RESEARCH REPORTS 2010

Institute of Geology AS CR, v. v. i.

Cover photo: The highest Nile river terrace of the Northern Sudan was discovered at the plaeau of Sabaloka Inlier south of the 6th Nile cataract. The terrace of possible Pliocene age is located aprox. 100 m above the present course of the river, but previously unknown younger levels aprox. +40−60 m above the present Nile were found as well (Photo V. Cilek).

Research Reports 2010

Institute of Geology AS CR, v. v. i.

The report was compiled and finally edited by T. Přikryl and P. Bosák. The English version was kindly revised by J. Adamovič.
This report is based on contributions of the individual authors; contents and scientific quality of the contributions lie within the responsibility of the respective author(s).

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Contents

Introduction

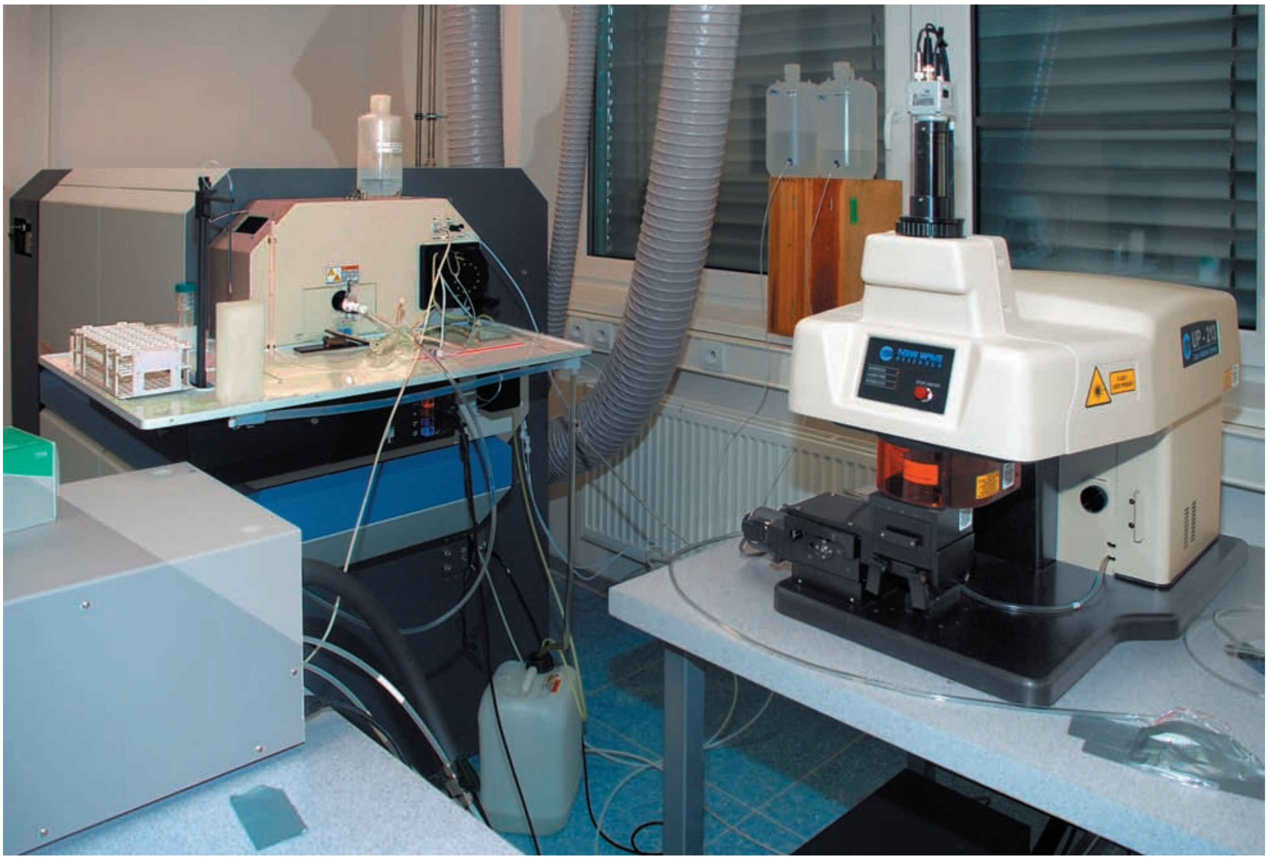
The life of the Institute of Geology has stabilized in the new building during year 2010. Spaces appeared as very suitable a favorable for quiet work, but especially analytical laboratories and library needed some time and adjustment to new spaces and conditions. The building disposition ensures future development of the Institute.

The main task of the whole Academy of Sciences of the Czech Republic for 2010 was the intensive preparation for evaluation to laboratory/team level by international commissions. Materials were prepared carefully with the help of individual Institute units, chairmen of laboratories and the Executive Board.

The scientific activities have otherwise continued in the style of "busines as usual" dictated by grant applications, obtained results and new emerging trends in global science. The number of published articles in peer reviewed international journals followed the long-term rising trend and even the impact factor of respective articles has generally increased. The research, as it is reflected in this and previous Annual and Research Reports, was focused on a "classic" array of topics such as Carboniferous forest, environmental biogeochemistry, Phanerozoic paleoecology and landscape evolution.

The basic team of the Institute has remained almost unchanged, but several young scientist and technicians started to work either with new facilities such as the LA-ICP MS or on their doctoral theses. Gradual "isovolumetric" generational exchange is taking place in a slow, natural rhythm and according to available financial funds. New challenges and tasks keep coming and new topics are evolving such as renewed stress on practical applications associated mostly with environmental changes, reclamation techniques or detailed stratigraphy of Lower Paleozoic shales searched recently from the point of gas production.

Václav Cílek, Director
Pavel Bosák, Chairman of Executive Board



■ Thermo-Finnigan Element 2 sector field ICP mass spectrometer coupled with 213 nm NdYAG laser (New Wave Research UP-213), photo by M. Svojtka.

2. General Information

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The Institute of Geology of the AS CR, v. v. i., is a research institute belonging to the Academy of Sciences of the Czech Republic (AS CR). It concentrates on the scientific study of the structure, composition and history of the Earth's lithosphere and the evolution of its biosphere. Although the Institute does not have the opportunity to cover all geological disciplines (in the widest sense) or regionally balanced geological studies, the methods of its activity span a relatively broad spectrum of problems in geology, geochemistry, paleontology, paleomagnetism and rock mechanics. The Institute takes part in the understanding of general rules governing evolutionary processes of the lithosphere and biosphere at regional as well as global scale; for this purpose, the Institute mostly employs acquisition and interpretation of relevant facts coming from the territory of the Czech Republic.

The Institute of Geology AS CR, v. v. i., is a wide-spectrum institute developing essential geological, paleontological, petrological, mineralogical and other disciplines, lately accentuating environmental geology and geochemistry. The major research areas covered by the Institute are:

- Petrology and geochemistry of igneous and metamorphic rocks
- Lithostratigraphy of crystalline complexes
- Volcanology and volcanostratigraphy
- Structural geology and tectonics
- Paleogeography
- Terrane identification
- Taxonomy and phylogeny of fossil organisms
- Paleobiogeography of Variscan Europe
- Paleoecology (incl. population dynamics, bioevents)
- Paleoclimatology as evidenced by fossil organisms and communities
- Biostratigraphy and high-resolution stratigraphy
- Basin analysis and sequence stratigraphy
- Exogenic geochemistry
- Exogenic geology, geomorphology
- Quaternary geology and landscape evolution
- Karstology and paleokarstology
- Paleomagnetism
- Magnetostratigraphy
- Petromagnetism
- Physical parameters of rocks

The Geological Institute of the Czechoslovak Academy of Sciences (ČSAV) was founded on July 1, 1960. Nevertheless its structure had developed in period of 1957 to 1961. During the period, several independent laboratories originated: Laboratory of Paleontology, Laboratory of Engineering Geology, Laboratory of Pedology and Laboratory of Geochemistry; Collegium for Geology and Geography of the ČSAV represented the cover organization. On July 1, 1960, also the Institute of Geochemistry and Raw Materials of the ČSAV was established. This Institute covered technical and organization affairs of adjoined geological workplaces until their unification into Geological Institute of the ČSAV on July 1960.

On August 1, 1964 the Institute of Geochemistry and Raw Materials of the ČSAV was integrated into the Geological Institute. On July 1, 1969 the Institute of Experimental Mineralogy and Geochemistry of the ČSAV, successor of the Geochemistry and Raw Materials was newly established. A part of the staff of the Geological Institute joined the new institute. On January 1, 1979 the Institute of Experimental Mineralogy and Geochemistry was integrated into the Geological Institute.

On March 1, 1979, the Geological Institute was united with the Mining Institute of the ČSAV under the Institute of Geology and Geotechnics of the ČSAV, and finally split from the latter on March 1, 1990 again.

On January 1, 1993 the Academy of Sciences of the Czech Republic was established by the transformation from the ČSAV, and the Geological Institute became a part of the ASCR. The Institute belongs to the I. Department of Mathematics, Physics and Earth Sciences and to the 3rd Section of Earth Sciences. On January 1, 2007 the Institute became the public research institution (v. v. i.) by the change of legislation on research and development.

The economic and scientific concept of the Institute of Geology AS CR, v. v. i., and the evaluation of its results lie within the responsibility of the Executive Board and Supervisory Board that include both the internal and external members. Institutional Research Plans are evaluated by the Committee for Evaluation of Institutional Research Plans of AS CR Institutes at the AS CR. Besides research, staff members of the Institute are involved in lecturing at universities and in the graduate/postgraduate education system. Special attention is also given to presentation of the most important scientific results in the public media.

3. Publication activity of the Institute of Geology

3a. Journals

The Institute of Geology AS CR, v. v. i., is the publisher of GeoLines. GeoLines (www.geolines.gli.cas.cz) is a series of papers and monothematic volumes of conference abstracts. GeoLines publishes articles in English on primary research in many field of geology (geochemistry, geochronology, geophysics, petrology, stratigraphy, paleontology, environmental geochemistry). Each issue of GeoLines journal is thematically consistent, containing several papers to a common topic. The journal accepts papers within their respective sectors of science without national limitations or preferences. However, in the case of extended abstracts, the conferences and workshops organized and/or co-organized by the Institute of Geology are preferred. The papers are subject to reviews. No volume was published in 2010.

Since 2000, the Institute of Geology AS CR, v. v. i., has been a co-producer of the international journal **Geologica Carpathica** (www.geologicacarpathica.sk), registered by Thomson Reuters WoS database. The Institute is represented by one journal co-editor (usually Institute Director) and several members of the Executive Committee (at present P. Bosák and J. Hladil).

Geologica Carpathica publishes contributions to: experimental petrology, petrology and mineralogy, geochemistry and isotope geology, applied geophysics, stratigraphy and paleontology, sedimentology, tectonics and structural geology, geology of deposits, etc. Geologica Carpathica is published six times a year. The distribution of the journal is done by the Geological Institute, SAS. Online publishing is also possible through Versita on MetaPress platform with rich reference linking. Online ISSN 1336-8052 / Print ISSN 1335-0552.
In 2010, six numbers (1 to 6) of Volume 61 were published with 36 scientific articles. For the contents and abstracts see www.geologicacarpathica.sk.

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3b. Monographs, proceedings, etc.

ČEJCHAN P. & BOSÁK P. (Eds., 2010): Research Reports 2007 & 2008. – Institute of Geology AS CR, v. v. i.: 1–180.

CÍLEK V., BOSÁK K. & ULRYCH J. (2010): Geologický ústav AV ČR, v. v. i. (1960–2010). – Institute of Geology AS CR, v. v. i.: 1–12.

4. Research Reports

4a. Foreign Grants, Joint Projects and International Programs

Bilateral co-operation between Czech Geological Survey, Praha and Geologisches Bundesanstalt Wien, Austria, No. 0051: **Palynological evaluation of plant-bearing localities of Lower Gosau-Subgroup in the area of St. Wolfgang and Gosau** (H. Lobitzer, Geologisches Bundesanstalt, Wien, Austria; L. Hradecká, L. Švábenická, Czech Geological Survey, Praha, Czech Republic & *M. Svobodová*; 2009–2010)

Grey marls of the Lower Gosau-Subgroup exposed in the Kohlbachgraben north of St. Gilgen yielded foraminifers, calcareous nannofossils as well as plant remains. The microfossils indicate Turonian or Turonian/Coniacian boundary age. The paleoenvironment was warm and dry as evidenced by the presence of *Ephedripites* pollen and thick-walled pteridophyte spores. Salt-marsh flora is represented by both *Classopollis* pollen as well as leaves of the genus *Dammarites.* Sediments were deposited in shallow marine environment (dinocysts of *Dinogymnium* sp.) with low oxygen content. Low oxygen content is documented by common scolecodonts (jaw apparatus of Polychaeta worms) and the presence of pyrite inside many palynomorph species.

Project of Joint Institute for Nuclear Research, Dubna, Russia, No. 04-4-1069–2009/2011: **Investigations of nanosystems and novel materials by neutron scattering methods** (*T. Lokajíček*, *V. Rudajev*, A. Nikitin & T. Ivankina, Joint Institute for Nuclear Research, Frank Laboratory of Neutron Physics, Dubna, Russia; 2009–2011)

Subproject 1: **Theoretical and experimental study of elastic wave field pattern in anisotropic texturized rocks under high pressures using modern methods of neutron diffraction, ultrasonic sounding and petrophysics**

Fine-grained biotite gneiss of a core sample from the Outokumpu Scientific Deep Drill Hole exhibiting strong crystallographic (LPO) and shape preferred orientation (SPO) of the biotite minerals provides an excellent material to investigate the relative contribution of oriented cracks, crystallographic (lattice) preferred orientation (LPO) and shape preferred orientation (SPO) to P- and S-wave velocities, bulk anisotropy and shear wave splitting. Different experimental and theoretical approaches were used for investigating the nature of elastic anisotropy. The crystallographic preferred orientation of minerals (CPO) was determined by means of neutron diffraction measurements at the time-of flight texture diffractometer at Dubna, Russia. Using the orientation distribution function (ODF) as a parameter to characterizing the CPO of the constituent minerals, the seismic properties of the bulk sample were calculated from the corresponding properties of major minerals. 3D velocity calculations together with laboratory seismic measurements on a sample cube in a multi-anvil pressure apparatus (Universität Kiel, Germany) as well as on a sample sphere in a pressure vessel (Institute of Geology of the ASCR, v. v. i., Praha) provide the basis for interpreting the nature of the bulk anisotropy. Measurements of compressional (Vp) and shear wave (Vs) velocities in the three foliation-related structural directions (up to 600 MPa) of the sample cube and of the 3D P-wave velocity distribution on the sample sphere (up to 200 MPa) revealed a strong pressure sensitivity of Vp, Vs and P-wave anisotropy in the low-pressure range. At conditions of high pressure (>150 MPa), where most cracks are closed, the residual velocity anisotropy is mainly caused by crystallographic (CPO) and shape preferred orientation (SPO) of minerals. Most important is biotite which displays the strongest preferred orientation and also the strongest anisotropy of single-crystal velocity, compared to the constituent quartz and plagioclase. The calculated bulk velocity anisotropy is significantly smaller than the experimentally determined anisotropy. We suggest that the experimentally determined Vp-anisotropy of the compacted aggregate cannot be explained by the crystallographic preferred orientation of major minerals alone. Other effects, such as the strong SPO of biotite, grain boundary effects and compositional layering may also contribute to the apparent anisotropy.

Subproject 2: **Laboratory study of rock fracturing and related processes by means of acoustic emission and neutron diffractions**

The changes of mechanical properties of thermal-heated rocks were studied. Granulite spherical samples were subjected to controlled loading and heating regimes. In the first step, granulite spherical sample was subjected to confining stress loading up to 400 MPa, Elastic anisotropy, measured at 132 independent directions, was determined for different stress levels. After unloading, the rock sample was gradually heated from 50 °C up to 600 °C. After individual heating regimes there was determined elastic anisotropy of the sample at atmospheric pressure. After final sample heating at 600 °C, there was again determined its elastic anisotropy up to confining stresses of 400 MPa. The original sample exhibits weak anisotropy (8%) at atmospheric pressure. At 400 MPa the granulite sample is nearly isotropic. Heating of the sample caused a significant decrease in P-wave velocity and a high increase in the coefficient of anisotropy. Subsequent determination of elastic anisotropy of heated rock sample under confining stresses up to 400 MPa shows a significant increase in P-wave velocities in all directions, which nearly reach the P-wave velocity values of the original sample before it was subjected to heating regime.

International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 510: **A-granites and related rocks through time** (Leader: Roberto Dall'Agnol, Federal University of Pará, Brazil, contribution by *K. Breiter*; 2005–2010)

The project finished this year with the concluding meeting in Helsinki, Finland, August 18–20. As a Czech contribution, two coexisting granite series, S- and A-type, were studied in the Variscan Krušné hory Mts. The Krušné Hory Variscan magmatic province differs from other parts of the Variscan belt in Europe in the coexistence of two contrasting types of granite plutons: (1) strongly peraluminous P-rich granites (S-type), and (2) mildly peraluminous P-poor granites (A-type). Both types of granites are similar in their age of about 325–310 Ma (with scarce exceptions down to 298 Ma), shallow intrusion levels with breccia-filled vents, and greisen-style Sn-W mineralization. The granites differ in the relative abundance of trace elements, chemical composition of rock-forming and accessory minerals, related volcanic activity, and structural style of the Sn-W mineralization.

The S-type granites form larger plutons in the western and central part of the area, granites and volcanics of the A-type form small stocks and bodies in the whole Krušné hory Mts.

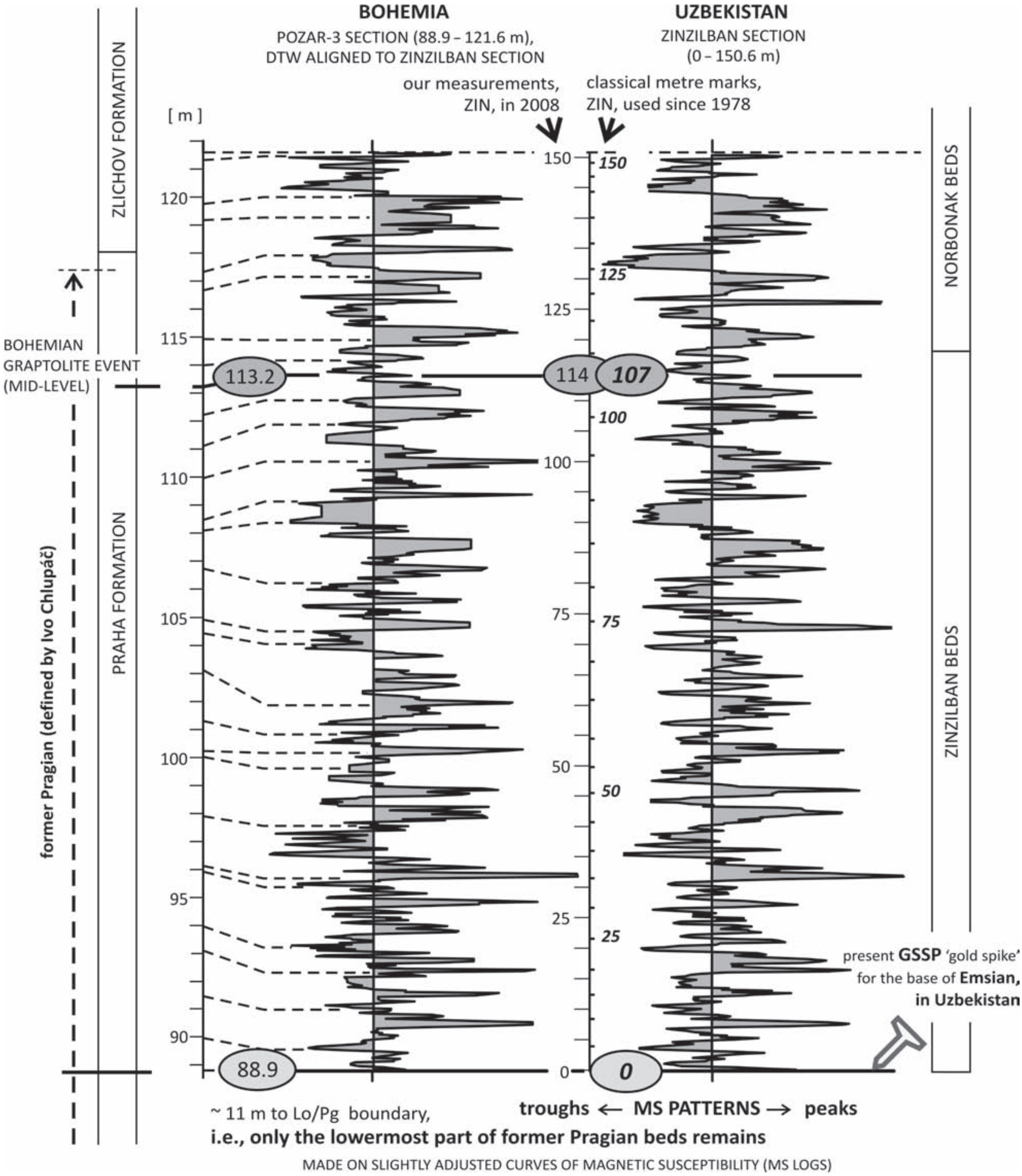
Volcanic equivalents of both types of granites erupted namely in the Altenberg-Teplice caldera. The S-type granites underwent a long fractionation path expressed in the increase of peraluminity (ASI 1.1 → 1.3), enrichment in fluxing agents (0.2 → 1.5 wt.% P_2O_5, 0.1 → 1.5 wt.% F), lithophile elements (100 → 1000 ppm Li, 200 → 1,500 ppm Rb), and ore elements (5 → 60 ppm Sn, 3 → 50 ppm U, 1 → 25 ppm Ta). A-type granites are, compared to the S-type granites, characterized by a lower peraluminity (ASI~1.05), higher contents of SiO_2, Zr, Th, Y, and HREE, lower contents of Al, Ca, and P, and a higher Fe/Mg-ratio. Wide differences in WR- and mineral-compositions among individual nearby located A-type intrusions suggest that the fractionation of the A-type melt proceeded in several small independent magma chambers.

Among primary accessory minerals, zircon rich in P, U, and Al, and poor in Th, Y, and Yb, together with uraninite, monazite, and rare xenotime, are typical for the S-granites. The A-granites and rhyolites contain Th, Y, Yb-rich zircon, common thorite, and xenotime. Transitional phases among zircon, thorite, and xenotime are quite common in A-type granites, especially in small stocks of subvolcanic character. Magmatic evolution of some plutons of both geochemical types culminates by the formation of Sn-W deposits. In S-granites, the main Sn, W-greisen formational events followed immediately after the magma emplacement via fluid-melt immiscibility and pervasive fluid-crystal interaction (Krásno deposit). In stocks and cupolas of A-granites, solidification of the granite was followed by intensive hydrofracturing and fracture-related greisenisation, later by the formation of hydrothermal veins (Cinovec/Zinnwald and Altenberg deposits).

International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 580: **Application of magnetic susceptibility as a paleoclimatic proxy on Paleozoic sedimentary rocks and characterization of the magnetic signal** (International Leader: A.C. da Silva, Liège University, Belgium, International Co-leaders: M.T. Whalen, University of Alaska Fairbanks, USA; *J. Hladil*; D. Chen, Chinese Academy of Sciences, Beijing, China; S. Spassov, Royal Meteorology Institute, Dourbes, Belgium; F. Boulvain & X. Devleeschouwer, Université Libre de Bruxelles, Belgium; Czech group representative and organizer: *L. Koptíková*; Czech participants: *S. Šlechta*, *P. Schnabl*, *P. Čejchan*, *L. Lisá*, *P. Lisý* & O. Bábek, Faculty of Science, Palacký University, Olomouc, Czech Republic; 2009–2013)

Magnetic susceptibility as a paleoclimatic proxy – the first worldwide IGCP project officially co-directed from the Institute of Geology of the ASCR, v. v. i.

The team of the GLI ASCR, v. v. i. came with several research products that developed the application of magnetic susceptibility in diverse fields of science and practice. In the early 2010, members of this team contributed to the first published IGCP 508 volume (*Geologica Belgica*, 13, 4) by 5 of 12 original papers accepted from the world. Here, a real novelty was the application of the dynamic time warping (DTW) alignment techniques to stratigraphic correlation of coeval outcrop logs, providing an increased capability to interconnect details in complexly structured records. Using this method, the magnetosusceptibility (MS) records (and potentially also any other geophysical logs) are point-by-point linked much more effectively than using any previous methods. This is because of the fact that the DTW algorithm allows a maximum sensitivity to stratigraphically condensed, swollen, gapped or variously deformed patterns until their basic structures and successions are detectable. The algorithm was originally written for the signal analysis tasks in the field of speech recognition but its implementations are rapidly extending to other disciplines including the records in chemistry or medical sciences. The DTW-based analytical and correlation techniques are really well fitting for sediments/sedimentary rocks where the above mentioned irregularities in sedimentary rates together with the occurrence of cryptic hiatuses are absolutely typical of almost every sedimentary record. On the other hand, the ignorance or underestimation of this typical nature of the stratigraphic record often leads to improperly calculated and fallacious results achieved by means of cyclostratigraphic analysis. The best evidence of correctness of the DTW alignment analysis is the verification of the DTW-indicated sizes of gaps and/or thickenings, thinnings or insertions directly in the sections. According to this evidence, the published data suggest that this really works and the methods are worth of further investigation and development. One of the very important contributions of this publication collection is the systematic extension of the combined MS and gamma-ray spectrometric (GRS) methods by high-resolution sedimentology/petrology, geochemistry and mineralogy of insoluble residues. These studies showed, for instance, the exact relationships of different MS-GRS records to variability of compositions of silt-sized impurities embedded in limestone. Although the ferromagnetic behaviour of detrital (but often diagenetically modified or authigenic iron oxide) phases gives the main characteristics of the MS signal from the carbonate rocks, there are still other significant features which reflects the presence of fine-grained non-carbonate minerals including the silicates. It was shown, using the material from Lower Devonian sections in the Praha Synform, that the well bedded grey coloured caciturbidites contain mostly pyrite-pyrhotite assemblages with lower abundance of iron oxides



■ **Fig. 1.** Magnetic susceptibility DTW correlation of the Devonian impurity-in-limestone records between Uzbekistan and Bohemia (in the Devonian on northern and southern hemisphere, respectlively, near Kazakhstania and Perunica), modified according to the SDS document manuscript by the same authors.

where goethite is more common than hematite. A large number of these grains have spherical to framboidal shape. In these limestones, also a higher abundance of silicate grains of pyroxene/amphibole composition or olivine (together with grains of augite, diopside or enstatite microprobe characteristics) were found. Ilmenite and rutile occur simultaneously with these minerals. Interestingly, micas with iron oxide dots and also plagioclases and microcline (partly authigenic) are relatively common components, whereas clay minerals are considerably rare (particularly in the Lochkovian). The pink coloured limestones of lower Emsian age (Praha Formation) differ in the presence of bipyramidal pyrite and superparamagnetic hematite which is substantially more magnetic than bulk hematite. Altered mixtures of finest silicate silt particles and oxidic grains rich in iron form a significant component with predominantly paramagnetic behaviour that is seen according to thermal variation of the MS. In general, these studies enriched the knowledge on MS characteristics of impurities in limestone, especially detrital input of eolian type (and its alteration in marine environments) and also mixtures of particles of volcanic ash/basaltic tuff origin with those that correspond to common sialic-crust weathering products. In the late 2010, the Czech academy team contributed to the Annual IGCP 580 meeting in Guilin, China, by 7 of the total of 19 accepted papers. These papers brought novelty insights from various fields of MS research, e.g., initiating the MS studies in organic skeletal structures and giving a parallel discipline to research in sediments; analyzing, for the first time, the effect of different acid dissolution methods on magnetic properties of insoluble residues of limestones; giving the outlines for the relationships between MS records and remagnetization of sedimentary rocks; developing the wavelets transformation methods as an alternative tool for MS-stratigraphic correlation; showing the environment and stratigraphy-orientated power of the analysis of magnetic carriers by means of frequency-dependent magnetic susceptibility analysis; and, finally, showing the trends between mean MS values and standard deviation of data which have a capability to characterize various carbonate facies associations in the Paleozoic and Mesozoic carbonate rocks in the World and thus also their global and regional environmental backgrounds.

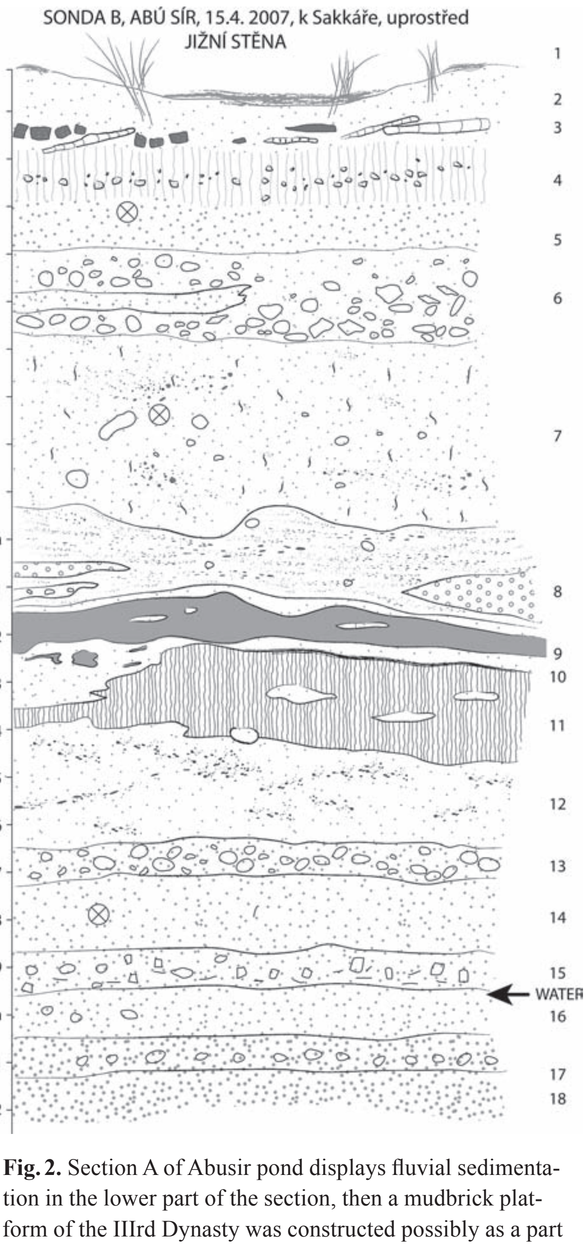
In addition, it is worth to note that also continued studies on the long-distance stratigraphic correlation using the MS-DTW methods show progress in the treatment of problems caused by strong variations in regional wind (and dust influx) patterns. These studies will be finished in 2011, but the preliminary stratigraphic correlation of Pragian–Emsian sections between Uzbekistan and Bohemia has already been discussed in the Subcommission on Devonian Stratigraphy (SDS) – Fig. 1.

Grant-in-aid internal program of international cooperation projects Academy of Sciences of the Czech Republic, Project Code M100130902: **Environmental history of Egyptian Western Desert: the case study of a civilization influenced by climatic changes** (*V. Cílek*, *L. Lisá*; M. Bárta, Czech Institute of Egyptology Faculty of Liberal Arts, Charles University, Praha; Z. Sůvová, A. Pokorná, J. Novák, private sector, Czech Republic & A. Fahmy Faculty of Science, University of Helwan, Egypt; 2008–2011)

Sub-project: **Holocene of Abusir Area, Cairo area, Egypt** (*V. Cílek* & *L. Lisá*)

The Abusir pond, more commonly named as the Lake of Abusir appeared already in former mappings of Lepsius, Borchardt and other Egyptologists and cartographers. It is depicted as an isolated body of water, which is in archaeological reconstructions (see e.g., Verner et al. 2006 for a review) connected by man-made channel with the Nile and Memphis area. The lake was reported to exist occasionally till the middle of the 1960s. With the completion of Aswan Dam it started to disappear and is now totally dry, covered by grasses and rimmed towards the Nile floodplain by date palms.

Our team led by M. Bárta and V. Bruna with the participation of J. Beneš, V. Cílek, L. Lisá and J. Novák opened four pits 2–3 m



■ **Fig. 2.** Section A of Abusir pond displays fluvial sedimentation in the lower part of the section, then a mudbrick platform of the IIIrd Dynasty was constructed possibly as a part of harbor area, but after 2500 BC the conditions changed into a desert environment and predominantly aeolian sedimentation (original V. Cilek).

wide and 1.8–3.2 m deep, located in the axis of the pond in the extent given by historical maps (especially Lepsius and younger sources; Figs. 2, 3). All studied sections included in this paper are dated by the presence of archaeological objects. The quartz grain surface analysis was performed on the spot together with the determination of ceramic fragments and pebble provenance analysis. We consider our sections to be rather discontinuous due to the episodic sedimentation, erosional events and scratching up the upper aeolian sand by farmers protecting their fields against desert.

The background geomorphology of the Abusir Pond and other depressions under the steep slopes of Abusir and Sakkara area were very probably formed by an older, now abandoned Early–Middle Holocene river course. Such irregular linear depressions are a common feature of all riverine systems. River erodes or undercuts the slope and then, after some flood or megaflood, shifts its course more to the middle part of the wide valley where aggradation takes place. The former river course under the slopes remains at lower altitudes in spite of some aeolian sedimentation, and water seeps in, resulting in the formation of a marsh or even a "lake".

The "lake" was, however, isolated by river levees, and a man-made channel might have been probably dug and regularly deepened during the construction of the Abusir pyramid complex. The existence of this channel that connected the main course of the river around Memphis and Sakkara–Abusir is indicated by geophysical research. The channel was probably only 10–15 m wide and not more than 2 m deep.

■ **Fig. 3.** Section D in the southern part of the depression consists mostly of rewashed aeolian sands and archaeological layers with frequent ceramic and bone fragments (photo by V. Cilek).

Sections observed in the excavated pits can be roughly divided into five parts: the lower part is formed by "pure" sands and gravels of fluvial origin, man-made mudbrick pavement overlain by washout sandy deposits while the upper parts of the sections are dominated by the desert aeolian sedimentation but may be intercalated by flash flood wadi deposittion (medium-sized gravels, in pits B and C). The lower fluvial sedimentation reflects the changes of hydrological regimes witnessed by sand-gravel rhythmicity. Wadis must have functioned at least as perennial rivers before IIIrd Dynasty of Old Kingdom.

The main result is that the change in sedimentation from fluvial to aeolian one happened some 10 cm above the horizon dated to the interval between IIIrd to Vth Dynasty of the Old Kingdom, i.e. after ca. 2460 BC. This date corresponds well with the first wave of Near East desiccation (Turkey, Sumer, Persia) that happened around 2500 BC, while the main droughts were coming around 1900–2100 BC at other sites (Issar & Zohar 2004).

ISSAR A.S. & ZOHAR M. (2004): *Climate-Change. Environment and Civilisation in the Middle East*. – Springer Verlag: 132–138. Heidelberg.
VERNER M. et al. (2006): The pyramid complex of Raneferef. – *Abusir*, 9: 26–85.

Grant-in-aid internal program of international cooperation projects Academy of Sciences of the Czech Republic, Project Code: M100130903: **Comparison of Czech and Chinese Carboniferous and Permian plant and spore assmeblages preserved in tuff beds of Upper Carboniferous coalfields** (*J. Bek*; W. Jun, H. Zhu, Institute of Geology and Paleontology, Chinese Academy of Sciences, Nanjiing, China & Z. Feng, University of Kunming, Kunming, Yunnan, China; 2009–2011)

Four different compression/impression floras were recognised within the geologic section in the Early Permian Shanxi Formation of the Wuda District of Inner Mongolia, northwestern China. These floras represent four different plant communities and landscapes that followed each other in time. The oldest flora was rooted in sandy clay and initiated peat accumulation that lead to the formation of the lower coal seam. This seam is 230 cm thick and overlain by a 66 cm thick volcanic tuff that preserves a second different flora that grew on the peat at the time of the ash-fall. Standing stems and large plant parts are present. The upper part of the tuff is rooted by a single species of lycopsid (the third flora) again initiating peat accumulation. On top of this second seam of 120 cm thickness rests a roof-shale, deposited as mud in a shallow lake, the formation of which was responsible for the cessation of peat deposition. This fourth flora represents the plants growing around the lake on clastic substrate. Four different environments followed each other in this locality over a geologically short time span and each time conditions prevailed to preserve plant macrofossils. Three of these floras represent peat-forming plant communities of essentially the same time interval. This demonstrates the great variability of vegetation and landscapes in the tropical Cathaysian realm of the Late Paleozoic. Taxa present; six groups of plants make up the peat-forming vegetation that was covered and preserved by the volcanic tuff. The first four are spore producing while the other two were seed producing gymnosperms. Lycopsids are represented by *Sigillaria* cf. *ichthyolepis*. *Sphenophyllum*, a dwarf shrub, and a very small form of *Asterophyllites* are the sphenopsids that were encountered. Marattialean tree ferns are common and at least eight species have been found. Herbaceous ferns present are *Pecopteris* (al. *Nemejcopteris*) *feminaeformis* and *Sphenopteris* sp. Noeggerathiales are represented by several species of *Tingia* and *Paratingia*. *Taeniopteris* and *Pterophyllum* can be interpreted as early relatives of cycads. *Cordaites* trees are early coniferophytes.

Life habits. *Sigillaria* and *Cordaites* were tall trees that stood higher than the general canopy and might have attained heights of 25 m or more. Marattialean tree ferns, Noeggerathiales and the cycad relatives were trees of up to 10–15 m height that formed an actual canopy in most places. Vines were rare but were probably represented by species of *Sphenopteris*. The groundcover was composed of the fern *Pecopteris* (al. *Nemejcopteris*) *feminaeformis*, *Sphenophyllum*, and *Asterophyllites*. It has to be emphasized that groundcover was not developed everywhere as is typical for tropical swamp forests.

Pattern of taxa distribution. The distribution of the six groups based on the counts shows the dominance of ferns with lycopsids and Noeggerathiales as the second most common groups. Sphenopsids, cordaites and cycads were rare. In terms of growth habits the lower storey trees predominate while the upper storey trees are the second most common group. Vines are very rare and the herb layer not continuous. This overall pattern characterizes the vegetation. However, there are local differences that exhibit a patchy pattern that one expects in a landscape.

WANG J., LABANDEIRA C.C., ZHANG G., BEK J. & PFEFFERKORN H. (2009): Permian *Circulipuncturites discinisporis* Labaindera, Wang, Zhang, Bek et Pfefferkorn gen. et spec. nov. (formerly *Discinispora*) from China, an ichnotaxon of a punch-and-sucking insect on Noeggerathialean spores. – *Review of Palaeobotany and Palynology*, 156, 3–4: 277–282.

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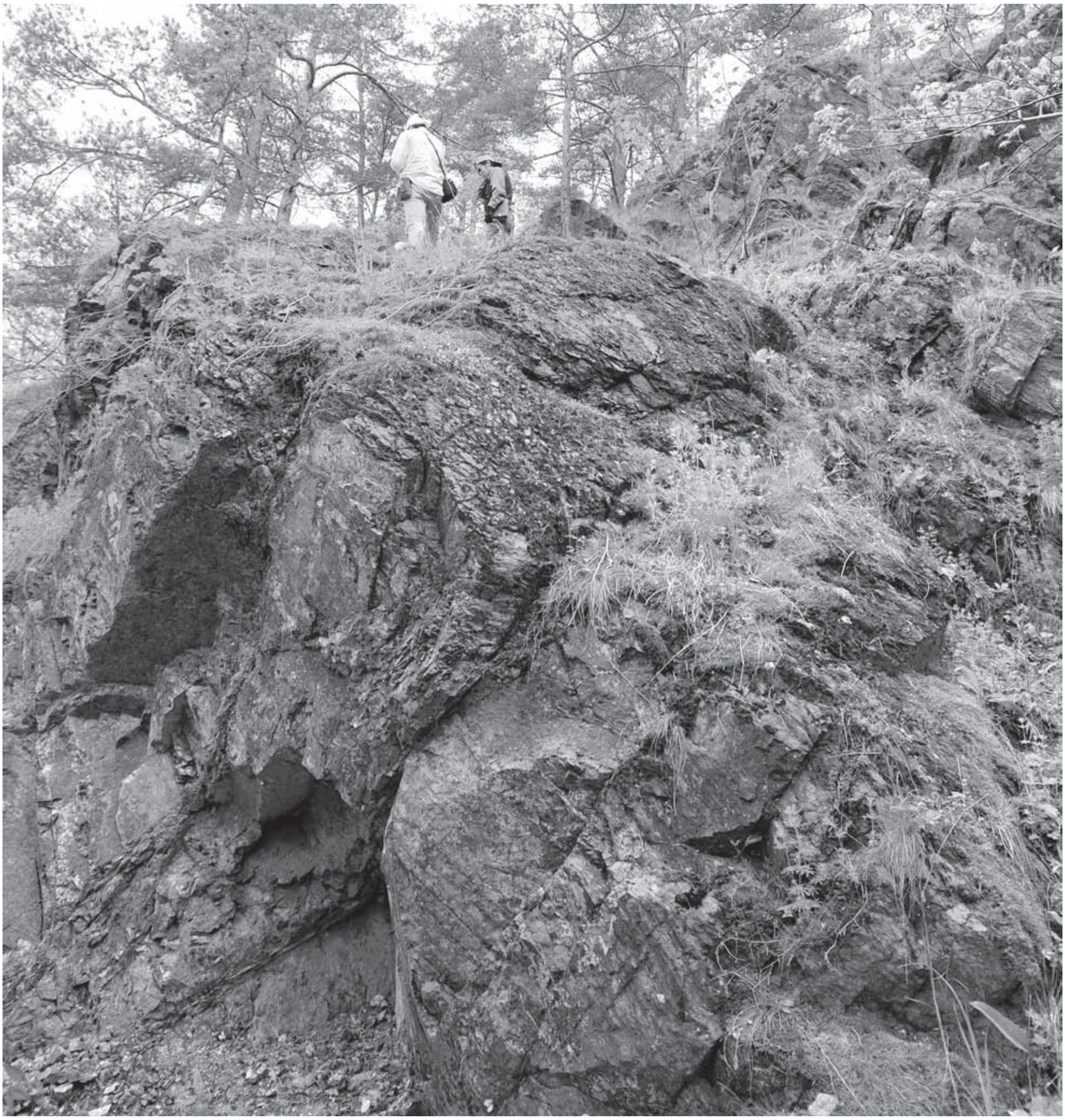
Grant-in-aid internal program of international cooperation projects Academy of Sciences of the Czech Republic, Project Code: M100130904: **Polyphase evolution of the highly metamorphosed rocks in collisional orogens: an example from Bohemian Massif (Czech Republic)** (*M. Svojtka*, *J. Sláma*, *L. Ackerman*; S.W. Faryad, Faculty of Science, Charles University, Praha, Czech Republic; T. Hirajima & T. Kobayashi, Kyoto University, Japan; 2009–2012)

Two papers and two conference abstracts were published in 2010. Both papers are focused on P-T recontrustuction of mantle-derived peridotites from the Bohemian Massif. The first paper deals with the origin of the Mohelno peridotite body, which is enclosed in the Gföhl granulites in the eastern part of the Bohemian Massif. It consists mainly of coarse spinel peridotite harzburgite and dunite; garnet peridotite occurs only in the sheared and deformed margins of the body. To decipher the origin and history of peridotites, we determined the mineral chemistry by electron microprobe analysis and olivine fabric patterns by the electron backscattered diffraction method for each rock type. We found two distinct types of olivine fabric (crystal-preferred orientation; CPO) in the peridotite, which can be correlated with the mineralogy and thermal history of each. The olivine CPO in coarse-grained spinel peridotite shows a strong concentration of [100] slightly oblique to the lineation and [010] and [001] girdles normal to the lineation (which is the so-called {0kl}[100] pattern typical of medium-temperature deformation). Olivine in coarse-grained garnet peridotite, on the other hand, shows a strong concentration of [010] normal to the foliation and a concentration of [100] parallel to the lineation (which is the so-called (010)[100] pattern typical of high-temperature deformation. We interpret the development of these contrasting fabric patterns and mineralogical types based on the pressure-temperature history of each rock type determined by applying published geothermometers and geobarometers to the constituent minerals. Starting from a high-temperature (>1,200 °C) spinel peridotite, during exhumation and cooling in contact with surrounding granulites, the marginal part of the body was transformed to garnet peridotite, whereas the interior remained in the spinel-peridotite facies because cooling was slower inside the body. The high-temperature fabric was preserved only at the margin of the body where cooling was more rapid. Reduction of grain size that occurred during later, low-temperature, deformation partly obliterated the high-temperature fabric patterns for both garnet and spinel peridotites. The initial rapid cooling at high temperatures associated with deformation probably occurred after the mantle peridotite was emplaced within the crustal granulites, which implies that the spinel- to garnet-peridotite transformation took place in the continental crust.

The second paper is focused on the description of Sr-bearing phase, celestine ($SrSO_4$) that was found in ultrahigh-pressure (UHP) eclogite associated with the Nové Dvory peridotite mass in the Moldanubian Zone of the Bohemian Massif, Czech Republic. Celestine is closely associated with anhydrite ($CaSO_4$) and sulphides; pyrite, pyrrhotite and chalcopyrite. Fe-rich unknown silicate mineral developing along the margin of the sulphide minerals was also found. Those minerals in the eclogite occur in the matrix that is mainly occupied with fine-grained clinopyroxene aggregate. A common Sr reservoir in eclogite is known to be epidote, but the maximum pressure-temperature (P-T) conditions of the studied eclogite were estimated at about 1,000–1,100 °C, 4.5–4.9 GPa. In such extremely high P-T conditions, epidote should be unstable. In fact, epidote is absent from most of eclogites in the Moldanubian Zone of the Czech Republic. This finding suggests that a possible Sr-reservoir after the epidote-breakdown in subducting eclogite can be celestine.

KAMEI A., OBATA M., MICHIBAYASHI K., HIRAJIMA T. & SVOJTKA M. (2010): Two Contrasting Fabric Patterns



■ **Fig. 4.** Outcrop of eclogites at the Nové Dvory locality. The Nové Dvory peridotite body consists largely of serpentinized garnet peridotite, which contains prominent lenses of eclogites (photo by M. Svojtka).

of Olivine Observed in Garnet and Spinel Peridotite from a Mantle-derived Ultramafic Mass Enclosed in Felsic Granulite, the Moldanubian Zone, Czech Republic. – *Journal of Petrology*, 51, 1–2: 1–23.

NAKAMURA D., KOBAYASHI T., SHIMOBAYASHI N., SVOJTKA M. & HIRAJIMA T. (2010): Sr-sulphate and associated minerals found from kyanite-bearing eclogite in the Moldanubian Zone of the Bohemian Massif, Czech Republic. – *Journal of Mineralogical and Petrological Sciences*, 105, 5: 251–261.

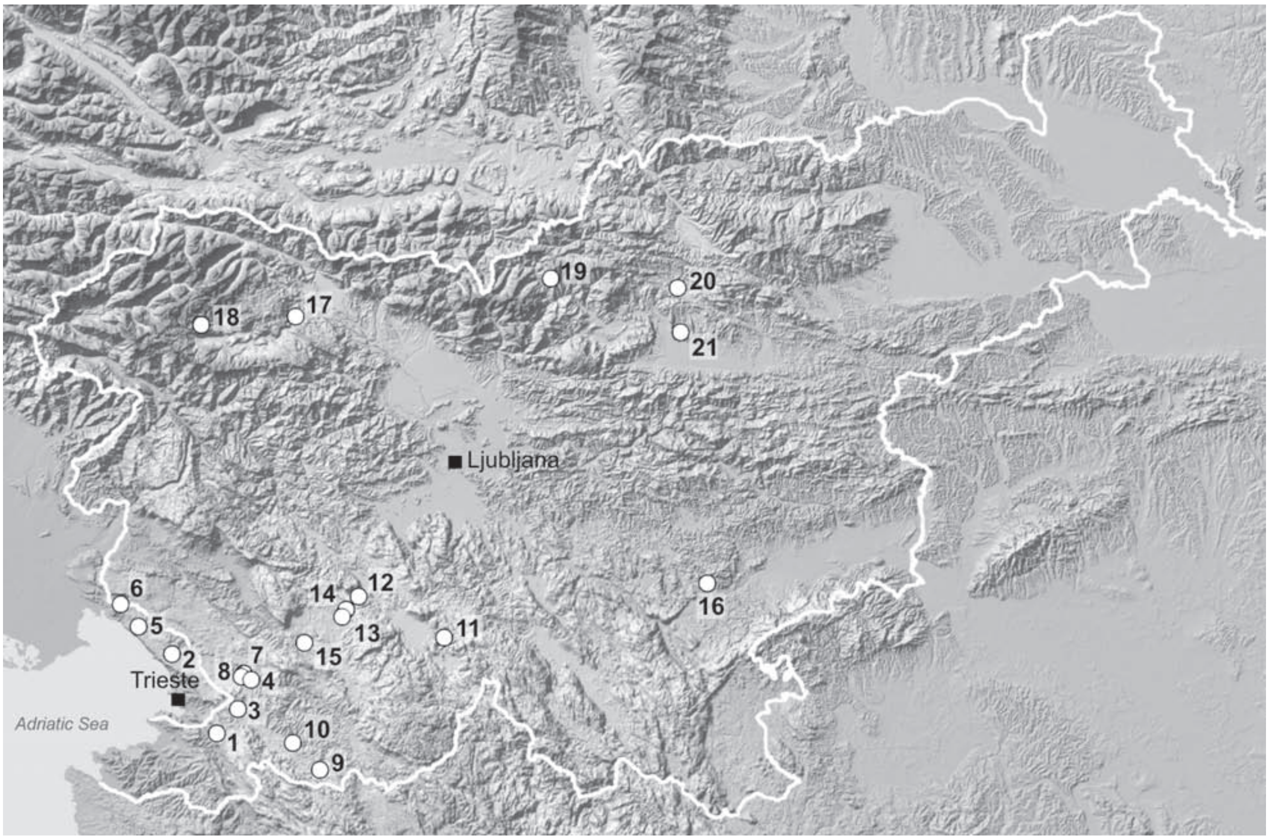
Ministry of Education, Youth and Sports of the CR. Czech–Slovenian Joint Programme KONTAKT No. MEB 090908: **Karst sediments: tools for the reconstruction of tectonic and geomorphic evolution of karst regions (exemplified on karst territories of Slovenia)** (*P. Bosák*, *P. Pruner*; N. Zupan Hajna & A. Mihevc, Karst Research Institute, SASA SAZU, Postojna; 2009–2010)

The territory of Slovenia, with its numerous karst regions from the Alps to the Mediterranean, long history of karst evolution and relatively good knowledge of karst sediments provide an ideal opportunity for dating of cave sediments using different dating methods. Paleomagentic and magnetostratigraphic methods have been applied in the research of karst in Slovenia for more than 13 years (Pruner et al. 2010). Dating of cave sediments by the application of the paleomagnetic method is a difficult and sometimes risky task, as the method is comparative in its principles and does not provide numerical ages. Repeated samplings of some sections have shown that only dense sampling (high-resolution approach with sampling distance of 2–4 cm) does guarantee reliable results. Correlation of the magnetostratigraphic results was obtained, and the interpretations tentatively placed upon them showed that in most cases, application of an additional dating method is needed to either reinforce paleomagnetic data or to help to match them with the geomagnetic polarity timescale.

The research was extended across a region with different geological structures and geomorphologic situations from lowlands to high mountains containing a number of caves and fragments of cave systems. Sections in cave sediments favourable for the use of the methods were not abundant, therefore we focused on the best known and accessible ones. Different genetic types of caves were studied – from hypogenic (e.g., Jama pod Babjim zobom) and phreatic ones (e.g., Grofova jama, Zguba jama) to ideal water-table cave systems (e.g., Postojnska jama, Markov spodmol; Fig. 5).

The results enabled to interpret the time span of karst evolution, the age of karst surfaces, speleogenesis and rates of the processes. The majority of datings of karst sediments were carried out in southwestern Slovenia (Kras) where Eocene flysch represents the last marine deposits preserved in the geologic record. The Oligocene to Quaternary period was mostly represented by surface denudation and erosion processes related to tectonic evolution of the area. Deposits of expected several short-lived transgressions (ingressions; like the Badenian one) are not preserved at all. Therefore only karst sediments can record karst evolution and its age.

The most important result is the discovery that cave fills have substantially older ages than generally expected earlier (max. 350 ka). Paleomagnetic data in combination with other dating methods, especially biostratigraphy, have shifted the possible beginning of speleogenesis and of cave infill processes far below the Tertiary/Quaternary boundary. Results from individual sites and their discussion clearly indicated some similarities in the evolution both of the caves and their fills in different geomorphic and tectonic settings. They are also provided information on the evolution of the surface, weathering conditions, pedogenesis, etc.



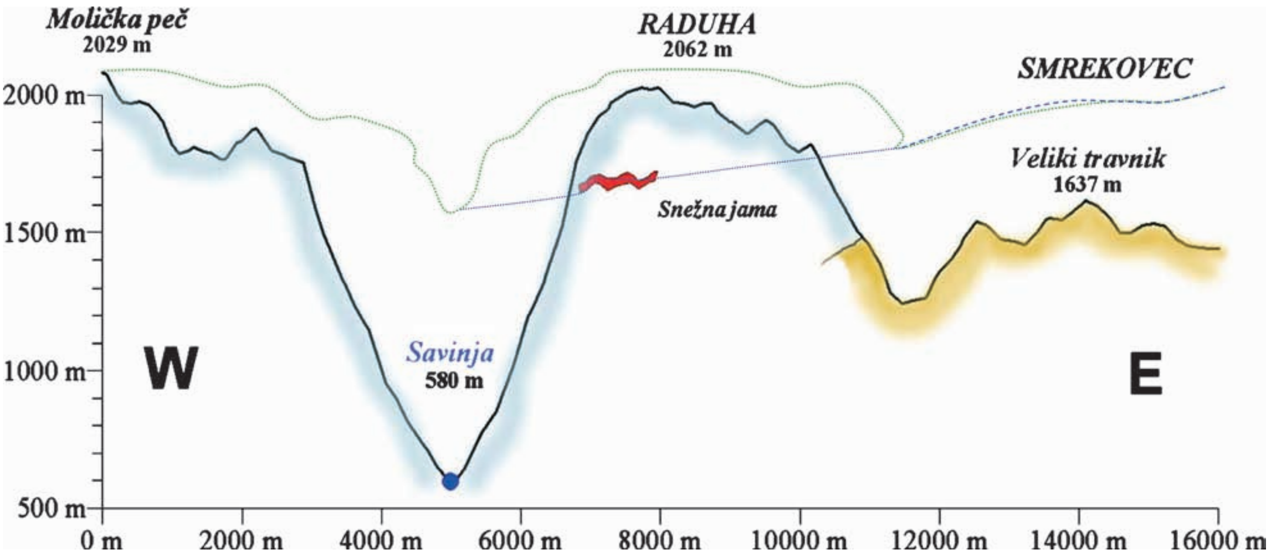
■ **Fig. 5.** Location of the studied sites in Slovenia and Italy. Explanations: 1 – Črnotiče section; 2 – Briščiki; 3 – Kozina section; 4 – Divača section; 5 – Jama pod Kalom; 6 – Grofova jama; 7 – Divaška jama; 8 – Trhlovca; 9 – Račiška pečina; 10 – Pečina v Borštu; 11 – Križna jama; 12 – Planinska jama; 13 – Postojnska jama; 14 – Zguba jama; 15 – Markov spodmol; 16 – Hrastje section; 17 – Jama pod Babjim zobom; 18 – Spodmol nad Planino Jezero; 19 – Snežna jama; 20 – Velenje section; 21 – Tajna jama (modified from Zupan Hajna et al. 2008).

The evolution of the caves took part within one karstification period, which started with the regression of Eocene sea and exposed limestones on the surface within a complicated overthrust structure, which formed principally during the Oligocene to early Miocene. Karstification and relief formation were substantially influenced by young tectonic movements, especially those younger than 6 Ma, and a series of transgressions and regressions related to the evolution of the Mediterranean–Paratethys realms (especially in the period between ca 17.2 and 5.3 Ma). The results suggest that three principal and distinct phases of massive deposition can be distinguished in the caves:

Sediments older than 1.2 Ma (numerical age)/1.77 Ma (paleomagnetic age); max. >5.0 Ma. The interpretation of the upper age limit, if based on paleomagnetic data, represents the rough estimate of the alternation of reverse (R) and normal (N) polarized magnetozones typical for the period of Matuyama and older chrons. Ages in this category are adjusted to the age interpreted at the Črnotiče I site and Divača and Kozina sections or Divaška jama. Jama pod Babjim zobom most probably belongs to this period, too, but the data are too scarce. Filling can be dated to the uppermost Miocene and Pliocene. Snežna jama (Kamnik–Savinja Alps) represented the second place with finds of small mammals. *Baranomys* belonging to lower part of MN14–MN16 (2.6 to 4.6 Ma) dates the age of the fill (re-deposited weathered/bentonitized Oligocene volcaniclastics) reflecting stable quiet tectonic conditions and the age of tectonic uplift in about 1 000 m (in the last ca. 2.6 Ma; Mihevc et al. 2010; Fig. 6). The cave with the presumably oldest sediments in our study is Grofova jama. The montmorillonite fill, if derived from intensive weathering of volcaniclastic products, could have originated from products of Oligocene to early Miocene volcanic activity in Italy or northeastern Slovenia. The age of the fill is ca 22 Ma according to apatite fission-track analysis; it can represent a much older period of cave evolution in the Kras region. The oldest one took place from about 1.8 to more than 5.4 Ma (phases at ca 1.8–3.6 and 4.1–5.4 Ma). The data support and better define the estimated ages of the surface and cave sediments that were based on geomorphic evidence, especially from unroofed caves. The substantial age of cave fills can be also judged from the fact that some studied sites in the Alpine karst occur at high altitudes with the entrances now located on upper slopes of deeply entrenched valleys. The fills in the studied caves are clearly older than 1.77 Ma, maybe even older than 5.0 Ma. The evolution of karst plateaus and massifs is comparable with another part of the Alpine chain – the Northern Calcareous Alps – where caves occur also at 1300 to 1700 m a. s. l. and higher, i.e., up to 900 m above recent river beds. The timing of the changes of the original hydrological systems can be also correlated with some caves in Dinaric karst, especially from the Kras.

Sediments dated from about 0.78 Ma to >4.0 Ma (paleomagnetic age). This group contains a succession of detected ages. The bases of most sections can be interpreted as probably not much older than 3.58 Ma, i.e., the datum adjusted by paleontological finds at the Črnotiče II and Račiška pečina sites. It seems that some phases could be distinguished: (a) more than 0.78 Ma to about 4.2 Ma (paleomagnetic ages; e.g., Račiška pečina, Črnotiče II, Tajna jama, Markov spodmol), and (b) less than 0.78 Ma to about 2 Ma (paleomagnetic ages), i.e., between the Brunhes/Matuyama boundary (and somewhat above) and the base of the Jaramillo and/or Olduvai subchrons (and somewhat below). Dates from Postojnska jama (Male jame, Spodnji Tartarus – white sandstone) and Zguba jama do not allow more detailed age determinations. It cannot be ruled out that the Spodmol nad Planino Jezero could belong to this stage also.

Sediments younger than 0.78 Ma. Caves containing sedimentary fill younger than the Brunhes/Matuyama boundary have one common and typical feature – a part of the cave is still hydrologically active, with one or more streams flowing in the lower levels (e.g., Postojnska jama, Križna jama – Zupan Hajna et al. 2010, Planinska jama). This category includes also young depositional



■ **Fig. 6.** Position of the Snežna jama in the Raduha Massif (Kamnik–Savinja Alps) and reconstructed Lower Pliocene relief before tectonic uplift. Ligth green = Mesozoic limestones; ochreous = Upper Oligocene marine volcanic suite of the Smrekovec Mountains (A. Mihevc, original).

phase(s) in caves with older fills (e.g., Jama pod Kalom, Račiška pečina, Divaška jama). We therefore interpreted most of the sediments as being younger than 0.78 Ma, belonging to different depositional events within the Brunhes chron. Nevertheless, the N polarity in some sections can be linked with N-polarized subchrons older than 0.78 Ma.

MIHEVC A., HORÁČEK I., PRUNER P., ZUPAN HAJNA N., ČERMÁK S., WAGNER J. & BOSAK P. (2010): Mio-pliocenska starost jamskih aluvialnih sedimentov v Snežni jami na Raduhi. – *3. slovenski geološki kongres, Bovec, 16. – 18. september 2010. Povzetki in ekskurzije. Abstracts and field trips*: 34. Ljubljana.

PRUNER P., BOSÁK P., ZUPAN HAJNA N. & MIHEVC A. (2010): Results of palaeomagnetic and magnetostratigraphic research of karst sediments in Slovenia. – *Travaux Géophysiques*, XXXIX (2010): 65. Praha.

ZUPAN HAJNA N., BOSÁK P., PRUNER P., HERCMAN H., MIHEVC A. & WAGNER J. (2010): Starost jamskih sedimentov v Medvedjem rovu Križne jame. – *3. slovenski geološki kongres, Bovec, 16. – 18. september 2010. Povzetki in ekskurzije. Abstracts and field trips*: 56. Ljubljana.

ZUPAN HAJNA N., MIHEVC A., PRUNER P. & BOSÁK P. (2008): *Palaeomagnetism and Magnetostratigraphy of Karst Sediments in Slovenia*. – Carsologica, 8: 1–266. Založba ZRC SAZU. Postojna–Ljubljana.

Bilateral co-operation between Schmidt Institute of Physics of the Earth, RAS, Moscow, Russia and Institute of Geology of the ASCR, v. v. i.: **Complex geological, geophysical, geochemical and petrographical modelling of lithosphere composition and their material properties** (A. V. Ponomarev, V.B. Smirnov, Schmidt Institute of Physics of the Earth (IPE), Russian Academy of Sciences, Moscow, Russia; *T. Lokajíček* & *V. Rudajev*; 2010)

The means for the simple assessment of the reflection and refraction of elastic waves on the interface between the isotropic and anisotropic media (or two anisotropic media) were proposed and developed. To describe the medium with one distinguished anisotropy direction a so-called "anisotropy vector" was introduced and a specific "wave function" was used for the representation of the elastic wave. Several examples of reflection and refraction on the interface were considered, and interesting effects such as wave splitting or transformation of the body waves to the surface waves are predicted. This work focuses on the experimental verification of the aforementioned theoretical calculations. The propagation of elastic waves of different polarization was studied in several samples composed of two parts: the isotropic and the anisotropic ones. The acrylic glass was chosen as the isotropic material. Synthetic quartz bars of different crystallographic orientations and the polycrystalline graphite sample which displays weak preferred orientations of grains were used as the anisotropic materials. Texture measurements of graphite sample were determined by means of neutron diffraction at the time-of-flight-texture diffractometer at the Joint Institute for Nuclear Research (Dubna, Russia). The propagation time of the ultrasonic wave between two resonant piezoelectric transducers was measured during the experiments. The transmitter was fixed at a certain point of the isotropic part of the sample, while the receiver was scanning the surface of the anisotropic part. As the first arrival time is dependent on the receiver position, it also depends on the grazing angle of the propagating elastic wave at the interface. The measured first arrival time patterns are compared with the theoretically predicted ones. The satisfactory agreement between the calculated and measured data will allow to complement the processing and interpretation of field seismic data by new characteristics, for example, seismic wave records from different sources including technogenic ones.

Bilateral co-operation between CMRI Regional Centre, CBRI Campus, Roorkee, India and Institute of Geology of the ASCR, v. v. i., No. 6: **Assessment of micro-cracks in rocks using acoustic emission and ultrasonic techniques** (R. K. Goel, R. D. Dwivedi, A. Swarup, Central Mining Research Institute (CMRI) Regional Centre, Central Bhabha Research Institute (CBRI) Campus, Roorkee, India; *T. Lokajíček* & *V. Rudajev*; 2009–2011)

An experimental attempt was made to study micro-cracks using the ultrasonic and acoustic emission techniques. The study was made on two different types of rock samples (granite and granulite). The first aim of this experiment was to show elastic anisotropy of P-wave velocity determined from direct laboratory measurements on rock samples of granites and granulites; the second aim was to analyse the acoustic emission, as a result of uni-axial loading of both rock types. The elastic anisotropy measurement of P-wave velocities was made on spherical rock samples in 132 independent directions at selected levels of confining pressure up to 400 MPa. The study shows that with the increase in confining pressure, the coefficient of anisotropy is decreased. The monitoring of acoustic emission was carried out on cylindrical samples loaded by uniaxial increasing stress up to their total rupturing. Different courses of the acoustic emission rate vs. acting stress were detected for both types of samples. It was deduced that this contrasting reaction of rocks to the acting stress is related to the contents of microcracks. This conclusion is in good agreement with P-wave velocity measurements.

Bilateral co-operation between Institute of Geology of the ASCR, v. v. i., and Russian Academy of Science (Institute for the History of Material Culture of Russian Academy of Science, Stone Age Archaeology Department), Sankt Peterburg, Russian Federation: **Cultural adaptations to natural (climatic) fluctuations in the Upper Paleolithic of Eastern (Kostenki group) and Central Europe (Moravian group)** (A. Sinitsin, Russian Academy of Sciences, Sankt Peterburg, Russian Federation & *L. Lisá*; 2009–2011)

The cooperation is based on the interdisciplinary project including sedimentological, pedological (paleosoils) and botanical (pollen record) research of the geological background, with comparison of zooarcheological and archaeological records from the same localities. The results will be used for a wider interpretation of similarities of the climatic and environmental conditions during the Late Paleolithic of central and eastern Europe. L. Lisa organized the international conference on the OIS3 stage in 2010, where she presented a paper on the environmental conditions within Moravian valleys during the Gravettian period. A. Sinitsin presented a comparative paper from the locality of Kostenki.

The question of what the Paleolithic landscape within Moravia looked like, how humans understood that landscape, whether they were able to exploit it for hunting, and how they adapted to the landscape morphology for their daily life is central to all interpretations. Three main Gravettian localities within the Moravian corridor with sedimentological records of the last 30 ky were included in this case study: the well known and long-studied site of Dolní Věstonice in southern Moravia, the site of Předmostí situated close to the Moravia/Silesia border, which had yielded the largest mammoth bone accumulations in central Europe, and the locality of Hošťálkovice on the southern edge of Silesia in the northeastern part of the Czech Republic.

What were the patterns that enabled humans to exploit the North European Plain, and subsequently even colder regions? Is it true that hunters followed mammoths to hunt them? Or were they just migrating within the landscape, looking for more suitable place for everyday life? Recent research suggests that the mammoth was not the predominant source of meat protein. The principal animals hunted were wolves, foxes and small fauna. If Paleolithic hunters were not dependent on mammoth meat *per se*, what was than the purpose of hunting them? Did they need their meat, or ivory or bones or fat? Each has a rationale. A large amount of meat will help to improve the diet and to hunt in the group may consolidate social grouping. Ivory is an ideal material for art production, which also has a social and cultural context. Bones, when exposed to the sun, produce an extremely white colour, which we have tentatively speculated may serve as a landscape marker. The question is why the pattern shows the movement of humans further and further north. Whatever its purpose, the link with mammoth hunting may be central. Mammoths were migrating to the North to spend their summer and to feed themselves for in preparation for the winter they would subsequently spend in the south. As the climate became increasingly cold and arid, it was probably still more and more difficult to move through the landscape, now with less vegetation and water on the valley bottoms. If fat was the critical resource from mammoths, then the best time when to hunt mammoth was when the mammoth was still strong and didn't lose weight (as well as fat). And if mammoths didn't migrate so often to the south, people had to move to the north or to the east (to the Carpathian valley refugees) to meet them. It is known that the north was colder, but also in some cases more humid. There was not higher precipitation, just better conditions for keeping the humidity because of the presence of permafrost. For example, the Northern Siberian Plains, now influenced by permafrost, provide relatively suitable conditions for plant growth, because the recently frozen layer holds the humidity needed for plant growth. In spite of the low temperatures, such an environment offered much better conditions for mammoths than warmer but arid conditions of the south.

4b. Czech Science Foundation

Finished projects

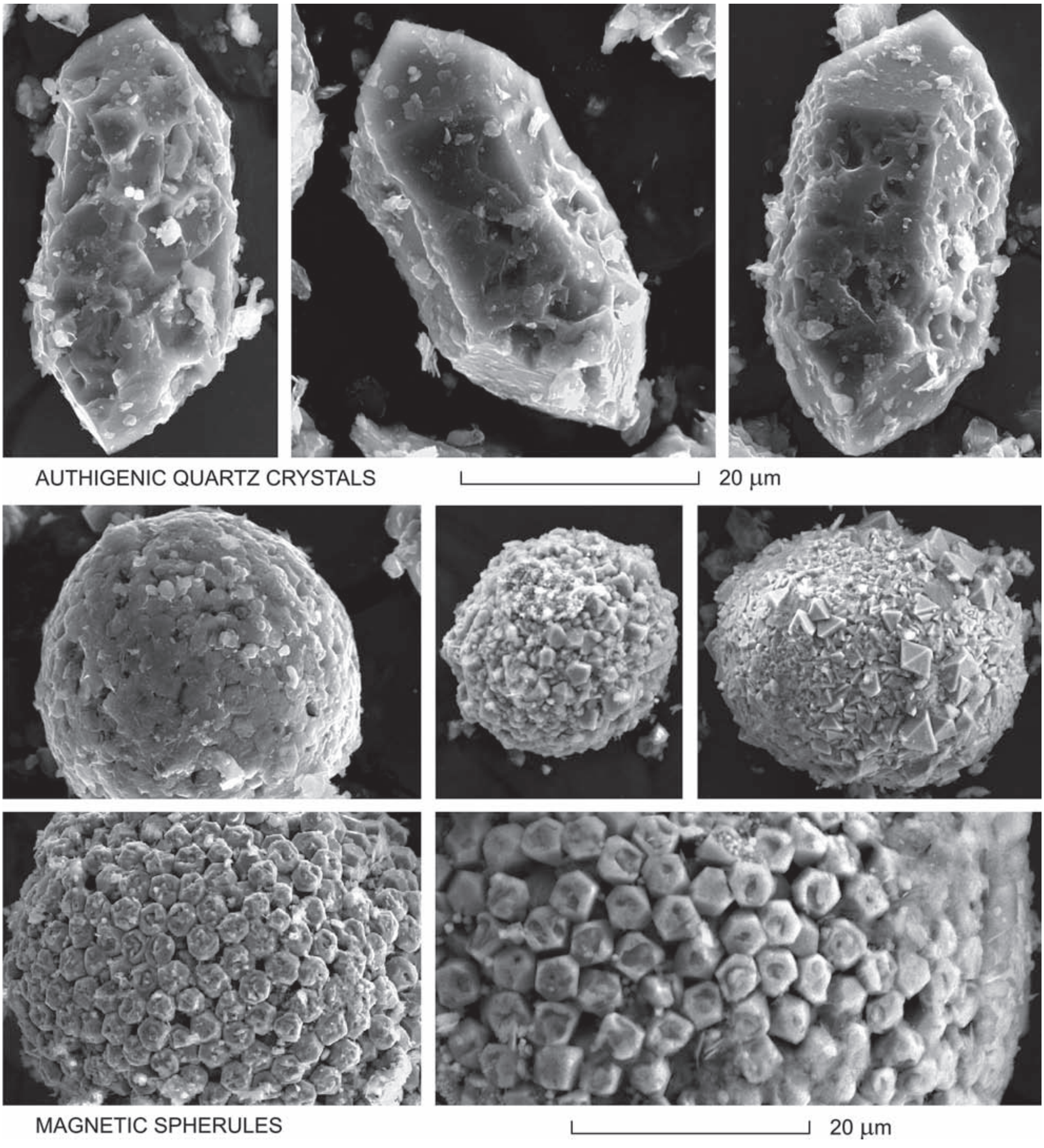
No. 202/08/0767: **Neutron texture analysis of carbonates and gabbros** (Project leader: L. Kalvoda; Co-investigators: M. Dlouhá, M. Dráb, Z. Pala, P. Sedlák & S. Vratislav, Faculty of Nuclear Science and Physical Engineering, Czech Technical University in Praha; Project co-leader: *J. Hladil*; Co-investigators: *L. Koptíková*, *M. Chadima*, *S. Šlechta*, *P. Kubínová*; Project co-leader: M. Machek; Co-investigators: P. Špaček & S. Ulrich, Institute of Geophysics of the ASCR, v. v. i., Praha, Czech Republic; 2008–2010)

The analytical and integral, neutron diffraction (ND) and multiproxy (MP) assessments of complex anisotropic fabrics in unmetamorphosed carbonate rocks belong to complicated tasks which are less understood than in marbles. This problem was solved on several types of limestones, but the study of folded Middle Devonian calciturbidites from Choteč-Škrábek in the Barrandian area was the most interesting, being a knotty subject among all these polygenetic carbonate-dominated polyaggregates with inherited features and different behaviour of components.

The ND-MP textural studies of limestones in sub-metamorphic conditions (case Choteč). The sampled fold belongs to a set of sub-horizontally arranged folds which underlie the limbs of a large fold which is capping the termination of the thrust fold (see the relevant chapters on Choteč in Research Reports 2007–2008 and 2009). Well visible deformational macrostructures that originated in conditions at only first kilometres of burial suggest that we may expect at least slight effects of the early deformation tangential stress also on the relatively deformation-resistant, rigid beds of fine-grained calciturbidic grainstones. This means that the effects of such a penetrative deformation are possible in spite of the strong localization of the deformation along with bed-to-bed slips which are so typical for these layered calciturbidite materials (flexural slip fold mechanism) so that much of deformation is localized to the bed interfaces but not within beds. The main evidence of this is the presence of tectonic stylolites, documenting strong tangential stress with the beginning of the deformation. These occur in the form of mm to cm indented pressure solution sutures on the planes which are sub-perpendicular or oblique to the direction of the general fault propagation which is towards the S–SSE. The angle of these tectonic stylolites to bedding planes increased also with the gradual rotation (steepening) of the fault slip, but was subsequently modified during the next possible phases of decapitation when the hangingwall structures (mostly eroded in present stage) were pushed over. Partial modifications are possible also due to individual development of domains during decapitation of the underlying folds and faulting and bending of the footwall syncline zone. The neutron diffraction (ND) data sets provided unquestionable evidence on the orientation of authigenic quartz prisms, details of which were also ascertained by means of the dissolution and cutting of these limestone rocks. These quartz prisms are tens of micrometres high, pyramid-terminated on both sides (see examples of these quartz crystals in Fig. 7). According to lattice orientation, these prisms are preferentially orientated with their longest axes oblique, and/or locally almost sub-perpendicular, to the folded bedding planes. In the present position (independently on normal or overturned position), the 'upper parts' of these elongated quartz objects show tipping which approximately corresponds to the inclination 'upper side to S to SSE'. In detail, there occur some specifics which can be explained in terms of macro-deformational characteristics. For example, the samples of one of examined folded beds which is in the normal (not overturned) position, the pole positions for this tipping indicate an uniform preference of this elongation which is ca 60° compared to sedimentary direction (perpendicular to bedding plane), but significantly declined to the SE, i.e. not in full accordance with this S–SSE heading of the translation along the thrust folds. This suggested that this is an effect of the gradual development in a domain, as mentioned above. Samples from the overturned limb of the fold show a very similar pole structure but another symmetrically arranged maximum (declined to the SSW–SW) is also present, and, in addition, a slight aggregated maximum close to the S direction. The pattern-rich image of the overturned limb of the fold corresponds to stronger deformation in these parts, where evidence is also based on optical micro- and mesoscale observations. At this place, the effects of shear and separation of individual beds resulted also in a slight thinning of the examined bed. We may speculate that the slight aggregated maximum close to the S direction may correspond to beginning stress which culminated with the formation of sub-perpendicular, subvertical tectonic stylolites. The forward inclined maximum with lateral divergence toward the SE possibly records the first phase of thrusting and folding, whereas that with the SSW divergence can be ascribed to the final deformation stage. This sort of interpretation slightly changes the ideas about the origin of authigenic quartz crystals, i.e. from early burial stages more to the advanced transitions between the stages still governed by multidirectional lithostatic/hydrostatic pressure but being already influenced by the first effects of the strong tangential stress. A significant question arose as to how to ascertain whether this orientation patterns on quartz reflect the growth where elongation and c-axis of prisms are driven by the maxima of the strain or a secondary reorientation (rotation) plays a role. The studies of the quartz crystal micromorphology provided interesting evidence about the origin of these orientations. The crystal surfaces show pits which are casts after the late diagenetic carbonate crystals. The morphology of these casts suggests that these quartz crystals were growing together with increased-size of aggregative recrystallization of calcite and are indicative of a slight rotation of diagenetic fabric still during this recrystallization. The contacts show that shear defects on these "immersed" calcite crystals are slight or absent: we can therefore conclude that the 'growth mechanism' predominates over the features that can be indicative of "grain-to-grain slip reorientation". The latter findings fit well with the timing of the main orientation patterns on quartz to the diagenetic stages close before and with the onset of tangential stress. Only the final complication of the orientation patterns can be ascribed to grain-to-grain slips of advanced deformation stages. In contrast to the image of these delicate prisms of early syndeformational quartz, the ND-detected structures of multigeneration polycrystalline calcite (a dominant component of the studied rocks) show unusually weak preferential orientations in the arrangement of calcite lattices and sizes and shapes of crystal domains. There are two reasons for this. First, the polyaggregate and polygenetic fabrics reflect a lot of parameters which are involved in the complex fabrics of unmetamorphosed carbonate rocks – there are fusions of many specific recrystallization fabrics that were influenced by original compositions and geometries of variety of bioclasts, peloids, internal micritic precipitates and crystalline cements, including all the subsequent generations of inhomogeneous diagenetic recrystallizates. Secondly, the crystallization-recrystallization of carbonate continued longer than it was possible in the case of the quartz. The carbonates recorded both the aggregative recrystallization with increased sizes of imperfect calcite crystals (still filled by many impurities and their structural ghosts) and the crystal size degradation which corresponds to later stages of diagenesis, being driven by uplift/exhumation of the rocks with change of rock fluid compositions and also, partly, also by degradation mechanisms caused by the exposure to shear in relatively "dry" conditions (the minimum porosity inside the rigid calciturbidite beds). In the case of this low sub-metamorphic evolution of sedimentary carbonate rock fabrics, a remarkable influence of inherited sedimentary fabrics on the newly forming structures exists, and applies to many individual primary locations, sizes and geometries of clastic aggregates and mainly the sizes and shapes of cemented pores in the sedimentary rock. These features seem to be very long persisting in the lower sub-metamorphic conditions, so the separation of early deformation responses by means of ND is based on very slight preferred orientation features (with a noise of local fabrics). Therefore, and in spite of the above mentioned "more isotropic, or chaotic contributions" by calcite, it is virtually interesting that the crystal pole orientation (CPO) of delicate authigenic quartz prisms mimics closely the shape pole orientation (SPO) of calcite.

Conclusions. The assessment of these structures suggests that the application of the ND on the analysis of the complex evolution of calcite fabrics from sedimentary and diagenetic to early deformational stages must be carried out in close connection to petrological data. At least three results are very promising. First, the ND method is a very robust tool for the analysis of extremely complex sedimentary-diagenetic-early deformational systems in limestone rocks. And this method is also least sensitive to the random occurrence of "flaws" in measured samples, e.g., those which can be exemplified by limonite-rich stripes or randomly occurring small cracks, calcite veins, or individual shell fragments of cephalopods, brachiopods or trilobites which "flow" in the structure, the strongest signal comes from integrated images of crystal lattice positions and shapes/sizes of their domains (grains). Secondly, there is a possibility to map the preferred orientations in many directions, i.e., not to describe them only in the form of an anisotropy ellipsoid. In addition, the extraction of individual components belongs to typical routines of this ND analysis. And thirdly, it was confirmed that the ND-based image of anisotropy does not inevitably confirm the anisotropy of magnetic susceptibility (AMS) image. At this point, the findings fulfil the expectations of the project which were to enlarge the number of anisotropy methods, compare them, and use the resulting differences for a better understanding of the selectively changed structural components in the rock as well as more realistic description of influence of recrystallization/deformation processes on these components.

As for the carriers of magnetism, significant differences were found in the same original material of a single calciturbidite bed, where a less stretched limb in a normal position shows prevalence of superparamagnetic iron-oxide particles but more intensely stretched upper (overturned) limbs yield the seemingly same particles (usually 20–30 μm sized spheroids to framboidal shapes) but with pseudo single-domain characteristics. These spheres have variable compositions, where some of them are still close to pyrite-pyrrhotite, but others consist of almost pure hematite or maghemite. They are frequently encountered not only in these calciturbidites, but are broadly typical of many grey-coloured calciturbidites and also tempestites worldwide. In the investigated case, some of them preserve the primary spherical shape, but about two thirds of such particles are prolate with axes ratios major/minor up to 1.6, and major/intermediate up to 1.4. The elongation with flattening is stronger when hematite prevails. Here, contacts with carbonate suggest that both de-



■ **Fig. 7.** Magnetic particles and quartz from the Choteč Limestone (original photos by J. Hladil and V. Böhmová).

lays and speeding exist in the internal rock fabrics with respect to mechanisms of rotation . This is indicative of two problems stemming from the observations on strong depletion in sulphur in these original spheres. First, this process must be shifted far more forward on the scale of diagenetic progression than commonly expected. And second, the elongation of these highly magnetic aggregates may significantly contribute to the specific and often varying mean AMS directions that often differ from the SPO or CPO directions for carbonates. (See examples of these magnetic spherules in Fig. 7).

In the context of this study, it is also worth mentioning that even minor concentrations of gadolinium in these carbonate materials cannot be neglected. It is because of the fact that gadolinium has exceptionally high absorption of neutrons, and even its small concentrations (2 to 9 mg.kg^{-1} in the Choteč Limestone) may significantly influence the neutron scattering results. The results on rock geochemistry obtained by means of instrumental neutron activation analysis (INAA) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) confirmed that the distribution of Gd in microstructures closely corresponds to those of other REEs and iron. A slight but consistent positive Gd anomaly related to standard REE distributions was found. In practical terms, this means that mapping of Fe concentrations provides a reasonable proxy for the understanding of the distribution of Gd in these geological materials.

No. 205/08/0676: **Three-dimensional fabric of pore space in sedimentary rocks: correlation to the physical and mechanical properties** (R. Přikryl, Faculty of Science, Charles University, Praha; Z. Weishauptová, Institute of Rock Structure and Mechanics of the ASCR, v. v. i.; J. Přikrylová, Academy of Fine Arts in Praha, Czech Republic & *T. Lokajíček*; 2008–2010)

Last year, measurements of magnetic anisotropy of pore space of 32 rock samples (26 quartz sandstone, 6 calcite – 2 of them biodetritic) were taken, interpreted and compared with elastic anisotropy. None of the rock samples exceed 10% AMS. This result is very important in several respects: (1) anisotropy of mechanical properties is normally higher and reaches the value of 10–20 %; (2) heterogeneity of mechanical properties obtained by the measurement of samples is very often higher than 10 % and can reach even 30 %; (3) elastic anisotropy determined by multidirectional ultrasonic sounding is again higher and roughly collates with anisotropy of deformable and toughness properties (static elastic properties). This result can be explained by the fact that the AMS response to the shape of pore space, while other tests are influenced by the complete anisotropy of the inner structure, i.e., including clusters orientation, level of their interconnection and also pore orientation.

Continued projects

No. 202/09/1206: **Nanocrystalline heterogeneous photovoltaic solar cells** (F. Schauer, I. Kuřitka, P. Sáha, V. Křesálek, J. Vilčáková, Tomas Bata University in Zlín; J. Toušková, J. Toušek, I. Křivka, Faculty of Mathematics and Physics, Charles University, Praha, Czech Republic & *J. Rohovec*; 2009–2011)

The project envisages to devise but, most importantly, to optimise thin film photovoltaic cells on the principle of donoracceptor systems with charge-transfer, specifically with organic polymers and inorganic nanoparticles on sulphide materials. The synthesis of polymers will be needed with appropriate long wave absorption in the 600–800 nm region, and outstanding transport properties and stability, but before all nanomaterials with optimised absorption and transport properties will be needed.

The main goal of the project is to optimise electron devices of radiation by means of the minimization of the loss of photons, successive photoexcited excitons and photogenerated charge carriers. The first step is to optimize the nanostructures (quantum rods, tripods and nets) used. The project is aiming at two application areas: sensors for the electromagnetic radiation in a wide spectral range 300–1 200 nm for the general-purpose applications and photovoltaic cells for low cost applications, aiming at the techniques of stamping and nanoprinting of electronic circuits.

The task of the co-investigator in the second year of the project solution was preparation of thin layers of nanoparticles spread on a solid support like the indium-tin oxide (ITO) conducting glass or dopped silicon. In order to prepare the thin layers, a new equipment was taken from the colaborating team in Zlín, namely the spin coater. The nanoparticles were freshly prepared and isolated using the procedures established in the first year of the project solution. The spin-coating conditions, like rotation frequency, concentration of nanoparticles, solvent, drying steps etc, were optimised. The solid supports bearing the thin layers were transfered to the Department of Physics (Charles University) to carry out the physical characterisation of the system developed.

A new material based on nanocrystaline cadmium sulphide was prepared and characterised. It consists of CdS nanoparticles in the hexagonal modification, being covered by a protective shell of alcoholamines, like diethanolamine or triethanolamine. This material was found to have interesting physical properties as well as favourable behaviour during the spin coating procedure.

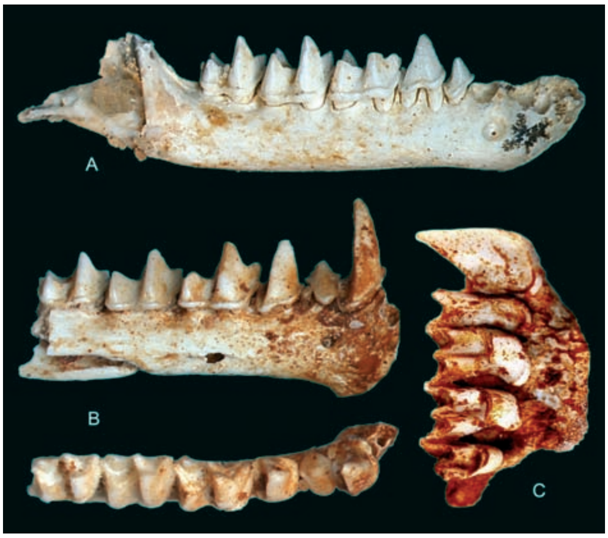
No. 205/09/0184: **Small mammals at time of the middle Pliocene faunal turnover: aspects of faunal and phenotypic rearrangements in Central Europe** (*J. Wagner*, *S. Čermák*, I. Horáček & O. Fejfar, Faculty of Science, Charles University, Praha, Czech Republic; 2009–2012)

The present project is intended to enlarge our knowledge of the history of mammalian communities and several model taxa during the Early Pliocene to Lower Pleistocene in Central Europe and open a possibility of a detailed paleobiogeographical comparison. During the second year we concerned on the following main areas of interest: (1) field prospection for new sites and the revisions of existing ones including excavations and extensive resampling in the Czech Republic (Měňany 1–3, Malá Panama, Javoříčské jeskyně) as well as in abroad (localities of Beremend; Hungary and Popovo 1–3, Verkhnyaya Krinitsa 2; Ukraine) including standard processing of material; (2) studying of important material for comparative purposes (Hungarian Natural History Museum, Budapest; National Natural History Museum, UAS, Kiev; Zoological Institute RAS, St. Petersburg); (3)

detailed morphometric and phyletic analysis of selected taxa, including comparisons with material from the important Pliocene and Lower Pleistocene localities.

The principal results are focused on stratigraphical and paleobiological aspects of selected localities and/or taxa, and can be expressed as follows:

Paleoecological and biostratigraphical characteristics of faunal assemblage from the Pliocene locality Vitošov (Czech Republic). About 200 determinable specimens of at least 26 mammalian taxa were obtained from the locality. The fauna is characterized by the dominance of diversified insectivores and bats (Fig. 8). The co-occurrence of *Desmanella* sp., *Beremendia fissidens*, *Blarinoides mariae*, and *Blarinella* cf. *europaea* among insectivores, as well as a relatively high percentage of shrews, is characteristic for the upper part of Early Pliocene (MN 15). This association closely resembles the situation described from localities Csarnóta 2 and Gundersheim. Also, in bats the phenotypic characteristics correspond to those in forms reported from Gundersheim or Węże and are preliminarily co-identified with them (*Rhinolophus* cf. *lissiensis*, *Myotis* cf. *gundersheimensis*, *Myotis* cf. *podlesicensis*, etc.). On the contrary, rodents are relatively rare. Except for *Germanomys weileri* and *Baranomys* sp., the archaic taxa of cricetids, two forms of *Mimomys* were identified. *M. hassiacus* and an advanced form of *M. gracilis* provided the most important evidence for the geological age of the locality. Thus, the species composition, as well as the structure of the fauna, suggests the age near the Late Ruscinian (MN 15b) – Early Villanyian (MN 16a) boundary, i.e. time span ca 3.3–4.0 Ma. From the paleoecological point of view the fossil record in Vitošov suggests the presence of highly diversified humid biotopes with substantial rate of broad-leaved woods; the situation well corresponding with present view of paleoenvironmental conditions during the Early Pliocene.



■ **Fig. 8.** Remains of bats – the most abundant component of Vitošov fauna. A – Myotis gundersheimensis (the most abundant species), mandibular fragment; B – Rhinolophus cf. kowalskii (a cavernicolous species typical for Early Pliocene), almost complete lower jaw; C – Rhinolophus cf. kowalskii, a complete upper jaw. Figures are not to scale. (after Čermák et al. 2010, modified).

Ursus ex gr. minimus-thibetanus from Villány 3 (Hungary) and its position among the Pliocene and Pleistocene black bears in Europe. A revision of the currently available mandibular and dental material of bears from the Late Villányian locality Villány 3 (Hungary) was studied in detail. The presence of 2 bear species, *Ursus* sp. (cf. gr. *etruscus*) and *Ursus* ex gr. *minimus-thibetanus*, was proved at this locality. In its morphometric features, the latter is not supposed to be an autochthonous descendent of *U. minimus* but represents an independent migration event of black bears from Asia. This form is most similar with recent *U. thibetanus* in its fine dental morphology, but absence of some important characters (e.g., enamel crest from metaconid to hypoconid on m1) does not allow us to co-identify these two species. Therefore the black bear from Villány 3 was preliminary determined as *Ursus* aff. *thibetanus*. Based on the critical revision/review of published material/data on black bears, the only positive record of their representatives in Europe is now available in the Late Villányian and since the Early Toringian.

Review of evolutionary history of pikas (Ochotoninae) and bears (Ursinae) in Europe. Detailed revisions/reviews of morphophyletic evolvement and faunal turnovers in the Miocene to Pleistocene Ochotoninae and/or Ursinae were provided. A new view on ochotonids taxonomy and distribution in the European Late Miocene and Pliocene, based also on rich new material of archaic forms from East and Central Europe studied by SČ, was presented. The traditional view on bears taxonomy and distribution in European Pliocene to Middle Pleistocene was critically reviewed based on both literature sources and personal revision of relevant material by JW.

ČERMÁK S., WAGNER J., MORÁVEK R., FEJFAR O. & HORÁČEK I. (2010): Pliocenní fauna obratlovců z krasových výplní vápencového lomu ve Vitošově na severní Moravě. – *Zprávy Vlastivědného muzea v Olomouci*, 299: 20–36.

No. 205/09/0619: **The Silurian sedgwickii Event: Carbon isotope excursion, graptolite mass extinction, sedimentary record.** (*P. Štorch*, *R. Mikuláš*; J. Frýda, Czech Geological Survey, Praha & O. Fatka, Faculty of Science, Charles University, Praha, Czech Republic; 2009–2011)

Late Aeronian mass extinction of planktic graptolites, recorded in the Barrandian area, Spanish Ossa Morena Zone and elsewhere, has been correlated with carbon isotope record and subtle changes in offshore black-shale sedimentation which, nonetheless, account for considerable environmental perturbations and sea-level fluctuations, presumably of glacio-eustatic origin.

Correlation of the Radotín highway tunnel section with other upper Aeronian sections throughout the Barrandian area (Barrande’s Colony Lapworth near Zdice, Zadní Třebaň, Nové Butovice, and Hýskov) revealed close similarity of graptolite assemblages and lithological successions including forms and abundance of sedimentary and early diagenetic pyrite. Basin-wide changes in lithology, callibrated with high-resolution intrazonal biostratigraphy and plotted with quantitative approach on graptolite faunal dynamics, shed new light on graptolite mass extinction called *sedgwickii* Event and subsequent recovery.

Rich and diverse mid-Aeronian graptolite fauna vanished from the black shale at about the top of the *Lituigraptus convolu-*

tus Biozone, hence the lower part of succeeding late Aeronian *Stimulograptus sedgwickii* Biozone, remarkable by both the lower content of organic matter and abundant pyrite, exhibits relatively few rhabdosomes and low graptolite diversity. Pyrite-rich interval is overlain by a heavily mottled, silty/sandy-micaceous bed in the most complete and best preserved Radotín-tunnel section. Increased input of the silty/sandy-micaceous fraction, that correlates with a gap in sedimentation elsewhere in Barrandian (Řeporyje–Velká Ohrada) and abroad is well assignable to glacio-eustatic sea-level drawdown supposed by Loydell (1998). Siliciclastic signal is compatible with low organic content and heavy bioturbation in this particular level and further coincides with a strong positive carbon isotope excursion which culminates by $\delta^{13}C_{org}$ values attaining −16.2‰ in the tunnel section. The level with $\delta^{13}C$ excursion is overlain by micaceous black shale characterized by a rapid return to baseline $\delta^{13}C_{org}$ values (−28 to −30 ‰), rapid increase in TOC, and rapid proliferation of low diversity-high abundance graptolite fauna newly assigned to the upper part of the *sedgwickii* Biozone. In the uppermost part of the original *sedgwickii* Biozone (sensu Bouček 1953 and Štorch 1994), however, a new graptolite biozone characterized by common *Lituigraptus rastrum* has been distinguished*. L. rastrum* Biozone is correlatable with lower part of *St. halli* Biozone applied in Wales (Loydell 1991). The new biozone is readily recognizable also at currently studied El Pintado section in the Ossa Morena Zone of Spain. The assemblage marked by incoming of several new taxa indicates that graptolite-fauna begun to recover at this level.

Positive carbon isotope excursion, recorded in the *sedgwickii* Biozone also in Dob's Linn, Scotland and Cornwallis Island of Arctic Canada (Melchin & Holmden 2006), is rather short-term, perhaps incomplete in the Barrandian area. It clearly postdates, however, the major phase of graptolite extinction. Lithology, sequence architecture, organic carbon content, isotope record, as well as graptolite faunal dynamics, are consistent with a conception of short term advance in continental glaciation in Gondwana.

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ŠTORCH P. (1994): Graptolite biostratigraphy of the Lower Silurian (Llandovery and Wenlock) of Bohemia. – *Geological Journal*, 29, 2: 137–165.

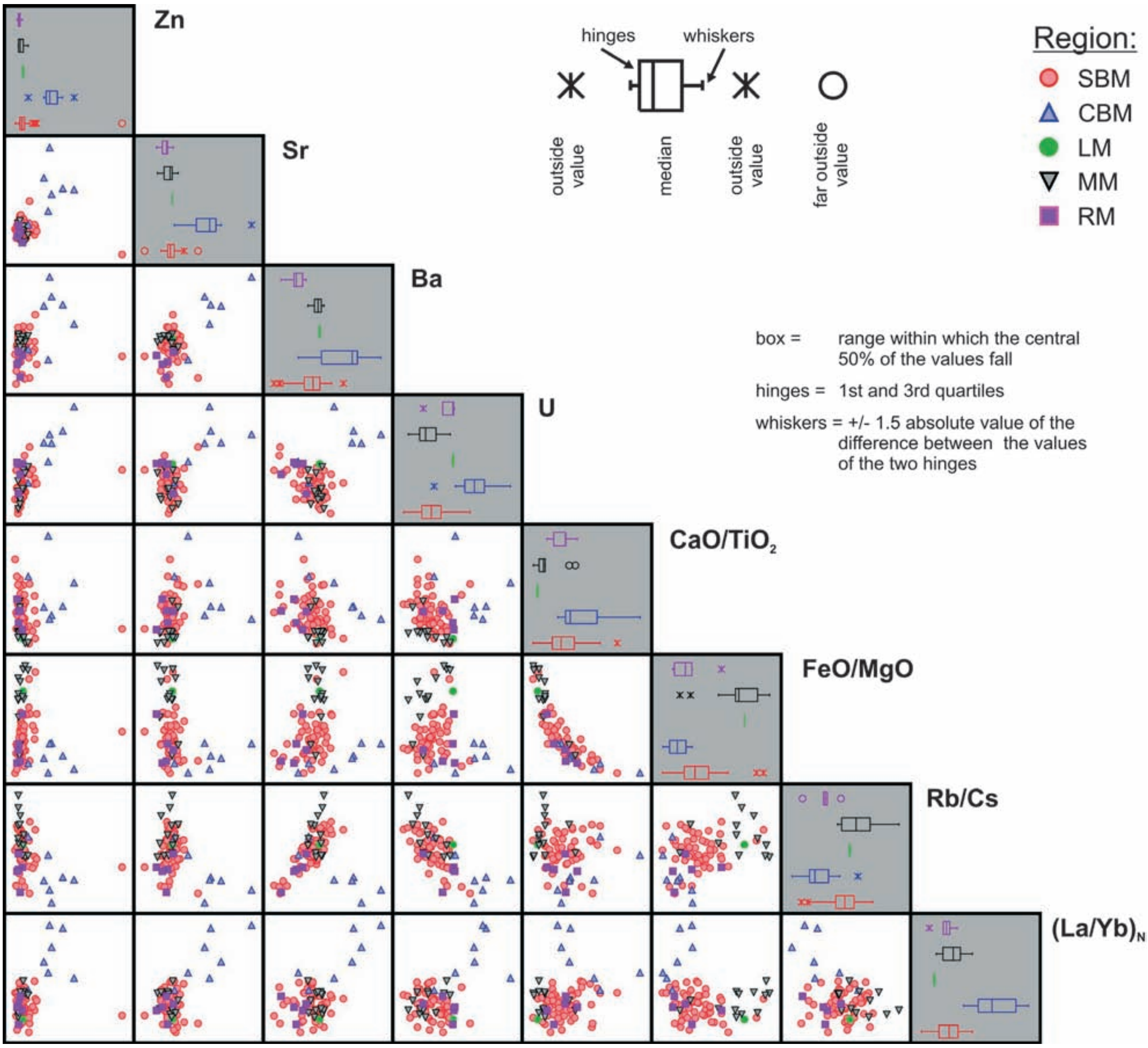
No. 205/09/0703: **Integrated late Silurian (Ludlow-Přídolí) stratigraphy of the Prague Synform** (*L. Slavík*, *P. Štorch*; Š. Manda, J. Kříž, J. Frýda & S. Berkyová, Czech Geological Survey, Praha,Czech Republic; 2009–2013)

The research in 2010 was focused mainly on major extinction events among different faunal groups during late Ludlow (Ludfordian), i.e., conodonts, graptolites and benthic faunas, and, interpretation of the paleoenvironment. Although the late Ludow graptolites are rather rare and only occasionally preserved in adequate quality in fossil record, their better understanding is of crucial importance as the whole Silurian correlation chart is fixed to graptolite biozones. Usually benthic faunas and sequence boundaries are used in correlations in individual basins, especially if conodont biozones are far behind precision of graptolites and benthos. In the Všeradice section, four graptolite biozones are distinguished in the latest Ludow between *B. tenuis* Biozone and base of Přídolí in Všeradice Section. It represents most complete graptoite record in a peri-Gondwanan setting in one section. Previously used latest Ludow biozones represent rather uncertain puzzle correlation including different sections. The correlation of graptolite Kozlowskii and conodont Lau Events is still unknown in needed detail although both events are roughly coincident as may be suggested from their position at beginning carbon isotope excursion. Conodont faunas of the *Polygnathoides siluricus* Zone (Ludfordian, Ludlow) from shallow-water environments of Bohemia are characterized by relatively high taxonomic diversity that reflects an interval with taxa thriving due to increased nutrient supply in rather stable environments during the pre-Lau Event time, as has been documented globally. Although the conodont faunas in strata with *P. siluricus* are more diversified and variable than those in the interval instantly following, the uninterrupted ranges of several taxa (of genera *Wurmiella*, *Ozarkodina* and *Delotaxis*) show that the change in conodont faunas in the sections is not as drastic in Bohemia as described on Gotland and that the extinction rate was rather moderate. A detailed correlation of conodont distribution in the sections indicates, however, that a large part of the Lau Event is not preserved in the shallow water environment of the former Řeporyje Volcanic Elevation. Accordingly, timing and spatial image of the conodont extinction are thus partly obscured. Only a short interval with considerably diminished conodont elements during the lower range of *Ozarkodina*? *snajdri* with random occurrences of *Pedavis latialatus*, corresponds to the part of the "Icriodontid Zone" on Gotland, i.e. the uppermost part of the Lau Event. This incompleteness in record confirms sedimentary starvation in the shallow environment on the former volcanic elevation in this part of the Prague Basin.

No. 205/09/0991: **Origin of moldavites – complex geochemical study** (J. Mizera, Z. Řanda, V. Havránek, J. Kučera, Nuclear Physics Institute of the ASCR, v. v. i., Řež, Czech Reppublic; *R. Skála*, *K. Žák* & *A. Langrová*; 2009-2011)

The set of moldavites for the study was supplemented by additional 40 moldavites from the South Bohemian partial strewn field. These samples will be characterized in the same manner as the previous materials.

At the moment, a well-documented collection of 80 moldavites representing various colors, shapes, and sculpture types, and covering localities in the South Bohemian (incl. Radomilice area), Western Moravian, Cheb and Lusatian partial strewn fields, was characterized compositionally by using various modes of instrumental neutron activation analysis (INAA/ENAA) and instrumental photon activation analysis (IPAA). Altogether, 52 major, minor, and trace elements were determined. The observed data revealed a substantial scatter in chemical composition, not only among the samples from different partial strewn fields, but also among the individual samples coming from a particular sub strewn field or even a single locality. Interesting feature observed in the compositional data is that the majority of the moldavites from the Cheb Basin display considerably different contents of several chemical elements. From a genetic point of view increased contents of Zn, Ba, Sr a U (among others) in the moldavites from the Cheb Basin represent a still unresolved question (Fig. 9). Prior to a two-way hierarchical clustering using Ward method with Euclidean distances and a factor analysis the compositional data were first log-transformed to obtain more homogenous ranges and once log-transformed data were further standardized to zero mean and unit variance. Cluster analysis using Ward method with Euclidean distances separated the data into 6 clusters allocating the majority of Cheb moldavites to a single cluster and a considerable number of the South Bohemian moldavites to another. Remaining clusters represent mixtures of samples from different substrewn fields. Factor analysis applying the Keiser criterion produced a two-dimensional factor loading plot with three distinct groups of elements. Standardized scores, superimposed on the component loading plots, show how individual samples are influenced by the given principal component trends. Most of the moldavites from the Cheb Basin appear to be influenced mainly by carbonate lithologies. The Radomilice area samples show a substantial enrichment in silica-rich component. Moravian samples together with the single available Lusatian moldavite seem to be influenced by clayey precursors. South Bohemian moldavites then display a multicomponent origin.



■ **Fig. 9.** Scatter-plot matrix with box plots along the graph diagonal. Individual panels show variations of pairs of selected elements whereas box plots demonstrate ranges and variability of the given elements or their ratios (original).

Most of the moldavite precursors came from the topmost part of the target regions. Consequently, it is most probable that a considerable amount of a biogenic material had been included to the tektite melt at the moment of moldavite formation. To test the validity of this hypothesis the concentration and isotopic composition of carbon contained in moldavite glass have been determined. Though the overall concentration of carbon is low (less than 30 ppm) the isotopic composition ($\delta^{13}C$ = −28.5 to −29.9 ‰ V-PDB) corresponds to the composition of terrestrial vegetation instead of that of marine carbonates building up the target area at the impact site.

In cooperation with the University in Münster (Germany) the content and isotopic composition of Li were determined. It appeared that Li isotopes are not significantly fractionated and that they rather reflect the composition of moldavite source sediments.

No. 205/09/1162: **Lacustrine and Coal Deposits of the Sokolov Basin, Eger Graben, as an Archive of Miocene Continental Paleoenvironments, Paleoclimate and Tectonics** (K. Martínek, S. Opluštil, Z. Kvaček, J. Sakala, Faculty of Science, Charles University, Praha; J. Franců, B. Kříbek, E. Franců, Czech Geological Survey, Praha; I. Sýkorová, M. Havelcová, M. Matysová, H. Trejtnarová, M. Vašíček, Institute of Rock Structure and Mechanics of the ASCR, v. v. i.; *J. Kadlec*, *O. Man*, *P. Pruner*, *P. Schnabl*, *S. Šlechta*, *J. Dašková* & P. Rojík, Sokolovská uhelná, právní nástupce, a. s., Sokolov, Czech Republic; 2009–2011)

The project is focused on the detailed study up to 200 m thick succession of lacustrine Cypris Formation and underlying Antonín Coal Seam in the Sokolov Basin, where depositional rhythmicity of several orders was observed. The high-resolution magnetostratigraphic approach is applied for the dating of the Cypris Fm. Magnetostratigraphic interpretation reveraled that a 71 m long core No. 333 drilled in the Družba Quarry indicates the possible deposition time interval between the C6Bn.1n (21.936 Ma) and C6r (19.722 Ma) polarity zones. A new core 93.5 m long was drilled in the Jiří Quarry. We collected 400 oriented samples with 20cm spacing. The low-field volume magnetic susceptibility and anisotropy of magnetic susceptibility were measured in all samples. The studied drill core section can be divided into three segments based on mineral magnetic properties similarly as the first core section from the Družba Quarry: high AMS degree in the topmost segment indicates possible presence of pyrrhotite, higher MS values in the middle segment reflect the presence of greigite and its absence in the lower segment showing low MS values. Inverse magnetic fabric dominating in the lower segment is a result of post-depositional origin of paramagnetic siderite. Pilot samples were demagnetised by alternating field in 9 fields from a natural state to 50 mT for magnetostratigraphic purposes.

Studies of organic debris and palynomorphs put new insights in the history of the Cypris paleolake clayey deposits. The green colonial and oil producing microalgae *Botryococcus* Kützing are the most characteristic microfossils in the studied sequence. They are often preserved in "subfossil" state. Their frequency and retained features indicate the alginitic clay containing immature organic matter. This is evident particularly in the top and the upper part of the core section. They were associated with abundant coniferous pollen produced by Pinaceae, blown on the open paleolake. General pollen spectrum: the low content of other wind-pollinated shrubs and trees, except Oleaceae and probably Salicaceae, which occur frequently. Symplocos, Cornaceae, Araliaceae and even Palmae are present. They characterize the middle and lower parts of the section. Poaceae (Gramineae) making often the border of the recent lakes, are almost absent, but exotic Restionaceae were recorded. Halophile pollen (Chenopodiaceae) occurred in the lower segment of the section.

No. 205/09/1170: **Upper mantle beneath neovolcanic zone of the Bohemian Massif: xenoliths and their host basalts** (P. Špaček, Institute of Geophysics of the ASCR, v. v. i., Praha, Czech Republic; *L. Ackerman* & *J. Ulrych*; 2009–2012)

Complementary sampling extended the studied region to the western parts of the neovolcanic belt. Main stress was given to analytical work on previously sampled material and preliminary petrological interpretations. We developed a co-operation with Polish team and established other cooperations with externists from neighbouring countries (joint petrological studies on some samples from Germany and Poland, use of analytical equipment in Germany and Austria). In 2010, the sampling was focused on the western part of the neovolcanic belt. More than 70 xenolith samples from Bavarian localities of Zinst, Hirschentanz and Teichelberg were collected (Fig. 10). In West Bohemia the localities of Číhaná and Kraslice were sampled (>30 samples). Host basaltic rocks were sampled at these localities and in other parts of the neovolcanic belt associated with the Ohře Rift.

Ultra-fine grained kelyphites of garnet composition were found in two lherzolite samples from Zinst and one pyroxenite sample from Kozákov. In the Zinst sample (see figures in attachment) the post-garnet relics have three main zones: the wide inner kelyphite zone is composed of fibrous kelyphite with grain size of ca. 200–400nm and composition of 69–71% pyrope, 11–13 % almandine, 8–10 % andradite and 3–5 % grossular. The outer kelyphite zone is coarser-grained (3–50 µ), displays radial fibrous structure and probably contains sigificant amount of quenched or finely crystallized anortite-rich melt. The outer symplectite zone has branch or simple granular structure and grain size on the order of X00 µ. It contains a significant amount of calcite. The melt concentrates in thin (100–200 µ) veins mostly terminated at the inner/outer kelyphite zone boundary; most of them were probably formed before the final decomposition of garnet. The high content of calcite in the symplectites and the presence of minerals of ilmenite-geikielite group, chalcopyrite, apatite, and srilankite in veins and melt pockets indicate external, CO_2-rich, possibly ultrabasic melt component. The analyses of xenolith suites and host basalts show a significant variability of their chemical composition. Xenoliths of the České středohoří Mts. and Krušné hory Mts. are mostly strongly depleted (harzburgites/dunites with olivine #Mg of 89.6 to 90.9) while xenoliths from German localities are characteristic by lherzolites. This points to the chemical heterogeneity of the lithospheric upper mantle beneath the Ohře Rift and contrasting processes of its evolution in different areas or periods. Isotopic Sr-Nd analyses of host basalts from the České středohoří Mts. show a relatively significant variation, too. Basalts from the western part of the region (Kuzov and Medvědí vrch hills) have lower values of epsilon Nd (+3.3–3.6) than the basalts of central part of the region (epsilon Nd of +4.2–4.6). Taking into account the calculated model ages of Nd, it seems that the magmas were derived from sources with different isotopic ratios of Nd.

No. 205/09/1521: **Feeding strategies from the Cambrian to the Middle Devonian of the Barrandian area** (O. Fatka, Faculty of Science, Charles University, Praha; *R. Mikuláš*; P. Budil, Czech Geological Survey, Praha; M. Mergl, Department of Biology, University of West Bohemia & M. Valent, National Museum, Praha, Czech Republic; 2009–2011)

Regardless of the variety of attitudes to the classification and interpretation of ichnofossils adjacent to partly skeletonized body fossils, the colloquial designation of them as *Gordia*-like or *Gordia*-type traces spread among the researchers of Cambrian *lagerstätten* after the publication of Wang et al. (2009). However, neither all the finds are attributable or similar to *Gordia*. The "true" *Gordia*-like traces described by Wang et al. (2009) represent only a selected portion of "poor skeleton-adjacent" trace fossils; without the study of the whole group, the ichnotaxonomic proposals and conclusions can hardly be convincing. The problem may have much broader consequences, especially for the study of the history of bioturbation.

1. The existence and presumed function of the trace fossil *Rejkovicichnus necrofilus* Mikuláš et al., 1996. Mikuláš (2000) presumed that these large endichnial structures, showing – if fully developed – the form of straight to moderately curved "walls", represent a very early example of *gardening*. The range of forms and internal structures points to the possibility of active accumulation of bioclasts bearing hardly digestible particles, and – after some time – revisiting the place to feed on the bacterial build-up. These structures have not been found in post-Cambrian strata. The explanation we suggest is that such feeding strategies could not be usable under the regime of intensive bioturbation, as a "gardener" would probably find its cultivation trough destroyed.
2. The *ichnofossils adjacent to partly skeletonized body fossils* are relatively infrequent in post-Cambrian sediments. This can be explained empirically: these ichnofossils are bound to Burgess Shale-type *Lagerstätten*, which in typical form are missing in younger strata; but such "evidence" would be a "begging the question". Partly skeletonized organic tissues are rather common in post-Cambrian strata (e.g., phyllocarid carapace valves).
3. Modern analogues. In 2010, the authors observed the development of the bottom surface of a dewatered recreation and flood pool in Prague (GPS: 50°2′11.8″N, 14°32′39.2″E). At a certain stage of its development, traces adjacent to thin algal mats developed here; these were a perfect morphological and size analogues of the above described Cambrian fossils-adjacent traces.

For the above mentioned reasons, we formulate the hypothesis that *Gordia*-like traces, *Cochlichnus*-like traces, *Treptichnus*-like traces and *Chondrites*-like traces adjacent to partly skeletonized body fossils in the Cambrian of the Barrandian area are feeding traces. Substrate in the immediate contact with weakly mineralized carapace of an arthropod (or a similar biologic material) became enriched in a bacterial buildup, which was the main food source.

MIKULÁŠ R. (2000): Trace fossils from the Middle Cambrian of the Barrandian area (Central Bohemia, Czech Republic). – *Czech Geological Survey Special Papers*, 12: 1–29.

MIKULÁŠ R., KORDULE V. & SZABAD M. (1996): The ichnofossil *Rejkovicichnus necrofilus* ichnogen. et ichnosp. nov. and body fossils in its filling (Middle Cambrian, Czech Republic). – *Věstník Českého geologického Ústavu*, 71, 2: 121–125.

■ **Fig. 10.** Teichelberg active quarry (photo by P. Špaček).

MIKULÁŠ R., SZABAD M. & FATKA O. (In press): Paleoecologic consequences of ichnofossils adjacent to partly skeletonized body fossils, Middle Cambrian of the Barrandian area, Czech Republic. – *Ichnos*.
WANG Y., LIN J.-P., ZHAO Y.-L. & ORR P.J. (2009): Palaeoecology of the trace fossils *Gordia* and its interaction with nonmineralizing taxa from the early Middle Cambrian Kaili Biota, Guizhou province, South China. – *Palaeogeography, Palaeoclimatology, Palaeoecology*, 277, 1–2: 141–148.

No. 205/09/1918: **Soluble and insoluble fraction of inorganic pollutants in various types of precipitation, their quantification and input into the ecosystems** (J. Fišák, D. Řezáčová, P. Chaloupecký, Institute of Atmospheric Physics of the ASCR, v. v. i., Praha; M. Tesař, M. Štír, J. Polívka, Institute of Hydrodynamics of the ASCR, v. v. i., Praha, Czech Republic; *J. Rohovec*, *P. Kubínová* & *P. Skřivan*; 2009–2014)

The project is focussed on the estimation of the occult and total precipitation and the formulation and validation of pollutant concentration (PC) in different precipitation types (PT) on meteorological conditions, on air particles transport, nature and conditions of the formation of precipitation. Pollutant input is evaluated in liquid and solid samples by ICP EOS, ICP MS and LA-ICP-MS technique, respectively. The samples are collected for selected rain/fog events at experimental sampling sites taking into account the local and distant pollution sources.

In the course of work on the project in 2010, a sample set was collected at five collection sites according to the collection protocol described previously. Another set of liquid samples was supplied by the principal investigator. In total, up to 160 samples were worked up and analysed. The methodical approach applicable for isolation and characterisation of solid particles from the liquid samples collected was established in the first year of project solution and was now applied directly. Namely, a one-step microwave digestion procedure in a mixture of nitric, hydrofluoric and hydrochloric acid is dealt with.

Basic chemical characterisation of the liquid samples and the solutions obtained by the decomposition of solid particles was done by ICP EOS. The contents of major elements (Al, Ca, Fe, K, Mg, Mn, Na, P, S, Si) and some of the microelements (As, Cd, Pb, Co, Ni, Ba, Sr, Be) were determined. The comparison of macro- and microelement contents of the solid particles pointed to a correlation between the composition of the solid phase in macroelements and the microelements transported on the solid. The samples rich in iron showed elevated amounts of As, Cd and Pb. On the other hand, the particles based on silica do not transport the microelements mentioned. The composition of the solid phases (in macro- as well as microelements) does depend on meteorological conditions at the collection time.

The ultra-trace elements U, Th, Rb, Cs, Tl were analysed by ICP MS technique. Due to the appreciable volatility of Tl it was possible to find correlation between its content in the liquid fraction of precipitation and the fraction bound on the solid particles. The Cs content showed similar trends like that of K and Rb.

Solid particles were analysed not only in the form of total decomposed samples, but also appreciable experimental effort was directed towards the analysis of single-components in the solid particle mixture by the LA-ICP-MS technique. Due to the complicated preparation of the sample before the analysis, as well as the tricky set-up of the experimental conditions, only semi-quantitative results were obtained. Clearly, the solid particles were found to be a highly inhomogeneous mixture, with variations in the trace element contents among individual grains.

Isotopic ratios of Pb were used as a further characterisation of the source and history of various solid particles isolated from the precipitation. Comparision of the data measured with the well documented literature examples gives an interesting approach to the tracing problem solution.

No. 206/09/1564: **Multi-proxy paleoecological study of unique sediments from the former Komořany Lake, Most Basin, Czech Republic** (J. Novák, University of South Bohemia, České Budějovice; V. Jankovská, Institute of Botany of the ASCR, v. v. i., Brno, Czech Republic & *L. Lisá*; 2009–2013)

The former Komořanské jezero Lake represented the largest natural water pool on the area of the Czech Republic in the past. Most of the lake deposits were destroyed during coal mining in the last century. It is therefore important to rescue paleolimnic information hidden in the re-discovered cores in lake sediments, which were sampled in the 1980s for the reconstruction of natural environment.

In 2010, seven samples were sent to the CAIS laboratory, University of Georgia, for ^{14}C AMS dating. Data are supposed to specify our depth–age model at problematic sites. "New" core samples were "found" in the depository of the Moravian Museum. The location of the samples is quite different from the already processed cores, so the comparison seems to be quite useful.

Besides the new paleoecological analyses, sedimentological analyses, measurements of magnetic susceptibility, TOC analyses and the measurements of pH from cores (PK-1-C, PK-1-CH aPK1I) were provided in 2010. Section PK1-C was, due to its complexity, chosen for isotope analyses of diatomites, and first samples were separated in the Laboratory of Jaume Almera (CSIC) in Barcelona. The samples will be measured in the NERC laboratory in Notthingham. Another set of samples from section PK1-C was chosen for $\delta^{13}C$ isotopes and measured in the Laboratory of the Czech Geological Survey in Prague. During the year 2010, D. Valentová started to study lithology of the Komořanské jezero Lake as the main subject of her diploma thesis.

First results show that the facies variability within the former lake was quite wide, as suggested by the position of the sampled cores and the changing water level of the lake. These changes were not high and according to the isotopic record, only two regressive stages were documented with prevailing C4 plant cover. There was a continuous aeolian input during the lake existence, grading during storm events. Thin section study provided a proof of seasonality which is reflected by thin layers of diatomite accumulations.

No. 526/08/0434: **Impact of soil structure on character of water flow and solute transport in soil environment** (R. Kodešová, M. Kutílek, M. Kočárek, M. Rohošková, L. Pavlů, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences, Praha,Czech Republic & *A. Žigová*; 2008–2011)

Agricultural activities frequently lead to a degradation of a soil structure and consequently of a porosity and soil hydraulic properties.

Seasonal variability of soil properties was measured in surface horizons of three soil types (Haplic Cambisol on orthogneiss, Greyic Phaeozem on loess, Haplic Luvisol on loess) for two years. Undisturbed and disturbed soil samples were taken every month to evaluate physical, chemical and micromorphological properties. Results show that the soil properties varied within the time.Values of pH slightly varied within both years at all localities. Organic matter content, organic matter quality and aggregate stability varied significantly during the first year. However, variability of those properties was considerably lower during the second year at all localities. Porosity and soil hydraulic properties were also more variable during the first year than during the second year.

Two soil profiles, which were at a small distance from each other, were chosen to study the impact of different land use and management on soil properties: under the conventional tillage (Fig. 11), and under the reestablished permanent grass cover 30 years ago (Fig. 12). The study was performed in the Hněvčeves village. Soil structure and soil hydraulic properties were studied for the same soil type (Haplic Luvisol on loess). Soil structure was analyzed using the micromorphological method. Soil hydraulic proprerties were measured in the laboratory using multistep outflow experiments. Tension disk infiltometers and Guelph permeameter were used to measure unsaturated and saturated hydraulic conductivities in the field. The similarity or dissimilarity of larger capillary pores was documented by micromorphological description. While soil properties studied in the deeper Bt_2 and C horizons were relatively similar at both sites, properties A and Bt_1 horizons measured at both sites were evidently different. Lower retention ability and slightly lower unsaturated conductivies for $h_0 = -2$ cm (from disk infiltrometers), K ($h_0 = -2$ cm) were measured at the arable land than those at grassland. This indicated that the fraction of the large capillary pores (pore radii between 20 (m and 740 (m) and also matrix pores (pore radii lower than 20 (m) A and Bt1 horizons of the soil profile under the conventional tillage were smaller than those in the horizons of the soil profile under the permanent grass. Larger and more variable saturated hydraulic coductivies, Ks (from the Guelph permeametr tests) and differences between the Ks and K (h0 = −2 cm) values were obtained at for arable land than at for grassland. This denoted that the fractions of gravitational pores (pore radii larger than 740 (m) and connectivity of large pores in the A and Bt1 horizons of soil profile under the conventional tillage were greater than those in the horizon of the soil profile under the permanent grassland. Thus grassland soil showed well

■ **Fig. 11.** Haplic Luvisol on loess under the conventional tillage (photo by A. Žigová).

■ **Fig. 12.** Haplic Luvisol on loess under the permanent grass (photo by A. Žigová).

reestablished stable soil structure with favourable soil hydraulic properties not only in the A horizons, but also in the deeper Bt1 horizon.

No. 526/09/P404: **Reconstruction of historical change in mercury deposition recorded in tree rings and tree bark pockets** (*M. Hojdová*; 2009–2011)

Previous results showed that tree rings may provide a good record of the course in Hg deposition in the area affected by ore mining and smelting. Further research on Hg record in trees at sites with different degree of Hg deposition was conducted to prove the suitability of this geochemical archive.

Tree rings in the vicinity of Pb smelter were studied in more detail. Deposition of antimony (Sb), other "emerging" contaminant, was studied. The initial results showed low accumulation of Sb in wood, but the concentration maxima corresponded with the increased smelting activities in the 1970s and 1990s.

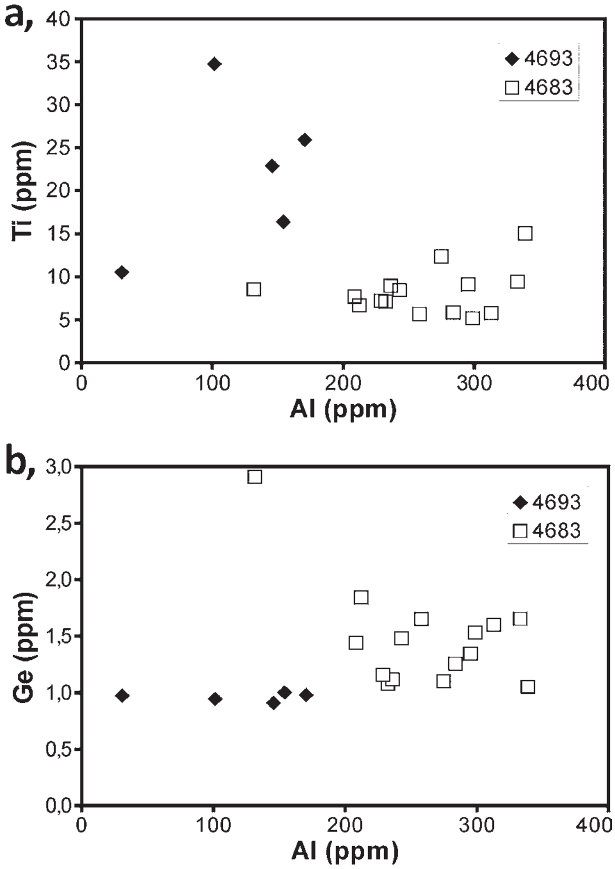
No. P210/10/1105: **Trace elements in igneous quartz – frozen information about silicite melt evolution** (*K. Breiter*, *M. Svojtka*, *L. Ackermann*, *Z. Korbelová*; J. Leichmann & K. Švecová, Faculty of Science, Masaryk University, Brno, Czech Republic; 2010–2012)

In the first year of the project solution, we focused our study to the Teplice rhyolite and genetically related Cínovec granite from the eastern Krušné hory Mts. We used representative samples from deep boreholes: about 1,600 m deep borehole CS-1 in granite and a 900 m deep borehole Mi-4 in rhyolite. Polished thin sections with a thickness of about 300 µm were studied first using a cathode luminescence (CL) detector on the microprobe and then analysed on LA-ICP-MS.

The CL (realized in MU Brno) showed a nearly homogeneous internal fabric of quartz from the granite, but strongly zoned structures in quartz phenocrysts from rhyolite.

Trace element concentrations in quartz were studied using a New Wave UP-213 laser system attached to a single collector ThermoFinnigan Element 2 ICP-MS at the Institute of Geology, Academy of Sciences. Laser was fired at repetition rate of 20 Hz and energy of 10–13 J.cm^{-2}. The laser lines (width of 55 µ and length 100 µ) were produced by repeated scanning of the leaser beam at a speed of 1 µ.s^{-1} across the quartz sample surface. Data for gas blank were acquired for 35 s followed by 100 s of laser ablation signal. All data were calibrated against the external standard NIST SRM612 glass and the internal standard of the Si value. Time-resolved signal data were processed using the Glitter software; caution was taken to constrain the signal to chemically homogeneous parts of the crystals and to avoid any inclusions and inhomogeneities that can be potentially present in the analysed minerals.

Figures 13a and 13b show the most interesting results of the first series of laser-ablation experiments with samples of granite from Cínovec. Sample 4693 from the depth of 1580 m represents the older, less fractionated protolithionite granite, while sample 4683 from the depth of 87 m represents the highly evolved zinnwaldite granite. The decreases in Ti contents and the increase in Al contents in quartz are generally accepted as

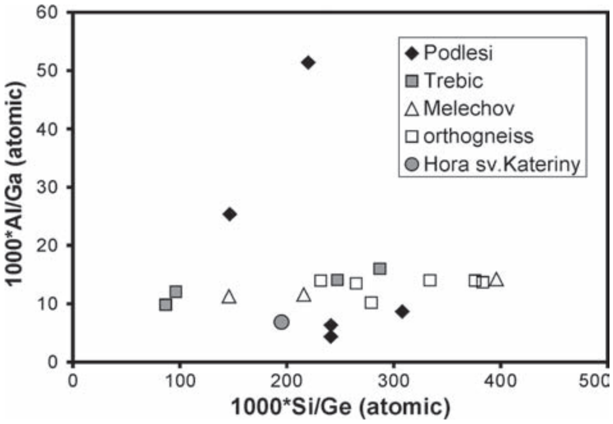


■ **Fig. 13a.** Contents of Al and Ti in quartz from Cínovec; **b.** Contents of Al and Ge in quartz from Cínovec (original).

the most remarkable and reliable markers of the parental melt fractionation. Our results are fully in agreement with the general assumption. Figure 13b shows a slight enrichment in Ge during the fractionation of the A-type melt.

No. P210/10/1309: **Behaviour of geochemical twins Al/Ga and Si/Ge in different types of acid silicate melts** (*K. Breiter*, *L. Ackermann*, *Z. Korbelová*; V. Kanický, T. Vaculovič & N. Kohoutková, Faculty of Science, Masaryk University, Brno, Czech Republic; 2010–2012)

Five types of contrasting granitoids from the Bohemiam Massif were selected for methodic works of the whole-rock Ga, Ge-analyses in the first year of the project solution: (1) late Variscan, highly fractionated peraluminous rare-metal granites and greisens from Podlesí (Krušné hory Mts.); (2) late Variscan peraluminous two-mica granites from the Melechov pluton, Moldanubicum); (3) Variscan melanocratic amphibole-biotite syenites (durbachites) from the Třebíč pluton; (4) a suite of Lower Paleozoic biotite, two-mica and garnet-muscovite orthogneisses from the Moldanubicum, and (5) late Variscan, only slightly peraluminous granites of A type from Cínovec and Hora Svaté Kateřiny (Krušné hory Mts.).These plutons differ significantly in their geochemical characteristic, so we expect to find also differenc-



■ **Fig. 14.** Contents of Ge and Ga expressed as 1000*Si/Ge and 1000*Al/Ga in the studied rocks from the Bohemian Massif (original).

es in the behaviour of Si/Ge and Al/Ga-ratios. Possible spectral interferences were examined before the analyses. The samples were dissolved after melting with $LiBO_2$ and then analysed at optimized parameters.

Results of whole-rock Ga and Ge analyses are shown in Fig. 14. Whereas the contents of Ga are in all rock suites relatively stable (1000Al/Ga~5-15), contents of Ge variegated extensively. The Si/Ge-ratio during fractionation increased (Ge-content decreased): in the Třebíč pluton from about 80 in amphibole-biotite durbachites to 250–300 in late biotite durbachites, in orthogneisses from about 230 in biotite otrhogneisses to about 380 in some of two-mica facies, in the Melechov pluton from about 150 in the Lipnice facies do about 400 in the Melechov facies. In the Podlesí granite system, the Ge- and Ga-contents are influenced by greisenisation: namely the Ga is during hydrothermal processes mobile and its content remarkably decrease (Al/Ga-ratio increase).

No. P210/10/1760: **Cryogenic cave carbonates: Mechanisms of formation and relationship to permafrost depth** (*K. Žák*, *M. Filippi*, *R. Živor* & *R. Skála*; 2010–2012)

The project is focused on the study of cryogenic cave carbonate (CCC). CCCs are formed in caves during freezing of karst water. During the water freezing the distribution of dissolved components between the formed ice and non-frozen water is irregular. The dissolved components are concentrated in the residual non-frozen water, and depleted in the ice (i.e., cryochemical process). If the water freezing is complete, the dissolved components are precipitated as cryogenic minerals.

The current project is focused on dating of the CCCs using U-series and radiocarbon dating, on the study of stable isotope fractionations during cryogenic precipitation related to the water freezing, and on the study of spatial distribution of the CCC in caves. Formation of the CCC requires temperatures below the water freezing point. In small, isolated cavities such conditions could have been formed only when a permafrost zone was developed around the cave. The CCCs therefore represent a new promising type of paleoclimatic indicator, which can improve our understanding of permafrost evolution and destruction during the last glacials.

The studied cave sites are located in a belt parallel to the southern limit of Upper Pleistocene (Weichselian) continental glaciation in the territory of Russia, Poland, Slovakia, Czech Republic, and Germany. For each studied cave, the cave morphology data (cave maps and cave sections) are collected, position of the CCC in the cave described and photo-documented, and samples are studied in laboratories by a wide set of mineralogical, geochemical, and geochronological methods.

The morphology and geochemistry of the studied CCCs is strongly dependent on the freezing rate and the quantity of water involved in the processes. During slow water freezing in pools, coarse-grained precipitates are formed. This process is typical for deeper cave sections and processes ongoing during the Glacial. Rapid water freezing produces fine-grained CCC with different C and O stable isotope characteristics. Production of fine-grained CCC can be commonly observed in caves, which are iced recently, or during seasonal drip-water freezing in cave entrances. Detailed mineralogical study of these seasonal fine-grained precipitates in Koda Cave in the Czech Karst confirmed the formation of metastable carbonate ikaite ($CaCO_3$•$6H_2O$) as the primary precipitate.

No. P210/10/2351: **Paleomegnetism & geochemistry of volcanic rocks: Implications to paleosetting and development of the Prague Basin (Late Ordovician–Early Devonian)** (*P. Pruner*, *P. Schnabl*, *P. Štorch*, *L. Koptíková*, *G. Kletetschka*; Z. Tasáryová, T. Hroch, Š. Manda, J. Frýda, V. Janoušek & P. Kraft, Faculty of Science, Charles University, Praha,Czech Republic; 2010–2014)

Remagnetization causes problems during the interpretation of the MS signal. Some of the lower Paleozoic rocks are slightly remagnetized while rock bodies around fault and fracture zones are strongly remagnetized. The major newly formed minerals that increase the rock MS are hematite, superparamagnetic (SP) magnetite and goethite. Although the effects of superparamagnetic goethite on the total rock MS signal have rarely been studied in limestones and carbonate sedimentary rocks in detail, the present study indicates that it is not an insignificant component contributing to the analyzed MS signal. According to evidence from thin sections and insoluble residues, goethite represents a quite ubiquitous component in these rocks. In Barrandian limestones and adjacent strata successions, the hematite enrichment of Variscan origin is quite regularly found at the bigger faults as well as accompanying or separate fracture zones, where an apparent evidence of this kind of mineral change is the reddish colour hue of rocks. Increased hematite contents were detected also by means of magnetomineralogic methods. The remagnetization corresponding to this change in rocks of Silurian and Devonian ages has a solid evidence base since being dated by the late Carboniferous to early Permian paleomagnetic directions. There is also a possibility that some hematite enrichments of this type are older, formed as early as with the major eo-Variscan deformation of these limestones during the late Devonian ages, but the final remagnetization is in most of the cases late – Carboniferous/Permian. Even minor enrichment by SP magnetite which has several orders higher MS than most minerals can degrade the MS signal; SP magnetite can be easily proved by frequency dependent MS. Some of the rocks are enriched during supergene processes by goethite because the Barrandian area is affected, at many places, by deeply penetrating weathering of wild relief. The occurrence and amounts of goethite can be easily proved by acquisition of isothermal remanent magnetization (IRM). The above mentioned remagnetization episodes can also be proved by fold, conglomerate and dike tests. The problems related to populations and neomorphism of magnetite and goethite have already been studied, and the preliminary results were published (Vacek et al. 2010). Here, the authors proved that exactly opposite situations can be found at several localities of Silurian–Devonian boundary successions. There are also large rock bodies and spots in the Barrandian area (exactly in the Prague Synform) where remagnetization has a negligible importance in sum of these diagenetic and remagnetization changes. On the other hand, remagnetization plays a very important role in many cases. It is particularly relevant to the Reporyje Limestone of early Devonian (late Pragian) age. In this limestone, large amount of hematite was embedded in synsedimentary to early diagenetic conditions, being related to precipitates in microborings and internal pores of altered bioclasts in general. In spite of this fact, the major part of this hematite was gradually recrystallized, and in the present state, a remagnetization overprint with Carboniferous–Permian paleomagnetic directions strongly prevails. The contribution for discussion is how to recognize MS depletion, which has been – according to our knowledge – never studied. One of the newly introduced methods consists in the measuring of basaltic dykes emplaced in the limestone beds. The basaltic dyke that intruded in the limestone beds at the site of Jelinkuv Mlyn (quarry) shows a strong MS depletion of the volcanic rock, so that there is also evident potential that also MS of surrounding limestones was changed. Our preliminary data show, e.g., that average MS depletion of one set of Silurian basaltic dykes is between 95 and 98 %, while a second set is absolutely untouched by late diagenetic episodes or by weathering. The paleomagnetic signal of the emplacement time is usually recorded in the contact aureole. However, also the diagenetic history and preservation of older magnetic mineral carriers in these most promising contact objects is diversified so that they need not be an absolutely reliable source of magnetic information in all imaginable cases. In summary, the remagnetization studies are necessary for proper interpretations of the MS record, and almost any kind of MS enrichment is, at least theoretically, detectable.

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SCHNABL et al. 2010: Local remagnetization of sedimentary and volcanosedimentary rocks from Barrandian area (Prague Synform, Bohemian Massif). – *2010 IGCP 580 Meeting, Applications of Magnetic Susceptibility on Paleozoic Rocks, Guilin, China. November 28 – December 4, 2010, Meeting Programme and Abstracts: Abstract – 9*: 16–17. Guilin.

4c. Grant Agency of the Academy of Sciences of the Czech Republic

Finished projects

No. IAA 300130612: **Combined magnetostratigraphic studies of Cenozoic volcanics, Bohemian Massif** (*V. Cajz*, *J. Dašková*, *M. Chadima*, *M. Konzalová*, *P. Pruner*, *P. Schnabl*, *S. Šlechta*, *J. Ulrych*, *D. Venhodová*; F. Holub, F. Hrouda & V. Tolar, Faculty of Science, Charles University, Praha, Czech Republic; 2006–2010)

Cenozoic volcanism in the NE part of the Bohemian Massif occurs prevalently in the Polish Silesia. It stretches to the territory of the Czech Republic in a limited extent, only. The volcanic locations constitute the Odra Tectono-Volcanic Zone (WNW–ESE), as a part of so-called Bohemo-Silesian Volcanic Arc. Basaltic volcanic products in Northern Moravia and Southernmost Silesia belong to the youngest ones on the territory of the Bohemian Massif. These rocks were studied in paleomagnetic dimensions by Marek (1969, 1973, 1974) and Kolofíková (1976) in the Czech Republic and by Birkenmajer et al. (2002) in Poland.

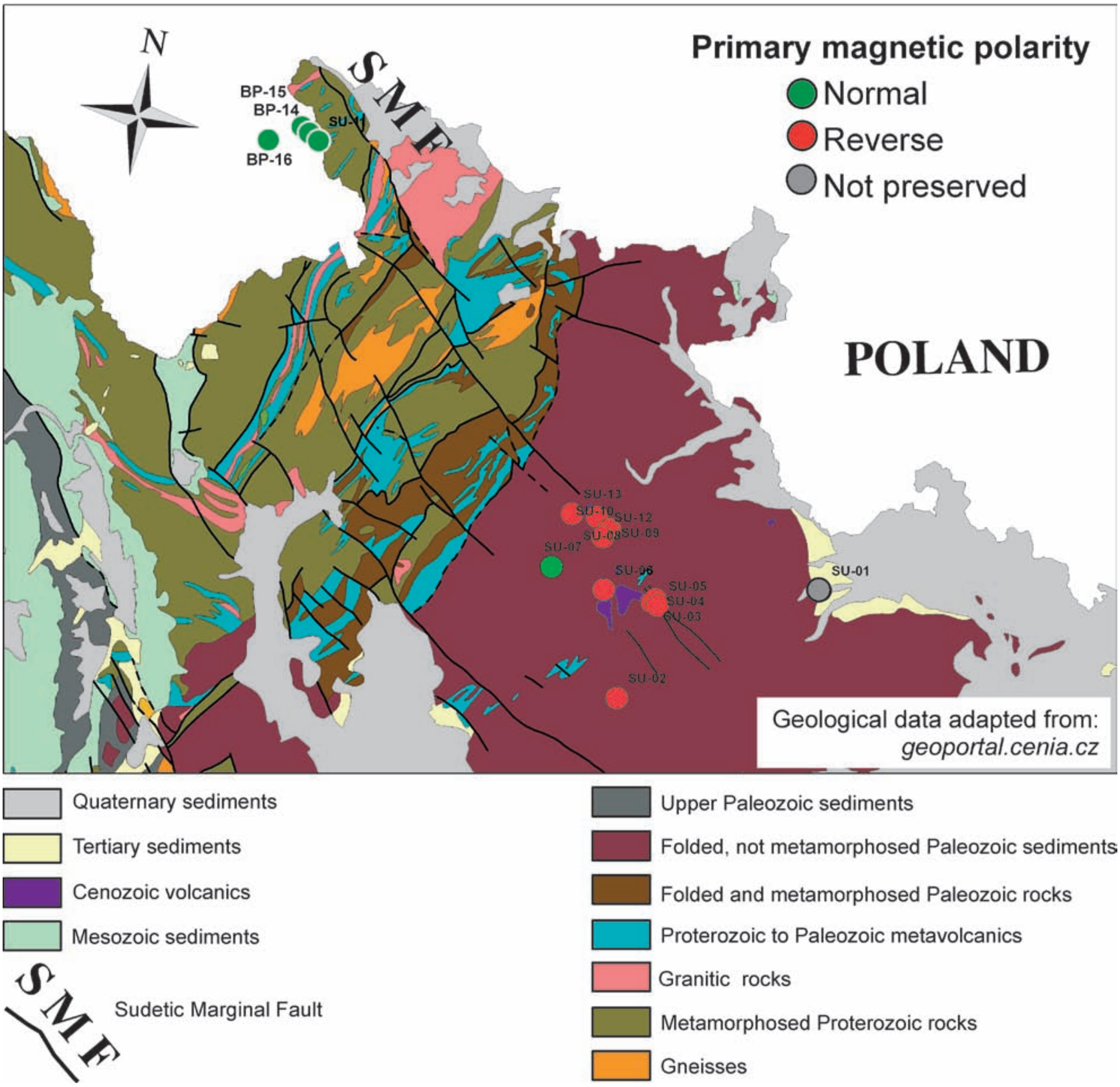
The greatest concentration of basalts can be called the Bruntál Volcanic Field (BVF); it is spread in wider surroundings of Bruntál city, in the Nízký Jeseník Mts. (Fig. 15). The Sudetic Marginal Fault, separating the Žulová granitic massif from the crystalline complexes of the Králický Sněžník Mts. and the Hrubý Jeseník Mts. in the territory of the Czech Republic, is accompanied by several faults of similar strike in both crystalline complexes. The continuation of one of the closest faults to the SMF, or the continuation of the SMF itself, runs into the area of the BVF.

Activity of volcanism in the BVF started as a bit explosive one and produced scoria cones. The explosiveness was partly influenced by water from environs and palagonitized tuffs were formed. It is best visible on the Venušina sopka Volcano. In this point of view, the role of the SMF-striking faults during volcano formation is acceptable well – surface water and ascending magma can meet on the fault planes. Nevertheless, this influence was relatively small, thus we can classify the activity of all below described volcanoes of the BVF as phreatomagmatic at the beginning, only. The continuation was of the magmatic type, producing scoriae and plastic bombs (Fig. 16). During further development, the activity changed into effusive one with smaller or larger lava production. This is a typical development of the most common type of monogenic volcano. We suppose mostly low-energy magmatic activity of the Strombolian type, close to the Hawaiian one.

The **Břidličná Volcano** (BV) is the oldest preserved basaltic rock of the BVF. The volcano is eroded down to the near-surface level of magmatic vent; the inner-crater facies passing to the vent-breccia is exposed in an old quarry. The majority of clastic material is represented by somewhat altered scoriae and the finest material is possibly primarily reduced in volume. The semi-plastic bombs are preserved documenting a position very close to the vent. The solid basalt of the plug is excavated. The size of near-surface vent cut gives a clue of relatively large scoria cone of the Břidličná Volcano at the time of its origin. The phreatic influence was slight; the alteration comes most probably from the weathering.

The **Uhlířský vrch Hill Volcano** (UV) is situated closest to Bruntál. It represents a remnant of a scoria cone with a thin lava flow in eastward direction. The exposed mostly centroclinal stratified layers (the inner facies) are constituted prevalently by scoriaceous lapilli and bombs. The stratification is visible in the grading and in colour – more and less palagonitized pyroclastics alternate. The palagonitisation decreases upwards and the frequency of semiplastic bombs increases. The red to brown coloured burned clasts of country rock are present. Relatively great number of larger ballistic transported bombs were plastic. Spindle- to cow dung-shaped forms were observed, sometimes the indication of bread-crust type bomb can be visible. Due to their plasticity, these bombs contain the paleomagnetic field vector.

The **Venušina sopka Volcano** (VS) near Mezina represents another small volcano of the BVF but with a stronger effusive activity. The cinder cone in the central part of the hill is the most phreatic-influenced among all the volcanoes of the BVF. But the signs of pulsation were not observed. Accidental pyroclasts of smelted Paleozioc country rocks are relatively frequent in altered scoriae. Basaltic vesiculated pyroclasts with chilled margins were observed. Spindle-shaped bombs are present as well. The thick lava flow is exposed in two abandoned quarries down



■ **Fig. 15.** Simplified geological map showing sampling locations and primary magnetic polarity of the studied rocks (adapted from Cajz et al. in print).

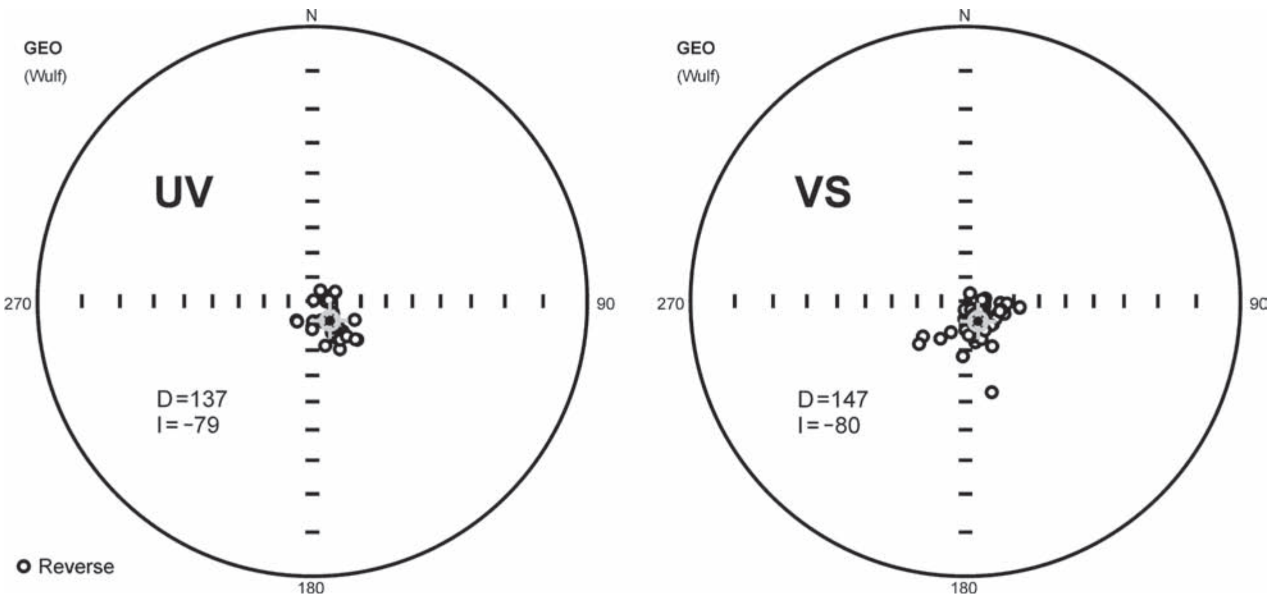
the slope. The lava breccias are developed at the base, different intensity-vesiculated levels and different intensity-sonnenbrand altered parts constitute the facies. The columnar jointing runs across all the facies. We suppose the thickness is not caused by several lava flows in superposition but resulted from deceleration of the flow and its stopping by hyaloclastic breccia at the lava front, constituted from the thermal shock at the contact of the lava and an active water flow, now mostly eroded.

The **Velký Roudný Hill Volcano** (VR) is the largest volcano of the BVF. It has the largest preserved effusive production as well. We suppose the location of the feeder between the future Velký Roudný and Malý Roudný Hills, building a large cinder cone with possible parasitic vents and production of several lava flows. No signs of separate vents are visible. All the exposed basalts show only signs of lavas. The largest preserved flow fills the paleovalley of the river. The southern flow can be traced as far as near Křišťanovice (4 km) in a small erosional relic. The lava production in several flows is deduced from spatial distribution of relics, not from superposition. No superimposed lavas are exposed now.

■ **Fig. 16.** Ballistic transported plastic bomb from the Uhlířský vrch Hill Volcano (UV) cinder cone (photo by V.Cajz).

The erosional remnant near Zálesí is situated just on the Czech-Polish border and is "rootless" in the territory of the Czech Republic. We suppose the production of this lava from the Lutynia area (Poland) where the vent is described (Birkenmajer et al. 2002). This was tested using magnetic properties of basalts on both sides of the border. We have tested the volcanological idea described above by using the orientation of the paleomagnetic field vector and evaluation of magnetic and gravimetric regional fields. The K/Ar radiometry was employed as well. Into the paleogeographic reconstruction of this volcano, we incorporated two other locations of tuffites, near Karlovec and Razová. The source area of majority of the scoriaceous material in tuffites is rather situated in the old cone of the Břidličná Volcano, destroyed and transported by the river. During effusive activity of the younger Velký Roudný Hill Volcano, the lava dam-lake was constituted, the stream gradient of the river got changed and the mixed pyroclastic-sedimentary material was deposited in the lake. Afterwards, the river used a contact of lava and former valley side to cut the current drainage.

Basaltic products were studied in their paleomagnetic properties and several of them were processed to get the K/Ar age (Cajz et al. in print). The paleomagnetic results prove that larger bombs of VS and UV were transported above the Curie temperature. Figure 17 represents paleomagnetic field of grouped products of separate volcanoes (lavas and pyroclastics). Difference of paleofield of UV and VS is 1.3 degree only. From this we can conclude a nearly identical time of origin of both volcanoes. Paleomagnetic field from the VR samples was compared with paleofield of smaller volcanoes UV and VS. The vector angle varies in the



■ **Fig. 17.** Paleomagnetic vector projection of products from the UV compared to the paleomagnetic vector projection of products from the VS (compiled from Cajz et al. in print).

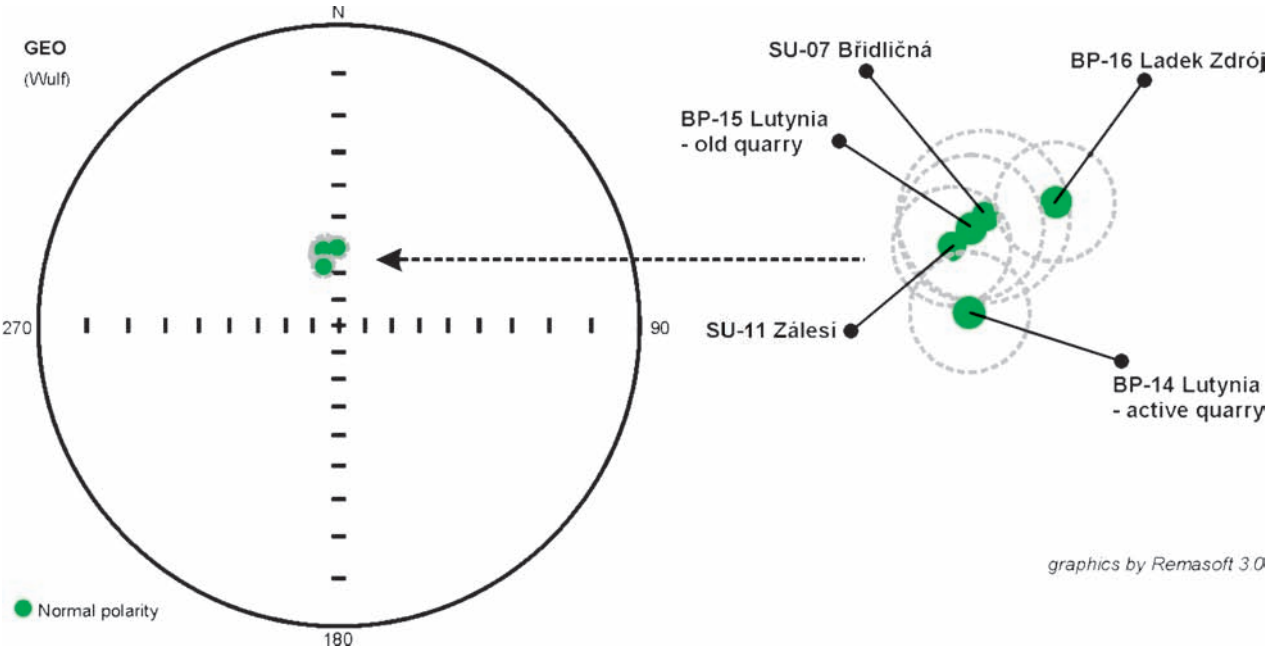


Fig. 18. Paleomagnetic vector projection of the Zálesí lava relic and the Břidličná Volcano vent, compared with products from the Lutynia area, including the detail (adapted from Cajz et al. in print).

range of 4.5–5.0 degree. Unfortunately, this small difference does not give relevant basis for a more detailed volcanologic interpretation.

The Břidličná Volcano which is normal-polarized has an extremely high Q-ratio (around 40). Usually, these high values are explained by secondary influence, e.g., a lightning. But in this case, the sampling site is situated deep in an old quarry, so the influence by a lightning is not realistic. The Curie temperature of 180 °C and the steep field-dependent susceptibility curve offer an explanation in the presence of the spinelid-group minerals. Another normal-polarized occurrence is represented by the lava relic near Zálesí on the Czech-Polish border. The paleomagnetic characteristics are comparable to the basaltic occurrences situated on the Polish territory. Figure 18 compares vector orientation data of all normal-polarized volcanics. Their very close orientation is visible, including the Břidličná Volcano. This situation can be explained by volcanic activity in a very close time span, and the conclusion offers two results: the Zálesí lava flow was produced from the Lutynia Volcano and the Břidličná and Lutynia Volcanoes were active nearly simultaneously. Figure 19 shows the existence of three different Upper Cenozoic volcanic phases with the most probable age: (1) Pliocene (Upper Zanclean or Lower Piacenzian) phase of normal polarity in the span of 4.3–4.2 Ma (C3n1n) or 3.6–3.3 Ma (C2An3n) constituting the Břidličná and Lutynia Volcanoes; (2) Gelasian phase (2.6 –2.1 Ma – C2r2r) which formed the Velký Roudný Volcano and its larg lava production; and (3) Lower Calabrian phase (1.8 –1.1 Ma – C1r1r+C1r2r) of Venušina sopka and Uhlířský vrch Hills, with possible remobilisation of the Velký Roudný Volcano (southern flow of Zlatá Lípa).

These results represent a strong basis for the Late Cenozoic volcanostratigraphy of this region. At the time of volcanic activity, tectonic remobilization – a change in the tensor of the paleostress field – can be supposed.

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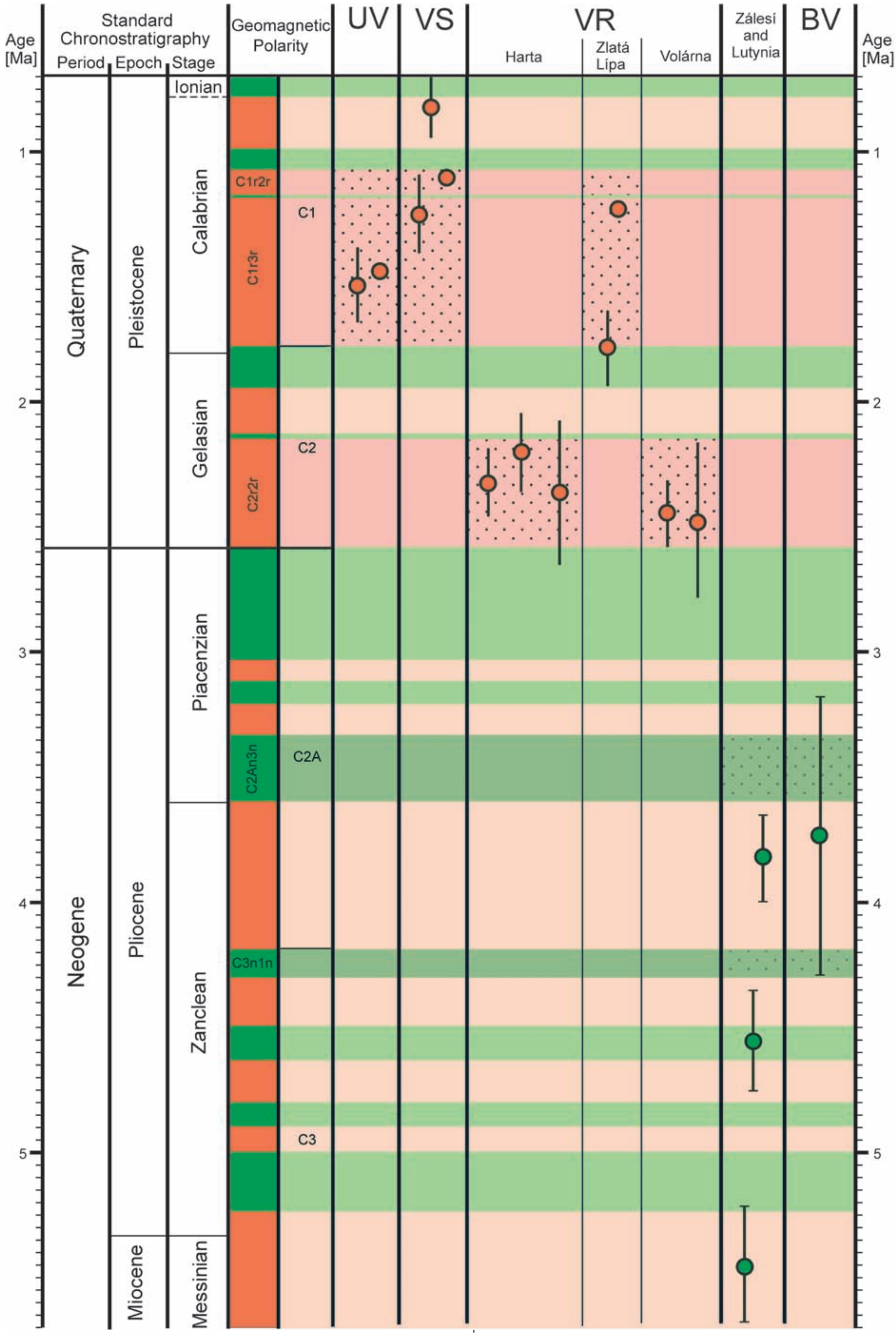

■ **Fig. 19.** The highest probability age (time spans of more intensive hues and dotted parts) of younger (reverse-polarized – red circles) volcanoes of the BVF compared to Pliocene (normal-polarized – green circles) volcanic activity. No analytical error was given for some samples (adapted from Cajz et al. in print).

No. IAA300130702: **Growth rhythms as an indicator of the Earth's rotation and climate changes in the geological past** (Project leader *A. Galle*, co-leader *J. Hladil*, co-investigators *P. Čejchan*, *L. Koptíková*, *J. Filip* & *L. Slavík*; C. Ron and his co-investigator J. Vondrák, Astronomical Institute of the ASCR, v. v. i., Ondřejov; D. Novotná, Institute of Atmospheric Physics of the ASCR, v. v. i., Praha & L. Strnad, Laboratories of Geological Institutes, Faculty of Science, Charles University, Praha, Czech Republic; 2007–2010)

Increments, their growth and chemistry. Berkowski & Belka (2008) studied, within the scope of this project, banding in *Scruttonia kunthi* from the Upper Devonian at Dzikowiec (Polish Sudetes). They mark the "dark bands" of previous authors as "high-density bands", and "light bands" as "low-density bands", and tabelarized characters of respective bands:

High-density bands (dark bands)	Low-density bands (light bands)
0.11– 0.23 mm	0.04 – 0.09 mm
Carinae well defined, numerous, thick	Carinae obscure
Contraction of corallites frequent (up to 62 % of the diameter)	Contraction of corallites not observed
Offsets frequent	Offsets rare
Ferroan calcite cements surrounding	Non-ferroan calcite cements
skeletal structures	surrounding skeletal structures

High-density bands (HDB) are typically thin and reach 2–4 mm in thickness; in contrast, the thickness of low density bands (LDB) ranges from 4 to 6 mm and as much as 7–8 mm at some places. Septa of the HDB are generally as much as two times thicker than those of LDB. The thickening of the septa is often emphasized by the development of the carinae, lateral flanges of septa which are more numerous and thick in HDB. HDB often coincide with a partial burial of the lateral parts of the colony and frequent contractions of corallites, manifested by strong narrowing of the corallite diameters within the HDB. At some places they may decrease to max. 62 % of their typical dimensions. The budding of the new corallites is more common in the HDB, particularly in their middle or upper parts.

Besides the banding of their inner skeletons, rugose and other epithecate corals display wrinkles (rugae) on the surface of their epitheca, some of them being fine and others coarser. The counts of fine wrinkles between two coarse ones display a certain periodicity. Unfortunately, well-preserved epithecae occur only rarely in the Moravian Devonian, as corals occur commonly in the massive limestone, while free specimens, for instance from the Čelechovice site, have their epithecae usually damaged.

Several of the Čelechovice specimens of *Calceola sandalina* show pronounced periodicity of the wrinkles of their epithecae: about eight of them within one cycle. If one of the growth rugae represents the daily increments, then coarser rugae – after eight days – would represent most probably one week: this may be related to the Moon phases, as the Moon not only influences the sea tides but also controls the sexual reproduction cycle in Recent corals and many other animals. Unfortunately, the length of the complete "weekly increment" is 3–5 mm; this would mean an increment of 156 mm at the present length of a year. Known yearly increments in Devonian corals range between 5–15 mm. This is in agreement with the estimated length of the Devonian yearly increments.

One of the interesting unpublished results of this project is the fact that most rugosans, tabulates and stromatoporoids from Moravian Upper Frasnian apparently show no growth banding at all. Under close scrutiny, however, it become clear that the zoning in the massive rugose coralla manifests itself in the alternation of zones of small, closely packed skeletal elements (dissepiments, tabulae, carinae etc.) with zones of large, thin unthickened ones. Berkowski (2001) acredited this to faster colony growth. As the mentioned elements are not thickened, it does not manifest by darkening of the zone. However, the banding in some cases actually disppears, and this phenomenon is influenced neither taxonomically, nor geographically. A similar case has been reported in the Belgian Frasnian, and it is introduced here from the Moravin Upper Frasnian. On the other hand, corals of the same age and of the same taxa with pronounced growth banding have been illustrated many times from close (Poland, Germany) or distant (Canada) regions. If we accept Berkowski's (2001) conclusions, it would imply extremely fast sedimentation rates through the Upper Frasnian in Moravia and accelerated Roth rates of corals and stromatoporoids; this way, the organisms mentioned tried to avoid their burial in sediment. In a way, this acknowledges Rothe of the anti-burial strategies, namely the disintegration of massive phillipsastreids into branching coralla, simulating the fasciculate ones, as is *Smithicyathus* from Poland and Moravia, and a yet undescribed species from Moravian Upper Frasnian with the corallum not only disintegrated into separate corallites, but thecae lost their peripheral dissepimentarial parts including septa, and the corallum was reduced into the bunch of tabularia surrounded by the thickened septotheca built of massive rhipidacanths.

Berkowski & Belka (2008) within the scope of this project stated that the analysis of oxygen stable isotopes reveals different signatures in the low- and high-density bands. The $\delta^{18}O$ values range from about –5.5 to –8.5 ‰ PDB; generally, there is a distinct variation between the low- and high-density bands. The latter have lower values than the adjacent low-density bands. The fluctuations are small, below 1 ‰, but in one colony they are as high as 1.8 ‰. The $\delta^{18}O$-variations are weakly developed in the lower parts of colonies. This is presumably due to the low number of the coenosteal skeletal elements that grew rapidly during the first stage of astogeny. In contrast to oxygen isotope data, there is no significant variation in the level of $\delta^{13}C$ which is around 1.8–2.0 ‰ PDB. Only samples taken close to the upper surface of the colony show slightly higher $\delta^{13}C$-values related probably to secondary processes (weathering). In the investigated colonies there is no dependence between $\delta^{18}O$ and $\delta^{13}C$.

The authors mentioned that in living corals growth-band formation is largely mediated by seasonal variations temperature but other environmental factors, such as nutrient supply, salinity, depth, water turbidity or insolation can also influence the growth of the coral skeleton. This is why it is not possible to correlate more dense and less dense bands of skeletal tissue with a certain environmental condition. Dense bands are usually associated with warm water and low insolation, while the low-density bands are formed in the season of relatively cooler water temperatures and high insolation. But reversal in band formation can also be observed.

In the observed Devonian corals the correlation between the coral $\delta^{18}O$ and the density of banding strongly suggests relation to past environmental changes. Moreover, the cyclicity in skeleton growth is assumed to represent an annual growth. If so, the growth rate of *Scruttonia kunthi* varied from 6 $mm.yr^{-1}$ to a maximum of 12 $mm.yr^{-1}$. These values are consistent with known growth rates in massive colonies of rugose corals (see Scrutton 1998). The relatively lower $\delta^{18}O$ values of the dense bands indicate higher temperature during their formation relative to the adjacent low-density portions. However, because of the lack of any reliable seawater temperature data from the Devonian and unknown metabolic effect on the isotopic composition of the rugose coral skeleton, it is not possible to calibrate the isotope signatures.

The $\delta^{13}C$ values of the Devonian corals are enigmatic. Living corals show generally a significant variation in $\delta^{13}C$ related both to endogenous (growth rate, respiration, calcification and photosynthesis) and to exogenous factors (insolation, temperature, changes in the $\delta^{13}C$ of dissolved inorganic carbon). The very uniform $\delta^{13}C$ values (around +2.0 ‰) recognized in *Scruttonia kunthi* are essentially identical to carbon isotope composition of the time-equivalent marine carbonates. Although the lack of significant variation in the $\delta^{13}C$ of the studied Devonian corals is surprising, it seems that growth rate, temperature, and possibly also sexual reproduction had no influence on the $\delta^{13}C$ of the skeleton. The data may indicate that some rugose corals could presumably precipitate the skeleton near carbon isotopic equilibrium with ambient seawater.

It is possible to conclude that the HDB were formed in the season of higher environmental stress with relatively warmer temperatures and higher sedimentation rates. Carbon isotopic analyses indicate that at least the growth rate of the skeleton and seawater temperature had no influence on the coral $\delta^{13}C$.

Climatic and cosmic influences. A pilot ascertainment of the project is that the regularity of incrementation or of the skeletal growth in general in earlier papers is overestimated. In reality, it is possible to find both visible and hidden faults in most sclerochronological records. In most cases this disqualifies the methods as yet routinely used to analyze these quasi-regular rows as they handled the rows of data as if these were true time series without deformations and gaps.

Some fundamental results were proved within the project: recording system, i.e., dark, thickened, slow-growing bands (DBs) vs. light, thinned, fast-growing bands (LBs) can vary as many as three times in a decade. The changes are controlled by "hot", "cold", and "pollution" events. Moreover, DBs-LBs banding does not necessarily mean one year, but it can pass into twofold monsoon systems and even into manifold irregular systems controlled by wildly oscillating climate with storms delivering large volumes of impurities into carbonatic realms. Further, it was ascertained that yearly, seasonal, etc., rhythms combine with relatively strong rhythms after 3 (3–4) years, 4 (pronounced), 7 (6–8), and 8 (weak); rarities are not, however, 13 or 21 year rhythms. Analysis of the recently identifiable astronomical factors resulting of the Earth–Moon–Sun interactions, solar energy, and cosmic radiation influencing upper parts of atmosphere including the magnetic field variations, enabled to predict variations comparable with astronomically or climatologically known 2–3 or 6–8 years rhythms, their transfer into the environment of strong environmental changes remains unclear. Far more probable than cosmic influence is that of the land–ocean regional domains where oscillation of linkages with strong several-years rhythms has a very strong controlling function. It is possible to say that a direct influence of such strongly oscillating environmental systems in realms of thousand kilometers to small niches can mask astronomical control in sclerochronology much more effectively than earlier admitted.

It is obvious that the project did not prove the influence of the Earth–Moon–Sun on the periodicity of the Devonian coral increments not only from Moravia, but also from Poland, Canada, and Gotland. All of them show usually yearly increments; daily or other short-time increments have not been observed. This correlates well with the results obtained by the Institute of Armospheric Physics. On the other hand, a decisive influence of the local climatic domains has been proved here, influencing temperature, salinity, pollution, turbulence, nutrient supply and further factors too complex to be traceable even approximately. Nevertheless, the studies of the skeletal accretion may be considered valuable information resource concerning the environments, adjacent sediments, and particularly contemporaneous climate.

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No. IAA300130703: **Paleoecology, Paleogeography, Stratigraphy and Climatic Changes of the Upper Stephanian (Gzhelian) of the Central and Western Bohemian Basins** (*J. Zajíc*, *P. Bosák*, *P. Čejchan*, *R. Mikuláš*; K. Martínek, S. Opluštil, Faculty of Science, Charles University, Praha; Z. Šimůnek, J. Drábková, V. Prouza, T. Sidorinová & Z. Táborský, Czech Geological Survey, Praha, Czech Republic; 2007–2010)

Petrological analysis completed the investigation of the K-1 Klobuky borehole. The sections of the Líně Formation are based on litology, sedimentary structures, well logs and fossil contents. The traditionaly used lithostratigraphic "horizons" vere well correlated and the new genetic stratigraphic units (Líně 1, 2, and 3) were defined. Processing of the 3D stratigraphc model of the Líně Formation was started with the help of the System Petrel software.

Pebbles of relatively pure, micritic to microsparitic limestones occur in C/P shales and conglomerates derived from old boreholes of the Mělník–Benátky nad Jizerou area, from P. Bosak's collection. These clasts resemble Devonian rocks of the Koneprusy area of the Prague Basin in their petrology and contained fossils. According to dacryoconarids, tabulate corals, and bryozoans encountered in thin sections of the pebbles, the age of these clasts is most probably Pragian (Koněprusy Limestone) to Lower Eifelian (Acanthopyge Limestone). The local occurrence of thick-shelled ostracodes is in good agreement with this conclusion. Also, there is a good agreement in the facies development with the presumed source area. Carbonate pebbles bear a resemblance to Devonian rocks of the Koněprusy area of the Praha Synform. Dacryoconarid tentaculites, tabulate corals and bryozoans indicate Pragian (the Koněprusy Limestone) to Lower Eifelian (the Acanthopyge Limestone) age. This interpretation is supported both by the thick-walled ostracodes and the facies development.

The drill core of the K-1 Klobuky borehole yielded samples for the heavy minerals, palynological and paleontological analyses. The floral (mostly *Odontopteris schlotheimii*) and faunal (*Sphaerolepis kounoviensis* a *Spinarichthys dispersus* only) lists are poor.

The rich plant samples obtained from the excavation at Klobuky (mainly in 2008) were compared with drill-core data. Both original phytopaleontologic reports and specimens from the samples depository of the Geological Survey in Lužná were used. Thirty boreholes (Be-1 Bechlín, Br-1 Brňany, Bř-1 Beřovice, Dm-9 Domoušice, Dn-1 Dřínov, Hš-1 Hobšovice, Ch-1 Chlum, K-1 Klobuky, Ke-1 Královice, Ln-1 Louny, MB-6 Hleďsebe, MB-7 Středmy, MB-15 Krpy, MB-20 Chotětov, MB-23 Chotětov, MJ-2 Stránka, MJ-8 Jenichov, Mo-10 Močidlec, Ne-1 Nečtiny, Ne-4 Plachtín, Nv-8 Novosedly, Ný-13 Nýřany, Sy-1 Skury, Sz-1 Sazená, Ty-1 Trpoměchy, VL-1 Vrbno nad Lesy, Vt-1 Vítov, Vy-1 Velvary, Zd-1 Zdětín, Zl-1 Zlonice) were included. These outcomes vere presented at the 8th European Paleobotanical and Palynology Conference in Budapest.

The test pits at Klobuky provided also a possibility to study the bioturbation of fossiliferous carbonate beds of the Klobuky Horizon as well as the ichnologic content of narrowly underlying and overlying beds. The bioturbation is weak. Two colonisation horizons left by invertebrate in-fauna occur 0.8 and 2.00 m below the carbonates of the Klobuky Horizon. The horizon itself shows several types of distinctive trace fossils, with prevailing dwelling structures and rare feeding traces. The succession of claystones and siltstones to fine-grained sandstones overlying the Klobuky Horizon bears four horizons with rootlets and with a bulbous structure resembling analogous features of some paleosols.

The rich faunal remains were obtained from the excavation in Klobuky (particularly in 2008), from other open-air localities (Panenský Týnec and Peruc) and from drill cores. Animal remains were re-evaluated both taxonomically and stratigraphicaly (lithostratigraphic units versus newly established genetic units). Thirty two boreholes (Bc-1 Brodce, Be-1 Bechlín, Br-1 Brňany, Bř-1 Beřovice, Dch-3 Drchkov, Dn-3 Dřínov, Jb-1 Jabkenice, K-1 Klobuky, Ke-5 Královice, Ke-8 Královice, Lib-1 Liběchov, MB-3 Chloumek u Mělníka, MB-6 Hleďsebe, MB-7 Středmy, MB-15 Krpy, MB-20 Chotětov, MB-22 Zdětín, MB-23 Horky nad Jizerou, MB-25 Horní Krnsko, MB-27 Všejany, MJ-2 Stránka, MJ-8 Jenichov, Mt-1 Martiněves, MV-1 Mělnické Vtelno, MV-2 Mělnické Vtelno, Nm-1 Nemyslovice, Se-1 Seletice, Sš-1 Sušno, Str-1 Strachaly, Sy-1 Skůry, Zd-1 Zdětín, Zl-1 Zlonice) were included. The extraordinarily faunal record was discovered in all three new genetic units (in the Be-1 Bechlín borehole. Sediments of the Líně Formation yielded animal remains in 5 beds of the Zdětín "Horizon", 4 beds between the Zdětín and Klobuky "Horizons", 9 beds of the Klobuky "Horizon", 2 beds between the Klobuky and Stránka "Horizons" and 3 beds of the Stránka "Horizon"). The conventional Carboniferous/Permian boundary is situated between the *Sphearolepis-Elonichthys* and *Acanthodes gracilis* local bio/ecozones in the Bohemian Massif. Scales of *Sphaerolepis kounoviensis* (almost ubiquitous especially in the upper *Sphaerolepis* subzone) are missing in the Stánka "Horizon" and their last occurrence was detected 28 m below the Stánka "Horizon" base. Some teeth of xenacanthid sharks give us a good chance to solve the exact affiliation of the Stránka "Horizon" (and actually the youngest sequence of the Líně Formation) with the local bio/ecozone.

Existing partial outcomes were presented at the 1st Slovak–Polish–Czech Paleontological Conference (Zajíc) and the 8th European Paleobotanical and Palynology Confer-

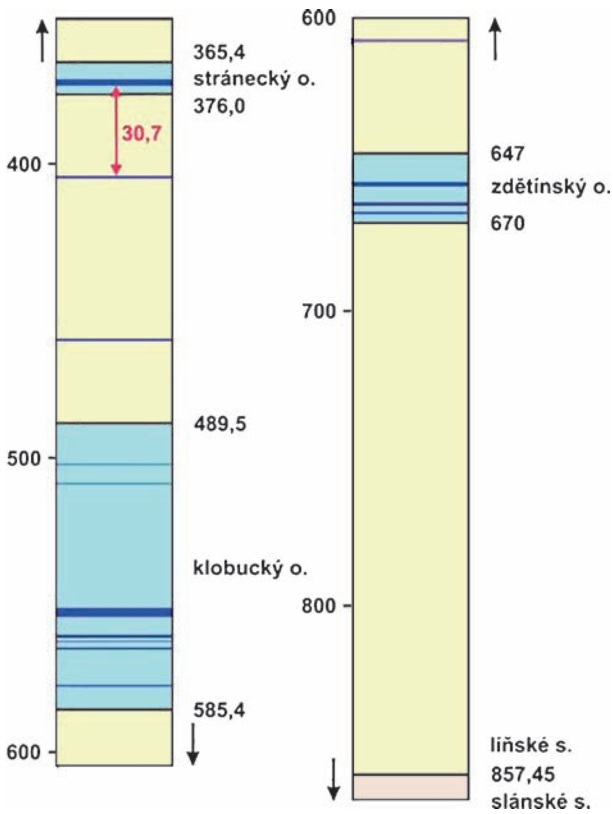
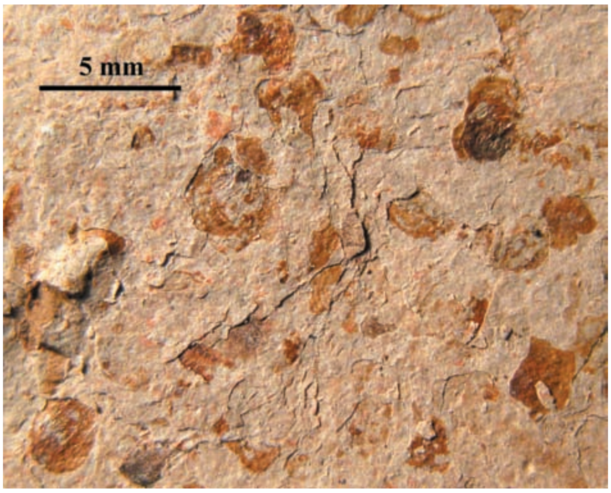
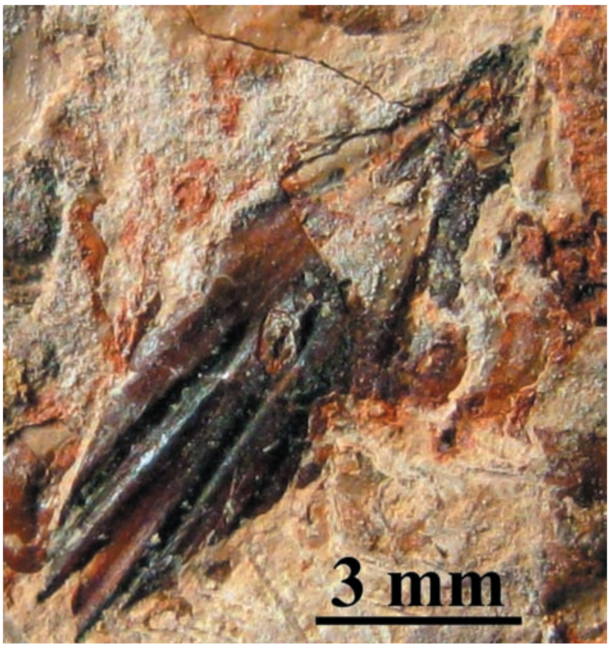


Fig. 20. The sketch section and fauna distribution in the Be-1 Bechlín borehole. The numbers denote depths in metres. The Líně Formation (except for the horizons) is marked in yellow. Grey colour means the continuation of the borehole to the Slaný Formation. Bright blue colour represents the horizons. Dark blue stands for the fossil beds. The supposed Pennsylvanian/Permian boundary occurs inside the red coloured interval (original).

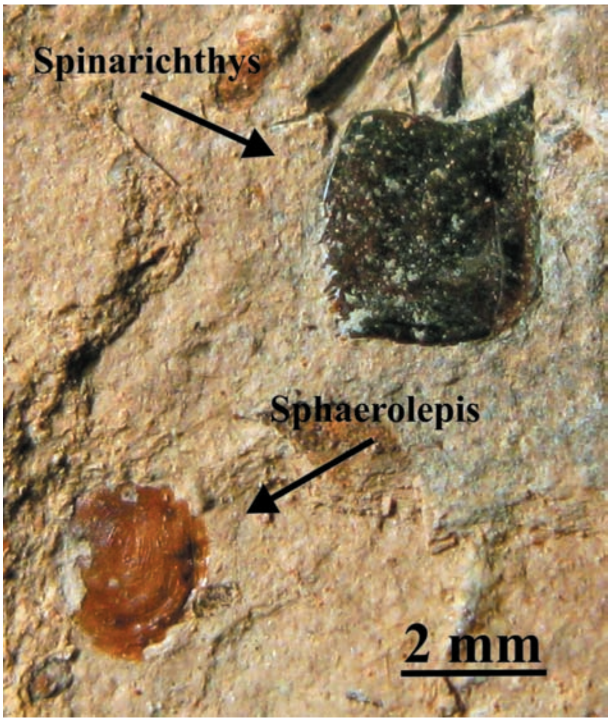


■ **Fig. 21.** Shells of pseudestheriid conchostracans, Klobuky, Stephanian C. Photo by the author.

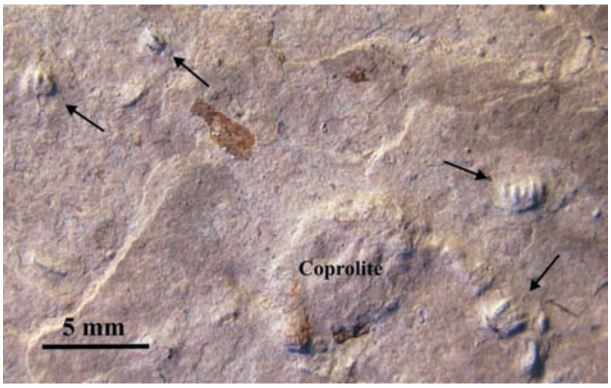
■ **Fig. 22.** The shell of a thin-walled fresh-water pelecypod, Klobuky, Stephanian C (photo by J. Zajíc).



■ **Fig. 23.** The parasphenoid of an actinopterygian fish, Klobuky, Stephanian C (photo by J. Zajíc).



■ **Fig. 24.** Scales of actinopterygian fishes Spinarichthys dispersus and Sphaerolepis kounoviensis, Klobuky, Stephanian C (photo by J. Zajíc).



■ **Fig. 25.** A bedding plane with the coprolite and scales of a hybodont shark Sphenacanthus carbonarius covered by a thin layer of sediment, Klobuky, Stephanian C (photo by J. Zajíc).

ence in Budapest (Šimůnek & Drábková). The web presentation of the project (http://www2.gli.cas.cz/IAA300130703/Projekt%20IAA300130703.htm) was continuously filled in (see there for additional information).

No. IAA300460602: **Upper crustal model of the Ohře Rift and its vicinity** (Leader: J. Málek, Institute of Rock Structure and Mechanics of the ASCR, v. v. i., Praha, Czech Republic; 2006–2010)

Subproject: **Fault tectonics in the sedimentary and volcanic fill of the Ohře Rift graben** (*V. Cajz* & *J. Adamovič*; 2006–2010)

New geological survey in the centre of the Ohře/Eger Rift (OR), focused on tectonic setting, brought detailed knowledge on position and age of faults constituting OR in this part. This area covers a space from the Bohemian Gate (Porta Bohemica – the Labe/Elbe River Canyon) to the cities of Teplice, Most and Bílina. It is situated in the SW part of the České středohoří Mts. and the most-NE part of the Most Basin (MB). Courses of the marginal graben faults were traced in detail and the internal tectonic structure of the graben was checked. At present, the courses of fault zones limiting the OR are generally well known. The course of the České středohoří Fault Zone (CSFZ – limiting the OR in the southeast) became better defined during the detailed survey at scale 1:10 000 (Šebesta et al. 1997; Valečka et al. 2003, 2008). The course of the Krušné hory Fault Zone (limiting the OR in the NW) and the related movements were identified very well in the area of lignite mining. Tectonic setting inside OR is still much more poorly known compared to that of the limiting fault zones. Cajz et al. (2004) published newly discovered faults in the central and eastern parts of the České středohoří Volcanic Complex (CSVC) and Rajchl et al. (2009) clarified tectonic conditions during sedimentation of the MB fill. The study area is situated between these two regions.

The study is based on detectable tectonic deformations, visible only in the post-Paleozoic sediments. Moreover, it is based on faults identified in outcropping geological units and is not focused on the comparison of these structures with the supposed tectonic setting of the basement. Lithological changes at the boundaries of the individual stratigraphical units of Upper Cretaceous sediments, Cenozoic volcanic products and sediments of the same age, were the basis for the fault detection. The evaluation of borehole data was employed as an auxiliary method. New faults were found and the older known ones were specified more precisely (Fig. 26). The faults are vertical or very steeply dipping. Dip-slip faults were mostly detected, but strike-slip and combined movements are also present. Typically, some of the faults were activated several times during the history and the movements on their fault planes may have undergone reversals. Unfortunately, the fault planes could not be traced along their full length and only their near-surface segments are described. Much of the volcanic material has been eroded from the studied region. Rocks of Variscan basement and Cretaceous sediments beneath the volcanics are exposed, being transgressed by sediments of the MB and by the youngest volcanic products. This setting is complicated by tectonic movements during the formation of nearly all geological units.

Saxothuringian Crystalline basement is exposed in the Oparno Valley, in the city of Bílina and its close surroundings; and several isolated bodies are located south of the highest peak, Milešovka Hill. Carboniferous rocks are represented mainly by rhyolite deposited in the style of pyroclastic flow (ignimbrite) produced from the Teplice-Altenberg Caldera. Less frequent are conglomerates containing rhyolite. These rocks are exposed especially in the area of the Oparno Valley, covering the crystalline basement, and in the Bílina area. Upper Cretaceous rocks are present in a complete succession described by Čech et al. (1980). Paleogene sediments have been preserved over a small area only. Volcanics of the CSVC are developed in all formations defined by Cajz (2000) and Cajz et al. (2009). Sediments of the MB are represented by sands of the Bílina delta. Typical fine-grained basinal sediments are developed as well, especially in the northern and northwestern part of the area.

In the relief of the basement, two positive morphological forms – elevations – with no sedimentation of the Peruc-Korycany Fm. can be recognized (Fig. 27). These elevations strongly influenced the spatial distribution, thickness and lithofacies development of the Peruc-Korycany, Bílá hora and Jizera Fms. – the elevations were developed in some shape before the sedimentation. The thickness of the transgressive Bílá hora Fm. attains only 1 m on top of this elevation. The Most–Teplice Elevation is NE–SW-elongated; it was the highest elevation in the entire Bohemian Cretaceous Basin. Its apical part was covered by the Jizera Fm. marlstones, whose thickness is reduced to 2.5 m. Its buried part near Bílina is herein called the *Bílina Basement Elevation* (BBE). Its SE slope is relatively steep, possibly of tectonic origin. At the foot of the slope, a narrow depression (paleovalley) is situated with fluvial fill of the Peruc Mb. The depression is elongated in the NE–SW direction. A similar depression with the Peruc Mb., oriented W–E or WNW–ESE, is present near the northern margin of the OBE, indicating its possible tectonic character.

Superficial rocks of the CSVC overlie the Cretaceous sediments, especially those of the Merboltice and Březno Fms. In the study area, relics of the Merboltice Fm. sandstones, max. 50–70 m thick, are limited to a small area S of Ústí nad Labem. In almost the whole study area, superficial rocks of the CSVC overlie the monotonous claystones of the Březno Fm., preserved commonly in the thickness of 60 to 120 m, which makes the fault identification very problematic. The nearly total erosion of the Merboltice Fm. sandstones and the erosion of a large part of the Březno Fm. claystones contrast with the central part of the CSVC where great volumes of these sandstones are preserved in thicknesses of up to 200 m. It can be therefore assumed that the relative tectonic uplift of most of the study area occurred before the onset of volcanic activity. Tectonic style with rhomboidal blocks, similar to that detected in the central part of the CSVC (Cajz et al. 2004), can be supposed. This tectonic activity was followed by a long period of peneplanation, leaving no sedimentary record. The peneplanation created flat morphology with shallow depressions, due to the stream network draining the area. This was coeval with the deposition of the Staré Sedlo Fm. Superficial rocks of the CSVC therefore overlie the Cretaceous sediments with a flat or only slightly inclined topography. Tectonic disintegration into blocks can be deduced from the erosion intensity of Cretaceous sediments preserved below the superficial volcanic products of the CSVC, evaluating borehole data only. This method resulted in the definition of two large tectonically contrasting areas resulting from pre-volcanic tectonic activity.

The beginning of volcanic activity was accompanied by the onset of another phase of tectonic activity. Low topography in the central part of the CSVC caused the presence of water reservoirs – most probably shallow lakes as a part of a drainage system. This was the host environment for primitive magmas of the Ústí Fm. The most subsided area was situated approximately between the Ploučnice F. in the NE (beyond the study area) and a line between the OBE and BBE in the SW. The largest vertical movements are drawn in Figure 28. This sunken area can be understood as the real central part of the CSVC: it represents the oldest Tertiary depocentre in the OR. Volcanism of the Ústí Fm. was accompanied by continued tectonic activity.

Faults detected in the study area were grouped by their orientation into: (1) faults parallel to the general OR course (ENE–WSW) and subdivided to those belonging to the marginal fault zone (CSFZ) and those of the internal OR part, and (2) faults transverse to the course of the OR and furthermore subdivided into faults striking generally NW–SE and trending E–W.

The course of the CSFZ ("*the marginal Rift structure*") is only roughly parallel to the graben axis. The CSFZ consists of a system of parallel faults transected by younger strike-slip faults. Along the parallel faults, southeasterly blocks subsided; the highest blocks are concentrated to the northern part of the CSFZ and constitute here the horst (OBH). The CSFZ has not a direct relationship to the "*Deep-seated Litoměřice Fault*". The existence of a morphological ridge in the basement (OBE–BBE) played a more important role during the origin of the CSFZ than a simplified course of the terrane boundary. It is also possible that the tectonic setting in the basement itself is much more complicated. We suppose a post-Cretaceous/pre-volcanic formation of the CSFZ. Its origin may be associated with a possible upwelling under a tensional paleostress field (using the riftogenic model). A change in paleostress field was necessary for the transverse segmentation of CSFZ. The expected largest vertical displacement magnitude is not parallel to the graben course and again, it is closely connected with the pre-existing basement ridges (OBE, BBE). Moreover, the maximum vertical displacement magnitude value is reached over a relatively short distance (N margin of the OBE); more frequently, the displacement magnitude is split to several faults of different strikes in the graben interior.

Faults in the graben interior are of different strikes in the study area, constituting an irregular network of rhomboidal blocks, much like in the central part of the CSVC (Cajz et al. 2004). The usual vertical displacement magnitude reaches tens of metres; it exceeds one hundred meters on several faults only. The repeated movement on some of faults was documented; of the same sense or an inverse one.

All the E–W-striking faults in the study area are of different behaviour than those in the MB sedimentary fill. In the opinion of Rajchl et al. (2009), these faults are older, overprinted by NE–SW-striking ones in the MB. Our results show a different situation: the E–W faults are not overprinted by the NE–SW ones. The CSFZ (NE–SW) in the study area represents some kind of a structural barrier for E–W faults because it is not affected by their activity.

The above mentioned grouping of faults due to their strike allowed synoptic description of the faults and evaluation of the movement on them in time (see in Cajz and Valečka 2010). There were defined faults of: (1) post-Cretaceous / pre-volcanic (older than 36 Ma); (2) intravolcanic (younger than 24 Ma), and (3) post-depositional / post-volcanic (younger than 16 Ma and some possibly younger than 9 Ma) activity. These age categories of faults are based on the recognized movements on each of them; they represent time ranges with verified uppermost age constraint recorded in the current geological setting. As the topmost units have been eroded from the study area, there may exist younger movements on these faults than those used for their age assignment. A field survey itself cannot be used for the determination of the paleostress tensor during the fault activation. Nevertheless, the function of faults can be compared with the paleostress field reported to be in operation at the given time (Adamovič & Coubal 1999, 2009 and Coubal & Adamovič 2000). Generally, the function of faults is in agreement with the supposed paleostress field (Cajz & Valečka 2010). Two areas with different tectonic and geological development were identified within this part of the OR. The Saxothuringian–Teplá-Barrandian terrane boundary was found to be less important for graben formation during the Cenozoic.

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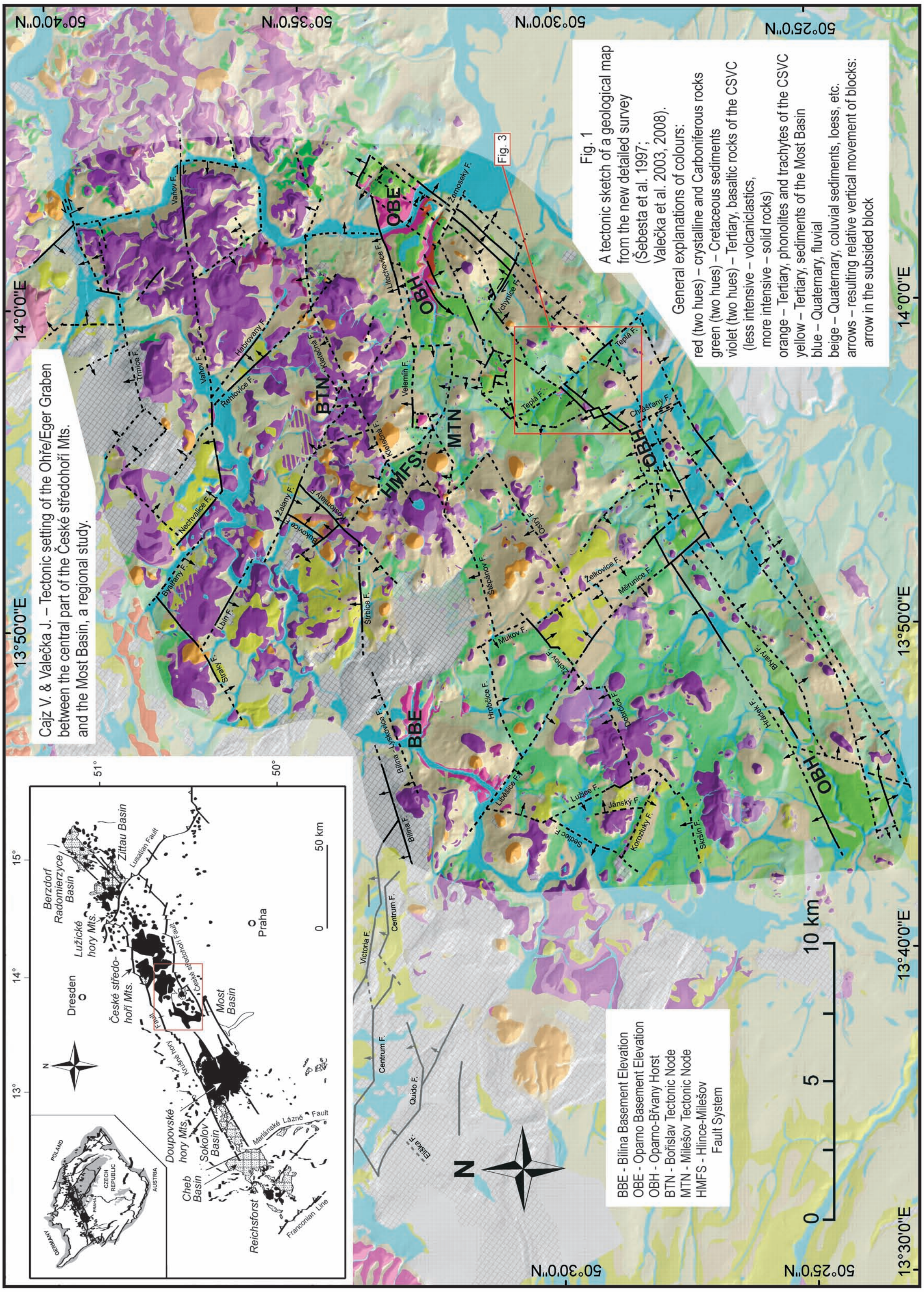
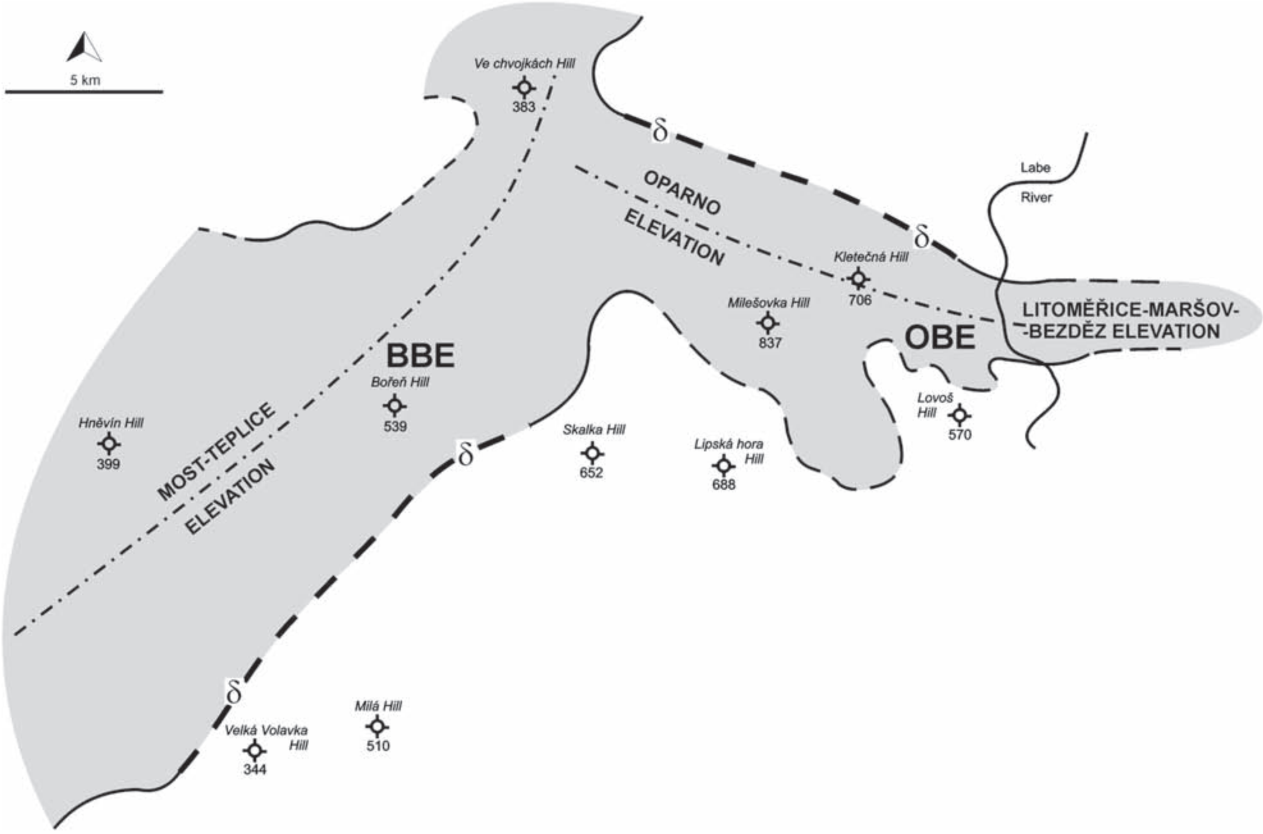
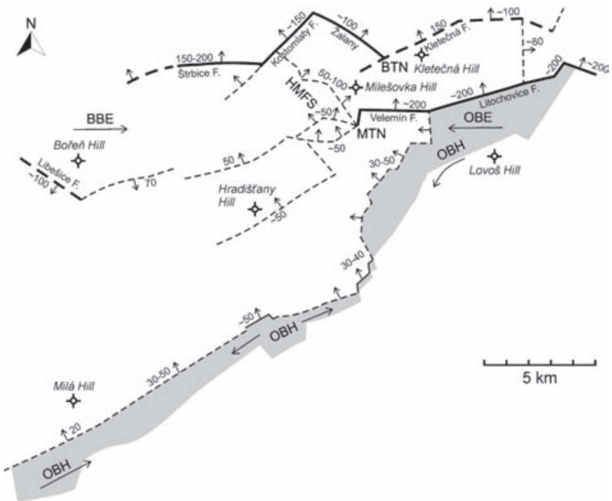


■ **Fig. 26.** A tectonic sketch of a geological map from the new detailed survey (compiled from Šebesta et al. 1997; Valečka et al. 2003, 2008). General explanation of colours: red (two hues) – crystalline and Carboniferous rocks; green (two hues) – Cretaceous sediments; violet (two hues) – Tertiary, basaltic rocks of the CSVC; less intensive – volcaniclastics; more intensive – solid rocks; orange – Tertiary, phonolites and trachytes of the CSVC; yellow – Tertiary, sediments of the Most Basin; blue – Quaternary, fluvial; beige – Quaternary, coluvial sediments, loess, etc.; arrows – resulting relative vertical movement of blocks, arrow in the subsided block.



■ **Fig. 27.** Basement elevations below Cretaceous sediments, Most–Teplice and Oparno Elevations boundaries (from Cajz & Valečka 2010, with permission): dot-and-dash line – elevation axes; grey – area of an "island" during the Peruc-Korycany Fm. Sedimentation; thick dashed line with a δ symbol – elevation margins of (old ?) tectonic origin.



■ **Fig. 28.** Graben-forming faults (from Cajz & Valečka 2010, with permission): Oparno–Břvany Horst (OBH) – its highest blocks in grey; Oparno Basement Elevation (OBE); Bílina Basement Elevation (BBE); Tectonic Nodes of Milešov (MTN) and Bořislav (BTN); the complicated Hlince–Milešov Faults System (HMFS); the largest vertical displacement magnitues on faults limiting the graben in metres; arrows – resulting relative vertical movement of blocks (vector sum): arrow in the subsided block.

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No. IAA 301110701: **Reproductive organs and their spores from Carboniferous coal basins of North America** (Z. Kvaček, Faculty of Science, Charles University, Praha; *J. Bek*; M. Libertín, National Museum, Praha & J. Pšenička, West Bohemian Museum, Plzeň, Czech Republic; 2007–2010)

Floristic assemblage of the Illinois Basin, USA from the Lower and Upper Block (lower Moscovian age) were collected and studied. Abundance of sub-arborescent lycospid of the genus *Omphalophloios* is rare and unique. this genus never occured in big numbers (except for the Puertollano Basin, Spain). A new species *Omphalophloios wagneri* will be proposed because all fragments of the plant were found on localities that will enable make the whole plant recontruction. Members of the team visited several localities and collected numbers of specimens of fossil plants of the Moscovian age. The result is represented by 500 specimens stored mainly in the West-Bohemian Museum, Plzeň. They also visited collections of Carboniferous plants; Cleveland Museum of Natural History, Field Museum, Chicago, Smithonian Institute, Washington and Natural History Museum in New York.

A great success is the oldest specimen of important callipterid fern species in the world. Palynological results of the project: thousands of dispersed megaspores of the *Valvisisporites auritus*-type, some isolated megasporangia still containing them and dispersed microspores of the *Endosporites globiformis*-type have been found occurring in close association in the Late Devonian (Famennian) of Ohio, USA. Until now, these spores have only been found in the Carboniferous, where they have been shown to have been produced by isoetalean lycopsids assigned to the plant genus *Chaloneria* and the morphogenus *Polysporia*. The discovery of dispersed megaspores of the *V. auritus*-type and microspores of the *E. globiformis*-type in the Famennian of the USA may indicate that such sub-arborescent lycopsids already existed in the Late Devonian, which thus extends the range of distribution of these taxa, at least in North America. The present work describes, using the light microscopy (LM), scanning electron microscope (SEM) and transmission electron microscope (TEM), megaspores of *V. auritus*-type, megasporangia containing these megaspores, and microspores of *E. globiformis*-type. A comparison with their Carboniferous representatives shows that they are quite similar. This comparative study permits clarification of some ultrastructural features of the megaspores of the *Valvisisporites*-type, such as the partly lamellate–partly amorphous innermost exospore, demonstrating that this is a characteristic and important ultrastructural feature of this genus.

Two specimens of compression strobili from the Bolsovian of the Kladno–Rakovník Basin, Czech Republic, were studied for *in situ* spores. Sporangia of strobili are disintegrated. Only fragments of sphenophyllalean axes and sphenophyllalean leaves occur in the rock together with the sporangia and sporangiophores. The direct evidence about sphenophyllalean affinity of strobili is that sporangia are connected with the axis by a short non-scutelliform sporangiophore that is typical only for the genus *Bowmanites*. The lack of morphological features of strobili does not enable the erection of a new species and, therefore, it is possible to classify the specimens only as *Bowmanites* sp. Reticulate spores comparable with the dispersed species *Reticulatisporites muricatus* are reported *in situ* for the first time.

A new sub-arborescent lycopsid species *Spencerites leismanii* was proposed for compression specimens yielding spores of the *Spencerisporites*-type. All specimens come from the Tlustice relict within the Bolsovian strata of the Radnice Member, Pennsylvanian. *Spencerites leismanii* is interpreted as a relatively small sub-arborescent lycopsid – probably more than 1 m high – with at least three orders of branching. Its sporangia are borne singly on peltate sporophylls, attached distally by a narrow base. *In situ* pseudosaccate trilete spores possess striate sculpture on the proximal and distal surfaces of the central body. The pseudosaccus is reticulate with a narrow rim on the margin. Spores isolated from *Spencerites leismanii* can be classified as *Spencerisporites* cf. *striatus*.

A new herbaceous lycopsid, compression species, *Selaginella labutae* was described from the Libušín (former Schöller) Mine, near Kladno, Kladno–Rakovník Basin, Czech Republic. The characterization is based on macroscopic observations and the study of *in situ* spores. The stratigraphic position of the type material is the Radnice Member, Bolsovian, Pennsylvanian. Strobili of *S. labutae* are the smallest known herbaceous lycopsid cones. Two types of leaves are recognized. Therefore, the new species belongs to *Selaginella* subgen. *Selaginella* and not to the subgenus *Hexaphyllum* which is characterized by three different types of leaves. Poorly preserved *in situ* megaspores are of the *Triangulatisporites*-type and *in situ* microspores are compared to the dispersed spore species *Cirratriradites saturni*.

No. IAA304070701: **Cretaceous fossil flowers and inflorescences bearing pollen** *in situ* (J. Kvaček, National Museum, Praha, Czech Republic & *J. Dašková*; 2007–2010)

Reproductive organs of angiosperms (i.e., flowers and inflorescences) were studied at selected Cretaceous localities in central Europe. Best results and preservation were recorded from sandy clays of the Cenomanian (localities at Pecínov, Praha-Hloubětín, Brník) and Turonian ages (Zliv). The study of compression fossils from Austrian locality Grünbach provided exceptional results (Herman & Kvaček 2010).

Project introduced significant results contributing to the knowledge of diversity of Cretaceous flora in the central Europe. Whole plant reconstruction concept was applied to several taxa, e.g., *Gruenbachia-Pandanites*, *Zlatkocarpus-Araliophyllum proteoides, Bohemistemon-Bohemicarpus-Pseudoasterophyllites*.

The effect of different maceration on the megaspores size was discussed in Dašková (2009; tab. 1). The following techniques were applied: acetolysis solution, KOH, HNO_3, Schulze‘s solution, H_2O_2, HCl. Megaspores size changes are important for their taxonomic evaluation. The spores may be dissolved in KOH and by Schulze‘s solution. This may cause problems in qualitative analysis of fossil assemblages.

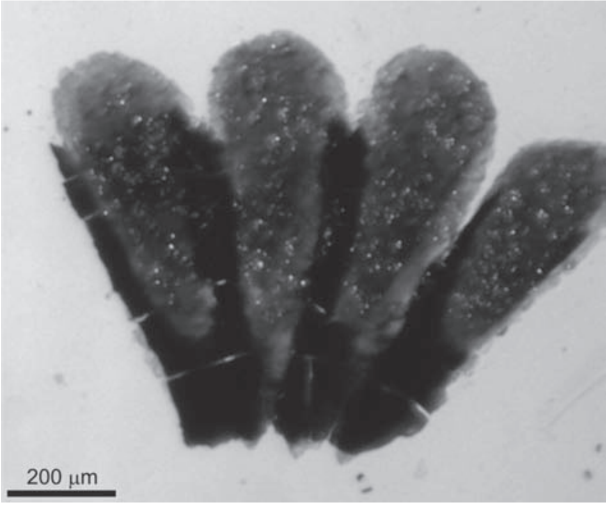
During the work on this project 7 new fossil plant taxa were described (3 genera and 4 species): *Zlatkocarpus*, *Gruenbachia*, *Konijnenburgia*, 2 species, *Z. pragensis, Z. brnikianus, K. bohemica, G. pandanoides* (Kvaček & Friis 2010; Kvaček & Dašková 2010; Herman & Kvaček 2010). Publications of 4 more taxa are in progress.

Budvaricarpus genus was redefined and classified as a member of plant group producing *Normapolles* type pollen grains. This genus was newly assigned to Juglandales order (Váchová et al., in press).

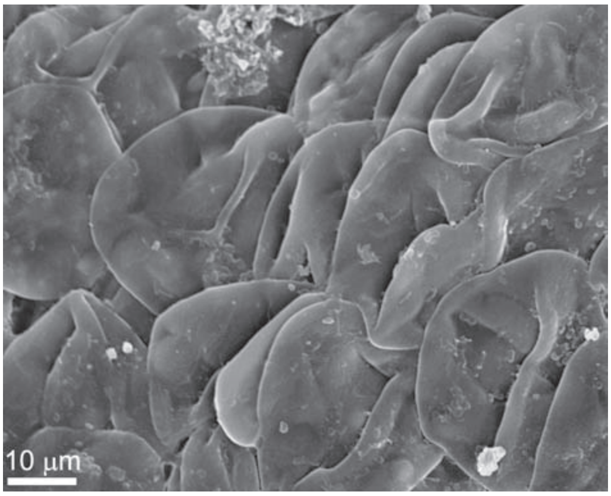
A new genus *Konijnenburgia* was introduced in 2010 (Kvaček & Dašková) for fertile, well preserved ferns of the family Matoniaceae, which were previously assigned to the genus *Na-*

	2 hours	6 hours	24 hours	48 hours
acetolysis solution	2,70	2,60	2,40	2,20
10% KOH	2,20	2,00	2,10	2,20
HNO_3	2,24	2,30	2,40	2,10
Schulze‘s solution	2,63	2,54	2,46	2,34
H_2O_2	2,10	2,10	2,10	2,00
HCl	2,00	2,00	2,30	2,10
Ø	mm	mm	mm	mm

■ **Tab. 1.** Effect of duration of maceration on the megaspores size (Laevigatisporites glabratus (Zerndt) Pot. et Kr.)



■ **Fig. 29.** Konijnenburgia latifolia (Nathorst) Kvacek et Daskova, Greenland, Atanekerdluk (the light microscope photo of radially arranged sori, photo by J. Dašková).



■ **Fig. 30.** Konijnenburgia latifolia (Nathorst) Kvacek et Daskova, Greenland, Atanekerdluk (the scanning electron microscope photo of group of spores, photo by J. Dašková).

■ **Fig. 31.** Konijnenburgia latifolia (Nathorst) Kvacek et Daskova, Greenland, Atanekerdluk. Fragment of sterile bipinnate leaf (photo by J. Dašková).

thorstia. *Konijnenburgia bohemica* is described from the Upper Cretaceous, Cenomanian of the Czech Republic and compared to *Konijnenburgia latifolia* (Figs. 29–31) and other Cretaceous members of the family. Each sorus of *Konijnenburgia bohemica* is covered by a massive circular persistent indusium. The indusium is relatively smooth, flat, showing delicate radial striation and biseriate margin. Distance between two sori is 2–2.5 mm. A sorus consists of 12–14 radially arranged wedge-shaped sporangia 500 µm long. Spores of Matonisporites type are trilete, triangular in equatorial outline, with slightly convex sides, leasurae raised, extending 75 % of the spore radius, interradial thickenings are well pronounced, equatorial thickening (crassitude) is present. Exine is psilate and perispore is not preserved. Spores mean diameter in equatorial view is 47 µm.

Study of Upper Cretaceous to Early Paleogene pollen spectra: Normapolles pollen, fern spores, recent Fungi and other palynomorphs were traced and identified from a sample of the calcareous/clayey deposits from the Gombasek Quarry. Normapolles, pollen of the extinct angiospermous plants, dominate the spectrum; spores of ferns are also frequent (Figs. 32–34). Presence of these types indicates the Mesozoic (Upper Cretaceous) to Early Paleogene ages of the source rocks (tab. 2). The assemblage is mixed with the specimens of the recent spores of Fungi, remains of algae and rare gymnosperm and angiosperm pollen grains, e.g., *Pinus*, Asteraceae (Dašková et al. in press).

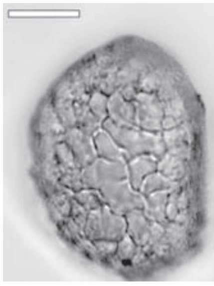
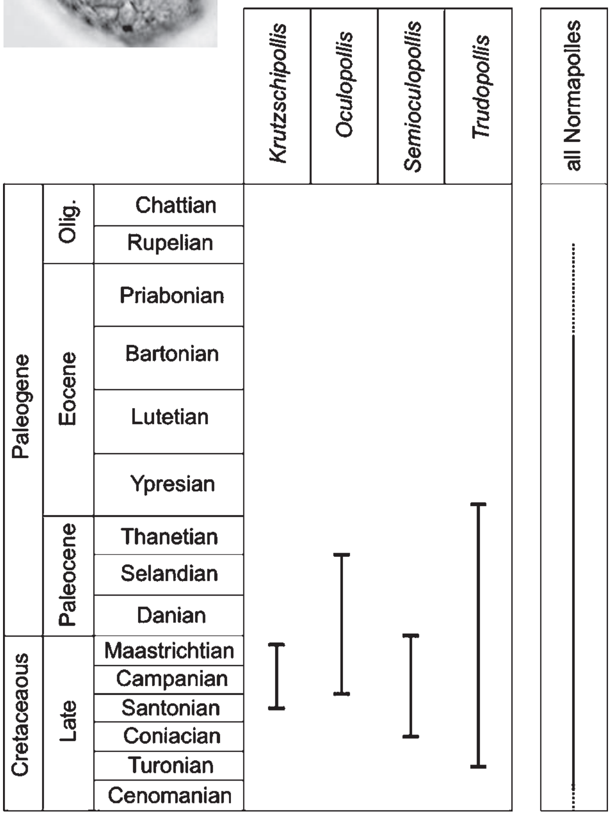
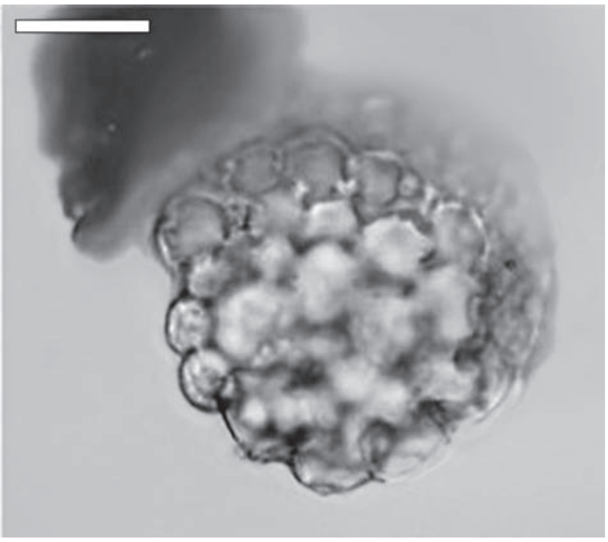


Fig. 32. Pinus silvestris type, saccus of exine (photo by J. Dašková).



■ **Tab. 2.** Range of Normapolles.



■ **Fig. 33.** Fungi vel Algae, light brown-yellow morula-like polyade, incertae sedis (photo by J. Dašková).

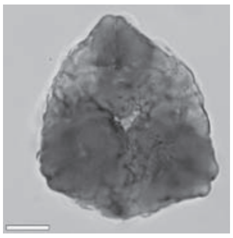


Fig. 34. Oculopollis cf. zaklinskaiae Góczán – Oculopollis semimaximus Krutzsch – types, Normapolles (photo by J. Dašková).

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No. KJB315040801: **Salt karst in Zagros Mts., Iran: Hydrogeology, dating and evolution** (J. Bruthans, Faculty of Science, Charles University, Praha, Czech Republic & *M. Filippi*; 2008–2010)

Three field trips to Iran were performed during the 3 years of the project. Geological documentation and repeated sampling was carried out to solve various tasks of the project. Collected data together with the previous experiences helped to conclude and publish several scientific topics related to the salt karst questions. Cooperation wit the Czech TV and BBC mediated results for the wide public. Some of the results provided within this project are as follows.

One important part of the research activities was focused on the characterization of the surficial deposits of salt diapirs in the Zagros Mountains. Results were concluded by Bruthans et al. (2009). Diapirs with different geology, morphology and climate were selected for this study. The X-ray fluorescence and X-ray diffraction were used for characterization of the mineralogical and chemical composition of the collected samples from selected types of the sedimentary cover. Changes in salinity along selected vertical sections were studied together with the halite and gypsum distribution. Subaerial residuum formed from minerals and rock released from the dissolved rock salt was found as the most abundant material on the diapirs. Fluvial sediments derived from subaerial residuum are the second most common deposits found. Submarine residuum and marine sediments have only local importance on salt diapirs located on Islands in the Persian Gulf and on the sea shore. The mineralogical composition of surficial deposits varies amongst the three end members comprising (1) evaporite minerals (especially gypsum/anhydrite); (2) carbonates (dolomite and calcite), and (3) silicates-oxides (mainly quartz, phyllosilicates, and hematite). Infiltration tests performed on the surficial sediments revealed that most of the rainwater will infiltrate which is the main reason why a rich vegetation cover may occur in some salt diapirs.

As was documented on several salt diapirs, the source material, diapir relief, climatic conditions and vegetation cover are the main factors affecting the development and erosion of surficial deposits. A clear difference was found in landscape morphology between the relatively humid NW part of the studied area and the arid Persian Gulf coast. In the NW, the medium and thick residuum on diapirs is typical and stable under current climatic conditions. Large sinkholes and blind valleys with sinking streams are characteristic for such type of the landscape. On the diapirs in (and close to) Persian gulf, the original thick residuum is undergoing erosion and the new originating morphology is represented by numerous salt exposures and badland-like landscapes with many small sinkholes in the thin residuum. The suggested model for evolution of the subaerial residuum and the diapir landscape/morphology suggests that the thick residuum has very low erosion rates while the salt exposures and thin residuum are eroded rapidly.

Relation among the marine, fluvial and cave sediments, and karst phenomena was another important part of the project objectives. This topic was solved using the radiocarbon, U-series and OSL dating with the main purpose to determine the recent evolution (Holocene and the Last Glacial) of the Namakdan diapir of that hides the world's longest salt cave (3N Cave). Based on known sea-level oscillations, geological dating, and other geological field evidences, the Namakdan diapir was repeatedly flooded by sea water between 130 and 80 ka BP. Submarine residuum composed mainly of gypsum and dolomite formed cap rock (surficial sedimentary cover) on the diapir. After ca. 80 kyr BP, surficial drainage network and karst development started. Blind valleys and their corresponding cave systems evolved continuously for ca 20–30 ka. Between 9 and 6 cal ka BP the rate of sea-level rise exceeded the Namakdan diapir uplift rate. As a consequence upward incision of cave streams (paragenetic trend) occurred, and blind valleys near the seashore were filled with gravels. Cave passages now accessible on the Namakdan and Hormoz diapirs started to form 3–6 cal ka BP when sea level stabilized and downward stream incision began. Older cave levels are still preserved but are filled with sediments and salt precipitates. A comparison of the Namakdan diapir evolution with data from the neighboring Hormoz and Larak diapirs shows that the evolution of diapir morphology is strongly affected by the differences in uplift rates and geological settings. The general scheme of the evolution of the Namakdan diapirs is believed to be partly applicable to many other diapirs in coastal settings.

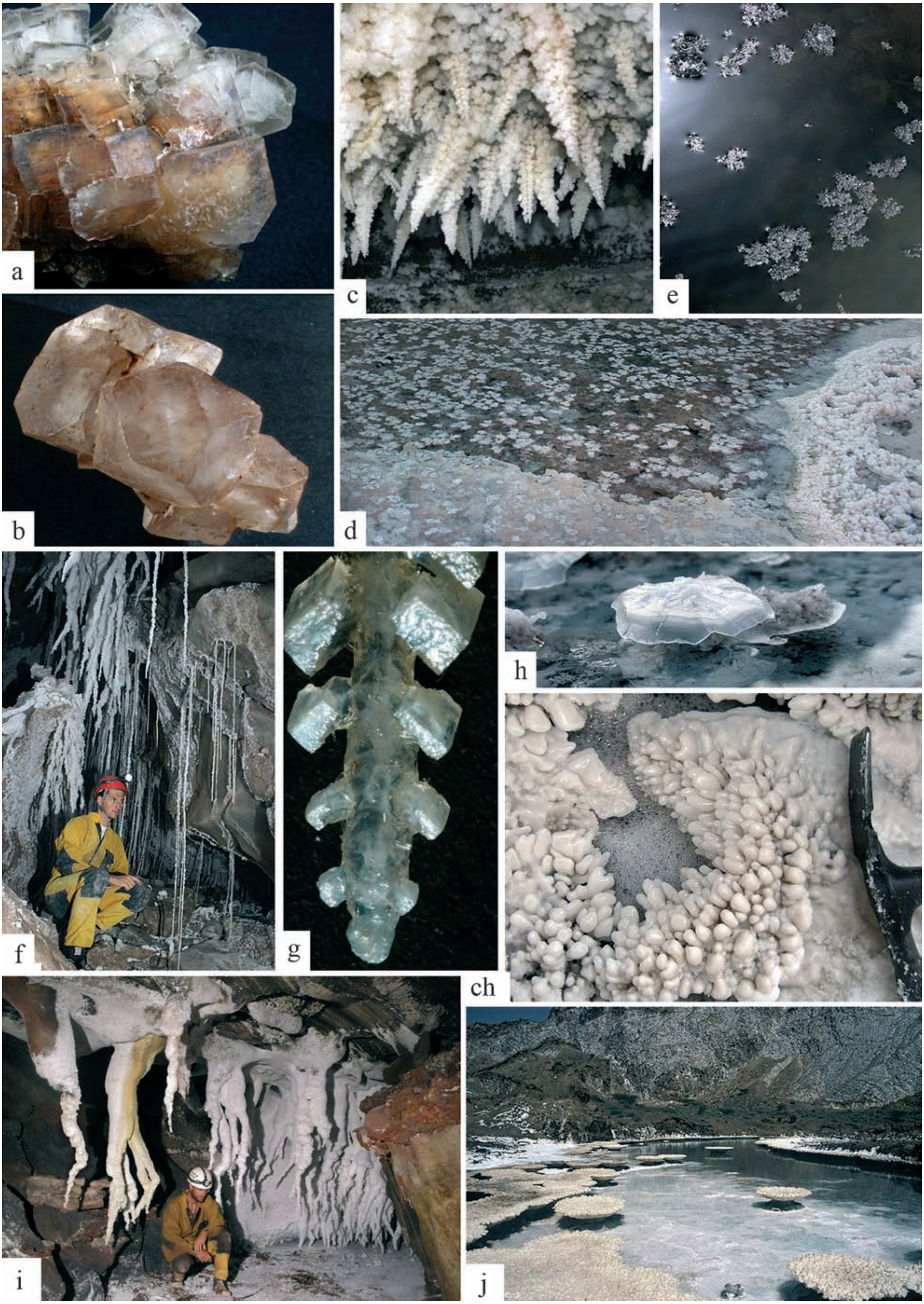
One of the latest partial finished topics was aimed on the classification and characterization of the secondary halite deposits found and documented in the Iranian salt karst. Results of this long-term study are presented by Filippi et al. (in review). A huge variety of secondary halite deposits were distinguished and ranked based on the place and mechanism of their origin into several groups. Deposits forming: (1) via crystallization in/on streams and pools; (2) from dripping, splashing and aerosol water; (3) from evaporation of the seeping and capillary water, and (4) other types of deposits. The following examples of halite forms were distinguished in each of above mentioned group: (1) euhedral crystals, floating rafts, thin brine surface crusts and films; (2) straw stalactites, macrocrystalline skeletal and hyaline deposits, aerosol deposits; (3) microcrystalline forms (crusts, stalactites and stalagmites, helictites), and (4) macrocrystalline helictites, halite bottom fibres and spiders, crystals in fluvial sediments, euhedral halite crystals in rock salt, combined or transient forms and biologically induced deposits (Filippi et al. 2010). The occurrence of particular forms depends strongly on the environment, especially on the type of the brine supply (dripping, splashing, etc.), flow rate and its variation, air humidity, evaporation rate and in some cases on air flow direction. Combined and transitional secondary deposits may be observed, if the conditions change during the deposition. Euhedral halite crystals (mostly cubes, sometimes in combination with the octahedron) originate solely below the brine surface of supersaturated streams and lakes. Macrocrystalline skeletal deposits occur at places with rich irregular dripping and splashing (i.e., waterfalls, places with strong dripping from the cave ceilings). Microcrystalline deposits (sometimes also called the grained) are generated by evaporation of capillary brine at places where brine is not present in a macroscopically visible form. Straw stalactites form at places where dripping is concentrated into small spots and is frequent enough to assure that the tip of the stalactite will not overgrow by halite precipitates. In case the tip is blocked by halite precipitates, brine remaining in the straw will seep through the walls and helictites start to grow in some places.

The macrocrystalline skeletal deposits and straw stalactites usually grow after major rain event when dripping is strong, while the microcrystalline speleothems are formed continuously during much longer periods and ultimately overgrow the other types of speleothems during dry periods. The rate of secondary halite growth is much faster if compared to the carbonate karst. Salt forms increase more than 0.5 m per the first year after the strong rain event, however, the age of speleothems is difficult to estimate, as they are often combination of segments of various age and grow periods are alternating with long intervals of inactivity.

Some halite forms may be considered in many cases as the analogs of forms found in the carbonate karst. As they are created in short time period the conditions of their origin are often still present or can be reconstructed. Described halite forms thus can be used for verification of origin of various carbonate forms. Some of the described forms carry clear evidence of paleo-water surface level (transition of the skeletal form to halite crystals and vise versa). Other kinds of deposits are possible indicators of microclimate under which they developed (humidity close to deliquescence relative humidity).

Composition of brine which is the source for secondary halite deposits was studied. About 30 samples of salt springs, streams and 5 drips in unsaturated zone at several diapirs were analyzed. Sodium and chloride are dominating ions followed by much lower concentrations of calcium, potassium and mag-

■ **Fig. 35.** Two different types of the diapir's surface morphology: a) gently surface with scarce vegetation cover and many wide dolines developed on the thick surficial deposit (central part of the Jahani diapir, Fars Province, Iran); a) wild (recently eroded) surface with deep valleys, salt exposures and number of small dolines (southern part of the Jahani diapir, Fars Province, Iran; photos by M. Filippi).



■ **Fig. 36.** – see next page.

■ **Fig. 36.** Selected most common types of secondary halite deposits in the Iranian halite karst and some locations where they occur: a), b) euhedral crystals from brine pools; c) macrocrystalline stalactites on the cave ceiling; d) floating rafts and microcrystalline crusts related to the surface of the brine pools; e) floating rafts on the brine table; f) straw and microcrystalline stalactites in the cave passage; g) detail of the tip of the macrocrystalline stalactite; h) thin halite crust (folia type) above the brine pool; ch) aerosol halite deposits covering the wild stream; i) microcrystalline stalactites and bottom crust in the salt cave; j) microcrystalline "plates" and crusts related to the brine pools (all photos by M. Filippi).

nesium, sulphate, and other ions. Total dissolved solids (TDS) of brine ranges between 255 and 347 $g.l^{-1}$. Based on the brine chemical composition the dissolved halite and gypsum is forming on average 95.7 wt. % and 1.3 wt. % of brine TDS respectively, and about 3 wt. % is left for other salts composed of K, Mg, SO_4 and Cl.

Sampled brine is mostly saturated with respect to halite, saturated or slightly undersaturated with respect to gypsum and supersaturated with respect to calcite and dolomite. Simulation of evaporation of brine using PHREEQC (Pitzer database) predicted precipitation of halite after evaporation 0–10 % of brine. Anhydrite (rather than gypsum) starts to precipitate after evaporation of 0–20 % of the original brine in all samples. When 90 % and more original brine is evaporated, one or a few of the following minerals are predicted to precipitate depending on water chemistry: syngenite, kainite, labile salt, glaserite, sylvite, bloedite, carnalite, pentahydrite, leonite, schönite and burkeite. However, these were not confirmed in the studied samples. Gypsum is the only confirmed admixture in the secondary halite precipitates. The secondary electron imaging in the electron microscope revealed that gypsum is present as small irregular grains in the halite matter or it forms well developed acicular crystals in cavities.

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Continued projects

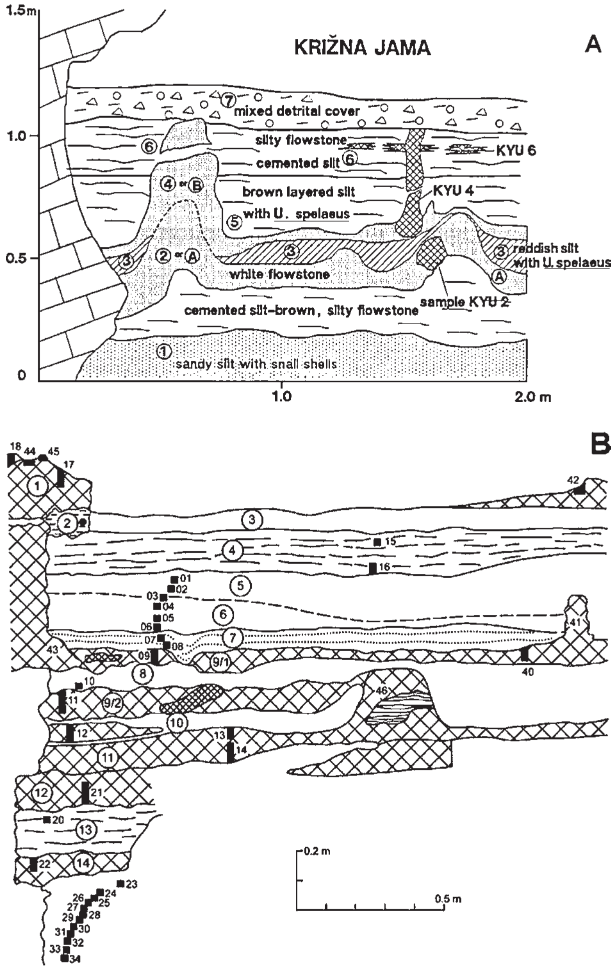
No. IAA300130701: **Paleomagnetic research of karst sediments: paleotectonic and geomorphological implications**
(*P. Bosák*, *P. Pruner*, *S. Šlechta*, *P. Schnabl*, *S. Čermák*, *J. Wagner*; N. Zupan Hajna, A. Mihevc, Karst Research Institute, SRC SASU, Postojna, Slovenia; H. Hercman, Institute of Geological Sciences, Polish Academy of Sciences, Warszawa & I. Horáček, Faculty of Science, Charles University, Praha, Czech Republic; 2007–2011)

Križna jama is a large river cave located between Loško and Cerkniško poljes under Križna gora Mountain in southern Slovenia. It has been known since the mid-19th century due to numerous cave bear finds. The cave is filled by complicated sequences of cave fluvial and lacustrine sediments, now partly eroded. We studied two paleontological excavations and sections in the Medvedji rov to contribute to dating the bone-bearing lithological horizons.

Sections Križna jama I and II represent remains of fill of the Medvedji rov. Sediments originally filled the whole passage, probably up to the cave roof, at least in some passage sections. The Križna jama I section (Fig. 37) can be correlated with the upper part of the Križna jama II section, but with a lesser preserved stratigraphic sequence. The upper part consists of alternation of speleothem layers (flowstone sheets with small stalagmites, sometimes with bones of *Ursus* gr. *spelaeus*) and fine-grained siliciclastics (loams, clays, silts), often with bones of cave bear. It resulted from alternation of subaerial conditions and floods. The middle fine-grained section resulted from calm water deposition in cave lakes, alluvial flats and crevasse splays. The sandy sequence at the section base is a fluvial deposit. Carbonate cementations in the lower part of the section distinctly indicate warmer climatic conditions.

Radiocarbon and U-series dates clearly indicate two different ages of cave bear thanatocenoses. Those above the flowstone crust numbered 4 (B) by Ford & Gospodarič (1989) were dated to ca. 47–45 ka by Rabeder & Withalm (2001); those included in Layers 4 (B), 3 and 2 (A; our layers 9/1, 8. 9/2, 10 and 11) are older than ca. 94 ka. The detailed internal lithology reflected in the alternation of our layers 10 to 9/1 and their low thicknesses exclude the expected sandwiching of younger layers into eroded/washed spaces among flowstone crusts Nos. 11, 10, 9/2 and 9/1 suggested by Ford & Gospodarič (1989); more crusts also contain bear bones cemented *in situ*. Rabeder & Withalm's (2001) radiocarbon dates and the state of bone preservation (Hochstetter 1882; Bohinec 1963) exclude Ford & Gospodarič's (1989) model on re-deposition of bear bones from older assemblage to sediments above flowstone crusts. U-series and isotopic data nevertheless indicate some post-depositional changes in calcitic flowstones, which make the record poorly readable.

According to the paleomagnetic results (prevailing normal polarity) and parameters we assume that deposition took place within the Brunhes Chron (<780 ka). There were a total of four short-lived R excursions of the magnetic field. The upper one (section I) might be correlated with the Blake excursion according to U-series dating of layer No. 9/2. The lower ones must be older than ca. 190/201 ka (error bars of U-series dates of Ford & Gospodarič 1989). If the calcite-cemented fluvial sandstones represent deposition in the Cromerian interglacial, the lower



■ **Fig. 37.** Križna jama I section. A – section drawing by Ford & Gospodarič (1989); B – state of the section in 2003 and 2004. Explanation: numbers in circles indicate the number of the layer; black squares with numbers indicate paleomagnetic samples (after Bosák et al. 2010).

three reverse polarity excursions can be correlated with some of Jamaica-Pringle Falls, Namaku, Calabrian Ridge, Portuguese margin or Calabrian Ridge 1 excursions (210–335 ka).

The sediments in the studied sections in Križna jama were deposited during the Last Glacial (Weichselian), Eemian interglacial, Saalian glacial and Holsteinian interglacial.

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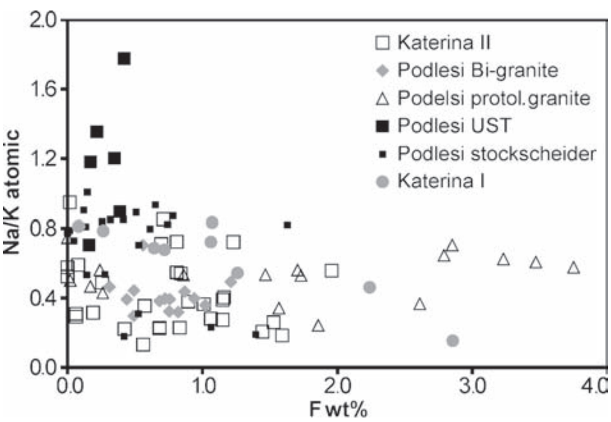
RABEDER G. & WITHALM G. (2001): The Križna jama near Lož in the classic karst. – In: *7th International Symposium on Cave Bear, Excursion Guide*: 1–4.

No. IAA300130801: **Chemical evolution of contrasting types of highly fractionated granitic melts used melt inclusions study** (*K. Breiter*, *L. Ackerman*, *V. Böhmová*; J. Leichman, S. Honig, R. Škoda, M. Holá, Faculty of Science, Masaryk University, Brno; M. Drábek, Czech Geological Survey, Praha, Czech Republic; 2008–2011)

We followed the optimization of the microprobe analyses of homogenized glasses during 2010. Sufficient international standards with appropriate content of water do not exist; therefore we prepared new standards from remelted rare-metal granites oversaturated in water. For microprobe analyses, we applied the method "extrapolation to the time zero". This method neutralizes the rapid escape of alkalis, namely sodium, during the several first seconds of the measurement. Simultaneously, we minimized the "dead time" of measurement between the localization of the electron beam on the analysed area and the real start of the measurement. Applying this procedure to our glass standard, the result of Na measurement was in good agreement with classical chemical method. So, we use this procedure now for the homogenized melt inclusions.

Analyzes of homogenized melt inclusions from the Podlesí and Hora Svaté Kateřiny granite systems were continued. Some samples are relatively rich in inclusions, but all inclusions are small, usually between 10–30 µm. They are suitable for microprobe analyses, but not for laser ablation. Chemical composition of the inclusions is highly variable, also within a single quartz grain. This indicates a high degree of inhomogeneity of late residual melt and supports the conception of co-existence of two immiscible silicate melts with different contents of Si, Al, P, B, Na, K and water.

The granite system at Podlesí (western Krušné hory Mts.) consists of several well defined evolutionary stages. Their suc-



■ **Fig. 38.** The content of F and the Na/K ratio in melt inclusions in quartz from Podlesí and Hora Svaté Kateřiny (original).

cession is in good accord with averaged chemical composition of melt inclusions. From the biotite granite through protolithionite granite to zinnwaldite granite with unidirectional solidification texture, the content of Al (peraluminity) and Na/K-ratio in inclusions increased; this is mineralogically expressed in the enrichment of albite. The highest content of F was found in inclusions from the protolithionite granite. The zinnwaldite granite has higher WR-content of F than the protolithionite granite, but the melt inclusions in the zinnwaldite granite were closed in quartz after extensive crystallization of zinnwaldite and topaz, which consumed the majority of F from the melt. The relatively low content of volatile elements in melt inclusions from the stockscheider is in agreement with its crystallization from devolatilized melt immediately after explosive brecciation and degassing.

Melt inclusions from the Hora Svaté Kateřiny granite differ especially in the very low contents of phosphorus, which is a result of the A-type character of this granite system.

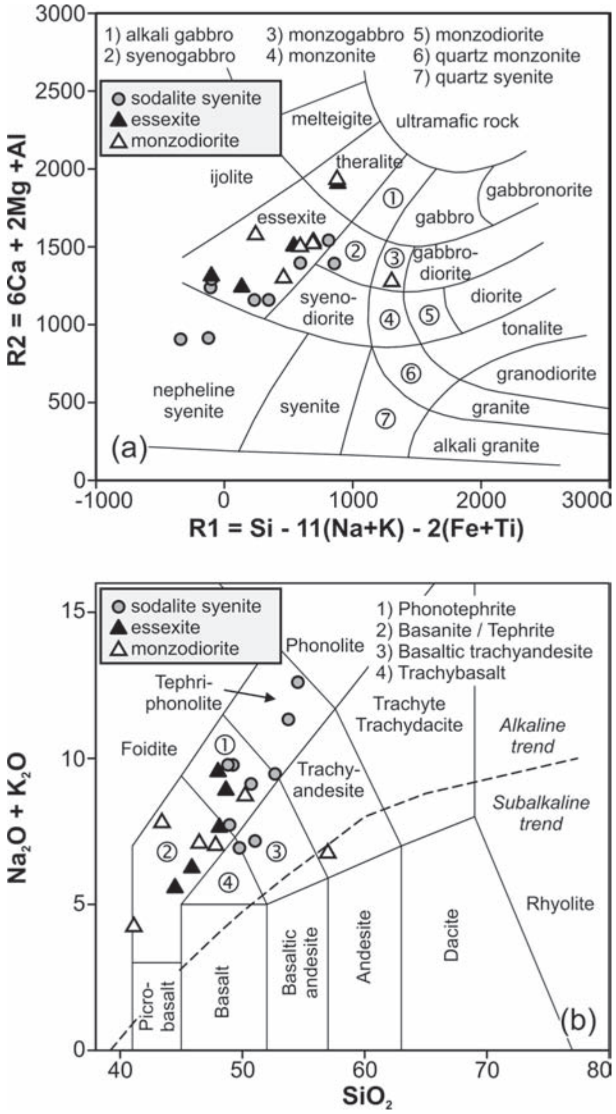
No. IAA300130806: **The concept of micro- to mesoscale sandstone morphofacies in the temperate zone** (*J. Adamovič*, *R. Mikuláš*, *R. Živor*, *A. Langrová*, *V. Böhmová*, *M. Šťastný*; J. Schweigstillová, Institute of Rock Structure and Mechanics of the ASCR, v. v. i., Praha, Czech Republic; 2008–2011)

The studies of weathering patterns on sandstones in the temperate zone of Europe concentrated on the origin of rock crusts and the related porosity changes in the superficial zone of sandstone outcrops. Different types of rock crusts and the underlying unweathered sandstone were sampled in the Bohemian Cretaceous Basin and studied using optical microscopy, EDS scanning electron microscopy, X-ray diffraction and mercury intrusion porosimetry. Two types of rock crusts were distinguished on morphological basis: (1) patterned rock crusts with a variety of weathering forms (honeycombs, wandkarren), ca 2–15 cm thick, and (2) armoured rock crusts with a relatively smooth, hardened layer several millimetres thick on medium-to coarse-grained quartzose sandstone but several centimetres thick on fine-grained clayey sandstone. Patterned rock crusts on medium-to coarse-grained quartzose sandstones show an increase in the size of macropores relative to unweathered sandstone, which mostly implies an increase in total effective porosity. This is explained by the subflorescent growth of salt crystals, the force of which leads to the loss of contact among grains and to pore widening. This process is manifested by granular disintegration, and its promotion by a slower evaporation in the deepest parts of honeycomb pits guarantees site-related "memory" of cavernous weathering. Tighter grain packing in surface-parallel zones is associated with a decrease in the volume and size of macropores, and a reduction of total effective porosity; it can be most readily explained by repetitive freezing of saline pore waters near the rock surface. Armoured rock crusts on fine-grained clayey sandstone show a reduced volume and size of macropores, as these are filled with clay mineral aggregates and gypsum crystals. A prominent increase in the volume of micropores in the armoured crusts should be attributed to secondary porosity in kaolinite and to the corrosion of feldspar grains. Insufficient passability of macropores in the armoured layer for pore waters shifts the evaporation front deeper into the rock. This results in contour scaling as the main process of rock-surface degradation, as opposed to granular disintegration on patterned rock crusts. Salts identified in the rock crusts and in the efflorescences are gypsum and alums; brushite, calcite and tschermigite were found in a few samples only. Prominent is the enrichment in clay minerals in the armoured layers.

No. IAA300130902: **Characteristics of the mantle sources and crystallization history of the subvolcanic alkaline rock series: Geochemical and Sr-Nd isotope signature (an example from the České středohoří Mts., Ohre/Eger Rift)** (*R. Skála*, *J. Ulrych*, *V. Böhmová*, *L. Ackerman*; Z. Řanda, J. Mizera, J. Kučera, Nuclear Physics Institute of the ASCR, v. v. i., Řež, E. Jelínek & D. Matějka, Faculty of Science, Charles University, Praha, Czech Republic; 2009–2013)

Sampling of the Roztoky intrusive center (RIC) continued in 2010 together with collecting materials for comparative purposes in the region of the České středohoří Mts. In addition to that, also magmatic rocks of the Bohemian and Moldanubian Massifs were sampled to provide apatite grains for intercalibration with apatites from the subvolcanic rocks of the RIC. In cooperation with the University in Munich, Sr and Nd contents were measured in these materials. For samples S-16 to S-18 and S-22 to S-25, the chemical composition was determined using INAA. More than 50 major elements and trace elements were measured. In the TAS diagram (Fig. 39), the bulk rock composition plots in a wide range varying between foidite and trachyandesite or tephriphonolite. Dating of apatite grains in the samples from the Bohemian Massif using fission track technique provided the age of 170 Ma, which is interpreted as an overprint Hercynian ages.

Further, a detailed crystal chemical study of pyroxenes, amphiboles and micas continued. A master thesis focused on the chemical composition and crystal structures of pyroxenes and amphiboles was successfully defended. The contents of major, minor and trace elements in clinopyroxenes and clinoamphiboles of basanites, volcaniclastics, essexites, sodalite syenites, and monzodiorites of the České středohoří Mts. were determined using an electrone microprobe and LA-ICP-MS techniques. The composition of clinopyroxenes corresponds to either diopside or augite, and clinoamphiboles can be classified as kaersutite or pargasite. Some pyroxenes display pronounced sector zoning showing increased contents of Mg and Si in pyramidal sectors whereas prismatic sectors show Fe, Ti and Al enrichment. Chemical composition of both sectors corresponds to diopside. Growth zoning was found in the samples of basanites and volcaniclastics. Grain cores display the chemistry of augite, and the chemical composition changes to diopside towards the rim. Samples were also analysed by powder and single crystal X-ray diffraction techniques. Samples of pyroxenes appear to be either pure or they contain negligible admixtures of phlogopite. Samples of amphiboles are also either without any admixtures or they show contamination by low amounts of diopside or augite, or phlogopite may rarely be encountered. Mutual relationship between the size of the unit cell parameters b and â and substitutions in M1,2,3 and A sites was observed. Longer mean T-O bond lengths correlate with significant Al → Si substitution in tetrahedra in both pyroxenes and amphiboles.



■ **Fig. 39.** Rocks of the Roztoky intrusive center in the classification diagram of plutonic rocks (a) compared to the position in the classification of the volcanic rocks (b); modified after Skála et al. (2010).

SKÁLA R., ULRYCH J., JELÍNEK E. & ŘANDA Z. (2010): Alkalické subvulkanity Českého středohoří ve srovnání se subvulkanity pohoří Kaiserstuhl (Německo) a Monteregian Hills (Kanada): petrologicko-geochemická studie. – *Bulletin mineralogicko-petrologického oddělení Národního muzea v Praze*, 18, 1: 42–50.

No. IAA300130906: **Relation between elastic moduli determined by seismic methods in laboratory and in the field** (*V. Rudajev*, *T. Lokajíček*, *M. Petružálek*, *R. Živor*; J. Vilhelm & T. Svitek, Faculty of Science, Charles University, Praha, Czech Republic; 2009–2011)

Field experiments carried out at the locality of Kostiviarska Quarry (near Banská Bystrica, Slovakia) with special orientation of three component sensors were processed, and velocities of P- and S-waves were determined. These measured velocities together with determined rock density enabled to evaluate the elastic moduli (Young modulus and Poisson's ratio) and their directional dependence.

The velocity anisotropy was also determined in laboratory conditions. The extracted rock samples (limestone) were radiated by ultrasonic waves with frequency 1 MHz. The elastic parameters were calculated. Scaling factor was studied on the basis of comparison laboratory and field data.

The obtained data from the Lubeník locality (seismic measurements were realized in 2009) were processed and the anisotropy of P-wave propagation was determined. It was found out that magnesite shows a small anisotropy.

The Bedřichov gallery was an another site of ultrasonic measurements. This gallery serves as a laboratory for radioactive waste deposits. It was partly excavated using a mechanical boring machine and partly manually, by firing explosives in shot holes run in the head of the gallery. The rock in both parts of the gallery has thus been fractured to a different degree. The measurements were made close to the point of transition from one method of advancing to another to be able to compare the results of the measurements in both types of tunnelling. Application of ultrasonic sounding and P- S-wave propagation analysis allowed to determine the depth of the fractured zone.

Special ultrasonic sounding was carried out at the locality of Ivrea (Italy) on the vertical and horizontal planes of a peridotite outcrop. The new piezoceramic transducers were used. This way P- and S-waves were excited with order different frequencies of 0.1 MHz and 1 MHz. A set of peridotite samples was collected. The obtained data create basis for the study of space anisotropy ultrasonic wave velocities and elastic moduli and also for scale factor analysis.

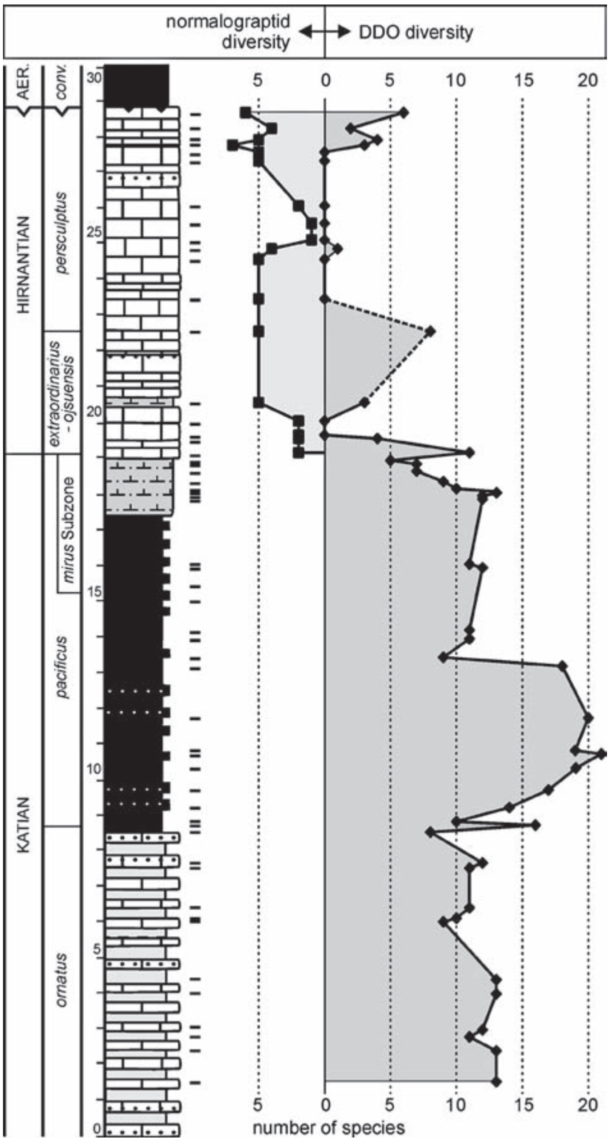
The new method was developed for the determination of the arrival of seismic wave phases.

Combination of laboratory study of ultrasonic wave propagation of peridotite and field seismic data enabled to calculate the gripping of natural fracture systems at the locality of Ivrea.

No. IAA301110908: **Dynamics of the Upper Ordovician climax-stage faunal assemblages before global crisis controlled by climatic changes: a record from the Králův Dvůr Formation of the Barrandian area** (P. Kraft, O. Fatka, Faculty of Science, Charles University, Praha; *P. Štorch*; P. Budil, Czech Geological Survey, Praha & M. Mergl, Faculty of Education, University of West Bohemia, Plzeň, Czech Republic; 2009–2011)

A parallel study of selected upper Katian and Hirnantian sections in tropical paleo-belt and of coeval sections in cool-temperate Barrandian area revealed that different nature and scenario of graptolite extinction and faunal turn-over developed under different paleolatitudial and paleoclimatic conditions.

Forty-three graptolite species belonging to fifteen genera were described from the upper Katian *ornatus* and *pacificus* biozones and Hirnantian *extraordinarius-ojsuensis* and *persculptus* biozones of Vinini Creek and Martin Ridge reference sections of central Nevada (Štorch et al. 2011). Approximately half of the species described had not been previously recorded from Nevada, six species were left in open nomenclature. Magnafamilies of Pan-Diplograpta and Pan-Neograpta, superfamily Neograptoidea, and *Styracograptus* gen. nov. were erected. The maximum graptolite diversity was recorded in the lower part of the *pacificus* Biozone. Species diversity decreased abruptly at the top of the *Diceratograptus mirus* Subzone, recognized in the upper part of



■ **Fig. 40.** Graptolite faunal dynamics (diversity curves) of upper Katian and Hirnantian plotted against simplified Vinini Creek section log. Graptolite diversity per sampling level is composed of positive records and presumable occurrences determined by interpolation between positive records in neighbouring levels above and below. Ten of 66 sampling levels were omitted due to small size of the sample which does not approach real species diversity. Graptolite records from sampling levels situated in couples only 5 cm apart (2.95 and 3.00 m, 13.15 and 13.20 m, 27.45 and 27.50 m) were merged and referred to 3.00, 13.15 and 27.50 m, respectively (from Štorch et al. 2011, with permission).

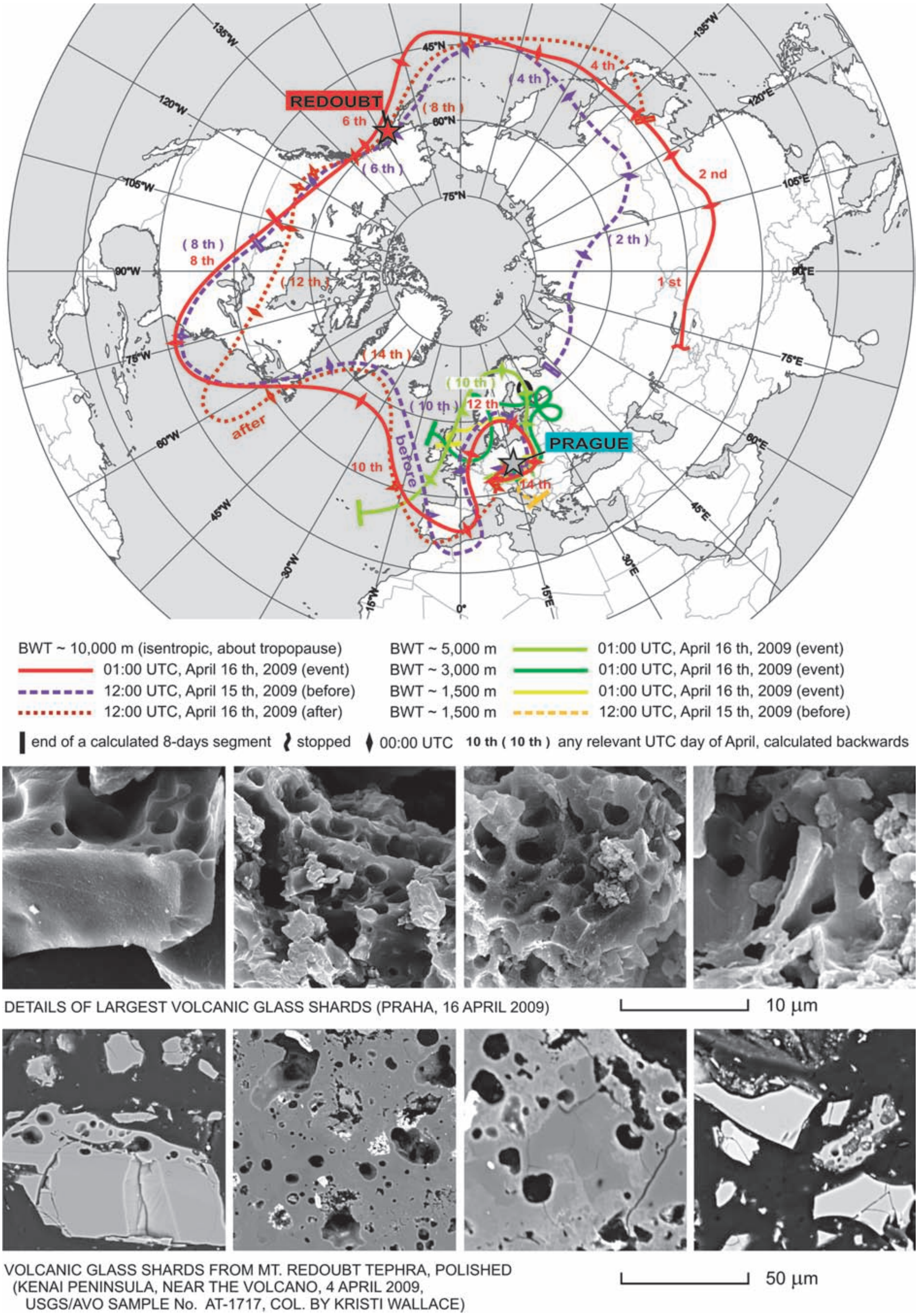
the *pacificus* Biozone (Fig. 40). Faunal turnover reached a peak in the lower part of early Hirnantian *extraordinarius-ojsuensis* Biozone where long-dominant Ordovician clades were rapidly replaced by normalograptids, presumably evolved in, and invading from, a less-temperate higher latitude, as suggested also by graptolite record from the Králův Dvůr Formation of the Barrandian area. Several lazarus taxa (*Dicellograptus, Anticostia, Rectograptus, Paraorthograptus, Phormograptus, Styracograptus* and *Appendispinograptus*) reappear in the upper part of the *extraordinarius – ojsuensis* Biozone in Nevada. The uppermost part of the Vinini Creek section, well into the *persculptus* Biozone topped by prominent stratigraphic unconformity, records their second emergence from hypothetical refugia due to temporarily ameliorated conditions. This occurrence accounts for a complex extinction pattern of graptolites rather than a synchronous global collapse of the pre-glacial ecosystem. In medium latitude cool- to temperate-water settings (icluding those of peri-Gondwanan Europe) the overall graptolite diversity was extremely low already in pre-glacial times. At the beginning of the glaciation, the old fauna entirely vanished. In tropical belt, however, some elements of the old fauna locally survived and the last phase of its extinction took place during postglacial transgression, in the course of a major evolutionary burst among normalogratids and their descendants. Reasons for ultimate extinction of diplograptid-dicellograptid-orthograptid fauna may be biological rather than environmental. Graptolite biozonation applied in Nevadan sections correlates well with those established in the Yangtze Platform of China, southern Kazakhstan, north-eastern Siberia and Northern Canada. Correlation with graptolite poor sections of England, peri-Gondwanan Europe and Africa remains only tentative.

ŠTORCH P., MITCHELL C.E., FINNEY S.C. & MELCHIN M.J. (2011): Uppermost Ordovician (Upper Katian-Hirnantian) graptolites of north-central Nevada, USA. – *Bulletin of Geosciences*, 86, 2: 301–386.

No. IAAX00020701: **Long-term development of cultural landscape in Central Bohemia as a co-evolution of human impacts and natural processes** (P. Pokorný, Institute of Archaeology of the ASCR, Praha, v. v. i.; *J. Hlaváč*, P. Kuneš, Faculty of Science, Charles University, Praha, Czech Republic; 2007–2011)

The project continued with analyses of molluscan thanatocoenoses in archaeological settlements from Kněževes near Prague. The settlements were dated to the Late Bronze Age period – the Knovíz culture, and many of them were filled with material containing abundant conchological specimens.

Two different molluscan groups were identified in 101 samples, with a total of 864 individuals belonging to 22 molluscan species (18 species of terrestrial snails, 4 species of freshwater molluscs). The first group consisted of molluscan species of allochthonous origin – in particular the terricolous blind snail *Cecilioides acicula* and freshwater molluscs such as the minute snail *Gyraulus albus* and three medium-sized mussel species of the genus *Unio*. The second group consisted of molluscan species of autochthonous origin, i.e. species fossilized in the studied deposits without being intentionally brought into the settlement by humans.



■ **Fig. 41.** – see next page.

■ **Fig. 41.** Backward trajectories and examples of tephra fragments. J. Hladil & L. Koptíková. Trajectories: Authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and READY, http://www.arl.noaa.gov/ready.php.

In the analysed samples, open-habitat species strongly dominated, which generally indicates the presence of woodless areas. This was probably a secondary steppe habitat, anthropogenically influenced, as indicated by species such as *Chondrula tridens*, *Truncatellina cylindrica*, *Vallonia costata*, *V. pulchella*, *V. excentrica*, and *Pupilla muscorum.* In addition, low numbers of open forest species and open warm forest species such as *Cepaea hortensis*, *Helix pomatia*, and *Fruticicola fruticum* were also found which require certain shaded habitats. Species requiring habitats with higher moisture were also occasionally identified (such as the species *Carychium tridentatum*, confined to damp habitats), as were even true wetland species (*Vertigo angustior*, *Vallonia enniensis*).

Based on the molluscs found in these archaeological settlements, it is possible to reconstruct the natural environment of the settlement and its nearby surroundings. There were likely open areas within the settlement, with ecotonal zones gradually changing to less anthropogenically influenced sites with smaller areas of bushes and tree patches, which became much larger farther from the settlement borders. These locations were occasionally accompanied by smaller damp patches, almost acquiring the characteristics of true wetland habitats.

No. IAAX00130702: **Hydrodynamic concept of stromatactis formation in geology** (Project leader: *J. Hladil*, co-investigators: *L. Koptíková*, *L. Lisá*, *J. Adamovič* & *P. Kubínová*; Project co-leader: M. Růžička, co-investigators: J. Drahoš, L. Kulaviak, J. Havlica, J. Vejražka, M. Zedníková & S. Kordač-Orvalho, Institute of Chemical Process Fundamentals of the ASCR, v. v. i., Praha, Czech Republic; 2007–2011)

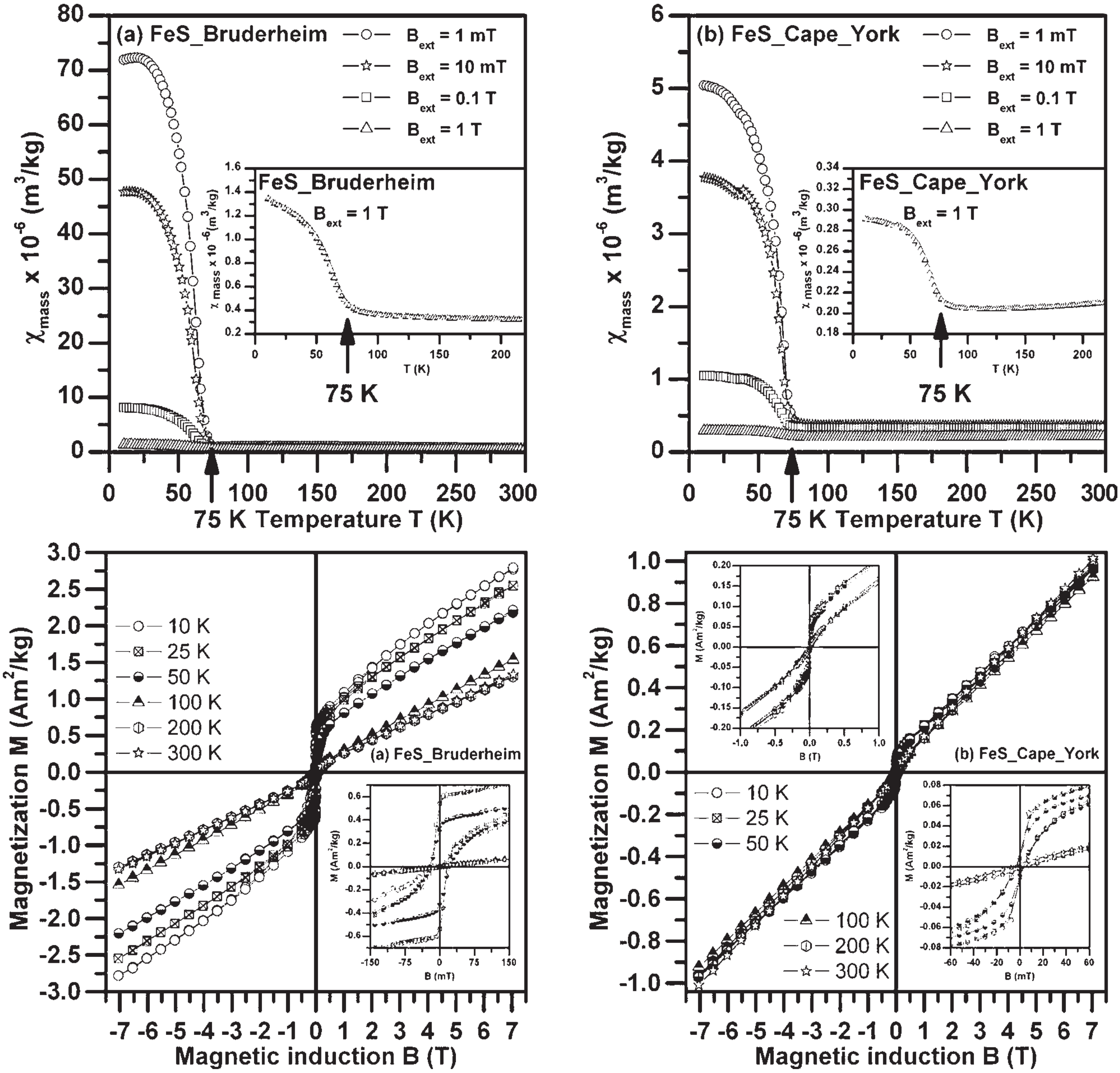
Although six principal directions related to laboratory experiments and outdoor activities merging the approaches of technical and geology-orientated sedimentology were equally developed in 2010, a considerable effort was devoted to studies of to finest (silt and dust) particulates. Some of outdoor studies brought many interdisciplinary aspects together, as exemplified by the case of Mt. Redoubt below.

Tephra ash from the Alaskan Mt. Redoubt 4 April 2009 eruption reached Prague in twelve days. In 2010, the extensive multiproxy studies of the material collected during the 16 April 2009 dust deposition event confirmed that a significant proportion of the lithic-mineral particles emitted from the Redoubt Volcano occurred (see Fig. 41). This dust sediment was found also at the Praha-Ruzyně airport. The mineralogically, chemically and physically orientated analytical data represent real evidence that about 15 to 20 wt. % content of this unusual event sediment was of Mt. Redoubt provenance. The high tropospheric backward trajectories show a perfect match with the theoretical paths of the transport which had to be considered as jetstream-mediated. With regard to composition of the dust particle mixtures, reloading of the particles between these high speed winds and turbulent mixing within the tropopause folds was a possible mechanism that significantly contributed to the mass and lifetime of these large but dynamically light particles. In spite of the general prevalence of dacitic-rhyolitic tephra fragments (few μm to 40–50 μm long), also crystalloclasts, crystals and aggregates of pyroxenes, amphiboles, high-Na, Fe anthophyllite, bytownite-labradorite, crystalline quartz, zeolites, and also titanomagnetite in small fragments of fresh volcanic microclasts were identified as common components. These ash particles from Mt. Redoubt were mixed with many other components of globally and also regionally circulating particulate matter so that the compositions of these particles provide tangible documents about a week to several weeks long history of atmospheric transport, dispersals and re-concentrations of these atmospheric particulates. The presence of aggregated dust particles together with sherd tephra covered by adhering clay-size particles provided a significant evidence of long survival and even further structural evolution of the respective porous and complex-shaped large lithic-mineral particles in the atmosphere. It is important because most of the recent models are constructed in that way that they are not compliant to specification of a long transport of such relatively coarse or in-air aggregated complex particles. The largest of the studied porous aggregate particles, being agglutinated from the smallest ash and dust components, crystallite-crystal needles and flakes, showed very flat prolate ellipsoid (surfboard-like) shapes where the major axes were 20–40 μm long. Particularly the mechanism of this event sedimentation itself was quite unusual, following a decrease of the transport velocities in a spiral, short period of vertical mixing of atmospheric layers and occurrence of calm weather conditions in the column between tropopause and lowermost troposphere. With the drawing on the dust portions to ground, the atmospheric boundary layer showed a centrifugal gentle wind pattern. The calculated shapes of the settling dust clouds were downward bent lenses, each several kilometres large but only one or few of hundred metres thick, arranged in a belt crossing the Bohemia in the SW–NE direction, with dust-matter depocentres more sharply limited on the SE than NW side of this belt. One of the most interesting aspects of this dust fall was the depletion of fine particles, so that these clouds consisted almost exclusively of large dust particles and spacing between them was several centimetres or more. These clouds with diluted but coarse dust particles (porous, rugged and dynamically light) are almost invisible for the normally used satellite or ground-based techniques of dust concentration warning systems. When accumulated, the collected particles of this type form particulate materials of great stiffness (high internal friction angle). This mixed ash and background dust material is also adhesive (surface electric potential, presence of pollen grains). In spite of the presence of cavities, this dust mixture is considerably resistant to removal from most of the natural, urban or technical substrates.

No. IAAX00130801: **Interplay of climate, human impact, and land erosion recorded in the natural archives of Strážnické Pomoraví (CR)** (*J. Kadlec*, *L. Lisá*, *S. Šlechta*, *F. Stehlík*; H. Svitavská-Svobodová, Institute of Botany of the ASCR, v. v. i., Praha; T. Grygar, Institute of Inorganic Chemistry AS CR, v. v. i., Řež; I. Světlík, Nuclear Physics Institute of the ASCR, v. v. i., Řež; R. Brázdil, P. Dobrovolný, Z. Máčka, Faculty of Science, Masaryk University, Brno & V. Beneš, G-Impuls, Ltd., Praha, Czech Republic; 2008–2011)

Behaviour of the Morava River in the Strážnické Pomoraví is reconstructed based on a multidisciplinary study of both fluvial and eolian natural archives. River processes are reconstructed based on floodplain architecture analysis supported by geophysical survey and radiocarbon dating of the sediments. We distinguished three main stages of the floodplain development: (1) Late glacial meandering system; (2) Middle to late Holocene anastomosing system, and (3) Recent meandering system. We found good correlation between floodplain sediment magnetic enhancement and organic carbon and persistent organic pollutant concentrations showing the age of the enhancement since about 1950. The wind directions (generaly from W to E) were reconstructed based on sand dunes architecture surveyed by the ground-penetrating radar. An existence of the Late Glacial lake in the Lower Moravian Basin was proved in the lower Dyje River Valley. The OSL datings of the recently found lake deposits will reveal if these sediments are the same as the lake sediments near Strážnice.

No. KJB300130902: **Highly siderophile element and Re-Os isotope geochemistry of mantle pyroxenites: implications for mantle refertilization** (*L. Ackerman* & *J. Rohovec*; 2009–2011)



■ **Fig. 42.** Change in magnetic susceptibility (up) and hysteresis properties (down) in troilite (FeS) at ~70 K. Left are presented measurements of troilite from Bruderheim chondrite meteorite, right from Cape York iron meteorite (Tomáš Kohout, original).

The research continued at the locality of Mohelno-Biskoupky. These peridotite bodies (garnet and spinel peridotites) show similar features as orogenic peridotites (e.g., Lanzo, Rando) rather than abyssal peridotites. Their modal composition as well as LREE-enriched patterns do not support previous ideas that they represent oceanic-astenospheric upper mantle remnants in the Bohemian Massif. Two different REE patterns indicate different histories (e.g., partial melting and/or metasomatism) of individual rocks within the Mohelno-Biskoupky bodies. Highly siderophile elements (HSE) show primitive distribution within I-PGE (Os, Ir, Ru) group and significant depletion in Re concentration. The high variation in Pd contents and superchondritic Pd/Ir and Ru/Ir ratios indicate a combination of partial melting with metasomatism, most likely by basaltic melts. Deviations in $^{187}Os/^{188}Os$ ratios from subchondritic to superchondritic values point out that at least some of the rocks underwent metasomatic processes resulting in import of radiogenic ^{187}Os. Low values of g Os point to a most likely upper mantle source of the metasomatic agent (melt and/or fluid). Therefore, metasomatism at the Mohelno-Biskoupky site is probably not linked to subduction-related metasomatic processes as in the case of some other Gföhl Unit peridotites (e.g., Horní Bory site).

No. KJB300130903: **Low temperature magnetic properties of iron bearing sulfides and their contribution to magnetism of cometary bodies** (*T. Kohout*; P. Týcová, J. Haloda, Czech Geological Survey, Praha & R. Zbořil, Faculty of Science, Palacký University, Olomouc, Czech Republic; 2009–2011)

Certain iron- and manganese-bearing sulphide minerals present within extraterrestrial material undergo various magnetic transitions at low temperatures and thus have significantly different magnetic properties at temperatures of the cold interplanetary environment compared to terrestrial conditions. This opens us a new look on asteroids and comets and on their interactions with magnetic fields in Solar System. Detailed research of the low-temperature magnetic properties of such sulphides is being done with natural and synthetic samples. Data are used to model and interpret magnetic observations and magnetic properties of Solar System minor bodies.

In 2010 a series of new low-temperature measurements were performed with the two troilite (FeS) samples obtained from the Bruderheim L6 chondrite and iron Cape York IIIA octahedrite meteorites by means of employing the macroscopic magnetic measurements and Mössbauer spectroscopy. This study confirmed that both samples undergo a magnetic transition (Fig. 42) at ~70 K from the high-temperature antiferromagnetic regime to the low-temperature ordered magnetic state exhibiting higher magnetization as it is evident from the temperature behaviour of the molar magnetic susceptibility at various external magnetic fields. The change in the profile of the hysteresis loops around origin was observed below and above this transition. On the contrary, Mössbauer measurement excluded the connection between the low-temperature transition at ~70 K and the Morin-type structural transition. More likely, it is governed by the temperature behaviour of the exchange interactions of the antiferromagnetic and ferromagnetic type when the ferromagnetic exchange interactions become dominant below the transition temperature. The obtained data support a hypothesis that this transition is specific for highly stoichiometric troilite systems as proved by comparison with magnetic behaviour of non-stoichiometric synthetic samples.

4d. Grant agency of the Charles University (GAUK)

GAUK No. 3010: **Uranium and thorium content in macrofungi** (J. Kubrová, Faculty of Science, Charles University, Praha, Czech Republic & *J. Borovička*; 2010–2011)

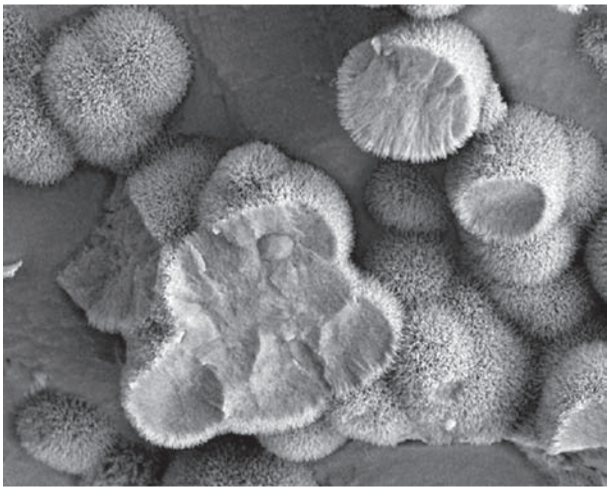
The concentrations of uranium, thorium and rare earth elements (REE) in 36 species of ectomycorrhizal (26 samples) and saprobic (25 samples) macrofungi from unpolluted sites with differing bedrock geochemistry were analysed by inductively coupled plasma mass spectrometry (ICP MS). Analytical results are supported by use of certified reference materials (BCR-670, BCR-667, NIST-1575a) and the reliability of the determination of uranium was verified by epithermal neutron activation analysis (ENAA). It appears that data recently published on these elements are erroneous, in part because of use of an inappropriate analytical method; and in part because of apparent contamination by soil particles resulting in elevated levels of thorium and REE. Macrofungi from unpolluted areas, in general, did not accumulate high levels of the investigated metals. Concentrations of uranium and thorium were generally below 30 and 125 ppb (dry weight), respectively. Concentrations of REE in macrofungi did not exceed 360 ppb (dry weight) and their distribution more or less followed the trend observed in post-Archean shales and loess.

4e. Grants of the State Departments

Ministry of the Environment of the Czech Republic, No. MŽP-OOHPP-10/10/SDD: **Study of mining waters in adit of Arnošt Mine, Rybářská street, Český Krumlov** (*P. Bosák*, *M. Filippi*, *T. Navrátil*, *J. Rohovec*, *K. Žák* & V. Krištůfek, Biological Centre of the ASCR, v. v. i. – Institute of Soil Biology, České Budějovice, Czech Republic; 2010)

This study dealt with the geochemistry, mineralogy, biology and hydrology of the acid mine drainage occurring at the draining adit of abandoned mine Arnošt on left bank of the Vltava River in Český Krumlov. The period of research was April to November 2010.

The acid mine drainage was characterized by low pH (mean value 3.16) and high mineralization of the solution (over 1 $g.l^{-1}$). Main cations of the drainage waters were calcium (Ca) and iron (Fe). The most important anion was sulphate (SO_4^{2-}). The environmentally toxic solutes identified in increased concentrations



■ **Fig. 43.** Globular formation of size 500 nm made by bacterium Acidithiobacillus ferrooxidans situated in the centre of an acicular aggregate of schwertmannite (photo by V. Kryštůfek).

were cobalt (Co) and uranium (U). The oxygen in the accessible part of the adit causes oxidation of dissolved Fe^{3+} and consequent increase of the Fe^{3+}/Fe^{2+} ratio. This was identified as the main reason for the deposition of the iron precipitates in the water draining the accessible part of adit. The oxidation of pyrite inside of the former mine was identified by the isotopic analyses of oxygen and sulphur as the main source of SO_4^{2-}. The dissolved SO_4^{2-} was not significantly bacterially reduced inside of the former mine.

The mine draining water showed a relatively high temperature of 10.5 °C. The tritium analysis indicated that great amounts of the water inside the former mine are characterized by prolonged residence time on the order order of tens of years. The analysed samples infiltrated in 1960 to 1980. Slow circulation of the water is in compliance with insignificant reaction of the mine discharge onto the precipitation episodes.

The main component of solid precipitates formed in the water mains inside of the adit were identified using bacteriological, microscopic and geochemical methods as weakly crystalline complex Fe oxy-hydroxy-sulphate - schwertmannite.

In the present regime of ventilation and mine drainage, iron precipitation cannot be prevented. The only hypothetical solution to decrease the mineralization of the drainage solutions and Fe precipitation would be to seal the mine and prevent from air input. The oxidation of pyrite is mediated, besides oxygen from infiltrating waters, also by oxygen from air entering the mine. But regarding the pressure changes of the outer atmosphere and weathering level of the subsurface part of mine cut by the Vltava River valley, hermetization of the mine or even significant decrease of current ventilation would be technically difficult or even impossible.

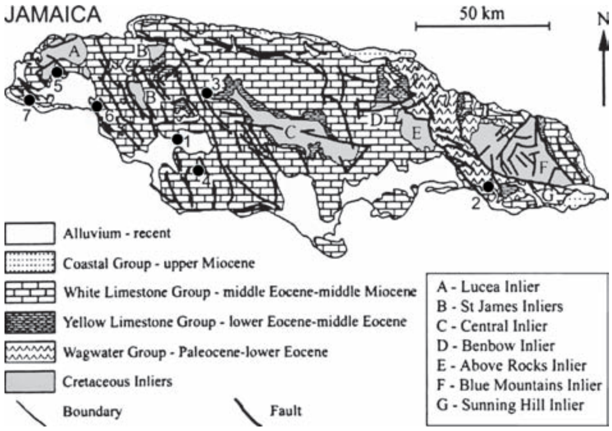
Ministry of the Environment of the CR, Project TYPE No. SP/2d1/141/07: **Reclamation and management of non-natural environments** (T. Gremlica, Institute of Ecopolitics, Praha, Czech Republic & *V. Cílek*; 2008–2011)

The last year of the project was dedicated to a synthesis of the results from 80 diferent sites (mostly abandoned quarries, open-pit mines and kaolin exposures), where a detailed biological inventory (e.g. birds, higher plants, fungi, algae, amphibians, rodents etc.) took place. The main result is a supremacy of gradual, slow natural revitalisation of the place over the relatively fast technical reclamation. A major, large-scale monograph on the theme is in the stage of compilation (T. Gremlica ed. et al.). The methods and changes in legislation were proposed to the Ministry of the Environment of the Czech Republic.

Ministry of Industry of the Czech Republic, No. 12/01-10/MPO/B-II: **Mining and processing of industrial minerals on Jamaica and selected CARICOM countries** (L. Opekar, GET, Ltd. Praha, Czech Republic; *J.K. Novák*, *P. Bosák*, *J. Erdingerová*, *Z. Korbelová*, *J. Pavková* & *R. Živor*; 2006–2011)

The aim of the project is to explore industrial minerals in Jamaica and to help to develop their extraction. The studies were focused especially on the exploration and characterization of different deposits of carbonate rocks (including high-grade limestones) and corrective raw materials (mostly volcanics and volcaniclastics) for the production of cements and limes to support the local construction industry and to decrease the import of such building materials.

HASTIE A.R., KERR A.C., MITTCHELL S.F. & MILLAR I.L. (2008): Geochemistry and petrogenesis of Cretaceous oceanic plateau lavas in eastern Jamaica. – *Lithos*, 101, 3-4: 323–343.



■ **Fig. 44.** Location of the studied sites on Jamaica (map modified after Hastie et al. 2008). 1. Black River Bay; 2. Bito and Ramble; 3. Sommerfield Group; 4. Santa Cruz Mts.; 5. Grange Hill; 6. Cave Mountains; 7. Negrill Hill.

Subproject: **Sedimentary kaolin and silica sand of the Black River Bay as the supplementary cementing materials** (*Novák J.K.*, *Bosák P.* & *Erdingerová J.*)

The small-scale deposit of kaolinitic quartz sand and that of high silica sand from Franchman´s Island, a result of suspended-sediment transport and re-sedimentation processes in the river-to tide-dominated estuary of Black River Bay, has been a focus of recent study. These conclusions represent an ongoing concern on the supplementary cementing materials for the future production of both the Portland cement and the metakaolin pozzolan.

Kaolinitic sand under study consists of variable of amounts of the silt- to sand-sized quartz, minor pyroclastic detritus, and quartzite fragments within the silty-clayey cement. The normative mineralogy shows 67.5–69.3 mole % kaolinite, 0.9–0.7 mole % of illite, 1.9–4.0 mole % of montmorillonite, 22.0–22.4 mole % of quartz, and variable amount of hematite pigment. Washed kaolin from the summary technological sample (76 % of fraction below 2 μm) consists dominantly of pM kaolinite and micron-sized quartz, montmorillonite and hematite occurring as accessory admixtures. The high value of refractoriness (in the range of 1,560–1,640 °C) is in agreement with mineralogical composition. Considering the results of technological testing, the processed kaolinitic substance is feasible for the use in the OPC or building ceramics and in the metakaolinite pozzolan. The dirty yellow firing colour of baked samples is a limiting factor in the production of WPC, sanitary ceramics and tiles.

Pure silica sand is represented by only one sample, which is a single-graded one, between 0.18–0.37 mm (median value of 0.25 mm), with 98.8 wt.% SiO_2 and 0.11 wt.% Fe_2O_3, and 0.28 wt.% TiO_2. It should be appreciated that a large proportion of oval-shaped grains, without excessive content of fines and deleterious minerals, will have a positive effect on the workability in both raw cement and/or sand-lime brick mixes.

Subproject: **Pyroclastic rocks from the Bito and Ramble areas: dacitic rheoignimbrite** (*Novák J.K.*, *Bosák P.* & *Korbelová Z.*)

The area between the villages of Bito and Ramble is marked by the line of dacite/low-K rhyodacite/(low-K rhyolite) and some of the volcanics are transitional between silicic lava and rheomorphic ignimbrite. Our previous work from 2008 has drawn attention to the coherent lava of the conduit-fed hybrid (trachy)dacite that seems to be suitable as hard rock source for the skid-resistant aggregates.

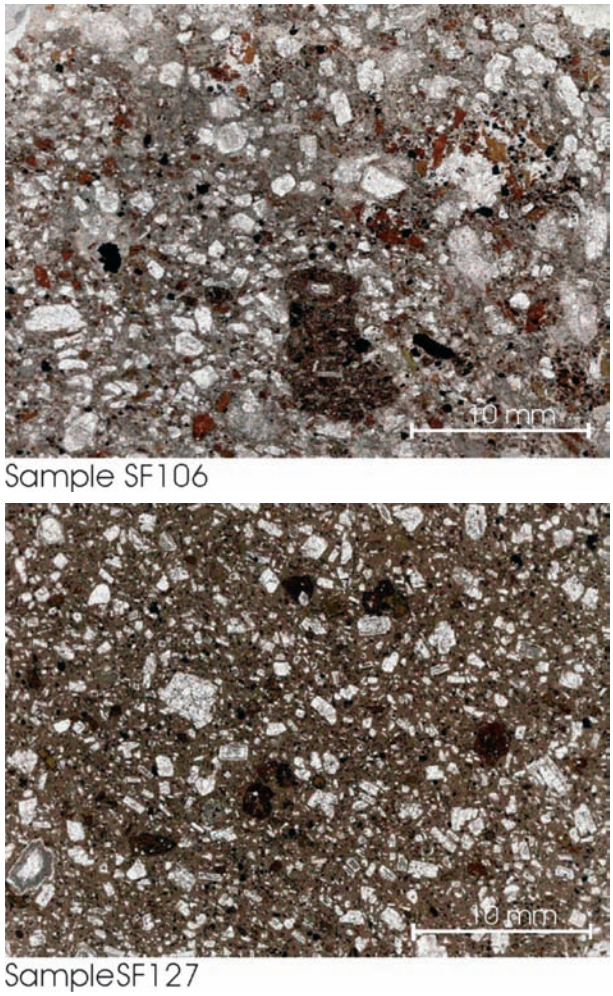
Dacitic distal facies provides properties which are comparable with the high-grade rheomorphic ignimbrite. This rock type was generated from a low explosivity dacitic eruption that conserved heat for long time and both the hot and relatively dry pyroclasts were densely welded, compacted, and fused together during aggradational deposition. The rheomorphic viscous flowage (producing viscous folds and deformed fiamme) is locally well developed.

The important petrographic characteristics include: (1) devitrification of metastable glass around vitroclasts and that in fiamme; (2) compactional-welding fabrice; (3) well physical properties; (4) resistance to abrasive wear; (5) toughness, and (6) selective weathering. It should be noted that devitrified ignimbrite is very strong (132–138 MPa, max. 182 MPa), durable in tropical climate and resistant to the polishing action of traffic as fine aggregate.

A key feature of the slightly altered specimens is the presence of magnetite-smectite pseudomorphs after dispersed amphibole crystalloclasts and newly-formed albite II, chlorite and accessory epidote by vapour-induced crystallization. In other words, a low percentage of the soft minerals have no importance in the production of fine aggregates for a particular purpose, since these cannot destroy the intergranular bonding. All rheoignimbrites from the target area showed best performance in terms of mechanical strenght, polishing resistance, index of abrasiveness, and water absorption.

Subproject: **Rheoignimbrite of the Sommerfield Group, Central Jamaica** (*Novák J.K.*, *Bosák P.* & *Korbelová Z.*)

A petrographical evaluation dealt with the Late Paleocene rheoignimbrite and co-ignimbrite lag breccia, which occur within the Waterworks Formation (the Sommerfield Group, Central Jamaica; Fig. 45). Both the vitric-enriched and devitrified (rheo)ignimbrite types are andesitic to dacitic in bulk composition (62.3–63.3 wt.% SiO_2), ash-sized, hornblend-bearing, and



■ **Fig. 45.** Textural features of Late Paleocene rheoignimbrite and rhyodacitic pumice (Waterworks Formation Sommerfield Group, Central Jamaica) in thin-section photographs. SF 106: crystal-rich andesite-like vitroclasts, dark brown scoriae (“fiamme”), and plagioclasite-like fragment in the vitric-rich rheoigimbrite; plane-polarized light; SF 127: the texture of dacitic vitroclastic tuff; plane-polarized light (photos by J.K. Novák).

poor in flattened scoriaceous fragments. They were created by agglutination of hot, plastic spatter from an eruption column collapse, aggradational deposition at the high *T*, and post-depositional secondary flowage. Nevertheless, we consider that they exhibit vertical and lateral variations in both texture and degree of rheomorphism and results of the geological site inspection may be essential. The basal lag breccia, previously incorrectly designed as fluvial conglomerate, comprises the clast-supported rhyodacitic pumices and vitroclastic matrix (67.30–68.60 wt.% SiO_2).

The attention should be drawn to the devitrified and recrystallized rheoignimbrite, devitrified welded ignimbrite, and devitrified fused breccia which could be classified as mechanically strong, resistant to abrasive wear, and relatively durable ones in tropical climate. However, a low amount of the scoriaceous fragments and/or flattened scoriae may be prone to the localized weathering. Crushed rock aggregate from this material may safisfy the rigorous requirements of the norms and may become more or less attractive for exploration. As an exception, the laminated rheoignimbrite reflects both the local schistosity and angularity of crushed stone.

By constrast, the vitric-enriched welded ignimbrite is, under certain conditions, susceptible to weathering and locally tends to weather flaky. Because of a significant proportion of the pristine glass and of potential alkali-aggregate reactivity in hydrated concrete, it is unacceptable as aggregate source.

Subproject: **High-grade limestones from the Santa Cruz Mts., southwestern Jamaica. Use of limestone as fillers, whitings, and the PCC** (*Novák J.K.*, *Bosák P.* & *Pavková J.*)

The suitability of Tertiary calcirudite and calcarenite from the Santa Cruz Mts. for a wide range of applications, such as carbonate fillers, whitings, and precipitated calcium carbonate is discussed in this report. The carbonate grit also satisfies requirements for lime burning and both quicklime and/or slaked lime involve a wide spectrum of uses.

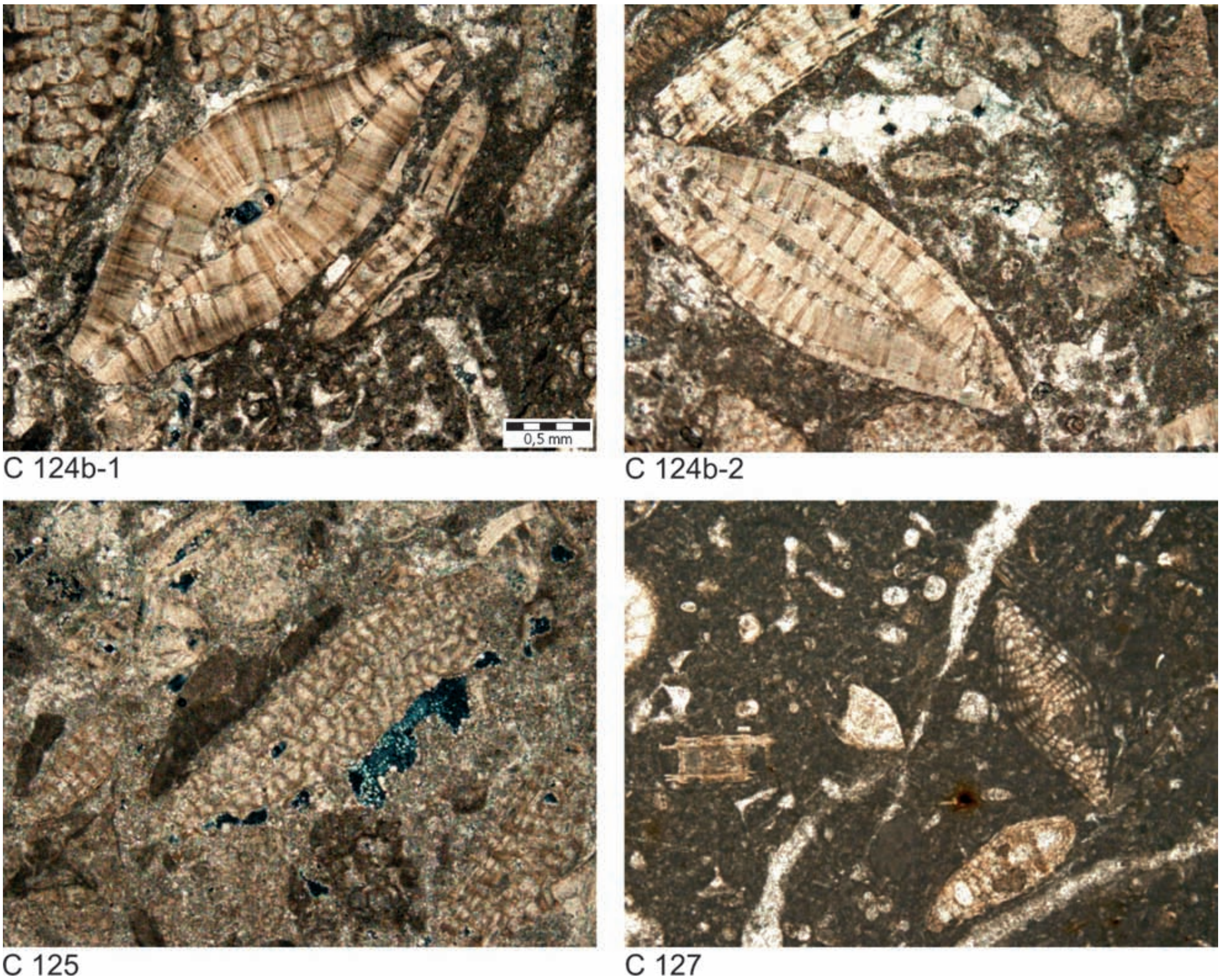
Rhodolithic calcirudite has a number of unusual characteristics: (1) in hand specimen it is yellowish white in colour, finely porous, locally chalky rock, (2) its compaction, low-degree of resistance to abrasion, and grindability are dependent on both the constructive diagenesis and pressure-solution processes, and (3) the pulverized samples show a very low concentration of colouring oxides (Fe_2O_3, TiO_2, and MnO). Examined samples are considered to be high-calcium in bulk chemical composition (>98.5 wt. % of low-Mg $CaCO_3$), if the surface contamination (dirty grey-coloured encrustation, aeolian dust, and occasional goethite disseminations) will be removed with water on a sieve screen and/or by wet electromagnetic separation of goethite in a suspension. A degree of the whiteness and brightness is relatively high and varies in the range from 82.2 to 87.8 and from 87.0 to 91.2, respectively. Compositional homogeneity is likely satisfied by the use of the larger pure blocks of calcirudite and/or the deeper (unkarstified) parts of geological section. The duration of exposure to meteoric water systems becomes critical to the devepment of undesirable colouring agents, predominantly within the packstone pebbles, and to surfacial adhering components (encrustations). Post-depositional burial diagenesis and compaction in these bioclastic carbonates involve marine constructive features (cementation of porous carbonate debris with microsparite, diagenetic alteration of micrite to microsparite, and stylolitization). They have a great influence on both the reduction of porosity and permeability, geomechanical properties, abrasion resistance, and grindability of the rudstone, although whole-rock chemical composition remains relatively stable.

Subproject: **High-grade limestones at Grange Hill, western Jamaica** (*Novák J.K.*, *Bosák P.* & *Pavková J.*)

Purpose-aimed petrography, whole-rock chemical composition, normative mineralogy, and some of the physical tests were accomplished on Middle Campanian calcarenites from the Grange Hill in order to determine their potential suitability for the production of fillers and pigments. Thin-section observations and the presence of pseudoorbitoidal foraminifers in samples clearly indicate that high-purity calcarenite horizon in a lower package of the Jerusalem Mountains Inlier is probably comparable with that in type section of the Green Island Inlier. A few comments are made concerning (1) the typically chalk-like (soft) calcarenite – essential raw material of the deposit at Grange Hill, and (2) diagenetically altered (harder) calcarenite (affected by chemical compaction). The limited data available suggest that chalk-like calcarenite becomes irregularly strong, due to development of stylolite and dissolution swarms as well as loss of porosity (cementation). From a geotechnical perspective, these properties and water permeability vary laterally and vertically and this heterogeneity has a consequence for rock excavatability, hydraulic conductivity, and slope stability. On the other hand, the high-calcium composition (98.5–99.2 molar % of low-Mg calcite) remained preserved for both the chalk-like calcarenite and diagenetically altered (recrystallized) ones, while the dolomite admixture is totally absent. A degree of both the whiteness and brightness is sufficiently high (in the range of 84.3–91.6 %; R457 and 91.0–93.9 %; RY, respectively). The difference found between chalky calcarenite and recrystallized ones most likely consist in physical properties (abrasion resistance; grindability); none of these calcarenites was deformed. In western Jamaica, the lime production can be exceeded by the use of chalky calcarenite for the high added-value products, such as natural chalky whitings, fillers for PVC resins, plastics, rubber, paper, paints and coatings. As a filter medium, these porous and pure calcarenites may neutralize acid water and improve drinking waters. The recrystallized high-calcium calcarenite may be fit with the production of the White Portland Cement, if the supplementary cementing materials are available.

Subproject: **Tertiary bioclastic limestones from the Cave Mountain, Westmoreland** (*Novák J.K.*, *Bosák P.* & *Pavková J.*)

The principal limestone microfacies from the Cave Mountain are represented by: (1) late Eocene rudstone and/or calcarenite with pebble-/sand-sized clasts of skeletal-foraminiferal packstone (Gibraltar Fm.; Fig. 46); (2) oncoidal packstone-wackstone (Brown´s Town Fm.), and (3) recrystallized ones with some stylolites. Using a combination of the purpose-aimed petrography, whole-rock XRF data, and physical testing, the following conclusions can be drawn: (1) The majority of bioclastic limestone samples show a high grade and low-Mg chemical composition (>97.5 % $CaCO_3$ and <1 % $MgCO_3$) and are most-



■ **Fig. 46.** Thin-section photomicrographs of the late Eocene bioclastic limestones (Cave Mountains, Westmoreland, Jamaica). Plane-parallel light. Sample C124b-1: abraded clast consisting of the foraminiferal-oncoidal packstone. Vertical section of lepidocyclinid larger foraminifera and oncoids with foraminiferal nuclei (light brown); Sample C124a-2: Lepidocyclinid larger foraminifera tests and bryozoan skeletons in the same sample; Sample G 125: bryooncoidal packstone showing medium-sorted bryo-oncoids with dark micritic borders and irregular distribution of the low-columnar cryptocrystalline stylolites (dark-brown); Sample C 127: foraminiferal-oncoidal wackstone with the megalospherical foraminifera in oncoid interior (photos by J.K. Novák).

ly yellowish white in colour instead of milky white coloured and friable ones. The abrasion resistance of these limestones is somewhat higher than that in competive chalk. These facts represent a limiting factors for the use as the ultra-fine carbonate fillers/extenders and white cement clinker, but these limestones are still acceptable for most applications (e. g., lime and ordinary Portland cement burning); (2) for the average practitioner in building industry, both the artificial limestone aggregate and sand, if correctly processed, may be useful in the production of medium strenght concrete, as sand for mortars and inexpensive filler for Portland limestone cement and asphalt concrete. These have to be, of course, hard, durable, and clean; they have the own standards (for grading, particle shape, water absorption, contamination with clayey fines, mechanical properties, alkali reactivity, frost susceptibility, and impurities); (3) the siliceous oncolitic packstone (e.g., C-130) is undesirable as coarse aggregate in concrete, because it may generate the demaging alkali-aggregate reactivity in the hardened concrete. Due to thermoreactivity and increasing opaline silica content (5.12 wt. % SiO_2), this limestone type may be advantageous in cement-making mixtures and, under a certain condition, in white cement production. It may be used as pozzolanic cement additive, and (4) in summary, the variations in CaO and MgO of low-Mg limestones (shown in two plots) are relatively constant, the range of CaO being from 54.8 wt. % to 55.4 wt. % (corresponding to 97.8–98.8 % $CaCO_3$). The relative constancy and low level of $MgCO_3$ content in limestone (in the range from 0.48 to 0.85 wt. %) is a minimum requirement either for the majority of uses directly (as traditional cement- and lime-making materials) or for other useful products, if the limestone is converted into slaked lime.

Subproject: **Tertiary bioclastic limestones at Negril Hill, Westmoreland** (*Novák J.K.*, *Bosák P.* & *Pavková J.*)

The information on petrographical and chemical composition given represents a summary of the integrated microscopical, chemical, and physical results of individual bioclastic limestone samples. A most significant feature of these limestones is the repetition of similar lithology, hence a mixture of both the extraclast-foraminiferal packstone and the oncoid-bearing wackstone in each sample, throughtout the Negril – Savanna-la-Mar Belt. By convention, we can evaluate the linkages between the periplatform basin allostratigraphy, grainsize distribution within gravity-controlled flows, and burial diagenesis. Of major interest is the development of burial stylolites or meteoric-vadose dissolution, because a little difficulty will be presented during limestone grinding. Some of samples require an approach taking into account the pecularities of these materials, particularly chalk-like coatings, which are soft, moist, and easy dispersed in water. To achieve the cleanliness of undersized lumps, the surface iron contamination may be reduced significantly with washing. The high-calcium carbonate content (over 97.5 wt.% $CaCO_3$) is evident and the $MgCO_3$-value ranges only from 0.53 wt. % to 0.90 wt. %, without siliciclastic input. The biogenic silica content reaches up to 1.02 wt.% and the Fe_2O_3 content is generally less than 0.13 wt.%. A plot also shows no characteristic difference between the high-$CaCO_3$ content in each limestone sample from the area of (1) Negril Hill and (2) Cave Mountain, even although the former is attributed to the Montpellier Formation (middle Miocene) and the latter to the Gibraltar Formation (late Eocene), the range in $MgCO_3$-values being similar (0.5–0.9 wt.%).

These bioclastic carbonates, generally white to yellowish white in colour, may be suitable for the uses that have rigid specifications on magnesium carbonate content of the raw material, and even specify high-purity $CaCO_3$ for producing hydrated lime and white cement clinker; sand-lime bricks; carbonate fillers and white pigments (after treatment), etc. A discontinuous intercalation of the volcanic clayey siltstone is not thick and the requirements for alumina, silica, and ferrite cannot be, therefore, satisfied for manufacturing of the ordinary Portland cement by adding to high-calcium limestone powder.

Project of the Ministry of the Environment of the Czech Republic (Code SP/2E6/97/0): **The UNESCO European Geopark Bohemian Paradise – development of a geoscientific information system for region's development and geological heritage protection** (L. Švábenická, Czech Geological Survey, Praha;T. Řídkošil, Museum of the Bohemian Paradise, Turnov; *M. Svobodová* & *J. Zajíc*)

S*ubproject*: **Palynology of selected samples from the borehole Střeleč (V-800)** (*M. Svobodová*; 2008–2010)

The Střeleč borehole (V-800) was drilled in the area of sand-dominated delta sequences of the UNESCO Geopark "Bohemian Paradise" across the Coniacian/Turonian boundary and reached the lithostratigraphic boundary of the Teplice and Jizera Formations (Čech 2009).

A relatively well-preserved and diversified palynomorph assemblage was ascertained in grey claystones. Marine elements prevailed in all 23 studied samples. The preservation of both the dinocysts and pollen grains in the upper part (flyschoid facies) of the borehole (Coniacian age) was better than the preservation of palynomorphs from the lower part (pelagic facies) of the borehole (Turonian age). The state of palynomorph preservation in pelagic facies was influenced by the presence of pyrite and amorphous matter. Biostratigraphically important angiosperm pollen of the Normapolles group were more abundant in the Coniacian sediments. *Emscheripollis* sp., *Plicapollis* sp., *Trudopollis* sp., and *Minorpollis* were most common. Dinoflagellate cyst composition and diversity document the deepening in the lower part of the borehole. Dinoflagellate cysts of Late Turonian age were comparable to those found in hemipelagic sediments of the Úpohlavy quarry.

ČECH S. (2009): Preliminary results of the borehole V 800 Střeleč (Bohemian Paradise Geopark, Bohemia). – *Acta Musei Turnoviensis*, 4: 39–44.

Subproject: **Permo-Carboniferous Zoopaleontology** (*J. Zajíc*; 2009–2010)

Chapter Zoopaleontology of the Carboniferous was compiled for the explanatory text to the Geological map No. 03-431 Lomnice nad Popelkou (1: 25,000). Fifteen outcrops and one borehole (SM-1 Smita) contain animal fossils. All fossil fauna is known from the Ploužnice "Horizon" of the Middle Semily Formation which is of Stephanian C (Upper Gzhelian) age. Animal remains are typical of the *Sphaerolepis* bio/ecosubzone (younger part of the *Sphaerolepis–Elonichthys* bio/ecozone). Upper Carboniferous fauna is known only from the southern area of the Ploužnice Lake. This part corresponds to a lake with comparatively frequent oscillation of water level. We can therefore recognize environments of the deeper lake and the shallower lake near the shore but also a terrestrial environment.

Poor and fragmentary fauna was described and evaluated from the SM-1 Smita borehole. All animal remains were found in the Ploužnice "Horizon" of the Middle Semily Formation. Seven samples were collected in tree beds. One shark tooth (Xenacanthiformes indet.) and remains of actinopterygian fishes (*Sphaerolepis kounoviensis*, ?*Elonichthys* sp. and Actinopterygii indet.) were acquired.

Chapter Zoopaleontology of the Permian was compiled for the explanatory text to the Geological map No. 03-342 Rovensko pod Troskami (1: 25,000). Seven outcrops and one borehole (Bv-2 Bítouchov) were mentioned. All as yet known animal remains come from the Kalná "Horizon" (locally named as the Veselá "Horizon") of the Upper Prosečné Formation which is of Rotliegendes (Sakmarian) age. Lower Permian fauna is typical for the local bio/ecozone *Xenacanthus decheni*. The Veselá "Horizon" is developed only in the small western part of the Krkonoše Piedmont Basin which is separated from the rest of the basin by the volcanic Kozákov Ridge. The Veselá "Horizon" is correlated with the Kalná "Horizon" of the Upper Prosečné Formation. The Veselá Lake was probably shallower and smaller than the Kalná one (if they are isochronous).

4f. Industrial Grants and Projects

Czech Geological Survey, Praha, Project No. 7117: **Biogeochemical monitoring at the Lesní potok catchment (Kostelec nad Černými lesy area)** (*I. Dobešová* & *P. Skřivan*)

Monthly sampling of bulk precipitation, beech- and spruce throughfall, and surface water continued at the Lesni potok catchment in the Voděradské bučiny National Nature Reserve within the contract with the Czech Geological Survey, Praha. Measurements of the sample pH and conductivity in all types of collected samples, determination of instant surface water discharge and sample volume determination proceeded throughout the hydrological year 2010 as well. The contractor was provided with all obtained field- and laboratory data concerning the monitored samples. Measurements of precipitation pH and evaluation of H^+ inputs into the ecosystem have shown considerable increase (the highest since 1997) which is attributed to the enhanced input of anthropogenic acidifiers (mostly from local coal burning facilities) throughout the tough winter 2009/2010 and to more intensive wash-out of atmosphere resulting from higher precipitation. New, more effective throughfall collectors were also installed at the sampling localities throughout the year 2010.

CEZ Group – Nuclear Power Plant Temelín. Project No. 7140: **Supervision of the seismic monitoring by local seismic network** (*V. Rudajev*)

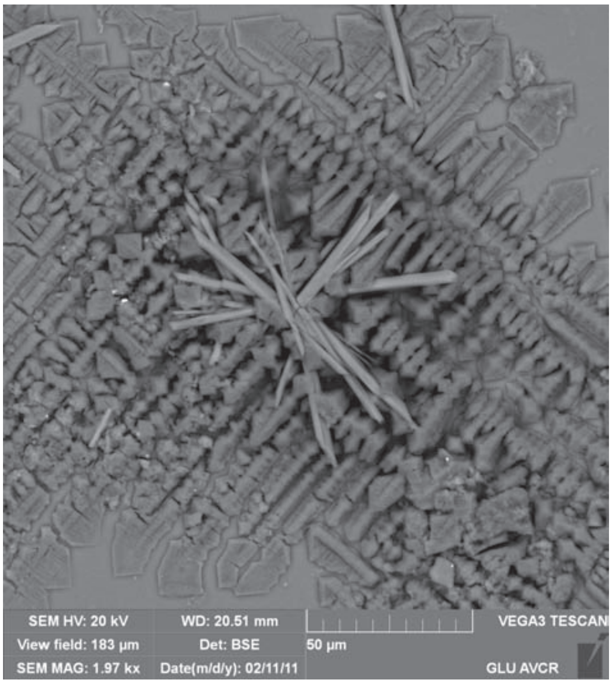
Evaluation of the local seismic network monitoring of the Temelín NPP, processing of records of local and regional seismic events. Elaboration of expertise of report: "Complex evaluation of seismotectonic, gravimetric and geological data recorded in years 2007, 2008 and 2009" produced by the Institute of Physics of the Earth, Faculty of Science, Masaryk University of Brno, Czech Republic.

Bohemian Switzerland National Park Administration, Project No. 7214: **Monitoring of the atmosperic deposition in the Bohemian Switzerland National Park.** (*T. Navrátil*, *I. Dobešová*, *J. Rohovec* & *S. Hubičková*)

The protected area of the "Bohemian Switzerland National Park" (BSNP) with its characteristic sandstone landscape was influenced by long-term air pollution and acidic deposition within the area known as Black Triangle. The Upper Cretaceous sandstone is subhorizontally stratified, fine- to coarse-grained, quartz-dominated, with low content of clay minerals. One of the significant negative effects of the intensive acidic deposition on sandstone outcrops was identified as chemical (salt) weathering, i.e., a process when the porous sandstone rock is, besides chemical influence, also attacked by the force of crystallization of growing salts crystals.

Primary data gathered within this project (May 2008 – December 2010) cover the period of 31 months. Thirty samples from each site were sampled, processed and analysed. The final database on deposition and mass fluxes contains 3,120 items related to the area of the BSNP.

Anions NO_3^- together with SO_4^{2-} and cation NH_4^+ were the most abundant solutes in bulk precipitation samples. Deposition of SO_4^{2-} through bulk precipitation ranged from 12.6 to 16.7 kg.ha^{-1} at the monitored stations in the area of the BSNP. In the forested parts of the BSNP the deposition of SO_4^{2-} was more than doubled, at 44.7 kg.ha^{-1}. The deposition of nitrogen compounds NO_3^- a NH_4^+ through bulk precipitation ranged from 16.0 to 20.7 kg.ha^{-1} and from 4.3 do 7.0 kg.ha^{-1}, respectively.



■ **Fig. 47.** Image of precipitate from percolate solution. The hedgehog-like body in the centre is an aggregate of gypsum crystals ($CaSO_4 \cdot 2H_2O$) and the flat crystals around are K-alum ($KAl(SO_4)_2$ $12H_2O$) (photo by A. Langrová).

Infiltration of bulk precipitation solutes into the sandstone mediates the weathering processes. Natural outflow of sandstone pore water (sandstone percolates) can be sampled only during certain days of year when the sandstone becomes saturated with water and percolates drip out on small number of sites from roofs of overhangs. Under usual conditions percolation water evaporates at the sandstone surface producing salt efflorescences; a typical example is the Pravčická brána Arch. The average pH of the dripping sandstone percolates was 3.76. Concentration of SO_4^{2-} and Al in sandstone percolates reached up to 46 and 10 mg.l^{-1}. The concentration of Al in percolates was 160-fold higher than in the precipitation samples suggesting the sandstone as a source. The water O and H isotopic composition of the percolates was virtually identical to the precipitation samples, thus indicating a relatively short residence time of the solutions within the sandstone pore-spaces. Evaporation experiments with bulk precipitation and percolate samples proved a possible origin of some Ca in bulk precipitation and the sandstone rock as the source of Al and possibly of K for the salt efflorescence identified at the Pravčická brána Arch body.

Velkolom Čertovy schody, Inc., Project No. 7301: **Documentation of progress of quarry walls – reclamation of the Quarry–West** (*P. Bosák*)

The reclamation exploitation of the Koněprusy Limestone (Pragian, Lower Devonian) was limited to two benches in the quarry in 2010. Continuation of cavities of the thermomineral paleokarst with calcite crystals along calcite veins discovered in 2009 was documented in the 3D view.

Prospecto Ltd., Praha, Project No. 7309: **Mineral magnetic study of loess/paleosol sequences exposed in the Blanka Tunnel** (*J. Kadlec* & *S. Šlechta*; 2009–2010)

The middle and basal segments of the loess/paleosol sequence deposited above the Middle Pleistocene Vltava River terrace was exposed in the Blanka Road Tunnel in Praha. The thickness of the loess intercalated by fossil soil horizon reaches up to 8 m. The studied section is underlain by fluvial sediments of a local stream. Oriented samples with a 5cm vertical distance were collected for mineral magnetic measurements. Low-field MS, frequency-dependent MS, low-field AMS and isotermal remanent magnetization aquisition (IRM) were conducted with the aim to reconstruct sedimentary and post-sedimentary processes. The MS values up to 1,200 10^{-6} (SI) and the frequency-dependent MS variations showed magnetic enhancement due to pedogenic processes. Besides magnetic parameters (concentration and type of magnetic minerals, magnetic grain size), the MS variations are also influenced by a pedogenic carbonate and calcareous sandstone clasts of variable concentration. The information about the mineral fabric was obtained by the AMS measurements. Magnetic lineation in the direction NE to SW and the k_3 ax of the AMS ellipsoid tilting toward SW indicate a dominating slope movement of the dust deposits by rain wash after deposition.

Doly Bílina a.s., Project No. 7347: **Evaluation of expected effect of Bílina mine on the concentration of fly dust in its vicinity** (Project Leader: Zbyněk Sokol, Institute of Atmospheric Physics of the ASCR, v. v. i., Praha, Czech Republic; *T. Navrátil*, *L. Koptíková*, *J. Rohovec*, *J. Hladil* & *S. Hubičková*)

The geochemical – geophysical monitoring of the atmospheric dust was performed at the Ledvice monitoring station. The calculated mean dustiness values for the individual moths of year indicate relatively lower levels during the hot period of year, while cold period of year was typical with greater levels. Periods of increased dustiness are usually typical with low values of magnetic susceptibility of the dust samples. Therefore contrary to the dustiness, the dust samples acquired during hot months of a year revealed elevated magnetic susceptibility (Fig. 48). The magnetic susceptibility of the weekly sampled dusts at the Ledvice station ranged from 986 do 5,211 10^{-9} $m^3 kg^{-1}$, while the average from 67 samples (monitoring lasts over 67 weeks) was 2,605 10^{-9} $m^3 kg^{-1}$.

The correlation of dustiness and susceptibility values was tested against the meteorological conditions. The preliminary results indicate that the weekly mean levels of dustiness correlated with weekly means of air humidity at some sites and with weekly means of vertical temperature gradient at other sites. This suggests that there could be a difference between the processes of dust generation between these sites.

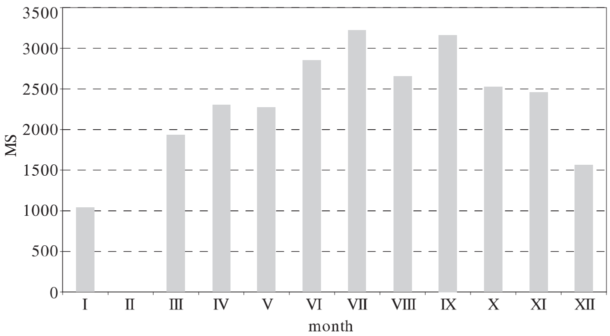


Fig. 48. Mean monthly values of magnetic susceptibility (10^{-9} $m^3 kg^{-1}$) at the monitoring station of Ledvice (original).

Institute of Archaeology of the ASCR, v. v. i., Praha, Project No. 7348: **Geoarchaeological report on ZAV road construction works II/242 in Roztoky, I.** (*L. Lisá*)

The aim of the report is the general characterization of geological background and geomorphology of this Early Slavic settlement. The project is sponsored by the Czech Science Foundation.

Institute of Archaeology of the ASCR, Praha, v. v. i., Project No. 7348002: **Geoarchaeological report on ZAV road construction works II/242 in Roztoky, II.** (*L. Lisá*)

The main aim of this report is the basic geoarchaeological documentation which was done during the rescue excavations of Early Slavic settlement near Roztoky near Prague. The report includes the review of objects infillings with the first results of geoarchaeological analyses.

Institute of Archaeology, Faculty of Philosophy, University of Hradec Králové, Hradec Králové, Project No. 7355: **The types of archaeological objects infilling, Hulín** (*L. Lisá*)

The principal aim of this geoarchaeological project was to evaluate the type of infilling within two archaeological objects from the locality of Hulín near Kroměříž. These archaeological objects are the "Brickyard" and the storage pit. The method of micromorphology was the main methodological approach used. Different macroscopically divided layers were sampled and described from the point of micromorphological view. The studied objects are generally composed of two types of material. First, by loess which also forms the background of the localities, and secondly, by the redeposited A and B horizons developed on loess. The bases of the objects are composed of inhomogeneous material and lenses rich of humus. Three hypotheses of infilling were suggested and the third one was chosen as the most probable one. Anthropogenically evoked erosion infilling the very bottom of the object was followed by the stage of surface and slope stabilization. The object was finally infilled again anthropogenically, but probably much later because of agricultural purposes.

Institute of Archaeology, Faculty of Philosophy, University of Hradec Králové, Hradec Králové, Project No. 7355002: **The types of archaeological objects infilling, Obědovice** (*L. Lisá*)

The aim of the geoarchaeological research was to evaluate the composition of infillings preserved within the Neolithic object at Obědovice village (near Hradec Králové). The object 8.5 × 19.55 m in area was surrounded by pits. The idea was to evaluate the anthropogenic contamination of sediments within the pits and in the close surroundings of the pits and decide what material was the house constructed from. The most probable technique of house construction was to dig a 50 cm deep canal around the planned house and the construction of piles min. 40 cm below the base of the canal. The infilling of the pits developed during one event when the house was abandoned and destructed. The big posthole was used as a deposit for ash coming from the house destruction.

Institute of Archaeology, Faculty of Philosophy, University of Hradec Králové, Hradec Králové, Project No. 7355003: **The way of archaeological objects infillings, Tuněchody** (L. Lisá)

The aim of the project was the study of a Laten sunken house from the Tuněchody locality near city of Hradec Králové. Based on sedimentological description, the infilling of the Tuněchody sunken house was divided into a number of horizons. This object is sunken into loess deposits. The bottom of the object is composed of a communication horizon ca. 10 cm thick. The horizon rich in organic waste is intercalated with thin layers rich in carbonates. These horizons were interpreted as floors maintained by adding of sanitary carbonate-rich material. This carbonate comes from the Cretaceous deposits exposed hundreds of meters away, which was confirmed by the presence of Cretaceous fossils *Globulina*. Two horizons above the communication horizon, marked as B and C, represent the infilling of the sunken house after the house was abandoned. Horizon B originated most probably naturally, while horizon C originated anthropogenically. The composition of horizon C includes organic waste as well as ash material, so the depression was most probably used as a waste pit. Rainwater migrating within the porous infilling and bringing once alkaline and once acid solutions accelerated the pedological processes within the studied infilling.

Czech Geolgical Survey, Praha, Project No. 7356: **Ichnolgic documentation, interpretation of trace fossils and ichnofabrics of the Carboniferous sediments in the SM-1 Smita Borehole** (*R. Mikuláš*)

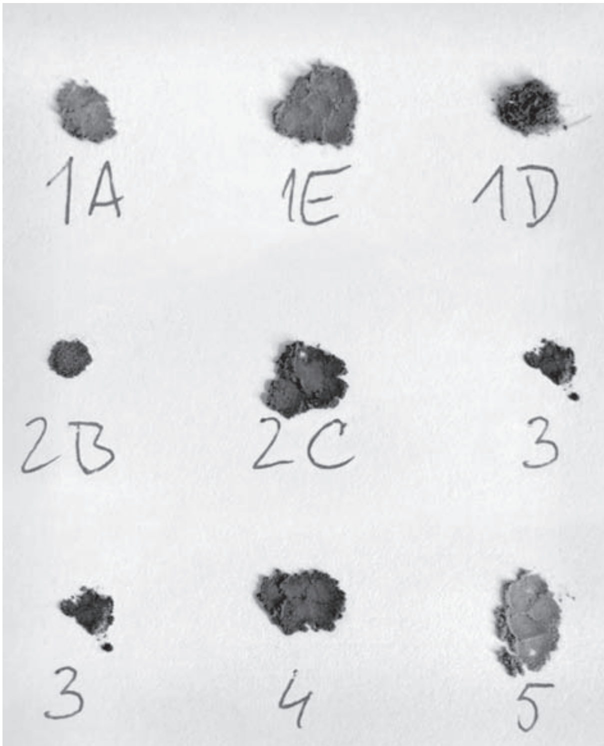
Based of the ichnological analysis of the drill core, six phases of sedimentary development were recognized in the SM-1 Borehole (Carboniferous, Krkonoše Piedmont Basin; NE Bohemia, Czech Republic). 1, braided river; 2, floodplain at the lake; 3, shallow lake; 4, lacustrine delta; 5, floodplain; 6, shallow episodic lake.

UNISTAV a. s., Project No. 7360: **Dust composition analysis** (*T. Navrátil*, *J. Rohovec*, *J. Hladil* & *L. Koptíková*)

The aim of this project was to identify the origin of different dust components sampled within the Library of the National Technical Museum, Prague. The dust samples in the area of the library were characterized by 4 independent methods: determination of dust colour, X-ray analysis, dust chemical analysis and morphological analysis using the scanning electron microscope.

The methods used indicate two different groups of samples, which were characterized by different physico-chemical properties. Samples from the close vicinity of the elevator doors (Fig. 49; samples 1A and 1E) were significantly contaminated by particles originating from the construction area in the floor above the library. Samples from the library were compared to dust sampled directly in the area of construction (Fig. 49, sample 5). The typical properties of the dust originating from the construction area was the light colour, low content of the amorphous phase, elevated concentrations of Ca and Si and finally the occurrence of the spherical objects identified on the microscopic images.

On the other hand, the samples uncontaminated with the dust from the upper floor (Fig. 49, samples 2B, 2C, 3 and 4) were dark in colour, showed elevated amounts of amorphous phases, elevated amounts of Al and Fe, and the occurrence of fabric and biological objects.



■ **Fig. 49.** Image of variability in dust samples colour (photo by T. Navrátil)

Institute of Archaeology of the ASCR, Praha, v. v. i., Project No. 7364: **The study of sunken houses from the Great Mi-**

gration Period (*L. Lisá* & P. Mudra, Institute of Archaeology, Faculty of Philosophy, West Bohemian University in Pilsen, Czech Republic)

The aim of the project was to evaluate the infilling of two sunken houses found at Kobylisy (northern part of the capital of Prague) and dated to the Great Migration Period. Such finds are quite rare so the geoarchaeological approach was applied to find the differences between the houses. Usually the infillings are interpreted in terms of subsistence strategies followed by erosion processes. The basic geological description of sunken houses infillings, including grain size evaluation and magnetic susceptibility measurement, was followed by a detailed geochemical and micromorphological study. As a result, the houses were described as objects with different purposes of use, maintenance and different way of infilling. One of the objects with maintained floor was used for living while the second one was probably used as a place for the production, and its floor was not maintained but covered by organic waste coming from the house surroundings.

Institute of Archaeology, Faculty of Philosophy, Masaryk University, Brno, Project No. 7365: **Mineralogical-petrographical and technical research of Medieval tiles from the localities of Jihlava and Rokštejn** (*L. Lisá* & M. Martini, Institute of Archaeology, Faculty of Philosophy, Masaryk University, Brno, Czech Republic)

The aim of the study was to find, using microscopic description, the differences between Medieval tiles coming from the localities of Jihlava and Rokštejn. Further interpretations of the techniques used for the tiles processing were interpreted. The composition of the studied tiles is different because of the different techniques (heating temperature) and different starting material. Generally, the tiles from the Jihlava locality were made from loess deposits, and fluvial sand was added. In contrast, material for the tiles from Rokštejn was coming straight from alluvial deposits. The internal structure of tiles from Jihlava is horizontal, which is interpreted as a result of the form used during the production, while tiles from Rokštejn have a chaotic internal structure. Tiles from Jihlava were heated to 800–900 °C, while the tiles from Rokštejn were heated only to 700–800 °C. As a result, the tiles from Jihlava are of higher quality than those from Rokštejn.

GEOTREND Ltd., Slaný, Project No. 7368: **Petrography of samples from the drainage works at Švermov** (*J.K. Novák*, *P. Bosák* & *R. Živor*)

In all areas of rock engineering, the measurement of rock properties is essential in determining the behaviour of the rock mass and purpose-aimed petrography is useful for explicating of unusual geomechanical characteristics. In this report it is shown how textural characteristics of the Lower Turonian marly siltstone affect mechanical performance. Why the strength of marly siltstone and/or siliceous marlstone (so-called "opuka" in the Czech language) is preserved on obvious levels (40–45 MPa) or are strong (up to the range of 88–108 MPa), is a question of the burial diagenesis. Development of diagenetic pressure dissolution in carbonate and marly sediments and that of reprecipitation of calcite and/or silica as stylolite surfaces is a very important phenomenon affecting the bulk rock porosity, final strength, mechanical compaction, economic cuttability/drillability, and permeability of the stone. Several types of stylolite surfaces have been recognized in studied samples from the drainage works at Švermov: (1) macrostylolite columns as anticrack infills; (2) massive residue seams forming stylolamination, and (3) flaser microstylolites with stylocumulates. The seam material is generally fine-grained and dark, due to pigmentation by organic matter. Stylolite zones also have a distinct morphology and are associated with both modified rock fabric and compaction bands. On the basis of preceding investigation, the quality assurance of this material meets the Czech standard No. 73 3050 as Class 6.

Arcadis Geotechnika a. s., Praha, Project No. 7370, 737002: **Dynamic moduli determination of sandstones** (*R. Živor*)

Dynamic moduli – Young's modulus of rock elasticity, modulus of shear deformation, and Poisson's ratio were determined by ultrasonic method on the samples of Cretaceous sandstones from tunneling of Prague Underground. Dynamic moduli were calculated from velocities of P- and S-waves which were found during ultrasonic wave propagation through rock specimens. The values of Young's modulus range from 1,000 to 5,600 MPa, the values of the modulus of shear deformation range from 350 to 2,100 MPa, and those of the Poisson's ratio from 0.28 to 0.43.

Faculty of Science, Charles University, Prague, Project No. 7373: **Strength properties of sandstones** (*R. Živor*)

Mechanical properties - simple compressive strength and cross-tensile strength (by Brazilian test) were determined on sandstone samples from various localities of the Bohemian Massif. The results are used for consequential research of the Faculty of Science.

Moravian Museum in Brno, Project No. 7382: **Pellets from the Blučina locality** (*L. Lisá*)

The purpose of this report is the interpretation of enigmatic pellets from the locality of Blučina near Brno. The description of the pellet composition explains the possible interpretations of their genesis and the importance for the locality. The main question was to decide if the pellets are relicts of bird pellets or animal excrements. The method of micromorphological study was used. Samples were impregnated and pedological thin sections were prepared and studied using a polarizing microscope. Carbonatized pellets included angular bone fragments and negatives of animal hairs. However, the pellets were interpreted as bird pellets, the interpretation is not final and additional analyses will be performed in year 2011.

4g. Programmes of Institutional Research Plan

Project No. 9100: **Complex insight on the development of the environment in period from Neogene until the youngest geological history with a special respect on present era (interactions and development of processes)** (Co-ordinator: *M. Filippi*, contributions: *P. Skřivan*, *P. Kubínová*, *M. Vach*, *J. Borovička* & *S. Šlechta*)

Specific directions of this project focus on geochemistry and mineralogy of selected elements (Ag, As, Au, Cd, Cu, Hg, Zn, and others) in various geological environments. This requires a complex research with using of various complementary techniques and approaches.

The long-term monitoring of the cycles of elements and ions continued in 2010 at the experimental catchment of Lesní potok. This year, the highest precipitation amount (813.1 mm) was measured throughout last 15 years (with the exception of the year 2002). Extensive precipitation and tough winter 2009/2010 contributed to the enhanced input of anthropogenic acidifiers, affected the pH of precipitation, and significantly heightened the input of H^+ ions into the environment in the studied area. Annual mean pH value in 2010 at the sampling locality was 4.49, which is the lowest since 2001. The input of H^+ ions through precipitation was 31.82 $mg.m^{-2}.yr^{-1}$, which is the highest since 1997. The enhanced precipitation amount as well as the acidification resulted in considerable increase in the output of cations from the catchment. The analysis of the character of input of strong acidifiers (ions SO_4^{2-}, Cl^- a F^-; data for NO_x are still not available) in bulk precipitation and throughfall reveals that the portion of gaseous forms of these substances decreases in the sequence $SO_4^{2-} > F^- > Cl^-$. It can therefore be supposed that with respect to still dominant role of SO_4^{2-} ions (possibly gaseous SO_2) in the input of anthropogenic acidifiers into the environment – the approximate input of H^+ ions (in both wet and dry deposition) in 2010 was significantly higher, probably up to 100 $mg.m^{-2}.yr^{-1}$. Recent results of monitoring the atmospheric inputs point out that efforts oriented on the reduction of (global) emissions of anthropogenic acidifiers should be at lest of same importance as the problematic international programmes concerning the reduction of emissions of greenhouse gases (**P. Skřivan**).

Repeated sampling and following treatment continued in 2010 within the study of the biogeodynamics of Ni and Co in the Lesní potok experimental catchment. The study of the element biogeodynamics was focused on the estimation of the element content in different types of the atmospheric deposition. It was confirmed that chemical compositions of both types of atmospheric deposition significantly differs, especially depending on the chemical character of the studied element and its role in woody-plant metabolism. Generally, the concentration of most of the studied elements was enriched in the samples of throughfall in comparison with its content in the samples of bulk deposition. An example of enriched content of the element in the samples of bulk deposition could be Fe, which is caused by its origin in terrigennic dust (**P. Kubínová**).

An important part of the project is focused on the inorganic pollutants in the wet deposition. Suitable sampling equipment, an automatic rain collector, was provided for sampling of wet-only precipitation episodes. The selected sampling site is located on the site Lounovice outside the urban areas and is shielded very well by forest stands from any effect of small local sources of air pollution. In order to identify the transport trajectories and possible common emission sources of the monitored elements, dependence was sought between the data on the chemical composition of the sampled precipitation episodes and the corresponding meteorological data using the HYSPLIT model (**M. Vach**).

Interesting data were obtained within the study of macrofungi that are effective accumulators of Ag. This study provides a comprehensive review of this phenomenon supported by original data on the Ag concentrations of macrofungi from pristine localities and Ag-polluted area in vicinity of Příbram. In pristine areas, the median Ag concentrations of ectomycorrhizal and saprobic macrofungi were 0.79 and 2.94 $mg.kg^{-1}$, respectively. In a Ag-polluted area, the Ag concentrations in macrofungi were significantly elevated with the median value of 24.7 $mg.kg^{-1}$ and the highest concentrations in Amanita spp. of the section Vaginatae (304–692 $mg.kg^{-1}$, species close to A. vaginata). The intracellular speciation of Ag in fruit-bodies of the Ag-accumulator A. submembranacea (section Vaginatae) was inspected. Virtually all Ag was found to be intracellular and sequestered in the major 7 kDa and minor 3.3 kDa complexes. The lack of glutathione and phytochelatins and the presence of a single 3 kDa sulfhydryl-containing peptide in the isolated Ag-complexes suggest that detoxification of Ag in A. submembranacea may rely on metallothionein. Vertical distribution of Ag in a polluted forest soil profile has shown a substantial enrichment in organic horizons (**J. Borovička**).

Paleomagnetic study continued with extensive *in situ* measurements of the magnetic susceptibility of various Paleozoic limestones. More than 100 files were used for the determination of the basic statistical properties, using the average magnetic susceptibility and standard deviations of the data sets. The purpose is to create a parent case for the investigation whether this methodology can (or cannot) provide some well definable trends for knowledge about the environmental evaluation of the relevant limestone sequences (basin analysis) with various facies characteristics (**S. Šlechta**).

Project No. 9200: **Development of the Bohemian Massif before and after its consolidation – Interaction and evolution of processes** (Co-ordinator: *V. Cajz*, contributions: *J. Fiala*, *J. Filip*, *T. Hrstka*, *M. Chadima*, *L. Koptíková*, *O. Man*, *P. Schnabl*, *T. Svitek*, *D. Venhodová* & *R. Živor*)

The reconstruction of the lithosphere structure and development beneath the western Eger Rift showed the close relation between crustal architecture and paths of volcanic products, and position of mantle domains boundaries derived from 3-D analysis of seismic anisotropy (Babuška et al. 2010). Three different fabrics of the mantle lithosphere belong to the Saxothuringian, Teplá-Barrandian and Moldanubian crustal units (**J. Fiala**).

Aeolian origin of detrital zircons found in the Lower Devonian limestone beds in the Prague Synform (Požár 3 section) is discussed in Koptíková et al. (2010). Morphology and first geochemical data on the zircon populations is confronted with already published data on the occurence of miospore assemblages in the Prague Synform which has affinities rather to the Laurussia than to peri-Gondwanan area which is in contrast to the marine fauna of Gondwanan affinities. Aeolian source is thus proposed for the miospores. Data on detrital zircons is in agreement with this interpretation and might clear up environmental changes and atmospheric processes in the Lower Devonian (**L. Koptíková**).

Granites from Smrčiny Mts. (western Bohemia) were AFTA dated and subsequent time temperature evolutions were modelled. All samples from different localities reveal very similar and monotonous evolution. The rocks were slowly uplifted from total annealing zone between 75 and 85 Ma (Upper Cretaceous), and then stagnated for a long time at temperatures from 60 to 80 °C. Stagnation period was interrupted by quick uplift from 3 to 10 Ma (Pliocene, Upper Miocene).

The Blanský les granulite massif (Gföl unit) was AFTA dated and time-temperature evolution was modelled (Svojtka et al. 2010). The modelling shows a similar thermal history of all samples involving a period of total thermal annealing and slow steady cooling. The rocks were situated above 120 °C until about the Permian age (ca 300–250 Ma) and subsequent slow cooling was followed by the period of relatively quick Neogene exhumation to the present erosion surface (**J. Filip**).

Complex study of automated SEM-EDS systems like QEMSCAN was performed to evaluate their applications in loess-paleosol horizons analysis and high-resolution particle-size analysis. Results of this research including development of automated petrology and its application to paleoenvironmental interpretation has been published in collaboration with Australian University of Adelaide in a prestigious Quaternary Science Reviews (Haberlah et al. 2010b) and presented on international conference (Haberlah et al. 2010a) (**T. Hrstka**).

Magnetic mineralogy of the Precambriam sediments in the Teplá–Barrandian unit was investigated for the purpose of tectonic interpretation of magnetic anisotropy (Hajná et al. 2010). In addition to phyllosilicates, pyrrhotite and siderite was found as the carriers of magnetic fabric. Pyrrhotite and siderite-bearing samples cannot be interpreted together with phyllosilicate-bearing samples.

New MS Windows software controlling the MFK1-FA Kappabridge was developed in order to facilitate the measurement of magnetic susceptibility and magnetic anisotropy of volcanic rocks (Chadima et al. 2010b).

Frequency dependence of magnetic susceptibility of weakly magnetic Quaternary sediments was measured in a loess/paleosol complex (Chadima et al. 2010a) of the Red Hill, Brno and in the Blanka tunnel in Prague in order to study the amount of very fine-grained superparamagnetic grains. Elevated amount of superparamagnetic grains is supposed to reflect pedogenetic processes due to the changes in climatic conditions (**M. Chadima**).

Remagnetization causes problems during interpretation of magnetic susceptibility (MS) signal. Some of the Lower Paleozoic rocks are slightly remagnetized while rock bodies around fault and fracture zones are strongly remagnetized. The major newly formed minerals that increase the rock MS are hematite, superparamagnetic (SP) magnetite and goethite. The remagnetization corresponding to this change in rocks of Silurian and Devonian ages has a solid evidence base since being dated by the late Carboniferous to early Permian paleomagnetic directions. The contribution for this project is how to recognize MS depletion, which has not been studied yet. One of the newly introduced methods consists in the measuring of basaltic dykes which intruded into the limestone beds. Such situation at the site of the Jelínkův Mlýn quarry shows a strong MS depletion on the volcanic rock, so that there is also evident potential that also MS of surrounding limestones was changed. Our preliminary data show, e.g., that average MS depletion on one set of Silurian basaltic dykes is between 95 and 98 percent (Schnabl et al. 2010), while a second set is absolutely untouched with the late diagenetic episodes or by weathering. The paleomagnetic signal of the emplacement time is usually recorded in the contact aureole (**P. Schnabl** *&* **D. Venhodová**).

According to a common practice, the magnetostratigraphic studies include the measurement of magnetic susceptibility. Since the changes of geomagnetic field polarity are observed simultaneously all over the world, this data combination enables to detect global events or global cycles recorded in the magnetic susceptibility of the sediments. As to the latter, we can compare, along with the frequencies, also the phases of cycles detected in distant localities so that their coincidence by chance may be minimized. For example, several cycles of nearly the same frequencies and phases were detected in magnetostratigraphic sections of Jurassic/Cretaceous age, located in Brodno (NW Slovakia) and Puerto Escaño (S Spain) about 2,200 km apart. Moreover, the frequencies of some of these cycles coincide with the present day frequencies of the variations of the Earth orbit eccenricity. It is important from the methodological point of view that, due to the dating of samples by means of magnetostatigraphy, the cycle detection is carried out in the time domain instead of the space domain. On the other hand, the fact that the samples in the time domain are always unevenly spaced required the development of new techniques of processing that may be useful in other branches, e.g., in astronomy. Preparations are under way for publication of these results (**O. Man**).

A method of automated determination of accurate arrival time of acoustic waves was developed. The waves were recorded during rocks samples loading (Svitek et al. 2010). The ability to recognize other phases of registered signal provides a better characterization of the material in which the elastic waves are propagated as well as a better description of its properties. For the identification of subsequent phases, new recording devices were developed that enable sounding of samples by S-waves. A method of the determination of particular phases of elastic waves, which is related by methodical manner to the mentioned work, is being developed and tested. Results from ongoing experiments will be published in the next year (**T. Svitek**).

The research was aimed to rheological behaviour of granite under various time regimes of long-term uniaxial loading. The simple compressive strength during long-term loading (in range of days to weeks) was found about 25 to 30 % lower than the strength determined by a standard short-time test. During rheological experiments, the samples were subjected to a regime of gradual loading in one-day, three-day and seven-day periods. No major differences in rock sample strength were found among these time test regimes. The axial and transversal strain measurement showed a steep rise of transversal strain at the end of loading in many cases, which signalized oncoming sample rupture. Owing to a great time demandingness of rheological tests, sufficiently representative data files have not gained yet for publication of results. Physical properties of rock were investigated for research of anisotropy of elastic properties of clay limestones from the locality of Kostiviarska near Banská Bystrica. They served as a basis for dynamic elastic moduli determination (Vilhelm et al. 2010) (**R. Živor**).

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Project No. 9300: **Study of fossil ecosystems and their dependence on global climatic and paleogeographic changes (interaction and development of processes)** (Co-ordinator: *M. Svobodová*; contributions: *T. Přikryl*, *M. Svobodová*, *J. Žítt*, *J. Zajíc*, *Z. Roček* & *M. Siblík*)

Specific directions of this project focus on paleobiology and paleoecology of selected fossil groups in various stratigraphical positions.

Study of the Mesozoic brachiopod assemblages in the middle parts of the Totes Gebirge Mts. was focused on the Liassic. In the mentioned area 3 new Middle Liassic brachiopod localities were ascertained and the presupposed existence of 2 Liassic brachiopod levels in the region thus confirmed. The taxonomic revision of the most representative species was finished and showed that *Liospiriferina brevirostris* (Oppel), *Prionorhynchia polyptycha* (Oppel) and *Zeilleria mutabilis* (Oppel) are characteristic for the Lower Liassic (biosparitic Hierlatz Limestone), and *Viallithyris gozzanensis* (Parona) and *Bakonyithyris ovimontana* (Böse) for the Middle Liassic (mostly red micritic limestones). Spiriferinids are relatively very rare in the Middle Liassic (**M. Siblík**).

Anurans from the Early Cretaceous Jehol Biota of northeastern China markedly differ from other Mesozoic anurans, which substantiates recognition of these frogs as a new subfamily Callobatrachinae. In contrast, taxonomic variation within the Callobatrachinae is rather low, mostly restricted to features associated with locomotion and degree of ossification in fully grown adults. These differences supposedly reflect taxonomic variation at species level, rather than at generic level. On the basis of available characters, four species (one of them new) belonging to a single genus *Liaobatrachus* may be formally recognized within the Callobatrachinae. Besides Callobatrachinae, two other frogs, small in size and different from each other, indicate presence of another group of anurans in Jehol Biota (**Z. Roček**).

Databases of the Permo-Carboniferous limnic faunas of the Bohemian Massif and the World acanthodians were continuously supplemented and updated. A new database – the boreholes with Permo-Carboniferous limnic faunas of the Bohemian Massif – was established (**J. Zajíc**).

The fossil fish fauna at the Oligocene locality of Hermanowa (Poland) was studied. Preliminary results show the presence of a large spectrum of different types of elasmobranchs and teleosts; some of them were recognized at the locality for the first time. The fine-grained sediment uniquely preserved tiny morphologic structures and fragile parts of bodies (e.g., soft parts of tissues, subtle skeletal crests and others). Furthermore, the locality provided a relatively large collection of different ontogenetic stages of several taxa, which allow us to study morphological changes during ontogeny (**T. Přikryl**).

Palynological assemblages from 15 samples of the siltstones the eastern part of the Bohemian Cretaceous Basin (Železnice–Těšín profile) were studied. Marine microplankton, i.e. dinoflagellate cysts, chitinous foraminiferal linings, acritarchs, prevailed. The presence of pyrite in the siltstones and calcareous environment in limestones caused a poor preservation and lower diversity of dinocysts. Black amorphous matter is abundant, and scolecodonts were occasionally present in the siltstones.

The dinocyst assemblage consists mostly of "long-ranging" forms. Depositional environment reflects neritic conditions. Biostratigraphically important are Normapolles, angiosperm pollen are rare. *Complexiopollis* cf. *complicatus, Plicapollis* sp., *Pseudoplicapollis* sp., *Trudopollis* sp. occur. The age of the siltstones corresponds to the Middle/Upper Turonian boundary (**M. Svobodová**).

The first attempt to reconstruct the sedimentary environments on a small Late Cretaceous (Upper Cenomanian–Lower Turonian) rocky island (Plaňany, Bohemian Cretaceous Basin) is presented. Based on the preservation of deeply weathered crystalline bedrock with burrows (*Thalassinoides*) and the features of overlying sedimentation, the western island flank was the most sheltered coastal section during the whole studied interval. The main wave force affected especially the northern and eastern island coasts where many deep depressions and downslope channels were eroded. Based on palynology, foraminifers and selected macrofauna, the strata around the island were correlated. Highly variable, coarse clastic to sandstone and limestone sedimentation prevailed in the Upper Cenomanian. An erosional event and a following condensation interval with mineralization (glauconization, phosphatization), deposition of dark grey, C_{org} enriched, and later the greenish glauconitic sediments were remarkable during the basal Lower Turonian (*Whiteinella archeocretacea* Biozone). All the Lower Turonian strata are relatively fine-grained (claystones, siltstones, marlstones) and evidence a rapid deepening of the sea. During the *Helvetoglobotruncana helvetica* Biozone, the Plaňany island was deeply submerged and covered by light siltstones with sponges. The early Turonian sea-level rise is well documented by changing microfaunal and macrofaunal (mainly sponge) populations (**J. Žítt**).

4h. Defended theses

Přikryl T. (2010): Research on Cenozoic fish faunae of the selected localities of the Czech Republic.

The thesis summarized data about Cenozoic fossil fish faunas reported by the literature from ten selected localities in the Czech Republic (Kelč, Rožnov pod Radhoštěm, Litenčice, Krumvíř, Vážany nad Litavou, Strachotín, Opava-Kateřinky, Kučlín u Bíliny, Byňov and Bechlejovice), compared it with the original material (or its parts) and concluded it in light of new information about systematics, anatomy and ecology. The results were also supported by specimens from other geographical regions.

A great part of the thesis is dedicated to the feeding habits, possibility to reconstruct it and analyse it. The reconstructions of the trophic systems were marked, and direct and indirect facts and clues were used for their constructions. Furthermore, documentation of highly specific types of feeding ecology, such as cannibalism, were recognized in an Oligocene fossil fish assemblage from Moravia.

The use of fish assemblages in the stratigraphy is widespread, especially otoliths in the micropaleontology. The macrofish fauna from the Strachotín locality has become the key post for recognizing the real age of the deposition.

The comparison of fossils with recent relatives and ecological or anatomical representatives is widely applied in paleontology and this method was employed as the main tool for recognizing ecologic characteristics in selected fish taxa.

5. Publication activity of staff members of the Institute of Geology

5a. Papers published in 2010

* publications in journals included in the ISI Web of Science (IF value according to a list from 2010)

4.657* ENGEL Z., NÝVLT D., KŘÍŽEK M., TREML V., JANKOVSKÁ V. & *LISÁ L.* (2010): Sedimentary evidence of landscape and climate history since the end of MIS 3 in the Krkonoše Mountains, Czech Republic. – *Quaternary Science Reviews*, 29, 7–8: 913–927.

4.116* HAJNÁ J., ŽÁK J., KACHLÍK V. & *CHADIMA M.* (2010): Subduction-driven shortening and differential exhumation in a Cadomian accretionary wedge: The Teplá - Barrandian unit, Bohemian Massif. – *Precambrian Research*, 176, 1–4: 27–45.

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KOŘEN V., JANOUŠEK E., *FILIPPI M.*, JÄGER O., MIKEŠ Š., PALATINUS L., ZARE M. & BRUTHANS J.: Čeští geologové v Íránu. *Česká televize, ČT1 a ČT24 Události, 28. 3. 2010.* Praha.

MIKULÁŠ R. & JEŽEK M.: Geologická činnost člověka. *Český rozhlas Leonardo, 7. 1. 2010*. Praha.

MIKULÁŠ R.: Aktuální pohledy na globální oteplování. – Přímý vstup do vysílání. *Radio Česko, 11. 2. 2010*. Praha.

MIKULÁŠ R. et al.: Vědcem na zkoušku (Projekt Otevřená věda II). Pozvání Terezy Burianové (*ČRo Leonardo*) k diskusi přijali Mgr. MICHAELA ŽALUDOVÁ, ing. KVĚTOSLAVA STEJSKALOVÁ, CSc., a RNDr. *RADEK MIKULÁŠ*, CSc., pořad Třetí dimenze. *Český rozhlas Leonardo, 14. 12. 2010*. Praha.

MIKULÁŠ R. & JANÁČ M.: Vyhynuli mamuti kvůli tajemným mikroskopickým kuličkám? *Český rozhlas 2, Meteor, 18. 9. 2010*. Praha

MIKULÁŠ R.: Jak změní glóbus tání ledovců? *Česká televize, ČT 24, Milénium, 16. 6. 2010*. Praha.

RŮŽIČKOVÁ R., with the cooperation of guests VELEK M., ERBAN V., *HLADIL J.* & *CAJZ V.*: Káva o čtvrté, Téma dne, Islandská sopka Eyjafjallajokull: vulkanologie, prach, letecká doprava. *Český rozhlas 2, 27. 4. 2010.* Praha.

ŠÍP K., with the cooperation of guests *CÍLEK V.*, *CAJZ V.* & BERAN J.: Všechnopárty, Novodobé katastrofy. *Česká televize, ČT1, 29. 10. 2010.* Praha.

Lectures for popular audience

ADAMOVIČ J.: Staré cesty a staré místní názvy pod Houskou. *Lecture. Přednáška pořádaná o.p.s. Pšovka, Blatce, September 18, 2010.* Dolní Houska.

BOROVIČKA J.: Houby a životní prostředí. *Lecture. Přednáškový cyklus Městské knihovny v Praze, Praha 6, December 8, 2010.* Praha.

BOROVIČKA J.: Houby pod mikroskopem. *Lecture. Přednáškový cyklus České mykologické společnosti, Praha 1, November 15, 2010.* Praha.

CÍLEK V.: Charles Darwin, the geologist. *Lecture. Western Bohemian University, Nečtiny 12. 1. 2010*. Nečtiny.

CÍLEK V.: Church of St, Nicolas and its century. *Lecture. International Congress of Crystalography, evening lecture and concerto, 21. 9. 2010*. Praha.

CÍLEK V.: Contemporary environmental problems. *Lecture. Municipality. 11. 10. 2010*. Kutná Hora.

CÍLEK V.: Creativity, landscape, environment. *Lecture. Johnson and Johnson, 16. 5. 2010*. Loučeň Castle.

CÍLEK V.: Desert Civilisations. *Lecture. Club Violino, 14. 6. 2010*. Praha.

CÍLEK V.: Education in changing Word. *Lecture. SCIO. 21. 10. 2010*. Praha.

CÍLEK V.: Energy Policy (together with V. Bartuška). *Lecture. Diplomatic Academy, Ministry of Foreign Affairs, 25. 1. 2010*. Praha.

CÍLEK V.: Environment and contemporary World. *Lecture. St. Salvator Church, Christian Academy, 20. 4. 2010*. Praha.

CÍLEK V.: Environment ich changing Word. *Lecture.* Young President Forum, U.S. Embassy., Hotel Marriot, 9. 11. 2010. Praha.

CÍLEK V.: Forest, soil, people. *Lecture. Duha in Dopravní podniky Forum. 8. 10. 2010*. Praha.

CÍLEK V.: Hypothesis of global cooling. *Lecture. Academy of Science – Národní, 11. 2. 2010*. Praha.

CÍLEK V.: J. Piepenhagen and landscape. *Lecture*. *National Gallery, 1. 1. 2010*. Praha.

CÍLEK V.: Landscape andf us. *Lecture. Academic Bookstore, 12. 2. 2010*. Ostrava.

CÍLEK V.: Landscape protectin in contemporary world. *Lecture. Charles University, Biology, 19. 1. 2010*. Praha.

CÍLEK V.: Net energy and EROEI concept. *Lecture. Jaseka – Hotel Holiday Inn, 22. 4. 2010*. Praha.

CÍLEK V.: Oil reserves. *Lecture. Diplomatic Academy, Ministry of Foreign Affairs, 26. 10. 2010*. Praha.

CÍLEK V.: Peak Oil. *Lecture. Internantional Conference on Global Security, Technical Library, 12. 11. 2010*. Praha.

CÍLEK V.: Prague-Národní, Genius loci. *Lecture. Festival 4 in movement, 18. 10. 2010*. Praha.

CÍLEK V.: Recclamation of non-natural biotopes. *Lecture. Ministry of Environment, 23. 9. 2010*. Praha.

CÍLEK V.: Strange Themes (with Jaroslav Dušek). *Lecture. Kampa Theatre, 20. 9. 2010*. Praha.

CÍLEK V.: Suburbanisation. *Lecture. Municipality, 8. 1. 2010*. Jičín.

CÍLEK V.: The discussion on environmental problems. *Lecture. Municipality, 26. 3. 2010*. Liberec.

CÍLEK V.: The economy of space and future development. *Lecture. Municipality, 13. 4. 2010*. Karlovy Vary.

CÍLEK V.: The Word Magnuna, waiting for revolution in Cairo. *Lecture. Science Café, 14. 12. 2010*. Praha.

CÍLEK V.: To understand landscape evolution. *Lecture. FAMU, 2. 3. 2010*. Praha.

CÍLEK V.: Water Harvesting. *Lecture. Symposium Gočár, 8. 9. 2010.* Hradec Královė.

CÍLEK V.: Water Management in Middle East. *Lecture. Forum 2000, 11. 10. 2010*. Praha.

CÍLEK V.: Water, oil and blood. *Lecture. Tea Club, 13. 10. 2010*. Strakonice.

ETTLER V., STRNAD L., RAPPRICH V., *HLADIL J.* & HALODA J.: Současná aktivita vulkánu Eyjafjallajökull. *Lecture. Přírodovědecká fakulta Univerzity Karlovy, May 25, 2010.* Praha.

FILIPPI M. & BRUTHANS J.: Výzkum jeskyní a solných hor v Íránu. *Lecture. Přednáškový cyklus v Týdnu vědy a techniky, Praha 4, November 2, 2010.* Praha.

FILIPPI M.: Význam mineralogie z hlediska ochrany životního prostředí. *Lecture. Přednáškový cyklus AV ČR Nebojte se vědy, Praha 1, March 9, 2010.* Praha.

KADLEC J.: Je nejdelší jeskyně světa v USA nebo v Rusku? *Lecture. Správa jeskyní ČR se sídlem v Průhonicích, October 7, 2010.* Průhonice.

KADLEC J.: Povodňové sedimenty řeky Moravy - významný archív vlivu člověka na krajinu. *Lecture. Týden vědy a techniky 1.– 7. listopadu 2010, Muzeum Policie, November 1, 2010.* Praha.

KADLEC J.: Světové jeskyně. Beseda nad fotografiemi. *Lecture. Přírodovědný klub Barrande, February 18, 2010.* Praha.

MIKULÁŠ R.: Džungle Poldi. Výklad o nejstarší části Vojtěšské huti - Koněv s Radkem Mikulášem aneb Jak se může stát bývalý průmyslový areál džunglí? *Lecture. Občanské sdružení Arteum ve spolupráci s Občanským sdružením Kladno Koněv, June 13, 2010*. Kladno.

RÁKOSNÍK J., PETÁKOVÁ J., POPP K. & *MIKULÁŠ R.*: Zábavná matematika … a truchlivé konce, pokud jí nerozumíme. *Lecture. Rada pro popularizaci vědy AV ČR v cyklu Akademické kavárny, December 1, 2010*. Praha.

ŽÁK K.: Kryogenní jeskynní karbonáty: nový mechanismus vzniku druhotných karbonátů v jeskyních. *Lecture. Přírodovědný klubu Café Barrande, April 15, 2010*. Praha

Exhibitions

ŘÍDKOŠIL T., PROSTŘEDNÍK J. & *ADAMOVIČ J.:* Geologie, geomorfologie a archeologie Českého ráje. *Stálá expozice uspořádaná o.p.s. Český ráj, vernisáž 30.5.2010.* Hrad Valdštejn.

STEHLÍK F. (2010): Geologická historie Prahy a okolí. Ordovik a karbon. *2. naučná geologická vycházka, 10.4.2010, Králův Dvůr – Stradonice*. Pořadatel: Obec Všenory, Mgr. Alena Sahánková.

STEHLÍK F. (2010): Geologická historie Prahy a okolí. Silur a devon v okolí Berouna a v údolí Kačáku. *3. naučná geologická vycházka, 23.10.2010, Beroun - Srbsko*. Pořadatel: Obec Všenory, Mgr. Alena Sahánková.

5g. Unpublished reports 2010

BOSÁK P. (2010): *Posudek postupu těžebních stěn Velkolomu Čertovy schody – západ. Akce sanace a rekultivace severní stěny. Období: leden až prosinec 2009*. – Inst. Geol. AS CR, v. v. i. for Velkolom Čertovy schody, a. s.: 1–98, 1–21. Praha.

BOSÁK P., FILIPPI M., KRIŠTŮFEK V., *NAVRÁTIL T., ROHOVEC J. & ŽÁK K.* (2010): *Studium důlních vod ve štole dolu Arnošt, Rybářská ulice, Český Krumlov. Závěrečná zpráva*. – Inst. Geology AS CR, v. v. i. for Ministery of the Environment of the Czech Republic: 1–38. Praha.

BOSÁK P., PRUNER P., ZUPAN HAJNA N. & MIHEVC A. (Eds., 2010): *Palaeomagnetic and biostratigraphic research of cave fill in Snežna jama, Slovenia. Progress Report.* – Inst. Geol. AS CR, v. v. i. and Karst Res. Inst ZRC SAZU: 1–27. Praha–Postojna.

SÁDLO J., ZAVADIL V. & *CÍLEK V.* (2010): *Návrh na vyhlášení přírodního parku Okolí Budče*. – Inst. Geol. AS CR, v. v. i. and Odbor životního prostředího, Město Kladno: 1–38. Kladno.

KADLEC J. & ŠLECHTA S. (2010): *Magnetomineralogické studium souvrství spraší a fosilních půd odkrytých v tunelu Blanka u stanice metra Hradčanská v Praze 6. Etapová zpráva za rok 2009.* – Inst. Geol. ASCR, v. v. i. for Prospecto v. o. s.: 1–13. Praha.

LISÁ L. (2010): *Geoarchaeological report on ZAV road construction works II/242 in Roztoky, report I.* – Inst. Geol. AS CR, v. v. i., for the Institute of Archaeology AS CR, v. v. i. in Prague: 1–8. Praha.

LISÁ L. (2010): *Geoarchaeological report on ZAV road construction works II/242 in Roztoky, report II.* – Inst. Geol. AS CR, v. v. i., for the Institute of Archaeology AS CR, v. v. i. in Prague: 1–16. Praha.

LISÁ L. (2010): *Pellets from the Blučina locality.* – Inst. Geol. ASCR, v. v. i., for the Moravian Museum in Brno, Brno: 1–13. Praha.

LISÁ L. (2010): *The type of archaeological objects infilling, I. Hulín.* – Inst. Geol. AS CR, v. v. i., for the University of Hradec Králové, Hradec Králové: 1–21. Praha.

LISÁ L. (2010): *The type of archaeological objects infilling, II. Obědovice.* – Inst. Geol. AS CR, v. v. i., for the University of Hradec Králové, Hradec Králové: 1–16. Praha.

LISÁ L. (2010): *The type of archaeological objects infilling, III. Tuněchody.* – Inst. Geol. AS CR, v. v. i., for the University of Hradec Králové, Hradec Králové: 1–26. Praha.

LISÁ L. & Martini M. (2010): *Mineralogical-petrographical and technical research of Medieval tiles from the localities of Jihlava and Rokštejn.* – Inst. Geol. AS CR, v. v. i., for the Institute of Archaeology, Faculty of Philosophy, Masaryk University, Brno: 1–10. Praha.

LISÁ L. & MUDRA P. (2010): *The study of sunken houses from the Great Migration Period.* – Inst. Geol. AS CR, v. v. i., for the Institute of Archaeology AS CR, v. v. i. in Prague: 1–28. Praha.

MIKULÁŠ R. (2010): *Ichnologická dokumentace, interpretace ichnofosilií a ichnostavby karbonských sedimentů ve vrtu SM-1. Smita. Závěrečná zpráva.* – Inst. Geol. ASCR, v. v. i.: 1–25. Praha.

NAVRÁTIL T., KOPTÍKOVÁ L., ROHOVEC J., HLADIL J., SKÁLA R. & NOVÁKOVÁ T. (2010): *Analýza vzorků prachu. Závěrečná zpráva*. – Inst. Geol. AS CR, v. v. i. for UNISTAV a. s.: 1–16. Praha.

NOVÁK J.K. & BOSÁK P. (2010): *High-grade limestones from the Santa Cruz Mts., southwestern Jamaica. Progress report 3: Use of limestone as fillers, whitings, and the PCC.* – Inst. of Geol. AS CR, v.v.i.: 1–33. Praha.

NOVÁK J.K., BOSÁK P. & ERDINGEROVÁ J. (2010): *Kaolinitic sandy clay and silica sand from the Black River Bay as supplementary cementing materials. Progress report No. 1.* – Inst. Geol. AS CR, v. v. i. for GET, Ltd.: 1–31. Praha.

NOVÁK J.K., BOSÁK P. & KORBELOVÁ Z. (2010): *Pyroclastic rocks from the Bito and Ramble areas: dacitic rheoignimbrite. Progress report No. 2.* – Inst. Geol. AS CR, v. v. i. for GET, Ltd.: 1–33. Praha.

NOVÁK J.K., BOSÁK P. & KORBELOVÁ Z. (2010): *Rheoignimbrite of the Sommerfield Group, Central Jamaica. Initial report*. – Inst. Geol. AS CR, v. v. i. for GET, Ltd.: 1–29. Praha.

NOVÁK J.K., BOSÁK P. & PAVKOVÁ J. (2010): *High-grade limestones at Grange Hill, western Jamaica. Initial report*. – MS, Inst. of Geology AS CR, v. v. i.: 1–28. Praha.

NOVÁK J.K., BOSÁK P. & PAVKOVÁ J. (2010): *High-grade limestones from the Santa Cruz Mts., southwestern Jamaica. Progress report No. 3: Use of limestone as fillers, whitings, and the PCC*. – Inst. of Geol. AS CR, v. v. i.: 1–35. Praha.

NOVÁK J.K., BOSÁK P. & PAVKOVÁ J. (2010): *Tertiary bioclastic limestones from the Cave Mountain, Westmoreland. Initial Report*. – Inst. Geol. AS CR, v. v. i. for GET, Ltd: 1–42. Praha.

NOVÁK J.K., BOSÁK P. & ŽIVOR R. (2010): *Petrography of samples from the drainage works at Švermov*. – MS Inst. of Geology, v. v. i.: 1–16, 1–5. Praha.

ROHOVEC J. (2010): *Stanovení rychlosti průniku vody puklinovým systémem s využitím UV-VIS sondy. Studie*. – Inst. Geol. AS CR, v. v. i. for ISATECH, Ltd.: 1–6. Praha.

ZAJÍC J. (2010): *Zoopaleontologie karbonu pro vysvětlivky ke geologické mapě list Lomnice nad Popelkou (03-431) a zoopaleontologie karbonu ve vrtu SM-1 Smita. Závěrečná zpráva*. – Inst. Geology AS CR, v. v. i. for Czech Geological Survey: 1–11. Praha.

ZAJÍC J. (2010): *Zoopaleontologie permu pro vysvětlivky ke geologické mapě list Rovensko pod Troskami (03-342). Závěrečná zpráva*. – Inst. Geology AS CR, v. v. i. for Czech Geological Survey: 1–9. Praha.

ŽIVOR R., LOKAJÍČEK T. & FILLER V. (2010): *Stanovení přetvárných charakteristik pískovce ultrazvukovou metodou*. – Inst. Geol. AS CR, v. v. i. for Arcadis Geotechnika a. s.: 1–11. Praha.

ŽIVOR R., LOKAJÍČEK T., FILLER V. & ERDINGEROVÁ J. (2010): *Stanovení přetvárných charakteristik pískovce ultrazvukovou metodou – II*. – Inst. Geol. AS CR, v. v. i. for Arcadis Geotechnika a. s.: 1–10. Praha.

6. Organization of conferences and scientific meetings

International Conference: **OIS 3 conference, Brno, March 15–17, 2010.** Organized by the Institute of Geology of the ASCR, v. v. i., Czech Geological Society, Moravian Museum in Brno and the Institute of Archaeology of the ASCR Brno, v. v. i., Czech Republic. Organizing Committee: *Lisá L.*, Neruda P. Nerudová Z & Nývltová Fišáková M.

The conference was joined by more than 50 persons from 7 countries. Different papers concerning the timescale of marine isotope stage 3 in context of archaeology was presented. One day of oral presentations and posters was followed by the day of excursion when mainly Gravettian localities in southern Moravia and in Moravian Karst were visited. As a result, the Book of Abstracts together with the conference guide were published in a paper version and on internet. The project was supported by the Institutional Research Plan No. AV0Z30130516 of the Institute of Geology of the ASCR, v. v. i.; by Project No. 404/07/0856 of the Czech Science Foundation; by the Institutional Research Plan No. AV0Z80010507 of the Institute of Archaeology of the ASCR Brno, v. v. i., and by the Nikon company www.mikroskopy.cz

Lisá L., Neruda P., Nerudová Z. & Nývltová Fišáková M. (eds.) (2010): OIS3 Conference, Anthropos Pavilion, Brno, March 15-17, 2010. *Book of Abstracts and the conference guide: 1–97pp*. Brno. http://www2.gli.cas.cz/kvarter/OIS3stage/OIS3_abstract_guide_final_final.pdf

Recently, a special issue of Quaternary International covering some of the presented papers is under preparation.

International Working Meeting: **Archaeological Soil Micromorphology, Brno, May 17–21, 2010.** Organized by the Institute of Geology of the ASCR, v. v. i., Czech Geological Society, Archaia Brno o. p. s. and the Masaryk University in Brno, Czech Republic. Organizing Committee: *Lisá L.* & Gregor M.

International Working Meeting in Archaeological Soil Micromorphology, was held in Brno, Czech Republic, on May 17–21, 2010. The meeting was joined by 50 people from more than 7 countries from Europe and China. The workshop lasted 4 days: microscope sessions in the mornings and oral and poster presentations in the afternoon. Three days of presentations were followed by one day of excursions where sites like Mikulčice or Moravian Karst were presented. As an output from this meeting, an abstract book together with the conference guide were published in a paper version and also in digital version on the internet.

Lisá L. (Ed.; 2010): International Working Meeting in Archaeological Soil Micromorphology, Brno, May 17-21, 2010. *Book of Abstracts*: 1–40. Brno.
http://www2.gli.cas.cz/kvarter/micromorph/abstract_book_micromorphology_brno_2010.pdf

International Conference: **Astrobiology Science Conference, April 26–30, 2010, section Adaptation of life in hostile environment.** Organized by the Lunar and Planetary Science Institute. Organizing Committee: Conrad P.G., Wagganer E. & Tanner L.; Organizing subcommittee: *Kletetschka G.* & Gusev. O.

For this session 16 oral presenters from 10 countries contributed on their present studies of extremofiles and organisms surviving in extreme environment. Session covered adaptation of existing life in places where no one ever imagined and such adaptation has been stretching our understanding of life.

International Conference: **11th Slovak–Polish–Czech Paleontological Conference, Prague, September 14 –16, 2010.** Organised by the National Museum, Praha, Czech Republic and the Institute of Geology of the ASCR, v. v. i. Organising Committee: Kvaček J., *Dašková J.*, Zágoršek K. & Turek V.

The annual paleontological meeting was attended by 48 participants from 3 countries (Czech Republic, Slovak Republic, Poland), they presented lectures and posters concerned paleontological and paleoecological topics. The conference was co-organized by the National Museum in Prague. The meeting was followed by a field trip to the Barrandian area. All contributions were published in a book of abstracts: *Dašková J.* & Kvaček J. (Eds., 2010): *11. slovensko-polsko-česká paleontologická conference: sborník abstraktů, 14.9. – 16.9. 2010.* – Národní museum. Praha.

International Conference: **Prague 2010 – International Commission on Stratigraphy Workshop: The GSSP Concept, Prague, May 30–June 3, 2009. Organized by the Faculty of Science of Charles University**, Prague and Institute of Geology of the ASCR, v. v. i., Prague. Organizing committee: Finney S.C., Peng S.C., Bown P., Kraft P. & *Štorch P.*

The 3rd workshop of the International Commission on Stratigraphy IUGS included three days of ICS business meetings and discussions and one day mid-conference field trip with two parallel excursions. ICS executive and chair-persons of all subcommissions were among 52 official participants from 20 countries. P. Štorch co-organized business program, took part in discussions, co-authored the excursion guidebook and acted as a guide of one of the two parallel excursions. J. Hladil and L. Slavík co-authored the excursion guidebook:

Kraft P., *Štorch P.*, Brocke R., Fatka O., *Hladil J.* & *Slavík L.* (2010): Prague 2010 – ICS Workshop, The GSSP Concept. *Excursion guidebook – Lower Paleozoic of the Barrandian area: 1–29.* Praha.

International Conference: **IV Workshop on Ichnotaxonomy, Moscow – St. Petesrburg, June 21–26 2010.** Organized by A.V. Dronov, Geological Institute, Russian Academy of Sciences, Moscow, M.V. Fedonkin & O.S. Ivantsov, The Paleontological Institute, Russian Academy of Sciences, Moscow. Organizing committee & excursion leaders: Dronov A.V. & *Mikuláš R.*

A specialized workshop focused to specialists in ichnology. The first international ichnological meeting in Russia, taking advantage from vast collections to study, and from excellent localities to see during the excursions. Russian Academy of Sciences & Borissak Paleontological Institute. Principal convener: A.V. Dronov; excursion guidance. Twenty-five participants; website: http://jurassic.ru/ichnoIV.htm and http://jurassic.ru/ichnoIV.htm #Fieldtrip_guidebook.

International field work: **Expedition Death Valley, June 21–25, 2010.** Organizing committee: Cheung C., *Kletetschka G.* & Jackson B.

16 summer internship students (LPSA-Lunar and Planetary Science Academy 2010) participated in 5 days of field work in Death Valley, California.

Summer School: **VIth Summer School of Quaternary Studies 2010, Czech Republic, June 19–26, 2010.** Organized by the Institute of Geology of the ASCR, v. v. i., Department of Geological Sciences, Faculty of Science Masaryk University and LABRYS o. p. s. Organizer: *Kadlec J***.**

33 participants from four central European countries took park in the summer school focused on Quaternary geology and archeology advances in central, western and northern areas of Bohemia. Participants heard a number of scientific presentations whose extended abstracts were published in the excursion guide edited by J. Kadlec.

National meeting: **Past Global Changes National Meeting - Paleoenvironmental Changes during last 15 ka, Prague, March 23, 2010**. Organized by the Institute of Geology of the ASCR, v. v. i., Organizer and chairman: *Kadlec J.*

The meeting the Czech PAGES community was focused on the presentation of highlights in paleoenvironmental science. Almost 60 specialists including undergraduate students discussed problems of natural archive studies and planned near future activities.

7. Undergraduate and Graduate Education

7a. Undergraduate and Graduate Courses at Universities given by Staff Members of the Institute of Geology AS CR

ACKERMAN L.: *Geochemistry of endogenic processes* (MG431P02). Untergraduate (obligatory) Course, Faculty of Science, Charles University, Praha.

BEK, J.: *Evolution of Palaeozoic spores* (MG422P54). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

CHADIMA M.: *Magnetic anisotropy* (G7891). Graduate (optional) Course, Faculty of Science, Masaryk University, Brno.

CÍLEK V.: *Landscape as site specific inspiration*.Theatre Academy of Arts (DAMU), Praha.

CÍLEK V.: *Landscape in Czech Republic*. Academy of Fine Arts (AVU) and School of architecture, Praha.

CÍLEK V.: *Study Abroad*. Collegium Hieronymi Pragensis, Praha.

DRAHOTA P.: *Environmental aspects of mining* (MG432P25). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

DRESLEROVÁ D., *LISÁ L.,* KOČÁR P., POKORNÝ P., RENÉ P. & ŠEFRNA L.: *Environmental Archaeology (lecture on Quaternary geology and geoarchaeology)* (KAR_ENV). Undergraduate (optional) Course, Faculty of Philosophy, University of West Bohemia, Plzeň.

HOJDOVÁ M.: *Fundamentals of geology* (APA35E). Untergraduate Course, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences, Praha.

JELÍNEK E., MIHALJEVIČ M., ETTLER V. & *DRAHOTA P.*: *Geochemistry* (MG431P01). Undergraduate Course, Faculty of Science, Charles University, Praha.

KADLEC J.: *Causes and consequences of Quaternary climatic features* (MG421P15). Graduate and Postgraduate Course, Faculty of Science, Charles University, Praha.

KADLEC J.: *Geology of Quaternary period* (MG421P18G). Untergraduate Course, Faculty of Science, Charles University, Praha.

KUBÍNOVÁ P.: Tutorial in: *Vach M.*: *Environmental chemistry I* (ZVZ05E). Undergraduate Course, Faculty of Environmental Sciences. Czech University of Life Sciences, Praha.

KUBÍNOVÁ P.: Tutorial in: *Vach M.*: *Environmental chemistry I* (ZVL02E). Undergraduate Course, Faculty of Environmental Sciences. Czech University of Life Sciences, Praha.

KUBÍNOVÁ P.: Tutorial in: *Vach M.*: *Environmental chemistry PRM* (ZVL03E). Undergraduate Course, Faculty of Environmental Sciences. Czech University of Life Sciences, Praha.

LISÁ L.: *Geoarchaeology* (KAR_GEOA) Graduate (optional) Course, Faculty of Philosophy, University of West Bohemia, Plzeň.

LISÁ L.: *Geoarchaeology* (UAR/MGA) Graduate (optional) Course, Faculty of Philosophy, University of South Bohemia, České Budějovice.

MIKULÁŠ R.: *Trace fossils and ichnofabric of sedimentary rocks* (MG421P40). Untergraduate and Postgraduate (optional) Course, Faculty of Science, Charles University, Praha.

NAVRÁTIL T & *HOJDOVÁ M.*: *The heavy metals in the environment* (G431P92). Graduate Course, Faculty of Science, Charles University, Praha.

PAVLÍČKOVÁ L. & *KUBÍNOVÁ P.*: *Drinking water treatment and sewage treatment* (ZVZ14Z). Undergraduate Course. Faculty of Environmental Sciences. Czech University of Life Sciences, Praha.

PAVLÍČKOVÁ L. & *KUBÍNOVÁ P.*: *Drinking water treatment and sewage treatment* (ZVZ28E). Graduate Course. Faculty of Environmental Sciences. Czech University of Life Sciences, Praha.

PŘIKRYL T. in HOLCOVÁ K. et al.: *Principles of paleobiology I* (MG422P02). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

PŘIKRYL T. in KOŠŤÁK M. et al.: *Paleoecology* (MG422P51). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

PŘIKRYL T. in MAREK J. et al.: *Systematic Paleontology II* (MG422P19). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

PŘIKRYL T.: *Comparative Anatomy of Vertebrates* (MB170P47). Undergraduate (optional) Course and Practical Study, Faculty of Science, Charles University, Praha.

PRUNER P.: *Paleomagnetism in plate tectonics* (MG440P61). Untergraduate and Graduate Course, Faculty of Science, Charles University, Praha.

PRUNER P.: *Paleomagnetism in plate tectonics* (MG440P61). Untergraduate and Graduate Course, Faculty of Science, Charles University, Praha.

ROČEK Z. & *PŘIKRYL T.*: *Morphology of animals* (MB170P46). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

ROČEK Z.: *Evolution of Vertebrates* (MB170P48). Undergraduate (optional) Course and Practical Study, Faculty of Science, Charles University, Praha.

SKÁLA R.: *Advanced methods in processing of diffraction data* (MG431P70). Under/graduate (optional) course, Faculty of Science, Charles University, Praha.

SKÁLA R.: *Chemical crystallography* (MG431P64). Under/graduate (optional) course, Faculty of Science, Charles University, Praha.

SKÁLA R.: *Introduction to systematic mineralogy* (MG431P48). Undergraduate course, Faculty of Science, Charles University, Praha.

SKÁLA R.: *Meteorites, their origin and composition* (MG431P40). Under/graduate (optional) course, Faculty of Science, Charles University, Praha.

SKÁLA R.: *Principles of mineralogy* (MG431P52/ MG431P52U). Undergraduate course, Faculty of Science, Charles University, Praha.

ŠPAČEK P., ŠVANCARA J. & *CHADIMA M.*: *Physics of the Earth and Seismology* (G8311). Undergraduate Course, Faculty of Science, Masaryk University, Brno.

ŠTORCH P.: *Principles and methods of stratigraphy* (G421P25). Untergraduate (optional) Course, Faculty of Science, Charles University, Praha.

ŠVÁTORA M. & *PŘIKRYL T.*: *Morphology of animals* (MB170C46). Practical Study, Faculty of Science, Charles University, Praha.

VACH M. & *KUBÍNOVÁ P.*: *Environmental Chemistry I* (ZVZ04E). Untergraduate Course, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha.

VACH M. & *KUBÍNOVÁ P.*: *Environmental Chemistry PRM* (ZVL03E). Untergraduate Course, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha.

VACH M.: *Air Protection* (ZVZ22E). Untergraduate Course, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha.

VACH M.: *Modeling of Processes in Environment* (DZVX02Y). Graduate Course, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha.

VACH M.: *Physico-chemical Aspects of Processes in Environment* (ZVZ09E). Untergraduate Course, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha.

VACH M.: *Transport of Contaminants in Atmosphere* (ZVL24E). Untergraduate Course, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha.

ZACHARIÁŠ J., PŘIKRYL R., OPLUŠTIL S., *DRAHOTA P.* & GOLIÁŠ V.: *Nonrenewable and renewable resources I.* (MG432P30). Undergraduate Course, Faculty of Science, Charles University, Praha.

ŽIGOVÁ A.: *Geography of soils and protection of soil resources of the Czech Republic* (MZ330P90). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

7b. Supervision in Undergraduate Studies

Mlada Veda 5.5 Vesmírné vědy

HRUSKA E. International Gymnazium in Ilmenau, Germany *(supervisor G. Kletetschka, since 2009)*

Lunar and Planetary Science Academy

SCHWEBLER K., University of Minnesota, Minneapolis, MN, USA *(supervisor G. Kletetschka, June 15-August 15, 2010)*

FOX V., Carlton College, Northfield, MN, USA *(supervisor G. Kletetschka, June 15-August 15, 2010)*

FERCANA G., Clemson University, Clemson, NC, USA *(supervisor G. Kletetschka, June 15-August 15, 2010)*

McINTIRE L., Seattle Pacific University, Seattle, WA, USA *(supervisor G. Kletetschka, June 15-August 15, 2010)*

BC. Theses

GRÖSSLOVÁ Z., Faculty of Science, Charles University, (*supervisor P. Drahota, since 2010*)
JAROŠOVÁ M., Faculty of Science, Masaryk University, Brno (*supervisor A. Přichystal, co-supervisor/advisor L. Lisá, defended 2010*)
VARGOŠ K., Faculty of Science, Charles University, Praha (*supervisor P. Drahota, since 2010*)

MSc. Theses

DOUCEK J., Faculty of Science, Charles University, Praha (*supervisor R. Mikuláš, defended 2010*)
GOLL J., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2009*)
IŠKOVÁ P., Faculty of Science, Charles University, Praha (*supervisor R. Skála, defended 2010*)
KALLISTOVÁ A., Faculty of Science, Charles University, Praha (*supervisor R. Skála, defended 2010*)
KOHOUTOVÁ I., Faculty of Science, Charles University, Praha (*supervisor L. Ackerman, since 2010*)
KOŘÍNKOVÁ D., Faculty of Science, Charles University, Praha (*supervisor M. Svojtka, defended 2010*)
KOVÁCS A., Faculty of Science, Charles University, Praha (*supervisor L. Ackerman, defended 2010*)
KOVÁČIKOVÁ V., Faculty of Science, Charles University, Praha (*supervisor T. Navrátil, defended in 2010*)
KUBROVÁ J., Faculty of Science, Charles University, Praha (*supervisor J. Borovička, since 2009*)
KUČERA V., Faculty of Environmental Sciences, Czech University of Life Sciences, Praha (*supervisor M. Vach, since 2009*)
KUČEROVÁ CHARVÁTOVÁ K., Institute of Geological Sciences, Faculty of Science, Masaryk University, Brno (*supervisor J. Hladil, since 2010*)
NOVÁKOVÁ B., Faculty of Science, Charles University, Praha (*supervisor P. Drahota, since 2009*)
POLECHA R., Institute of Geology and Paleontology, Faculty of Science, Charles University, Praha (*supervisor F. Vacek, co-supervisor/advisor J. Hladil, defended 2010*)
REDLICH A., Faculty of Science, Charles University, Praha (*supervisor P. Drahota, since 2009*)
SOUMAR J., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2009*)
SVATUŠKOVÁ A., Faculty of Philosophy, University of South Bohemia, České Budějovice (*supervisor J. Beneš, co-supervisor/advisor L. Lisá, since 2009*)
VALENTOVÁ J., Faculty of Science, Charles University, Praha (*supervisor K. Martínek, co-supervisor/advisor L. Lisá, since 2009*)

7c. Supervision in Graduate Studies

PhD. Theses

ALTOVÁ V., Department of Physical Geography and Geoecology, Faculty of Science, Charles University, Praha (*co-supervisor P. Bosák; since 2006*)
AXMANN D., Faculty of Sciences, Masaryk University, Brno (*supervisor R. Mikuláš, since 2008*)
DOUCEK J., Faculty of Science, Charles University, Praha (*supervisor R. Mikuláš, since 2010*)
DRÁBKOVÁ J., Faculty of Science, Charles University, Praha (*co-supervisor/advisor J. Bek, since 2005*)
DZIKOVÁ L., Faculty of Sciences, Masaryk University, Brno (*supervisor R. Skála, since 2007*)
HOŠEK J., Department of Geology, Faculty of Science, Charles University, Praha (*supervisor L. Lisá, since 2010*)
JANEČKA J., Institute of Geological Sciences, Faculty of Science, Masaryk University, Brno (*supervisor J. Hladil, since 2004*)
KALLISTOVÁ A., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2010*)
KOPTÍKOVÁ L., Institute of Geology and Paleontology, Faculty of Science, Charles University, Praha (*supervisor J. Hladil, since 2004*)
KRÁLOVEC K., Faculty of Science, Charles University, Praha (*supervisor Z. Roček, defended 2010*)
KULAVIAK L., Faculty of Chemical Engineering, Institute of Chemical Technology, Praha (*supervisor M. Růžička, co-supervisor/advisor J. Hladil, since 2005*)
MATOUŠKOVÁ Š., Faculty of Science, Charles University, Praha (co-*supervisor J.Rohovec, since 2007*)
PETRUŽÁLEK M., Faculty of Science, Charles University, Praha (*co-supervisor T. Lokajíček, since 2006*)
SCHNABL P., Institute of Hydrogeology, Engineering Geology and Applied Geophysics Faculty of Science, Charles University, Praha (*supervisor P. Pruner, since 2004*)
SIDORINOVÁ T., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2009*)
ŠLECHTA S., Faculty of Science, Charles University, Praha (*co-supervisor J. Kadlec, since 2005*)
STEHLÍK F., Faculty of Science, Charles University, Praha (*advisor J. Kadlec, since 2008*)
SVITEK T., Faculty of Science, Charles University, Praha (*supervisor T. Lokajíček, since 2008*)
VAŠKANINOVÁ KAŠPAR V., Institute of geology and paleontology, Faculty of Science, Charles University, Praha (*co-supervisor J. Zajíc, since 2010*)
ŽIVOR R., Faculty of Science, Charles University, Praha (*co-supervisor V. Rudajev, since 2006*)

7d. Membership in scientific and academic boards

BOROVIČKA J.
Member, Presidium, Scientific Secretary, Czech Mycological Society, Praha

BOSÁK P.
Member, Interdepartamental Evaluation Committee for Evaluation of Proposals and Results of Research Plans from

the Field of Physics, Mathematics and Earth Sciences, Ministry of Education, Youths and Sports of the Czech Republic, Praha
Vice-Chairman, Committee for degree of Doctor of Sciences (DSc.) in geological sciences at Academy of Sciences of the Czech Republic, Praha
Chairman of Executive Board of Institute of Geology of the ASCR, v. v. i., Praha
Member, Scientific Council of Faculty of Science, Masaryk University, Brno
Member, Academic Assembly of the Academy of Sciences of the Czech Republic, Praha
Member, Board of Graduate Studies in Geology (4 years), Faculty of Science, Charles University, Praha
Member, Committee for Interdisciplinary study of Quaternary at the Board of Graduate Studies in Geology, Faculty of Science, Masaryk University, Brno
Supervisor for PhD studies, Faculty of Science, Masaryk University, Brno
Member, Committee for State Doctoral Examinations for Interdisciplinary study of Quaternary at the Board of Graduate Studies in Geology, Faculty of Science, Masaryk University, Brno
Member, Committee for State Doctoral Examinations, PhD Study Program of Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Defenses of Dissertations, PhD Study Program of Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Defenses of Dissertations, PhD Study Program of Physical Geography and Geoecology, Faculty of Science, Charles University, Praha
Member, Committee for State Doctoral Examinations, PhD Study Program of Physical Geography and Geoecology, Faculty of Science, Charles University, Praha
Member, Committee for State Rigorosum Examinations in Geology (general geology), Faculty of Science, Charles University, Praha

CÍLEK V.
Vice-Chairman, Executive board of the Institute of Geology of the ASCR, v. v. i.

GOTTSTEIN O.
Member, Executive board of the Institute of Geology of the ASCR, v. v. i.

HLADIL J.
Member, Committee for Degree of Doctor of Sciences (DSc.) in Geological Sciences at Academy of Sciences of the Czech Republic, Praha
Member, Board of Graduate Studies in Geology, Faculty of Science, Charles University, Praha
Member, Board of Graduate Studies in Geology, Faculty of Science, Masaryk University, Brno
Member, Committee for Finals of Undergraduate Stu dents in Geology, Faculty of Science, Masaryk University, Brno
Member, Examination Committee for Degree of Doctor of Natural Sciences (RNDr.) in Geological Sciences, Faculty of Science, Masaryk University, Brno

HOJDOVÁ M.
Member, Committee for Finals of Doctoral Students in Applied Geology, Faculty of Science, Charles University, Praha

KADLEC J.
Member, Board of the Doctoral Studies in Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Finals of Doctoral Students in Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Finals of Graduate Students in Geology, Faculty of Science, Charles University, Praha
Member, RNDr. Doctoral Examination Committee in Geology, Faculty of Science, Charles University, Praha
Member, International Geosphere-Biosphere Programme – National Committee

LOKAJÍČEK T.
Member, Board of Graduate Studies in Applied Geology, Faculty of Science, Charles University, Praha

MIKULÁŠ R.
Alternating Member, Doctoral Examination Committee in Geology, Faculty of Science, Charles University, Praha
Deputy Chairman, Board for Popularization of Sciences, Academy of Sciences of the Czech Republic, Praha
Secretary, Czech National Geologic Committee, Academy of Sciences of the Czech Republic, Praha

NAVRÁTIL T.
Member, Committee for Finals of Doctoral Students in Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Doctoral Thesis Defense in Applied Geology, Faculty of Science, Charles University, Praha
External Member, State Magisterium and Rigorosa Examinations in Geology, Faculty of Science, Charles University, Praha

PRUNER P.
Member, Executive board of the Institute of Geology of the ASCR, v. v. i.
Member, Board of the Graduate Studies in Geophysics, Faculty of Science, Charles University, Praha
Alternating member, Commitee for degree of Doctor of Sciences (DSc.) in geological sciences at Academy of Sciences of the Czech Republic, Praha

RUDAJEV V.
Member, Supervisory board of the Astronomical Institute of the ASCR, v. v. i.
Member, Supervisory board of the Institute of Theoretical and Applied Mechanics of the ASCR, v. v. i.
Member, Executive board of the Institute of Geology of the ASCR, v. v. i.
Member, Czech National Committee of Geodesy and Geophysics
Chairman, Commission for defending Doctor of Sciences Thesis (DSc.) in Geological Sciences, Academy of Sciences of the Czech Republic
Member, Committee for degree of Doctor of Sciences (DSc.) in geophysical sciences at Academy of Sciences of the Czech Republic, Praha
Member, Committee for State Doctoral Examinations, PhD Study Program of Geophysics, Faculty of Mathematics and Physics, Charles University, Praha

Member, Committee for Defenses of Dissertations, PhD Study Program of Geophysics, Faculty of Mathematics and Physics, Charles University, Praha

Vice-Chairman of Grant Agency of Academy of Sciences of the Czech Republic, Praha

SKÁLA R.

Chairman, Committee for Finals of Undergraduate Students in Geology, specialization Mineralogy and Crystallography, Faculty of Science, Charles University, Praha

Member, Committee for Finals of Undergraduate Students in Geology, specialization Geochemistry, Faculty of Science, Charles University, Praha

SKŘIVAN P.

Member, Committee for Finals of Undergraduate Students in Applied and Landscape Ecology, Faculty of Environmental Sciences, Czech Agricultural University, Praha

Member, Board of Graduate Studies in Applied and Landscape Ecology, Faculty of Forestry, Czech University of Agriculture, Praha

Vice-chairman, Advisory Board of the Institute of Geology AS CR, v. v. i., Praha

ŠTORCH P.

Member, Czech Science Foundation, Discipline Committee No 2: "Natural Sciences", and member & vice-chairman of Discipline Committee No 205: "Earth and Planetary Sciences", Praha (since April, 2009)

Alternating member, Committee for Degree of Doctor of Science in Geological Sciences, AS CR, Praha

Vice-Chairman, Czech Commission on Stratigraphy, Praha

SVOBODOVÁ M.

Secretary, Grant Commission of the Academy of Sciences, Council No. 3 Earth and Space Sciences, Praha

Member, Academic Assembly of the Academy of Sciences of the Czech Republic, Praha

Member, Executive Board of the Institute of Geology of the ASCR, v. v. i., Praha

Ulrych J.

Member, Commitee for degree of Doctor of Sciences (DrSc.) in geological sciences at Slovak Academy of Science, Bratislava

Alternative member, Commitee for degree of Doctor of Sciences (DSc.) in geological sciences at the Academy of Sciences, Praha

Vice-chairman, Grant Commission of the Academy of Sciences, Council No. 3 Earth and Space Science, Praha

Member, Board of Graduate Studies in Geology, Faculty of Science, Charles University, Praha

Member, Committee for Finals of Undergraduate Students in Geochemistry, Faculty of Science, Charles University, Faculty of Science, Praha

Member, Committee for Finals of Undergraduate Students in Mineralogy, Faculty of Science, Charles University, Faculty of Science, Praha

Member, Examination Committee for Degree of Doctor of Natural Sciences (RNDr.) in Gechemistry and Mineralogy, Charles University, Faculty of Science, Praha

VACH M.

Member, Board of Graduate Studies in Environmental Modeling, Faculty of Environmental Sciences, Czech University of Life Sciences, Praha

ZAJÍC J.

Member, Committee for the PhD Examination and Defence of Theses in Geology, Faculty of Science, Charles University, Praha

Member, Committee for the Master's and RNDr. Doctoral Examination in Paleontology, Faculty of Science, Charles University, Praha

ŽÁK K.

Member, Working Group Geology of the Accreditation Commission of the Czech Ministry of Education, Youth and Sports (until: March 2010), Praha

ŽIGOVÁ A.

Member, Committee of Soil Science and Soil Conservation of Scientific Council of Research Institute for Soil and Water Conservation, v. v. i., Praha

Member, Committee of the Czech Society of Soil Science, Praha

Member, Board of the Doctoral Examination Committee in Physical Geography and Geoecology, Faculty of Science, Charles University, Praha

Member, Board of the Graduate Studies in Geography, Faculty of Science, Charles University, Praha

Member, Board of the Committee of Soil Science of the Czech Academy of Agricultural Science, Praha

7e. Membership in Foreign Academies

BOSÁK P.: Corresponding Member, Slovenian Academy of Sciences and Arts (elected 2005)

BOSÁK P.: Foreign Member, Polish Academy of Arts and Sciences (election approved by the Polish President in 2007)

LOŽEK V.: Foreign Member, Polish Academy of Arts and Sciences (election approved by the Polish President in 1999)

7f. Degrees obtained by the staff of the Institute of Geology AS CR

PhD.

PŘIKRYL T. (2010): *Research on Cenozoic fish faunae of the selected localities of the Czech Republic*. – Ph.D. Thesis, Department of Geology and Paleontology, Faculty of Science, Charles University: 1–85. Praha (defended on April 21, 2010).

7g. Awards

BOROVIČKA J.: Silver Cantharellus, Czech Mycological Society, Praha; award for young scientists of the dean of Faculty of Science, Charles University, Praha

ROČEK Z.: Visiting Professor for Senior International Scientists of the Chinese Academy of Sciences in 2010, Beijing

SLÁMA J.: One of the „Top-50 most cited articles" published in Chemical Geology 2005–2010.

7h. Institute staff on Fellowships and Stages

LISÁ L.: Research fellowship of the Royal Society of Edinburgh (stay at University of Aberdeen, Scotland, September 22, 2010–October 19, 2010, 4 weeks).

As a part of the ongoing research on the geoarchaeology of sunken houses (long-term collaboration), Dr. Lenka Lisa, a geoarchaeologist based at the Institute of Geology of the ASCR, v. v. i., has started a collaborative research project with Dr. Karen Milek, an archaeologist based at the University of Aberdeen. They compare the size, form, and the composition of the floor deposits in Slavic (6^{th}–8^{th} century AD) and Scandinavian (8^{th}–11^{th} century AD) pit houses in order to better understand the similarities and differences in how these buildings had been constructed, used and maintained. The goal of the project is to clarify the degree and nature of culture contact between Slavs and Scandinavians in the centuries leading up to the Viking Age, and to investigate claims that Slavs (rather than their house types) might have had a role in the settlement of Iceland in the 9^{th} century AD.

ROČEK Z.: *Visiting Research Fellow* (Professor at Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, 2009–2013).

Research is done in the following areas: Anura of Jehol Biota (Lower Cretaceous, Liaoning Province, NE China); Middle Miocene Anura of the locality Shanwang (Shandong Province, China).

8. Positions in Editorial Boards and International Organizations

8a. Editorial Boards

ADAMOVIČ J.: Příroda, Member of Editorial Board, Agency for Nature Conservation and Landscape Protection CR, Praha (since 2007).

BOROVIČKA J.: Mykologický sborník, Editor-in-Chief, Czech Mycological Society, Praha (since 2007).

BOSÁK P.: Acta Carsologica, Member of Executive Board (since 2007), International journal, published by Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia; (Member of Advisory Committee 2004–2007).
Aragonit; Member of Editorial Board, published by the Administration of Slovak Caves, Liptovský Mikuláš, Slovakia (since 2008).
Geologica Carpathica, Member of the Executive Committee (since 2005), Official journal of the Carpathian-Balkan Geological Association, Bratislava, Slovak Republic (Co-editor 2001–2005).
Geologos, Member of Editorial Board, Scientific journal published by Faculty of Geology, Adam Mickiewicz University, Poznań, Poland (since 2000).
International Journal of Speleology, Member of Advisory Board, Official international journal of the Union Internationale de Spéléologie and Societá Speleologica Italiana, Bologna, Italy (since 1994).
Theoretical and Applied Karstology, Member of editorial board, Scientific journal published by Speleological Institute „Emil Rakoviţa", Bucuresti – Cluj, Romania (since 2000).
Český kras, Co-editor (since 1998), Regional journal published by the Museum of the Czech Karst in Beroun, Czech Republic (Member of Editorial Board since 1976).
Research Reports of the Institute of Geology, Co-editor, Academy of Sciences of the Czech Republic (since 2007).
Speleo (Praha), Member of Editorial Board, Society bulletin published by the Czech Speleological Society, Praha, Czech Republic (since 1990).
Speleofórum, Co-editor, published by the Czech Speleological Society, Praha, Czech Republic (since 2000).

CÍLEK V.: Geologica Carpathica, Co-editor, Geological Institute of the Slovak Academy of Sciences, Bratislava, Slovakia (since 2004).
Slovenský kras, Member of Editorial Board, Slovak Museum of Speleology, Liptovský Mikuláš, Slovakia (since 2004).
Vesmír, Member of Editorial Board, Vesmír Ltd, Praha (since 1998).

HLADIL J.: Geological Quarterly, Member of Editorial Team – Consulting Editor, Polish Geological Institute – National Research Institute, Warsaw, Poland (since 2004).
Geologica Carpathica, Member of the Executive Committee, Geological Institute of the Slovak Academy of Sciences, Bratislava, Slovakia (since 2001).
Bulletin of Geosciences, Co-editor, Czech Geological Survey, Praha (since 2006).

HLAVÁČ J.: Malacologica Bohemoslovaca, Member of Editorial Board, Institute of Zoology, Slovak Academy of Sciences, Bratislava, Slovakia (since 2006).

MIKULÁŠ R.: Geolines, Member of Editorial Board, Institute of Geology of the ASCR, v. v. i., Praha (since 1998).
Member of Editorial Board of the Academy of Sciences of the Czech Republic, Praha.

PRUNER P.: *Acta Universitatis Carolinae, Geologica*, Member of Editorial Board, Charles University, Praha (since 2000). *Geolines*, Member of Editorial Board, Institute of Geology of the ASCR, v. v. i., Praha (since 1997). *Research Journal of Earth Sciences*, Member of Editorial Board, IDOSI Publications, Dubai, UAE (since 2009).

ROČEK Z.: Palaeobiodiversity and Palaeoenvironments, Nominated for a Member of Editorial Board, Springer Verlag (since December 2010).

RUDAJEV V.: *Acta geodynamica et geomaterialia*, Member of Editorial Board, Institute of Rock Structure and Mechanics of the ASCR, v. v. i. Praha (since 1990).

SKÁLA R.: Journal of Geosciences, Member of the Editorial Board, Czech Geological Society, Praha (since 2006).

SVOJTKA M.: Geolines, Editor-in-chief, Institute of Geology of the AS CR, v. v. i., Praha (since 1996).

ŠTORCH P.: *Bulletin of Geosciences*, International journal, Czech Geological Survey, Praha (since 2001). *Geolines*, Institute of Geology AS CR, Praha (since 1995). *Paleontological Contribution*s, Member of Editorial Board, Electronic Journal, University of Kansas, Lawrence (since 2008).

ZAJÍC J.: *Bulletin of Geosciences*, Member of Editorial Board, International journal, Czech Geological Survey, Praha (since 2001).

ŽÁK K.: *Bulletin of Geosciences*, Co-editor, Czech Geological Survey, Praha (since 2006). *Český kras*, Member of the Editorial Board (since 2007), Co-editor (since 2008), regional journal published by the Museum of the Czech Karst, Beroun.

8b. Positions in International Organizations

BOSÁK P.: Honorary Member, the UIS Bureau, the International Union of Speleology (UIS; elected in 2009) Member, Advisory Committee, the International Union of Speleology (UIS; elected in 2009)

DAŠKOVÁ J.: Councillor, Organization of Czech and Slovak palynologists in the International Federation of Palynological Societies (OCSP in IFPS; 2008-2010)

HLADIL J.: Committee Member and Web Site Administrator, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 1994) Titular Member, Subcommission on Devonian Stratigraphy of the ICS and IUGS (since 2003)

KADLEC J.: National Co-ordinator, IGBP-PAGES Project (since 1998)

KOPTÍKOVÁ L.: Committee Member, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 2010)

MIKULÁŠ R.: Czech Representative, International Paleontologic Association (since 2006) Working Group of the Treatise on Invertebrate Paleontology, Part W, Trace Fossils (since 2001)

SLAVÍK L.: Corresponding Member, Subcommission on Devonian Stratigraphy of the IUGS (since 1999)

ŠTORCH P.: Titular Member, Subcommission on Silurian Stratigraphy of the IUGS (since 2004)

ŽIGOVÁ A.: Member of the Committee C - Soil and regolith morphology and genesis, Division on Soil System Sciences, European Geosciences Union (since 2006)

9. Institute structure and staff

9a. Organization units

The research potential of the Institute is divided into 6 units:

1. *Laboratory of Geological Processes* extends the knowledge of temperature, pressure and time conditions of different stages of magmatic process in crustal and upper mantle settings as well as of the set of hydrothermal, low- and high-grade metamorphic processes. The evolution of sedimentary basins is studied with special reference to processes affecting the character of sedimentation and diagenesis, and to tectonic deformation of basin fills. Besides the employment of a classical set of geological, petrographic and geochemical methods, new, progressive laboratory approaches have been developed.
2. *Laboratory of Paleobiology and Paleoecology* develops in four principal directions. These comprise the study of living conditions and biostratigraphy of invertebrate fossil groups (conodonts, corals, brachiopods, echinoderms and graptolites), evolution of vertebrate groups (fishes and amphibians), palynology of Carboniferous and Cretaceous sediments, and paleoichnology in a broad stratigraphic range from the Ordovician to the Recent.
3. *Laboratory of Environmental Geochemistry and Geology* integrates the studies of chemical elements dynamics in the environment with the geological processes, as they are recorded in sediments and soils formed during the Tertiary and Quaternary. Basic attention is given to the study of complicated interactions between biotic and abiotic components of the nature, climatic oscillations and environmental changes in the past, and anthropogenic impact on the present natural processes.
4. *Laboratory of Paleomagnetism* deals with paleomagnetism, magnetostratigraphy, mineral magnetism, geological interpretation of obtained data, and development of new laboratory techniques. Research is focused on the determination of basic magnetic and paleomagnetic characteristics of Phanerozoic terrestrial and extraterrestrial materials including high-resolution magnetostratigraphy, and environmental magnetism. Data interpretations encompass geotectonic, stratigraphic and paleogeographic synthesis including paleoclimatic and human-impact reconstructions.
5. *Laboratory of Physical Properties of Rocks* concentrates on the study of strain response of ultrabasic rocks to a dual regime of loading and the analysis of changes of acoustic emission and ultrasound permeability during sample loading. Ul-

trasonic sounding of rocks and changes in their elastic anisotropy under high pressure are also investigated.
6. *Laboratory of Physical Methods* represents a service analytical unit.

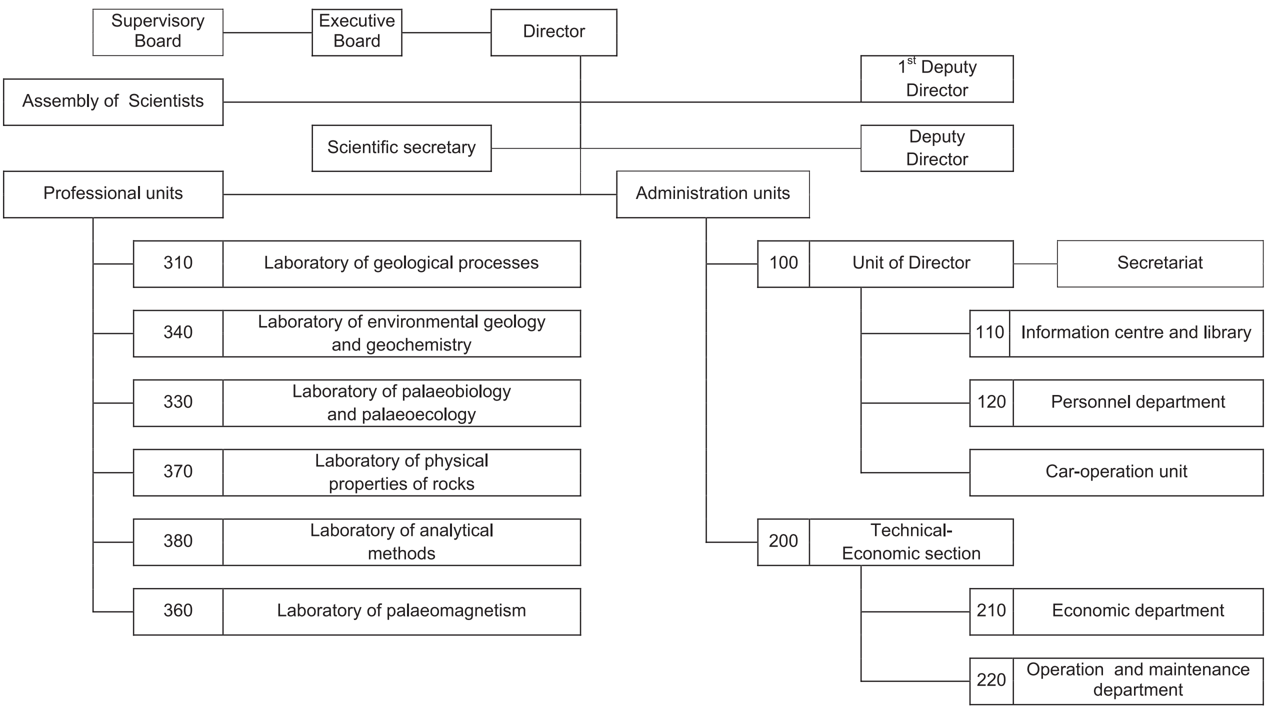
Specialized laboratories

Laboratories of the Institute are not independent units. They are incorporated within the structure of scientific and service departments. The following specialized laboratories have been set up:

1. Paleomagnetic laboratory (Head: Ing. Petr Pruner, DrSc.).
2. Micropaleontological laboratory (Heads: RNDr. Jiří Bek, CSc. & RNDr. Ladislav Slavík, CSc.).
3. X-ray and DTA/TG laboratory (Head: RNDr. Roman Skála, PhD.).
4. Electron scanning and microprobe laboratory (Head: Ing. Anna Langrová).
5. Laboratory of rock processing and mineral separation (Head: RNDr. Martin Šťastný, CSc.).
6. Laboratory for thin and polished sections (Head: Ing. Anna Langrová).
7. Laboratory of microscopy (Head: Mgr. Michal Filippi, Ph.D.).
8. Sedimentary laboratory (Head: RNDr. Anna Žigová, CSc.).
9. Fission track laboratory (Head: Mgr. Jiří Filip, CSc.).
10. Laboratory of liquid and solid samples (Head: RNDr. Jan Rohovec, PhD.).
11. LA–ICP–MS Laboratory (Supervised by Mgr. Martin Svojtka, PhD. & Mgr. Jan Rohovec, PhD.)
12. Clean Chemistry Laboratory (Supervised by Mgr. Lukáš Ackerman, PhD.)
13. Laboratory of rock behavior under high pressure (Head: RNDr. Vladimír Rudajev, DrSc.).
14. Laboratory of rock elastic anisotropy (Head: Ing. Tomáš Lokajíček, CSc.).

The scientific concept of the Institute and the evaluation of its results lie within the responsibility of the Executive Board that includes both the internal and external members. Besides research, staff members of the Institute are involved in lecturing at universities and in the postgraduate education system. Special attention is also given to presentation of the most important scientific results in the public media.

Organization chart



9b. Contact information

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Doc. Ing. Petr Skřivan, CSc. . . . . Vice-Chairman
Prof. Ing. Jiří Čtyroký, DrSc. (Scientific Council AS CR), ... Member
Prof. Jiří Pešek, DrSc. (Faculty of Science, Charles University, Praha) . . . . Member
Doc. Ing. Richard Šňupárek, CSc. (Institute of Geonics AS CR, Ostrava) . . . . Member

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Ing. Petr Pruner, DrSc. . . . . Member
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RNDr. Marcela Svobodová, CSc. . . . . Member
Mgr. Pavel Kavina, PhD (Ministry of Industry and Trade of the Czech Republic, Praha) . . . . Member
RNDr. Jan Krhovský, CSc. (Ministry of the Environment of the Czech Republic, Praha) . . . . Member
Doc. RNDr. Jiří Souček, CSc. (University of Finance and Administration, Praha) . . . . Member

Management

RNDr. Václav Cílek, CSc. .... Director of the Institute (CEO)
Prof. RNDr. Pavel Bosák, DrSc. .... 1st Deputy Director

Administration units

Unit of Director

Secretariat
Michaela Uldrychová (assistant to the Director)
Marcela Nováková (assistant to the Director, international exchange)

Information Centre and Library
Mgr. Martina Podhradská – Head (librarian)
Mgr. Václava Škvorová (librarian)

Personnel Department
Věra Štěrbová (human resources)

Car Operation Unit
Karel Jeřábek (garage attendant, driver, storeman, janitor)

Technical-Economic Section

Ing. Ondřej Caha – Head
Ing. Ottomar Gottstein, CSc. – Deputy Head

Economic Department
Jana Klímová (accountant)
Božena Trenzeluková (phone operator, mail service)
Alena Chadrabová (accountant)

Operation and Maintenance Department
Ing. Ottomar Gottstein, CSc. – Head
Antonín Čejka (technical service)
Petr Vachalovský (technical service)

Scientific laboratories

Laboratory of Geological Processes

Scientific Staff:
Mgr. Jiří Adamovič, CSc. – Head (basin analysis, tectonics)
Mgr. Leona Koptíková – Deputy Head (sedimentary petrology, metasediments, magnetic susceptibility)
Mgr. Lukáš Ackerman, Ph.D. (geochemistry, mantle petrology)
RNDr. Karel Breiter, PhD. (petrology, mineralogy)
RNDr. Vladimír Cajz, CSc. (volcanology)
Ing. Jiří Fiala, CSc. (petrology and structure of lithosphere, western and northern
Mgr. Jiří Filip, CSc. (fission track dating)
Doc. RNDr. Jindřich Hladil, DrSc. (basins in orogens, terranes, carbonate sediments)
Mgr. Tomáš Hrstka (petrology)
Mgr. Lenka Lisá, PhD. (Quaternary sedimentology)
prom. geol. Jiří Novák, CSc. (petrology)
Mgr. Jiří Sláma (metamorphic petrology, isotope dating)
Mgr. Martin Svojtka, PhD. (petrology of deep crustal rocks, fission track methods, geochronology, geochemistry)
Doc. RNDr. Jaromír Ulrych, DrSc. (igneous petrology, geochemistry)

Technical Staff:
RNDr. Martin Štastný, CSc. (technician, chemical analyst)
Josef Forman (topography, geodetic maps, GPS)
Ing. Jaroslava Pavková (secretary, technician)
Jana Rajlichová (technician)

Laboratory of Paleobiology and Paleoecology

Scientific Staff:
RNDr. Marcela Svobodová, CSc. – Head (Cretaceous palynology)
RNDr. Radek Mikuláš, CSc. – Deputy Head (ichnofossils)
RNDr. Jiří Bek, CSc. (Devonian and Carboniferous spores)
RNDr. Petr Čejchan, CSc. (paleoecology, Radiolaria, mazuelloids)
RNDr. Stanislav Čermák, Ph.D. (Cenozoic vertebrate paleontology, small mammals)
Mgr. Jiřina Dašková (Cenozoic palynology)
prom. geol. Arnošt Galle, CSc. (Devonian corals and paleogeography)
RNDr. Tomáš Přikryl, Ph.D. (vertebrate paleontology, fishes)
Prof. RNDr. Zbyněk Roček, DrSc. (origin and evolution of the Amphibia, Tertiary Anura and Sauria)
RNDr. Ladislav Slavík, CSc. (Silurian–Devonian stratigraphy, conodont biostratigraphy, sedimentary sequences, paleogeography)
RNDr. Petr Štorch, DrSc. (graptolite stratigraphy, stratigraphy in general, sedimentary sequences, paleogeography)
Mgr. Jan Wagner (Cenozoic vertebrate paleontology, large mammals)
RNDr. Jaroslav Zajíc, CSc. (Carboniferous and Permian vertebrates and stratigraphy, acanthodians)
RNDr. Jiří Žítt, CSc. (Cretaceous and Tertiary paleoecology and sedimentology, echinoids and crinoids)

Technical Staff:
Josef Brožek (photographer)

Laboratory of Environmental Geology and Geochemistry

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Mgr. Michal Filippi, PhD. – Deputy Head (mineralogy, environmental geochemistry)
Mgr. Jan Borovička (biogeochemistry)
Prof. RNDr. Pavel Bosák, DrSc. (karstology, geomorphology, sedimentology)
RNDr. Václav Cílek, CSc. (Quaternary and environmental geology)
Mgr. Petr Drahota (environmental geochemistry)

Mgr. Jaroslav Hlaváč, PhD. (Quaternary geology, malacozoology)
RNDr. Maria Hojdová (environmental geochemistry)
Ing. Petra Kubínová (biogeochemistry)
RNDr. Jan Rohovec, PhD. (analytical chemistry, ICP analyses)
Doc. Ing. Petr Skřivan, CSc. (exogenic and environmental geochemistry)
Mgr. Marek Vach, PhD. (environmental geochemistry)
RNDr. Karel Žák, CSc. (Quaternary geology, environmental geochemistry)
RNDr. Anna Žigová, CSc. (pedology, paleopedology)

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Michaela Uldrychová (secretary)

Laboratory of Paleomagnetism

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Mgr. Martin Chadima, PhD. (geophysics, paleomagnetism)
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Mgr. Tomáš Kohout, Ph.D. (physical properties of meteorites)
prom. fyz. Otakar Man, CSc. (geophysics)
Mgr. Filip Stehlík (paleomagnetism)
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Jiří Petráček (technician)
RNDr. Daniela Venhodová (technician)

Laboratory of Physical Properties of Rocks

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RNDr. Roman Živor – Deputy Head (geomechanics)
Ing. Tomáš Lokajíček, CSc. (rock elastic anisotropy)
Mgr. Matěj Petružálek (geophysics, acoustic emission analysis)
Mgr. Tomáš Svitek (geophysics)
Doc. RNDr. Jan Vilhelm, CSc. (geophysics)

Technical Staff:
Zdeněk Erdinger (technician, rock cutter)
Julie Erdingerová (technician)
Vlastimil Filler (technician, electrician)
Miroslav Grusman (mechanic)
Vlastimil Nemejovský (mechanic, technician, rock cutter)

Laboratory of Analytical Methods

RNDr. Roman Skála, PhD. – Head (X-ray powder diffraction)
RNDr. Zuzana Korbelová – Deputy Head (microprobe and scanning microscope analyst)
Ing. Anna Langrová (microprobe and scanning microscope analyst)
Ing. Vlasta Böhmová, PhD. (microprobe and scanning microscope analyst)
Jiří Dobrovolný (X-ray powder diffraction, technician)
Jaroslava Jabůrková (technician, grinding, preparation of thin/polished sections)

Foreign consultants

Prof. György Buda (Department of Mineralogy, L. Eötvös University, Budapest, Hungary)
Dr. Pavel Čepek (Burgwedel, Germany)
Prof. Petr Černý (Department of Earth Sciences, University of Manitoba, Winnipeg, Canada)
Prof. Jaroslav Dostal (Department of Geology, Saint Mary's University, Halifax, Canada)
Prof. Peter E. Isaacson (Department of Geology, College of Mines and Earth Resources, University of Idaho, Moscow, USA)
Dr. Horst Kämpf (GeoForschungsZentrum, Postdam, Germany)
Prof. Dr hab. Ryszard Kryza (Institute of Geological Sciences, Wroclaw University, Poland)
Prof. Henri Maluski (Université Montpelier II, Montpelier, France)
Prof. Ronald Parsley (Department of Geology, Tulane University, New Orleans, USA)
Prof. Dr. Franz Pertlik (Institut für Mineralogie und Kristallografie, Universität Wien, Geozentrum, Austria)
Prof. Henning Sørensen (Geological Institute, University of Kobenhagen, Denmark)
Prof. John A. Winchester (Department of Geology, University of Keele, Great Britain)

Note: Czech scientific and pedagogical degrees are equivalents of:

Czech degree	**Equivalent**
Bc.	BSc, BA
prom. geol., prom. fyz., Mgr.	MSc, MA
RNDr., PhDr.	no equiv.
CSc.	PhD.
DrSc.	DSc
Doc.	Assoc. Prof.
Ing.	Dipl.-Ing.

Staff News

left the Institute:

Lechnýřová Kateřina (librarian)	January 31
Siblík Miloš (scientist)	March 31
Balabán Mikuláš (computer specialist)	August 31
Nováková Tereza (chemical analyst)	August 31
Marek Ondřej (technician)	June 30
Galle Arnošt (scientist)	December 31
Novák Jiří K. (scientist)	December 31

joined the Institute:

Lisý Pavel (technician)	January 1
Podhradská Martina (librarian)	February 15
Chadrabová Alena (accountant)	March 2
Caha Ondřej (head of technical-economic section)	March 29
Šťastný Martin (technician)	August 1
Hubičková Světlana (technician)	October 5

9d. Laboratories

The chapter summarizes the list of the most important laboratory equipment.

Paleomagnetic laboratory (Head: Ing. Petr Pruner, DrSc.)

The *Magnetic Vacuum Control System (MAVACS)* (1984) is a self-contained automatic system creating a limited space with the magnetic field eliminated i. e. a non-magnetic environment or magnetic vacuum. The operation of MAVACS is based on the feedback loop principle. The Earth's magnetic field is compensated for by the triaxial Helmholz Induction Coil System HELICOS. The resulting field difference is continually measured in each of its three axes by the Rotating Coil Magnetometer ROCOMA, which has its sensors installed inside the HELICOS. The output of the ROCOMA controls the Iduction Coil Control Unit ICCON, which supplies the HELICOS generating the compensating magnetic field. In this way the feedback loop is closed in all the three axes, thus securing a variation-free magnetic vacuum. The above mentioned factors formed the basis for the development of a system which creates a magnetic vacuum in a space of about 5 litres below a value of ± 2nT, the typical offset of the magnetic field sensor being smaller than ± 0.1nT. Multi-component analysis of the structure of the remanent magnetization and reproduction of the paleomagnetic directions even in rocks whose magnitude of secondary magnetization represents 97 to 99 % of the magnitude of natural remanent magnetization, can be achieved accurately with this system.

The *JR-6A* and two *JR-5A Spinner Magnetometers* (2002, 1997, 2003) – the most sensitive and accurate instruments for measurement of remanent magnetization of rocks. All functions are microprocessor-controlled.

The *KLY-4S Kappabridge*, *CS-23* and *CS-L Furnance Apparatus* (2000) – sensitive, commercially available laboratory instrument for measuring anisotropy of magnetic susceptibility (AMS) as well as bulk susceptibility and for measuring the temperature variation of susceptibility (from -190 to 700 °C).

Two *LDA -3 AF Demagnetizer* (2000, 2002) – the process is microprocessor-controlled and automated.

The *MMPM 10 PULSE MAGNETISER* (2006) and the magnetizing coil serves for the induction of the isothermal remanent magnetization.

The *AMU-1A Anhysteretic Magnetizer* (2003) is an option to the LDA-3 AF demagnetizer. This equipment permits the deliberate, controlled anhysteretic magnetization of a specimen.

The *KLF-4 magnetic susceptibility meter* (2004) is designed for rapid and precise laboratory measurement of magnetic susceptibility of rocks, soils, and materials investigated in environmental studies in weak magnetic fields ranging in their intensity from 5 A/m to 300 A/m.

755 SRM for Discrete Samples with Automatic Sample Handler and AF Degausser (2007).

Liquid helium-free Superconducting Rock Magnetometer (SRM), type 755 4K SRM (2007) – the set includes a measurement system, alternating field demagnetizer, three-layer permalloy degauss shield, automatic sample holder, electronic unit and software. Sensitivity of the dipole moment is lower than $1x10^{-12}$ Am^2 RMS for aperture size (sample size) of 4.2 cm. A system is including an automatic sample holder, permitting remanent magnetization measurement in three axes. Possibility of remanent magnetization measurement is without sample rotation.

Micropaleontological laboratory (Heads: RNDr. Jiří Bek, CSc. & RNDr. Ladislav Slavík, CSc.)

The laboratory of micropaleontology disposes of room for sample preparation with standard equipment and chemicals and laboratory of sample processing with renovated laboratory hoods and other usual equipment.

X-ray powder diffraction laboratory (Head: RNDr. Roman Skála, PhD.)

PHILIPS X´Pert APD (1997) is an X-ray powder diffractometer used for phase composition and crystal structures investigations. The diffractometer is of theta-2theta type with moving detector arm. It is equipped with fixed divergence and receiving optics, secondary graphite monochromator and a point proportional counter.

Electron scanning and microprobe laboratory (head Ing. Anna Langrová)

Microprobe CAMECA 100 (2002) is the central instrument of the Laboratory used mainly for local chemical analysis of solid geological materials. The microprobe is equipped by four crystal spectrometers and detectors for imaging in secondary and back-scattered electrons. The choice of spectrometer crystals makes the instrument capable of analyzing elements in the range from B to U from (thin-) sectioned and polished solid-state samples.

The brand new scanning electron microscope with variable vacuum TESCAN VEGA3 equipped with SE, BSE and LVSTD detectors as well as energy-dispersive spectrometer Bruker X'Flash 5010 is installed in the laboratory since October.

Accesory devices for preparation of samples include carbon coating devices and gold sputtering machine and they are crucial to keep the analytical laboratory running smoothly.

Laboratory of rock processing and mineral separation (head RNDr. Martin Šťastný, CSc.)

Electromagnetic separator SIM-I (1968)
Electromagnetic separator (1969)
Laboratory table WILFLEY 13 B (1990)
Vibration processor VT 750 (1992)
*Crusher CD 160*90* (1991)
Laboratory mill RETSCH (1970)
Crusher ŽELBA D 160/3 (1999)
Mill SIEBTECHNIK (1995)

Laboratory of thin and polished sections (head Ing. Anna Langrová)

MINOSECAR (1962, 1970) is a cut-off machine with a diamond cutting wheel

DISCOPLAN (1990) is a precision cutting and grinding machine.

PEDEMOX PLANOPOL (1989) is a grinding and polishing machine
Montasupal (1977) is a grinding machine with a diamond grinding wheel.
DP.U.4 PDM-Force (1993) is a lapping machine used with deagglomerated grinding powder (alumina) mixed with water before use.

Laboratory of Microscopy (head Mgr. Michal Filippi, PhD.)
Laboratory of microscopy is used for the first (and free-of-charge) identification of the studied samples and for a detailed preparation for other more sophisticated methods. The equipment of the laboratory enable a photographic documentation of samples and also basic image analyses (for example in case of the thin sections). No changes in the laboratory in 2009.
Polarization microscope OLYMPUS BX51 with digital camera OLYMPUS DP70 equipped by X-ray fluorescence with wave-length filters; QuickPHOTO MICRO 2.2 software (2006)
Binocular microscope OLYMPUS SZX16 with digital camera OLYMPUS SP 350; software Deep Focus 3.0 (2007)
Binocular microscope OLYMPUS SZ51 (2007)
Microscope NIKON ALPHAHOT 2/HP (1995)
Polarization microscope AMPLIVAL ZEISS (1974)
Polarization microscope POLMI (1967)
Binocular microscope (1959)
Polarization microscope ORTHOPLAN Photometre LEITZ (1983)

Sedimentary laboratory (Head: RNDr. Anna Žigová, CSc.).
The laboratory is equipped with apparatus for preparing of samples and measuring of pH:
Analytical balance SETRA EL - 2000S (1999)
Muffle furnace VEB ELEKTRO BAD FRANKENHAUSEN (1984)
Laboratory dryer WST 5010 (1991)
Planetary mill FRITSCH (1986)
pHmeter pH 330 / SET (2000)
Ultrasonic cleaner TESLA (1985)

Fisson track laboratory (Head: Mgr. Jiří Filip, CSc.)
The laboratory develops fission-track dating analysis for determining the age and time-temperature evolution of minerals and rocks.
Analytical system for fisson track:
– Microscope AXIOPLAN ZEISS and Trackscan system 452110 AUTOSCAN (1999)
– Microscope ZEISS IMAGER M1m and computer-controlled microscope stage AUTOSCAN (2008)
Polishing and grinding machine MTH APX 010 (2003)

Laboratory of liquid and solid samples (Head: RNDr. Jan Rohovec, PhD.)
*A*AS Spectrometer VARIAN SpectrAA 300 (1991)
lamps As, Be, Cd, Cu, Cr, Fe, Mn, Ni, Co, Pb, Sr, Zn, Rb, Ba+GTA96+VEA76
Analytical weights SARTORIUS Basic analytical (1992)
Filtration blocks B-2A Epi/FL (1996)
Analytical weights BALANCE 2000G (1999)
Set of vacuum lysimeters PRENART (1999)
ICP-EOS spectrometer Iris Intrepid XSP (2004)
Ultrasonic Nebulizer CETAC (2004)
Microwave digestion unit Mars, prod. CEM (2009) – with 8 fully equipped PTFE digestion vessels.
Mercury analyser AMA 254 (2008) – for analysis of ultra-low amounts of mercury and mercury speciation was acquired. The apparatus producted by PSAnalytical (England) is working on principle of fluorescence spectroscopy. It is equipped with single-purpose HPLC for various mercury containing species separation. The detection limit is about 0,1 ppt Hg. The apparatus is used for mercury monitoring in the environment. Identification of the mercury species present is considered to be an advanced analytical technique. Speciation analysis is performed after pre-concentration of Hg containing species and followed by separation on HPLC.
DOC/TOC analyzer Shimadzu (2010): Dissolved organic carbon content, total organic carbon content, inorganic carbon in aqueous samples.
*HPLC syste*m (Knauer/Chromspec 2010): anion analysis in aqueous samples using ion-exchanging column and conductivity detector.

LA–ICP–MS Laboratory (Supervised by Mgr. Martin Svojtka, PhD. & Mgr. Jan Rohovec, PhD.)
The laboratory is equipped with high-resolution magnetic sector *ICP-MS* (2009; inductively coupled plasma – mass spectrometer) *ELEMENT 2* (ThermoFisher Scientific). An instrument has high mass resolution to access spectrally interfered isotopes and is used for: (1) multielement analysis (trace and major elements) across the periodic table covering a $mg.l^{-1}$ to sub $pg.l^{-1}$ concentration range, and (2) measuring of high-precision isotope ratios.
Element 2 is coupled with New Wave UP213 LASER ABLATION SYSTEM (2009) for analyzing solid samples and backup power system *UPS PW9355 POWERWARE* (Eaton).

Clean Chemistry Laboratory (Supervised by Mgr. Lukáš Ackerman, PhD.)
Laboratories for processing of samples destined for (ultra)trace and isotopic analyses. Both labs are supplied with HEPA filtered air. One lab (class-100000 filtered air) is using for sample decomposition and labware cleaning. It contains 1 x fume-hood designed for the work with strong acids. The other lab (class-10000 filtered air) is using for a clean chemistry (e.g. ion exchange chromatography separation, special chemical procedures for separation of certain elements) and final preparation of the samples for mass spectrometry (HR–ICP–MS, MC–ICP–MS, TIMS). It contains 2 x originally designed laminar flow hoods (class-100 filtered air), 1 x open laminar flow work space (class-100 filtered air), 1 x analytical weight (0.0000X g), 1 x device for the preparation of clean water (Millipore Elix 3 + Millipore Milli-Q Element) and 1 x centrifuge (2009).

Laboratory of rock behaviour under high pressure (Head: RNDr. Vladimír Rudajev, DrSc.) and

Laboratory of rock elastic anisotropy (Head: Ing. Tomáš Lokajíček, CSc.)

The research of the laboratory was focused on grant projects solving, on projects of international cooperation, training of undergraduate and graduate students and solving of special practical problems in terms of the industrial projects in 2009.

The new methods are developed for assessment of stability mechanically loaded rocks, for multichannel monitoring of seismoacoustic signals occurring during various loading regime. The special software programs are created for automatic preprocessing of acoustic signals and for processing of acoustic series. Processing of acoustic series is based on the correlation and fractal analysis.

Special unique apparatus for investigation of elastic anisotropy enables to measure in 132 independent directions. Obtained results are processed by form of isolines of P-wave velocities in the dependence on confining stress.

MTS 815 – PC controlled servo hydraulic rock testing system with high stiffness for compressive loading up to 4,500 kN (2004).

High pressure chamber for elastic anisotropy measurement under hydrostatic pressure up to 700 MPa (2000).

Electronically controlled high pressure generator PG-HY-700-1270 (700 MPa; 2007)

Hydraulic press for uniaxial compressive loading up to 3,000 kN (1958) with conventional triaxial cell for confining pressure up to 150 MPa (1990).

Hydraulic press for uniaxial compressive loading up to 300 kN (1960).

Hydraulic press for uniaxial compressive loading up to 100 kN (1965).

Rheological weight press for uniaxial compressive loading up to 500 kN (1974).

Rheological mechanical presses for uniaxial compressive loading up to 80 kN (1969).

Rheological weight presses for tensile loading up to 3 kN (1974).

Vallen AMSY-5 – multichannel acoustic emission system (2003).

Digital strain meters Hottinger (Centipede-100, UPM-40, UPM-60; 2003).

Permeability apparatus for measurement of permeable and low permeable materials under constant hydraulic incline (2006).

Piezo-ceramics sensors for monitoring P and S waves in the wide frequency band.

Equipment for sample preparation (stone saw machines, drilling machines, grinding and milling machines) allows preparation of test samples (specimens) of various shapes (cubic, prismatic, cylindrical, spherical).

10. Financial Report

In thousands of Czech Crowns (CZK)

A. INCOMES		
1.	From the annual budget of AS CR	38 413
2.	From the Grant Agency of the AS CR (accepted research projects)	6 175
3.	From the Czech Science Foundation (accepted research projects)	6 013
4.	From the internal research projects of the AS CR	1 641
5.	From other public sources	122
6.	Applied research	1 603
7.	Investment (instruments)	11 091
8.	Investment (constructions)	2 488
TOTAL INCOMES		67 546
B. EXPENSES		
1.	Scientific staff (wages, insurances)	32 910
2.	Research and scientific activities	12 010
3.	Administration and technical staff (wages, insurances)	4 797
4.	General expenses (postage shipping, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc.)	3 205
5.	Library	817
6.	Editorial activities	228
7.	Investment (instruments)	11 091
8.	Investment (constructions)	2 488
TOTAL EXPENSES		67 546

Notes

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