Hieroglyphic Beds (Eocene) and Oligocene beds: the Grybów Beds, the Cergowa Sandstones and the Krosno Beds. The important achievements of that research are two finds of fossil remnants of fishes from the Oligocene deposits. The first was found in the Cergowa Beds (shaly olistolith of the Grybów Beds) in the northern zone of the Grybów Unit. The skull of this fish is characterized by extended, several centimeters long muzzle with a sharp triangle tooth on the both sides of it (it resembles a sawfish). The remnants of the second were found in the Krosno Beds of the southern zone of the Grybów Unit.

The Upper Cieszyn Beds, the Hradište Beds and the Veřovice Beds, Early Cretaceous in age, and so-called "tabular sandstones" considered as Late Cretaceous in age (Burtan, 1968) are cropping out below the deposits of the northern zone of the Grybów Unit. All these deposits were traditionally called "The Kurów Cretaceous". Three first divisions are known from the Silesian nappe, so for a long time there was thought that they arrived here from below of the northern zone of the Grybów Unit in the tectonic window. There are premises that these deposits do not form a tectonic window, but they are very large olistoliths in the olistostrome placed at the base of the Early Oligocene deposits of the northern Grybów Unit. The Late Cretaceous age of the "tabular sandstones" was estimated on the base of their position in interpreted lithostratigraphic section of the Grybów Series. Author has not got good results of micropaleontological data, because there were no foraminifers, coccoliths nor dinocysts in these deposits, but during the microscopic investigations the very distinct petrological similarities of the "tabular sandstones" and the Cergowa Sandstones were found. It allows to rate the "tabular sandstones" as a basal part of the Cergowa Beds. It would also be consistent with the idea that the Cretaceous strata in Kurów are olistoliths within the Cergowa Beds.

Some mineralizations were found in the field. Among others those were pyrites in the sandstones of the Lower Cieszyn Beds and jarosite in the Grybów Beds. Within joints of sandstones some traces of oil were noticed, being especially common in the Cieszyn Beds. Within the sandstones of the Cergowa Beds, in the open joints with calcite veins and bituminous traces, the Marmaros diamonds occasionally occur.

M. KROBICKI: **Bajocian crinoidal limestones of the Pieniny Klippen Belt in Poland: Their stratigraphical position and geotectonic significance**

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The Jurassic crinoidal limestones in the Pieniny Klippen Belt in Poland consist of three formal lithostratigraphic units: Smolegowa, Flaki and Krupianka Limestone formations. The first one is developed mainly by the white, massive (very rare as thick bedded) grainstones, sporadically with cross-bedding structures. The Flaki Limestone Formation is usually represented by the grey, thin bedded crinoidal limestones with multicoloured cherts. These limestones are facial equivalent of the Smolegowa Limestone Formation and occur in the Branisko Succession and partially in the Czertezik Succession, whereas the first one (Smolegowa Lst. Fm.) is typical for the Czorsztyn and Niedzica successions (occasionally in the Czertezik Succession; Birkenmajer, 1977; Krobicki and Wierzbowski, 2004, 2009; Krobicki, 2009 with literature cited therein). The Krupianka Limestone Formation is developed as the pink/reddish/red crinoidal limestones and overlies stratigraphically both crinoidal units mentioned above. All these crinoidal lithofacies are covered either by the red nodular limestones of the *Ammonitico Rosso* facies of the Czorsztyn and/or Niedzica Limestone formations (Czorsztyn, Niedzica and Czertezik successions) or by radiolarites of the Czajakowa and/or Sokolica Radiolarite formations [Branisko and Czertezik (partly) successions]. According to very detail biostratigraphical data, based on abundant ammonite faunas derived both from the base of the crinoidal limestones and the base of younger red nodular limestones, the stratigraphical range of these crinoidal limestones is limited to the late Early– to early Late Bajocian only (opposite to Birkenmajer, 2007). Thus, the start of the crinoidal sedimentation took place during the Early Bajocian time and was preceded by a marked stratigraphical hiatus, which occurs between underlying black shales of the Skrzypny Shale Formation (Krobicki and Wierzbowski, 2004, 2009; Krobicki, 2009 with literature therein) and the bulk of crinoidal limestones. This hiatus corresponds to the origin and uplift of the Czorsztyn Ridge, one of the greatest geotectonic reorganization within the Pieniny Klippen Basin during the whole Jurassic-Cretaceous history of this basin. Additionally, special sedimentary features (in the lowermost part of these limestones – 10 to 20 cm in thickness) – phosphatic concretions concentration, pyrite concretions, large clasts of green micritic limestones and numerous ammonites, indicate condensation episode at the beginning of the crinoidal limestones sedimentation. Such deposits represent an isochronic level even in sections where crinoidal limestones have completely different thickness (between 10 and 100 m) connected with the synsedimentary faulted blocks, contrary to opinion on the recent tectonic reduction of their primary thickness (comp. Birkenmajer, 1963, 1977).

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K. KRONOME: **Study of upper Triassic limestone in Drienčanský Karst area based on microfacies analysis – preliminary results**

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The Drienčany Karst is situated in the Western Carpathians, in the wider vicinity of the village Slizké in the Revúcka vrchovina Mts., in the southern part of the Slovenské rudohorie Mts. The Drienčany Karst belongs to the Inner Western Carpathians tectonic unit and is built by complexes of the Silica Nappe. The present study is mainly focused on the investigations of the Upper Triassic Hallstatt Limestones. Hallstatt Limestones extend on the both sides of the Kamenný jarok gorge between the villages Hostišovce and Slizké. In the northern part they extend to the southern margin of the Drienocká pustatina area, where they pass into the underlying Tisovec limestone. They are overlain by Neogene sediments and andesitic volcaniclastics. The Hallstatt Limestones are exposed on the surface in small areas near Budikovany and Drienčany villages.

Limestones on the locality Drienocká pustatina area are pink to grey, fine-grained, almost microsparitic packstones with peloids, thin--shelled bivalvias, echinoderms, agglutinated and hyaline foraminifers, thin-shelled ostracods and *Globochaetes*. The rocks are often bioturbated; they belong to FZ 2, SMF 9. On the basis of conodonts (Gaál, 1982) the limestones on the locality Drienocká pustatina area are upper Tuvalian to lower Norian in age.

On the locality Kamenný jarok (A) are present light grey, fine--grained limestones. In the upper parts they are represented by pinkish crinoidal limestones. In the lower part of the section are present mostly grainstones/packstones belonging to FZ 3, SMF 2 with echinoderms, agglutinated foraminifers, thin-shelled bivalvias and green algae. Peloids, lithoclasts and clasts with micritic aureole were also observed. This limestone is more shallow-water, its age is recently subject of study. The upper part of the section belongs to FZ 1, SMF 3 and is built by radiolarian and thin-shelled bivalvian wackestone.

On the basis of conodonts (Gaál, 1982) limestones on the locality Kamenný jarok gorge (A) sedimented in Alaunian up to lower Sevatian. Limestones on the locality Kamenný jarok (B) are light--grey, bedded and fine-grained with gray cherts and lumachelles. They are wackestones belonging to FZ 1, SMF 3 with radiolarians and very abundant spicules of calcified silicic sponges. These beds alternate with cocquina layers. In the uppermost part of the section bioclastic packstones with echinoderms and agglutinated foraminifers are present. The Triassic part of the outcrop terminates with erosive surface of the Hallstatt Limestones and transgression of Egerian breccias of the Budikovany beds. On the basis of conodonts (Gaál, 1982) the limestones on the locality Kamenný jarok gorge (B) are of lower to middle Sevatian age.

The limestones on the locality Budikovany are light gray, pinkish gray fine-grained with dark lithoclasts. In the upper part of the section bedded gray limestones with red nodules and cherts are present. They are almost bioclastic packstones with radiolarians, echinodermatas, sponge spicules and filaments. The second outcrop (Budikovany HO) on this locality is situated in light gray fine grained limestones – wackestones with radiolarians and silicisponge spicules. Limestones on both outcrops belong to FZ 1, SMF 3.

The Triassic part of the section ends with limestones sometimes with cherts and is overlain by Egerian breccias. Limestones on the locality Budikovany shows lower Sevatian age (Kozur and Mock, 1974).

M. ŁOZIŃSKI: **The Orava–Nowy Targ Basin: Overview of data on the tectonics and Miocene sedimentary basin infill**

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The Orava–Nowy Targ basin is crucial in the understanding of the Miocene history of the Carpathian area, because this basin is one of the few records on the sedimentological history, postdating the uplift and erosion of older structural units. The Orava–Nowy Targ basin originated in the Middle Miocene as a tectonic depression overlying the folded units of the Inner and Outer Carpathians. The subsidence trend is observed till present, however tectonic inversion can also be found at basin margins. Most researchers consider this basin as a pull-apart structure. Although some geophysical investigations have been done, the tectonic style of the basin is still poorly known. During its sedimentation history, the basin was filled with the clastic deposits from silts to gravels. Provenance of the deposits is considered to be mainly from the local Magura and Podhale flysch units and rarely from the Pieniny Klippen Belt and Tatra Mountains. Accordingly, it should be possible to estimate the time of uplift of the Tatra Mts. Autochthonic and detritic brown coal is also present. Alteration grade shows that the organic matter exposed now at the surface was buried at over 1 km deep. Pyroclastic layers are widespread in the basin and can be used in the future for dating and correlation. Depositional structures may allow interpreting the sedimentary environment, but so far only general investigations have been done. Some new local tectonic and sedimentary observations are shown based on examples from the Slovak localities along the Oravica river near Čimhova.

E. MACHANIEC, R. JACH and A. UCHMAN: **Trace fossil *Nummipera eocenica* Hölder from the Eocene (Barthonian) detritic carbonates from the Tatra Mountains, Poland**

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The Middle-Upper Eocene (Upper Lutetian – Priabonian) deposits crop out along the northern margin of the Tatra Mountains (southern Poland). These deposits overlain unconformably the older Mesozoic basement and are covered by the Central Carpathian flysch. They represent a transgressive sequence, which is characterized by the distinct facies and lateral changes of the thickness. Generally, the Eocene deposits start with the conglomerates, contain bedrock clasts. They are usually ascribed to the Lutetian.

The conglomerates are covered by the littoral detritic carbonates (Barthonian), which locally in the upper part contain nummulitic bank facies. The upper part of the Eocene sequence is formed by the complex limestone facies containing nummulites, dyscocyclines and coralline algae. They represent the Upper Barthonian – Priabonian. The limestone complex facies show evidences of the deposition in the transition zone between the middle to distal middle ramp. Locally, they are replaced by the detritic carbonates containing flora remains and deposited in a deeper (offshore) environment.

Just below the detrital carbonates and the limestone complex facies, the trace fossil *Nummipera eocenica* Hölder 1989 occurs, probably in the same stratigraphic horizon. The wall of *N. eocenica* is built of bioclats represented mainly by *Nummulitidae* (larger foraminifera), very rarely by fragments of the *Ditrupa* (Polychaeta) tubes, bivalve shell fragments, echinoid spines and coralline algae. The studied *N. eocenica* is generally built almost exclusively of the tests of *Discocyclina* Gümpel, 1868, dominated by macrospherical species. The flat fusiform shape of *Discocyclina* is very suitable for constructing of the wall, because the tests overlap as shingles. Such arrangement of tests permits to build a resistant wall. Morphology of other *Nummulites* tests is less suitable for this purpose. Therefore, the tracameker, probably a polychaete, selected the tests.

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J. MAJKA[1], I. BROSKA[2], Y. BEE'RI-SHLEVIN[3], I. PETRIK[2], P. SIMAN[2] and K. BÓNOVÁ[4]: **New U-Pb SIMS zircon dating of the Variscan I-type granitoids from Western Carpathians (Slovakia)**

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We present here new U-Pb ion microprobe dating results from several I-type Variscan granitoid massifs from the Western Carpathians (Slovakia). Four samples from the Tribeč Mts. yielded the ages in the range of 368 – 358 Ma. Sample T-63, collected from a cliff containing microgranular mafic enclaves, yielded the age of 365 ± 3.9 Ma, whereas magmatic differenciate, the sample T-60, collected from the same place yielded the age of 368 ± 2.5 Ma. Two other samples from the Tribeč Massif yielded somewhat younger ages, but similar within the error with two older ones. Sample T-70 from the southern part of the massif (Nitra quarry) yielded the age of 360 ± 2.5 Ma, which is similar to 358 ± 2.9 Ma age of sample T-22, collected in abandoned quarry in Kostoľany pod Tribečom. Three other dated samples from the Nízke Tatry Mts. granite (Ďumbier type, sample NTBS-1), Veporic unit (Sihla) granite (sample SIHLA-1) and Čierna hora granite (sample CH-SK2) yielded ages similar to the younger cluster from the Tribeč Massif. The obtained ages are: 356 ± 1.9 Ma for the sample NTBS-1, 357 ± 2.5 Ma for the Sihla granite and 357 ± 2.9 for the Čierna hora granite. Two age groups may be recognized basing on our results: the older biotite tonalite with the mafic enclave from the Tribeč Mts. (ca. 365 Ma) and all other biotite tonalites from Tribeč, Nízke Tatry and Veporic unit (ca. 355 Ma).

Obtained data show that main massifs of the I-type granitoids in the Western Carpathians were emplaced during the early Variscan and contemporaneously to the S-type granites. The results presented herein are in agreement with the older dating of High Tatra I-type granite (Poller et al., 2001) and the recent dating of the Modra I-type granite (Kohút et al., 2009). Taking into account the data from the Tatra Mts. and our dating results, along with all the previous dating (e.g. Kohút et al., 2009) results, suggest the post-tectonic Meso-Variscan age for the Carpathian I-type granitoids. The former interpretation of I-type granitoids based on the conventional U-Pb zircon datings (e.g. Bibikova et al., 1988) from Sihla, Tribeč, Tatra Mts. or Smrekovica will have to be revised. Our geochronological results call for a new large--scale model explaining the succession of granite forming events in the Western Carpathian realm during the Early Carboniferous.

J. MICHALÍK: **Biostatistics, distribution and paleoecology of Rhaetian brachiopods in benthic fauna of the Hybe Formation**

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Abundant benthic faunal remnants are a typical feature of the Hybe Formation, studied by several paleontologists for more than a century. The fauna occurs in dark marl sequence with cyclical architecture containing tempestite beds. Measurement of shell size parameters shows that part of the fossil association is allochthonous: some fossils have been removed from their life position in shallows and transported on a short distance. Also the occurrence of slumped bodies indicates the deposition in a channel like depression, partially below the biostromal growth zone.

The faunal associations are dominated by brachiopod *Rhaetina pyrifomis*, accompanied by *Rhaetina hybensis*, *Zeilleria norica*, *Zeilleria austriaca*, *Oxycolpella oxycolpos*, *Sinucosta emmrichi*, *Zugmayerella koessenensis*, *Fissirhynchia fissicostata*, *Austrirhynchia cornigera* and by many bivalves and gastropods. Brachiopod and bivalve shells are often covered by tubes of comensalic polychaete worms. Bryozoans, corals, brachiopods *(Thecospira, Bactrynium)*. These surfaces were attacked by grazing echinoids (Gnathichnus), or fishes. Vertebrate reains are represented by the sole teeth and by only finding of fish reptile column segment. Corals are relatively scarce, occurring in discrete beds in lower part of the section.

Burrowing fauna was probably rich, its traces being preserved on bed surface, inside shell cavities, or in concretions. Nautiloids, foraminifers and a sole finding of conodont *Misikella posthernsteini* proves for middle Rhaetian age of the associations. The position of sedimentary environment was in a complex of Koessen-like basins in a wide carbonate platform distant from any terrigenous sources.

K. NEJBERT[1], M. G. ŚLIWIŃSKI[2], P. LAYER[2], D. OLSZEWSKA-NEJBERT[1], M. BĄBEL[1], A. GĄSIEWICZ[3] and B. C. SCHREIBER[4]: **Ar^{40}/Ar^{39} dating of a Badenian tuff from the Babczyn-2 core (near Lubaczów, Polish Carpathian Foredeep) and its paleogeographic and stratigraphic significance**

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The Miocene section of the Babczyn-2 core (E. of Lubaczów), drilled in the NE part of the Polish Carpathian Foredeep (CF) (near the Polish-Ukrainian border), is composed of (from bottom to top): (1) marine clastic-carbonate deposits (13 m) overlying a Cretaceous substrate that represents the "early" Badenian (Moravian) transgression and depositional events in the CF, (2) evaporite gypsum deposits (32 m) of the Paratethyan Badenian (= Wielician) salinity crisis (BSC) (known as the Krzyżanowice Formation in Poland and the Tyras Formation in Ukraine), (3) marly marine deposits with abundant pectinids (Pecten Beds, 9.4 m) and scarce bivalves (*Abra* [= *Syndesmya*]) related to post-evaporite, late Badenian (Kosovian) transgression and marine deposition, and (4) the Syndesmya (or Syndosmya) Beds (12.6 m) deposited during the Sarmatian, which are made up of monotonous clays lacking pectinids but containing *Abra* (= *Syndesmya*) and other molluscs, suggesting slightly brackish or mixed water conditions (as inferred from the paleoecology of these molluscs; e.g. Kowalewski, 1966, Biuletyn IG, without number, 1 – 143). Lithostratigrapic units (2), (3) and (4) extend westward from Lubaczów along the northern margin of the CF until the environs of Cracow. The boundary horizon between the Pecten and Syndesmya Beds marks the transition from marine to mixed-water conditions (characterized by the disappearance of pectinids in the studied core). In the CF, this is more or less coincident with the appearance of the endemic Sarmatian foraminifer *Anomalinoides dividens* Łuczkowska, and defines the base of the Sarmatian in many Paratethyan basins.

A pyroclastic horizon found within the Pecten Beds (3.4 m above the gypsum deposits) revealed well preserved volcanic components within a primary grain-supported fabric, without admixture of any non-pyroclastic sedimentary material. This tuff is dominated by the fresh volcanic glass (platy and cuspate glass shards, and less common pumice shards), with lesser amounts of biotite, Na-K-feldspars, plagioclase, apatite and Fe-Ti oxides. Tiny porphyritic volcanic lithoclasts were also observed. Major oxide contents are as follows: SiO_2 73.39 – 75.71 wt.%, Al_2O_3 11.71 – 12.28 wt.%, Na_2O 0.84 – 2.24 wt.%, and K_2O 2.5 – 3.97 wt.%. The composition of the volcanic glass corresponds to that of a rhyolitic melt, and is consistent with the chemical make-up of other tuffs of similar age common throughout the CF. The provenance is presumably one of the nearest volcanic provinces, e.g. the Central European Volcanic Province (CEVP) or the Carpathian-Pannonian Region (CPR). Radiometric Ar^{40}/Ar^{39} dating of several biotite and glass grains gave an average age of 13.06 ± 0.11 Ma for the timing of the tuff deposition. Taking into account the geochronological data on the CPR volcanics, the origin of the Babczyn tuff is likely related to magmatic activity in the Western and/or Central Segment of the CPR volcanic arc (Pécskay et al., 2006; Geologica Carpathica, 57, 511 – 530).

The obtained age demonstrates that (1) the Pecten Beds overlying the gypsum deposits in the northern part of the CF were deposited during the lower part of the NN 6 nannoplankton zone, corresponding (in the Mediterranean) to the time interval between 13.654 – 11.905 Ma (according to present estimates, see Raffi et al., 2006; Quaternary Science Reviews, 25, 3 113 – 3 137), and not during NN 8 or later as was previously suggested. (2) The Badenian-Sarmatian transition in the CF took place soon after 13.06 ± 0.11 Ma. (3) The Badenian salinity crisis in the CF and Paratethys certainly ended before ca. 13.06 ± 0.11 Ma. This supports the view that the crisis took place during the lower part of the NN 6 zone. Recent radiometric dating of the WT-1 and WT-3 tuff beds that underlie and intercalate with the Badenian salt evaporites in the Wieliczka-Bochnia area near Cracow (de Leeuw et al., 2010; Geology, 38, 715 – 718) indicates that evaporite deposition began soon after 13.81 ± 0.08 Ma (WT-1 tuff) and continued at least until 13.60 ± 0.07 Ma (WT-3 tuff), ending no later than 13.06 ± 0.11 Ma (Babczyn tuff). The total duration of the BSC is thus estimated (including analytical errors) to have been less than 940 k.y.

P. MINOR and S. LESZCZYŃSKI: **Borings in rhodoliths from the Late Paleocene Upper Istebna Sandstone at Melsztyn (Silesian nappe, Polish Outer Carpathians)**

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Sandstones and granule to pebble conglomerates rich in rhodoliths occur in the sedimentary succession of the Upper Istebna Sandstone (Upper Paleocene) of the Silesian nappe of the Polish Outer Carpathians outcropped at the village of Melsztyn and its surroundings. The deposits show features indicative of a deep-sea deposition by the high-density turbidity currents and debris flows flowing from a shoal located to southwest (?Silesian Ridge). Rhodoliths are one to several centimetres in large and show irregularly oval shape with a warty to lumpy surface. They are composed by coralline red algae mainly of the genera *Sporolithon*, *Lihtotamnion* and *Mesophyllum*. Moreover, Peyssonneliaceans are also present. The rhodoliths commonly show numerous borings. According to shape and size they represent ichnogenera *Trypanites*, *Entobia* and *Gastrochaenolites* and were produced respectively by polychaetes and/or barnacles, sponges and bivalves. Moreover, borings in the form of networks of branched micro-galleries, 0.10 – 0.20 mm in size, which can result from the activities of fungi, algae or sponges, occur locally.

Borings of the ichnogenus *Trypanites* are cylindrical and elongate in shape. Their sizes reach 0.2 – 0.5 mm in diameter and 0.8 – 1.4 mm in length. They show smooth walls and are filled with sparite. *Entobia* is represented by the single or multiple chambers, often connected. The sizes of single chamber reach 0.1 mm in diameter and 0.5 – 1 mm in length. *Gastrochaenolites* borings are characterized by the elliptical, elongate and rounded shapes. Their sizes reach 2.5 mm in diameter and 1 mm in length. They are filled by packstone/wackestone-type sediment with fragments of coralline algae, bryozoans, echinoderms and foraminifers, subordinately with the quartz grains.

Structure of the rhodoliths together with their borings indicates their origin in shallow water environment on moderately mobile siliciclastic substrates and under low net sedimentation rates. Rhodolith growth was favoured during the sea-level rise. During subsequent sea-level fall, the rhodoliths and associated siliciclastic deposits were re-sedimented into deeper settings.

N. OSZCZYPKO and M. OSZCZYPKO-CLOWES: **The boundary zone between the Magura nappe and Grajcarek thrust-sheets east of Szczawnica (Outer Carpathians, Poland)**

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In the Grajcarek Valley, east of the Szczawnica, the contact zone between the Magura nappe, Grajcarek thrust-sheets and the Pieniny Klippen Belt (PKB) is located. The Magura nappe is composed of the Paleogene flysch deposits of the Krynica facies-tectonic zone (Birkenmajer and Oszczypko, 1989). Recently in this area the Early Miocene Kremna Fm. has been recognized in several sections (Oszczypko and Oszczypko-Clowes, 2010). From the south the Magura nappe contacts along the subvertical thrust fault with the narrow, strongly deformed zone, known as the Grajcarek Unit (Birkenmajer, 1977, 1986). This unit is composed of the Jurassic to Paleocene pelagic and flysch deposits, which occur both along the contact with the Magura nappe as well as inside of the PKB together with "Autochthonous Magura Paleogene (AMP)". On the bases of new geological mapping it has been proven that "AMF" belongs to the Kremna Fm. and together with the Grajcarek trust-sheets are exposed in the tectonic windows inside of PKB (Oszczypko et al., 2010). Synchronous occurrence of the Kremna Fm. both at the front of the Grajcarek thrust- as well as in the tectonic window beneath Grajcarek thrust sheets/PKB documented post Early Burdigalian trust of these units over the Magura nappe.

During the Late Burdigalian/Middle Miocene dextral transpression, eastwards escape and counter clock rotation of the ALCAPA, the Grajcarek thrust-sheets and PKB were involved into the strike-slip movements and development of flower structure (Oszczypko et al., 2010).

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N. OSZCZYPKO and P. WÓJCIK-TABOL: **REE – geochemistry of the Grajcarek Succession (Pieniny Klippen Belt, Poland)**

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The Grajcarek Succession (Polish Pieniny Klippen Belt) contains the "black flysch" deposits (the Szlachtowa and Opaleniec formations), that are followed by the Cenomanian radiolarian shales (CRS, Hulina Fm.), then variegated shales of the Late Cretaceous Malinowa Fm. and the coarse clastic deposits of the Jarmuta Fm. (Maastrichtian-Paleocene). Geochemical and petrological indicators have been used to examine the depositional conditions and provenance of studied material. The studied samples represent a mixture of terrigenous detrital material and biogenic silica with various amounts of carbonates. The most of samples display strong correlation between K_2O, Al_2O_3, TiO_2, Rb, Zr and Th. The only exception is represented by the "black flysch" samples of the Szlachtowa Fm., where above correlation is irregular.

The samples show relatively flat REE profiles, with (La/Yb)PAAS ratios ranging between 0.84 – 1.17. The red sediments of the Malinowa Fm. are the most enriched by REE because of strong relation REE to Fe hydroxides. The lowest contents of REE occur within pelagic sediments of the Hulina Fm. Both of them display the highest enrichment of HREE. It can be explained by the presence of zircon (positive correlation Yb to Zr) and phyllosilicates that is suggested by correlation to Al_2O_3.

The samples show slight variation in Ce and Eu anomalies (Ce/Ce*: 0.85 to 1.16; Eu/Eu*: 0.94 to 1.12) that may reflect mixing of authigenic phases and detritic material. The Ce depletion is common, whereas the CRS display enrichment of Ce mainly due to the synsedimentary scavenging of Ce^{4+} by Mn-Fe oxides. Most of samples show weak positive Eu anomalies, whereas few samples of CRS and Opaleniec Fm. contain the negative anomalies that could be a result of the variation in Eu-rich plagioclase content.

M. OSZCZYPKO-CLOWES and N. OSZCZYPKO: **The new data on the relationship between the Bystrica and Krynica zones in the Krynica-Tylicz area (Magura nappe, Western Carpathians, Poland)**

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Traditionally in the Krynica–Tylicz area (Beskid Sadecki Range) two facies-tectonic units of the Magura nappe have been described (see Nowak, 1924; Świdziński, 1972). In 1969 Węcławik distinguished the transitional Tylicz Zone, located between the Bystrica (Sącz) and Krynica zones. According to this concept, the lower part of the Tylicz Succession, is characterized by the Bystrica (Sącz) Development while the upper part is typical for the Krynica Development. Węcławik (1969) suggested that the boundary between the lower and upper parts of the Tylicz Succession is situated at the base of the red shales with *Reticulophragmium amplectens* (Middle-? Late Eocene). This concept was questioned by Oszczypko (1979), who suggested that Tylicz Zone represents the tectonic superposition of the Bystrica and Krynica zones of the Magura nappe.

The new geological mapping followed by the calcareous nannoplankton studies (Oszczypko-Clowes and Oszczypko, 2010) in SE part of the Beskid Sądecki Range has proved that the Bystrica and Krynica subunits are divided by the sub-vertical, north dipping inverse fault only in the Krynica area. At the same time in Tylicz area (east of the Mochnaczka and Muszynka rivers) there is a transition between the Eocene succession of the Bystrica Zone and younger Late Eocene to Oligocene deposits (Mniszek and Poprad members of the Magura Formation) of the Krynica Zone. This conclusion allows us to restore the former view of Węcławik (1969b) on the existence of the Tylicz transitional zone, between the Bystrica and Krynica facies zones.

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S. OZDÍNOVÁ: **Biostratigraphical and paleoecological research of the Paleocene sediments of the Western Carpathians**

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The Upper Paleocene Nanoplankton zones NP 9 – NP 11 were determined in the Paleocene–Eocene sediments from the Veľké Kršteňany Borehole (Upper Nitra region). In the samples from the interval 57 – 54 m the Upper Paleocene nannoassemblage was found, being represented by the species *Cruciplacolithus cribellum*, *Cyclagelosphaera reinhardtii*, *Discoaster mediosus*, *Ellipsolithus macellus*, *Helicosphaera lophota*, *Helicosphaera seminulum*, *Sphenolithus anarrhopus*, *Sphenolithus primus*, *Tribrachiathus orthostylus*. There is possible to estimate the geochrone of the Zones NP 9 – Discoaster multiradiatus, following Perch-Nielsen (1985) and Martini (1971), and this zone is quantitative and qualitative rich by abundant calcareous nannofossils.

Increase of the abundance of the species *Zygrhablithus bijugatus* and *Thoracospahaera* in the samples from the interval 50 – 44 m is characteristic for the Paleocene/Eocene boundary (Raffi et al., 2005), geochron of the Zone NP 10 – Tribrachiathus contortus. This association *Braarudosphaera bigelowii* with the species signalized the change in the salinity and shallow water conditions.

In the samples from the interval 44 – 40 m there was a decrease in the diversity of the species, the nannoassemblage was composed from the species of the nannoplankton Zone NP 11 – Discoaster binodosus, like a *Tribrachiathus contortus*, *Discoaster barbadiensis*, *Discoaster deflandre* and *Ellipsolithus macellus*.

The research is supported by the Slovak Research Agency (APVV--51-011305).

J. ROSZKOWSKA – REMIN: **Paleomagnetic correlations of the Miocene carbonates and clays from the north-eastern, marginal part of the Carpathian foredeep: Research perspectives**

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The area of the northern, marginal part of the Carpathian foredeep since decades is the aim of detail studies from the stratigraphy to paleoenvironment and paleogeographic reconstructions. During the Middle Miocene, area of the Carpathian foredeep was the northernmost part of the Paratethys – complex system of inland seas which were temporarily connected or separated from the World Ocean. The complex geological situation is visible in the lithological and faunal changes, even on the local scale.

The different, variable history of the Paratethys basins prevents the use of the biostratigraphy at a large scale of the whole Carpathian foredeep. The most useful tool in the stratigraphy in the studied area are the evaporates interpreted as the marker beds. However the evaporates do not occur in the whole Carpathian foredeep, what results in the serious correlation problems of the different parts of the foredeep.

The first goal of presented studies is to evaluate the usefulness of the paleomagnetic methods in correlations between the local sections in the southeastern Poland and western Ukraine. The second goal is the correlation of these sections to the world reversed log. The paleomagnetic methods, especially magnetostratigraphy, are very comfortable, because the reversals of magnetic field are independent of lithology, paleoenviromental situation, paleogeography and occur isochronically worldwide.

The studies have been carried out in the southeastern Poland, Roztocze Hills (6 sampled sites), southern margin of the Holy Cross Mountains (one sampled site and borehole) and in the western Ukraine (7 sampled sites). The sampled sites are represented by large active quarries, natural exposures and the borehole. For the paleomagnetic investigations the carbonates and clays of the Middle Miocene (Badenian and Sarmatian) were taken. Besides a natural remnant magnetization and demagnetization analyses, the magnetic susceptibility and rock magnetism analyses were applied. The preliminary results show a potential in the use of paleomagnetic methods in correlations of the Miocene rocks in the Carpathian foredeep. However in some cases, to obtain the reliable results, the paleomagnetic methods need strong support of the sedimentological and petrographical research.

The presented studies are the author´s PhD thesis project currently proceed on the University of Warsaw and in the Polish Geological Institute – National Research Institute.

L. RYŠAVÁ: **Mikrofaciálna analýza mezozoických sekvencií Čachtických Karpát (Západné Karpaty)**

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Študovaná oblasť je súčasťou Čachtických Karpát a nachádza sa v záreze cesty nad dedinkou Bzince pod Javorinou/časť Hrušové. V záreze cesty nad Hrušovým je čiastočne odkrytý vrstevnatý sled od triasu až po spodnú kriedu, z ktorého boli odoberané vzorky na mikrofaciálnu analýzu. Jednotlivé litofácie reprezentujú mezozoické sekvencie hronika, konkrétne jeho čiastkového nedzovského príkrovu. Sedimenty triasu (schreyeralmské a dachsteinské vápence) sú súčasťou jablonickej skupiny v študovanej oblasti a sedimenty jury až kriedy (hierlatzské súvrstvie, rotensteinské vápence, tegernseeské vápence a oberalmské súvrstvie) predstavujú v danej oblasti hrušovskú skupinu. Za najstarší člen nedzovského príkrovu považujeme schreyeralmské vápence (?stredný anis – ?spodný ladin) s pelbiomikrosparitovou mikrofáciou (wackestone s prechodom do filamentovej mikrofácie typu packstone) s ojedinelým výskytom foraminifer, úlomkov bivalvií, krinoidových článkov, ostrakódov a mikroproblematík. Vzorky získané z oblasti Hrušového možno makroskopicky charakterizovať ako prevažne ružové až tmavočervené, miestami aj svetlé a svetlosivé, masívne vápence. Tieto vápence sedimentovali v rozsiahlych intraplatformových depresiách, formujúcich sa počas stredného triasu. Za najmladší a najvyšší triasový člen nedzovského príkrovu možno považovať dachsteinské vápence (vrchný norik – rét), ktoré majú v tejto oblasti značné rozšírenie. Vápence sú veľmi pestré, často je aj v rámci jedného výskytu litologická a faciálna náplň veľmi rozmanitá. Z mikrofaciálneho hľadiska ide o pelbiomikrosparitovú mikrofáciu s početnými ooidmi až prechodom do ooidového vápenca (packstone až grainstone). Dachsteinské vápence predstavujú najmä sedimenty vnútornej lagúny s prevahou subtidálnych fácií. Spodná a stredná jura v nedzovskom príkrove Čachtických Karpát je zastúpená v plytkovodnom vývoji, kým vrchná jura patrí k hlbokovodným fáciám, čo dokazuje prítomnosť rádiolárií a kalpionel. V spodnom liase sa v hronických sukcesiách predpokladá hiát, po ňom sedimentovali vo vrchnom liase a dogeri sčasti kondenzované prahové litofácie ako hierlatzké súvrstvie (sinemúr – domér), ktoré je budované výlučne článkami krinoidov (grainstone). Vystupuje tu vo viacerých šupinách ako úzke dlhé pásy alebo v nepatrných šošovkách, zvyčajne s hľuzami rohovcov. V nadloží krinoidových vápencov sa vyskytujú rotensteinské vápence (kelovej – oxford) s filamnetovou mikrofáciou s prechodmi do rádioláriovo-filamentovej mikrofácie (wackestone až packstone). V oblasti vystupujú v súvislých neprerušených pásoch – až 1 km dlhých a 100 m hrubých – alebo v tenkých (5 m) kratších šošovkách. Tieto vápence sedimentovali vo fácii „Ammonitico Rosso". Sedimenty malmského veku sú zastúpené v tegernseeskom vápenci (kimeridž – titón) s globochétovo-sakokómovou, globochétovo--filamentovou a rádioláriovo-spongiovou mikrofáciou (wackestone až packstone). Biostratigraficky vápence patria vrchnokimeridžskej zóne Borzai a spodnotitónskej zóne Malmica (Reháková, 2000). Vápence vznikali v hlbokomorských valoch obklopených batyálnou panvovou fáciou. Vrchnú juru v študovanej oblasti zastupuje aj pelagické panvové súvrstvie oberalm (vrchný titón – vrchný berias), ktorého sedimentácia bola 30-krát rýchlejšia ako pri predchádzajúcom súvrství. Mikrofaciálne ide o rádioláriovo-kalpionelovú, kalpionelovo--globochétovú mikrofáciu (wackestone). Na základe kalpionelíd bolo možné indikovať vrchnotitónsku zónu Crassicollaria, subzónu Colomi a beriaskú zónu Calpionella s vrchnoberiaskou subzónou Elliptica (Reháková, 1995).

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A. SOBSTYL: **Prospects for paleoclimatic studies in the Pieniny Klippen Belt using stable isotopes**

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The purpose of the research is to present the reliable brachiopod and belemnite $\delta^{13}C$ and $\delta^{18}O$ trends, derived from the stratigraphically well-dated Middle and Upper Jurassic sections in the Czorsztyn Succession of the Pieniny Klippen Belt.

The isotope composition of calcite can be used for determining the temperatures of the ocean at the time of its precipitation. In order for this method to work, the calcite has to be formed in the isotopic equilibrium with ambient water and cannot be altered by diagenetic processes. Detailed biostratigraphy allows verification and precise dating of isotopic events.

Belemnites and brachiopods are thought to secrete their shells in the isotopic equilibrium with ambient seawater. First samples were collected from the Oxfordian-Kimmeridgian (Tithonian?) limestones from the Stankowa Skała section in Zaskale (Poland). The belemnite rostra and brachiopod shells have been screened for possible diagenetic alteration using the cathodoluminescence and the trace element analyses. The cathodoluminescence analysis revealed good preservation of a half of the examined belemnite rostra with the exception of slight cracks. Belemnite rostra showing orange to red luminescence will not be further investigated. The majority of the studied brachiopod shells were too thin and too badly preserved for the isotope analysis.

Field work is planned to collect new samples from the Middle – Upper Jurassic sections in the Czorsztyn Succession of the Pieniny Klippen Belt.

J. SOTÁK[1], S. OZDÍNOVÁ[2] and P. PRUNER[3]: **Hyperthermal and greenhouse events in the Paleogene sequence of the Central Western Carpathians (PETM, EECO, MECO): Multiproxy records from the Kršteňany section**

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The Paleocene/Eocene boundary is marked by one of the prominent events of the global warming and perturbation of the carbon cycle in the Cenozoic history. The sedimentary record of the Paleocene-Eocene Thermal Maximum (PETM) has been determined in the Kršteňany section by using of the high-resolution foraminiferal and nannofossil stratigraphy, isotopic stratigraphy and magnetostratigraphy.

The PETM is approximated in the transitional interval between the grey and ochry-yellow marls in the depth around 41 m (Kršteňany KRS-1 borehole). The grey marls contain the Late Paleocene microfauna of planktonic foraminifera with the index species of the P3 and P4 Biozones – *Globanomalina* cf. *pseudomenardi*, *G. luxorensis*, *Morozovella apanthesma*, *Igorina pusilla* and *Parasubbotina varianta*. Calcareous nannoplankton of the grey marls also indicates the Late Paleocene age, evidenced by the species of the NP 9 Biozone like *Tribrachiatus contortus*, *T. orthostylus*, *Cruciplacolithus cribellum*, *Discoaster mediosus*, etc. The specific components of the PETM interval represent the diatom frustules and pteropods. The PETM is expressed by the carbon isotopic values, which became markedly negative and shifted from +0.24 to –1.62 ‰ $\delta^{13}C$. This isotopic signal is considered to define the Paleocene–Eocene boundary in the global scale. In paleomagnetic scale, the transitional interval reveals the reverse magnetization, which could correspond to the C24r magnetozone around the Paleocene–Eocene boundary.

Early Ypresian sequence of the Kršteňany section introduced the Early Eocene climatic optimum (EECO), which is evidenced by the large-sized muricate foraminifers like *Morozovella lensiformis*, *M. formosa*, *M. occlusa*, *Acarinina strabocella*, *A. cuneicamerata*, *A. pentacamerata*, *A. praetopilensis*, *Muricoglobigerina seni*, etc. The share of subbotinid species, which are constrained to be the cool--temperate forms, increased to the Late Ypresian in the zone *Subbotina (T.) boweri*. Ypresian nannofossils consist of the species, which had the last occurrences in the NP 12 Biozone (*Tribrachiatus orthostylus*, *Ellipsolithus macellus*, etc.). Subsequent interval reveals a radiated nannoplankton bloom of the family *Discoasteraceae* – with more than 10 % partition in the assemblage, which indicated EECO. The most common nannofossils are the species *Discoaster barbadiensis* and *D. saipanensis*. Normal polarity of the C24n magnetozone has been recognized in the interval between 36 – 38 m (Middle Ypresian).

The Lutetian – Bartonian sequence is rich in morozovellid, truncorotaloid and morozovelloid species. Their abundance is indicative for the Middle Eocene climatic optimum – MECO. The most frequent foraminiferal species of the Lutetian marls are follows: *Morozovella aragonensis*, *M. crater*, *M. spinulosa*, *Acarinina (T.) topilensis*, *Morozovelloides crassata*, etc. Late Lutetian – Bartonian formation is significantly enriched by *Turborotalia centralis*, *Turborotalia cerroazulensis* and *Orbulinoides beckmanii*. These foraminiferal index species allow determining the biostratigraphic zones E 8 – E 13. Nannoplankton zones of the NP 14 – NP 16 have been recognized by the species of *Discoaster sublodoensis*, *Chiphragmalithus alatus* and *Discoaster tani nodifer*. The MECO is pronounced at the carbon isotope curve, where the KRS-1 sequence in interval between 17.0 to 5.0 m shows the distinct negative excursion of $\delta^{13}C$ up to – 6.75 ‰. The Middle Lutetian sequence records the normal magnetic event (18.2 – 32.4 m), which could correspond to the C21n magnetozone.

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M. SÝKORA[1], M. SIBLÍK[1] and J. SOTÁK[2]: **Siliciclastic interbeds in the Upper Triassic dolomite formations of the Krížna nappe (Malá Fatra Mts., Western Carpathians): constrains for the Carnian Pluvial Event in the Fatric Basin**

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The analysed Upper Triassic sequences of the Krížna nappe in the eastern part of the Krivánska Fatra Mts. have unique development. The lower part belongs to the Ramsau Dolomite Formation and contains numerous Carnian foraminifers. Its deposition took place in peritidal environment. The upper part covers the time of the Reingraben Event, or carbonate productivity gap (Carnian). It is represented by claystone layers of so far not exactly described in introduced Mts. This upper part consists of two members: 1. beds of claystones with variable dolomite content, 2. layers of pale-grey dolomite. In the claystone part, rare *Lingularia* brachiopods and spinicaudatan crustaceans *Euestheria* were identified and no typical marine bioclasts were found. Presumed deposition place of the claystones were fresh – to brackish – marine waters environments. The alternating layers of dolomites were deposited in shallow – peritidal environments. The mentioned formation should be distinguished as a new lithostratigraphic unit Tržinovo Formation.

R. SYNAK and M. KOVÁČ: **Infill of the Danube Basin inferred from the timing of the sedimentary facies changes**

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Danube Basin represents a separate depocentre in the NW part of the Pannonian Basin System, which developed after isolation of the individual parts of the Central Paratethys Sea. The Upper Miocene to Pliocene Lake Pannon was continuously filled up by sediments, well reflected in changes of the sedimentary facies in space and time. This fact is observable not only in the outcrops but also in seismic lines and well log data as well. Principally three periods of development can be distinguished:

First period, comprising the Lower and Middle Pannonian development (11.6 – 9.7 Ma) is in the Slovak part of the basin represented by the Ivanka Formation. Sediments of this time interval were deposited on the prograding basin margin in various environments, depending on the position within the Lake Pannon. We can define this succession (similarly to Hungarian part of the Danube Basin) as depositional system of alluvial, lagoonal, and deltaic to basin slope and basin floor facies shifting in time and towards the basin centre. Sedimentary facies of the first sedimentary cycle are following: shallow water setting deposits of alluvial and delta plain (marches, lagoons, coastal and delta plain built ups, Újfalu Formation), deposits of the Lake Pannon paleoslope or delta-slope (Algyő Formation) and deepwater setting marls, clays and sandy turbidites (Endrőd and Szolnok formations). Several stages of the Lake Pannon paleoslope progradation phases can be set into a timeframe based on the magnetostratigraphic measurements from several wells from the Hungarian part of the basin.

Second period of the basin development started after fulfilling of the lacustrine accommodation space during the Upper Pannonian--Pliocene time (9.7 – 4.2 Ma). The alluvial package of sediments is represented by the Beladice and Volkovce formations. Sedimentary environments of the second sedimentary cycle can be characterized as alluvial – with wide range of facies – from fluvial, deltaic, ephemeral lake to marches and dry land deposits. Alluvial sediments of this environment provide typical response on well logs (serrated pattern) and seismic data.

Third period of the basin development comprises the Pliocene and Pleistocene sedimentation in the Danube Basin (4.2 – 2.6 Ma to Present). It is represented mostly by the Kolárovo Formation, deposited in the fluvial and alluvial environments.

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Z. VAŠÍČEK[1], P. SKUPIEN[2], D. BOOROVÁ[3] and D. REHÁKOVÁ[4]:
To the question of the Čupek Limestone at Štramberk (Lower Cretaceous of Baška Development of the Silesian Unit, Outer Western Carpathians)

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Štramberk Limestone, exposed in several quarries in the Štramberk area, are accompanied by the younger, Lower Cretaceous carbonate rocks which are lithologically different mainly by their clay admixture. In the original stratigraphical division of these carbonates Houša (1965, 1975, 1976) divided the Olivetská hora Limestone to the Ropice Member (erroneously) and the Čupek Member. After a short hiatus followed Gloriet Formation and Kopřivnice Limestone, without any closer description of the type localities for the newly defined formations. Later on, the Lower Cretaceous carbonates were divided by Houša (in Houša and Vašíček, 2004) to the Čupek, Gloriet and Kopřivnice formations. For the Čupek Formation, the type locality was established in the Obecní lom Quarry. The name was derived from the Čupek Elevation which reaches the northern margin of the quarry.

The Čupek Limestone represents the oldest part of the Lower Cretaceous succession. Its eventual gradual transition to the Štramberk Limestone is not known; also its basis is not defined. The Čupek Lst. crops out in situ in the western part of the quarry, partly on the first but mainly on the second floor. Conglomeratic sediments in the Obecní lom Quarry were attributed also to it by Houša (in Houša and Vašíček, 2004). The author ranked it to the calpionellid zones Calpionella elliptica and Calpionellopsis simplex. Younger deposits (e.g. Calpionellopsis oblonga Zone), as well as the direct overlying of the Čupek Limestone are not known. At other places, the limestone occurs in the form of fissure and cavity fillings, in the bigger or smaller fragments and as pebbles in younger rocks (mainly in the Kopřivnice Limestone).

The Čupek Lst. is mostly present as greyish-green, greenish--grey to bluish-grey, limestone with clayey admixture which causes their colouration. Locally, some brachiopods reminding the genus *Moutonithyris* were found in the Obecní lom Quarry. Any stratigraphically important macrofauna is not known from the Čupek Lst. In the Obecní lom Quarry, as well as in the fissure-fillings the Čupek Limestone usually contain angular fragments of the Štramberk Limestone. The limestone lacks any bedding.

Two sets of samples, independently evaluated recently by Boorová and Reháková, have brought more detailed facies analysis. The Čupek Lst. represents shallow marine carbonates deposited in the open marine to the slope of distally steepened mid-ramp. Scalenohedral dogteeth cement lining locally the voids could reflect the influx of meteoritic water from exposed parts of the nearby platform. The fine-grained bioclastic (intrabiopelmicrite/intrabiopelsparite) or brecciated (intraclast-biogenic-peloidal wackestone to grainstone), partially marly limestones (mudstones to wackestones) contain various types of fossil fragments, common detritic sandy quartz admixture, sporadic glauconite, and very rare grains of heavy mineral zircon. Skeletal grains are often worn. Frequent oncoids of *Crescentiella morronensis morronensis* (Crescenti) are accompanied by *Lithocodium aggregatum* Elliott, *Baccinella irregularis Radoičić* Radoicic, *Thaumatoporrella parvovesiculifera* (Raineri), dasycladacean algae (*Permocalculus dragastani* Bucur, *Salpingoporella* sp.), tubes of *Aeolisaccus*, common miliolids, another benthic foraminifera (*Charentia cuvillieri* Neumann, *Conicospirillina basiliensis* Mohler, *Trocholina elongata* (Leupold), *Neotrocholina infragranulata* (Noth), *Andersenolina* sp., hyaline foraminifera (*Spirillina* sp., *Lenticulina* sp., *Patellina* sp.), *Thurammina* sp., and nubecularid encrusting foraminifera, fragments of crinoids, bivalves, ostracods, hydrozoans, very rare gastropods, bryozoans, and corals. Slightly recrystallized micrite matrix contains also rare globochaetes, radiolarians, sponge spicules and calpionellids (*Crassicollaria parvula* Remane, *Calpionella alpina* Lorenz, *C. elliptica* Cadisch, *C. minuta* Houša, *Tintinnopsella carpathica* (Murg. et Filip.), *T. longa* (Colom), *Remaniella duranddelgai* Pop, *R. catalanoi* Pop, *Lorenziella hungarica* (Knauer et Nagy), *Calpionellopsis simplex* (Colom), which confirmed the Elliptica Subzone of the standard Calpionella Zone, and Simplex Subzone of the standard Calpionellopsis Zone and determine the age of the sediments as the upper most part of Early and lowermost part of Late Berriasian. The presence of *Cadosina semiradiata cieszynica* (Nowak), *Cadosina semiradiata olzae* (Nowak), *Stomiosphaera* cf. *wanneri* Borza among the associations of calcareous dinoflagellates of calpionellid zones mentioned could indicate their wider stratigraphical distribution if compare with those published in Reháková (2000).

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A. WAŚKOWSKA and J. GOLONKA: **Beloveža Formation in the Rača Unit, Magura nappe in Hańczowa Mts. (Polish Flysch Carpathians) and adjacent part of Slovakia and remarks on the Beloveža Formation – Hieroglyphic Beds controversy**

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The presenting authors investigated the Eocene thin-bedded flysch within the Magura nappe, the larger Outer Carpathian unit. The Eocene thin-bedded flysch sedimentation accompanying by hemipelagic shales was present in the entire Magura Basin. These deposits were a subject of live discussion and controversies.

The different names like Hieroglyphic Beds, Hieroglyphic Formation, Łabowa Shale Formation, Beloveža Beds, Beloveža Formation were used in the Outer Carpathian literature. The Beloveža Beds (Schichten) was first used by Paul (1869) for variegated shales and thin-bedded flysch (Eocene) in the locality Beloveža near Bardejov (Rača Unit) in Slovakia (Paul's locality is still available for detail studies). Next Uhlig (1889) distinguished separately the thin-bedded flysch as Beloveža Beds and variegated shales. Beloveža Beds are represented by the thin-bedded typical flysch with dominant shales. Shales are grey to green, blue and olive in colour, usually clayey, small amount of carbonates can occur. Shales are intercalated by the fine-grained grey to blue-grey siliceous sandstones with abundant hieroglyphs and lamination. However Uhlig's division was accepted in the 1950s and 1970s for Rača Unit in Beskid Niski, name Beloveža Beds was only applied for the Bystrica Unit in the Polish flysch Carpathians. Oszczypko (1991) formalized the name Beloveža Formation, giving the reference sections in the Zbludza and Żeleźnikowski streams.

The presenting authors noted striking resemblance of the Beloveža Beds (Formation) from the type locality to the typical Hieroglyphic Beds from Wilczna in Beskid Wysoki area and to typical Beloveža Beds from Hańczowa Mts. They propose to restrict the name Hieroglyphic Formation to the Skole Unit and apply name Beloveža Formation to thin-bedded flysch in both Bystrica and Rača Units. The original type locality in Beloveža near Bardejov was selected for the type section of the Beloveža Formation.

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M. WENDORFF: **Evidence against the paradigm of disorganised nature of olistostromes**

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Classical publications devoted to olistostromes place emphasis on disorganized structure of these coarse clastic depositional bodies (e.g. Flores, 1959; Hsü, 1974). More recent papers stress the importance of the mass-wasting phenomena (responsible for generation of the coarse debris and initiation of the gravity-driven redeposition), and debris flows, slumping and sliding of rock masses as the chief transportation mechanisms. However, little attention is devoted to detailed sedimentological analysis of olistostrome bodies. Borehole cores and open-cast mining operations intersecting syn-rift and synorogenic olistostromes in the Neoproterozoic Lufilian Arc/orogen of the Central Africa enabled the presenting author to collect detailed observations that document a varying degree of their organisation observed in both, vertical succession and laterally. The architecture of these olistostrome bodies reflects variations in the tectonic regimes and sediment transportation phenomena.

The Lufilian Arc, a segment of the Neoproterozoic-Lower Paleozoic Pan-African orogenic belts network within the southern and central Africa deforms a sedimentary succession defined as the Katanga Supergroup. Olistostrome bodies mark major turning points in tectonic evolution of the Lufilian belt. Rifting between the Congo Craton in the N and the Kalahari Craton in the S at ca. 880 Ma resulted in opening of the Roan rift located in the southern part of the Lufilian Arc region. Prominent uplift of the southern shoulder of the Roan rift at ca. 765 Ma led to the deposition of the rift olistostromes at the base of the succeeding sequence that fills the Nguba rift, and resulted in the northward shift of the rifting depocentre. During post--735 Ma orogenesis, north-advancing nappes supplied foreland basin by the coarse detritus of the Fungurume Group, including synorogenic olistostromes with olistoliths of the pre-existing Katangan rocks involved in thrusting and shed by the orogenic front.

A syn-rift olistostrome of the Nguba Gp. at Mufulira in Zambia was interpreted by the previous authors as a massive tectonic megabreccia of the Roan rocks. However, it appears to be an almost intact sedimentary olistostrome succession that rests upon the Roan strata with a subtle local unconformity. The olistostrome succession consists of three complexes typified by matrix-supported debris--flow conglomerates with Roan clasts. Some of the conglomerate beds pass upwards to normally graded turbidite layers and are accompanied by the solitary slump beds. Clasts in some of the debris flow conglomerates represent dismembered fragments of the slump folds. Three conglomeratic assemblages are separated by two intervals of sedimentary breccia composed of allochthonous Roan blocks interpreted as mass-wasting debris redeposited into the basin by the high-volume sediment-gravity flows. Sedimentary features are the primary characteristics of the olistostrome sequence, which is slightly sheared and brecciated in places, but stratigraphic continuity is retained throughout the succession.

Synorogenic olistostromes in the fold-thrust region in the north of the Lufilian Belt (in the Dem. Rep of Congo – DRC) consist of coarse detritus shed by the north-advancing orogenic front. Their main bodies contain massive, matrix-supported conglomerates with olistoliths that represent all the pre-orogenic rock units. The largest olistoliths reach several kilometres across. Some olistoliths that represent the Roan Group strata contain orebodies with rich Co-Co mineralization.

The synorogenic olistostrome in Kambove attains a maximum thickness of ca. 650 m. Its lower part is a C-U succession evolving from thin turbidites to debris flow conglomerates with olistoliths increasing in size up the section. The largest olistoliths, reaching up to 800 m across, are present in the southern and central sector of the olistostrome but are absent in the northern part. All large olistoliths grade laterally towards the north and away from the orogenic source into pebble conglomerate. Such a lateral transition in maximum clast size implies a facies gradient from the proximal in the south to distal in the northern part of the depositional body.

The massive lower part of the olistostrome at Fungurume is succeeded by an organized uppermost part characterized by the crudely bedded massive conglomerates with thin discontinuous intercalations of mudstone and water escape structures. Fine olistoliths (of pebble size) are subrounded to rounded but in the uppermost part angular clasts appear. They were shed into the basin from advancing orogenic front composed of the Roan Group strata, thrust slabs of which finally overrode the olistostrome and now rest at its top.

W. WRÓBLEWSKI[1], M. GRADZIŃSKI[1] and H. HERCMAN[2]: **Geochemical and sedimentological evidence of allochthonous origin of the terra rossa from the Dreveník travertine buildup (Spiš, Slovakia)**

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Terra rossa soils are reddish clayey and silty-clayey sediments spatially associated with the carbonate deposits in the karst regions. They are considered to be residual or detrital in origin.

Geochemical and sedimentological studies of the terra rossa samples from the Dreveník travertine buildup located near the town of Spišské Podhradie (Northern Slovakia) suggest their allochthonous origin. Geochemical analysis of travertines demonstrated that they are composed almost entirely of pure carbonate with only subordinate content of insoluble components. The mass balance calculations of the main insoluble components in travertine and terra rossa were carried out. They indicate that the volume of the terra rossa soils is grater than it can be deposited during the karstification processes. It suggests that the terra rossa is not of residual origin. Zr/Nb and Zr/Y ratios in the terra rossa are significantly different from the values in underlying travertine. It indicates that travertine was not the parent material of the terra rossa. Furthermore the geometry of the Dreveník travertine buildup rules out fluvial transport of the components of the terra rossa, which in turn suggests that it is aeolian in origin. U-series dating of speleothems occurring in cavities in travertine implies the formation of the terra rossa before 255 ka.

The above interpretation adds a new dimension to the discussion on the formation of terra rossa in Slovakia and indicates that the methods used in this study can be successfully adapted to verify the origin of other terra rossa soils in other regions of Slovakia.

A. WYSOCKA, M. GÓRKA and A. RADWAŃSKI: **Shallow-water Miocene deposits of the northern marginal part of the Carpathian Foredeep (Podolia, Ukraine)**

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The northern margin of the Carpathian Foredeep basin, widely spread from Slovakia, through Poland and the Ukraine as far as Moldova, yields a wide range of diverse lithofacies which all reflect both the morphology of, and the terrestrial supplies from, the Tertiary hinterland of Podolia and Volhynia. Moreover, sedimentological features record a change in the hydrodynamic and diastrophic factors that are connected with the evolution of the Carpathian Foredeep basin, as well as the Paratethys area. The Miocene deposits of the Podolia area consist of normal marine Badenian and restricted semi-marine Sarmatian deposits that are characterized by the diversified sets of sedimentological and biogenic structures ascribed mainly to the shallow-water environment. The Lower Badenian deposits form a continuous cover and reach a maximum thickness of up to 80 metres in the area of the Roztocze Hills near Lviv. They represent a set of lithologically diversified rocks with a predominance of sandy, quartz and quartz-glauconite deposits, more rarely accompanied by calcarenites and *Lithothamnium* limestones. These deposits may pass laterally into each other, as well as occur several times within the sections, moreover, they are directly overlain by the Ratyń Limestones belonging to the Evaporitic-Chemical Beds. The most prominent components of the Upper Badenian are coralline algal reefs constructed mainly by the crustose coralline algae that form the Medobory Hills well visible in the recent morphology. The reefal-type deposits are associated with a variety of bioclastic, marly and rodoid facies. They are covered by the Lower Sarmatian serpulid-microbialite reefs which are placed at the SW foot of the Medobory Hills where they build rocky hills called the "tovtra" mounds. The "tovtra" mounds are usually arranged in the linear rows more or less perpendicular to the Medobory Hills.

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Nine shallow boreholes were drilled near the villages Přemyslovice and Hluchov (wider surroundings of Prostějov) through Miocene sediments in the Czech (Moravian) part of the Carpathian Foredeep. Seven of them (PY1 to PY7) were situated near Přemyslovice (GPS 49°34.169´ N; 016°57.928´ E), the rest two (HL1 and HL2) close to Hluchov (GPS 49°32.322´ N; 017°00.504´ E). While the PY boreholes reached the Paleozoic basement in the depths of about 5 meters, the HL boreholes even in the depths of 20 m penetrated still Miocene sediments.

In all boreholes the fossiliferous Miocene sediments were represented by sands, sandy clays, mudstones, limestones, gravels and marls. The PY boreholes include a distinct interval of whitish, light, unfossiliferous sediments with the Lower Badenian tephra admixture. All boreholes were sampled in approximate interval of 1 meter. Most of the samples yielded rich fauna and flora of Foraminifera, Bryozoa, Molluscs, red algae and other elements.

Preliminary study of Bryozoa in the samples from PY boreholes indicates the oldest known (lowermost Badenian) assemblages from the Carpathian Foredeep (Holcová et al., 2007; Zágoršek and Holcová, 2009), representing a base of the Lower Badenian bryozoan event reported up to now only from three other locations in the Central Paratethys, namely from Kralice nad Oslavou (Carpathian Foredeep), Szentkút (Pannonian Basin), and Garbova de Sus (Transylvanian Basin). The samples yielded very abundant fauna and flora (Foraminifera, Bryozoa, Mollusca, red algae, Echinodermata, Arthropoda, namely Cirripedia and Crustacea, Teleostei, and Chondrichthyes). Foraminifers and molluscs confirm the Lower Badenian age. The presence of stenohaline elements and practically total absence of brackish and estuary ones indicated fully marine (~35 ‰) environment. A specific molluscan association with *Corbula gibba* and *Gouldia minima* has been ascertained in the basal parts of the PY5 and PY7 cores. The association represents a pioneer community, generally opportunists, optimally adapted to unstable conditions (muddy bottoms, infauna – shallow burrowers, suspension or sediment feeders) in the shallow, intertidal/subtidal to bathyal zones. In the same samples, the pioneer bryozoans association (represented by the genera *Tervia*, *Retepoella* and *Idmidronea*) was also found that may be fully correlated with the lowermost part of the Kralice profile (Zágoršek et al., 2008). Above the mentioned interval of unfossiliferous sediments, the fossils in PY boreholes indicate a more stable environment – shallow, with normal salinity and high water dynamics, dominated by epibionts living on hard substrates (rocky sublittoral). The only known occurrence of *Tremogasterina* (Bryozoa) within the Moravian part of Carpathian Foredeep is ascertained from this interval.

The Lower Badenian sediments with abundant fauna and flora (mainly Foraminifera, Bryozoa, Mollusca, Echinodermata, and Cirripedia) have been ascertained also in the HL boreholes. In the lower parts of the profiles an admixture of elements from the highly exposed rocky medio/sublittoral (intertidal to shallow subtidal), and from less exposed, somewhat deeper infralittoral (shallow subtidal) occurs. The molluscan shells bear frequent drilling, bioerosion, corrosion, and dissolution traces. In the upper parts of the profiles the elements from a deeper infralittoral (shallow subtidal) zone dominate, documenting the fully marine environment, inhabited mainly by suspension feeders. Bryozoans are represented by a rich association of *Reteporella* and new species of *Cribellopora*, indicating high energy of water.

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