RESEARCH REPORTS 2014

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Praha, May 2016

Cover photo: Erosion surface of Neoproterozoic granitoids of the Coastal Terrane, part of the Kaoko Belt on the Namibian Skeleton Coast. Photo by J. Sláma.

2014

Research Reports

This report is based on contributions of the individual authors; the contents and scientific quality of the contributions lie within the responsibility of the respective author(s).

The report was compiled and finally edited by T. Přikryl and P. Bosák.
The English version was kindly revised by J. Adamovič.

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of the Czech Academy of Sciences, v. v. i.

Contents

Introduction

As I wrote last year, the life of the Institute was passing in relatively calm manner without any substantial shocks. But nothing is so idyllic, especially the life of the research centre with a multi-disciplinary focus. We continued the tender for internal projects. Compared with 2013, the projects were smaller and with more restricted budgets. Totally 19 projects were selected by the tender committee. Evaluation and presentation of the results of the projects was held in November. Most projects were successful again – i.e., researchers obtained materials for a submission of a paper to peer-reviewed journals. Some results were already submitted or even published.

During November, the traditional tender for positions was held as well. This year, the number of external persons attending the tender was very modest. Only one person was accepted as a new employee.

We obtained a substantial financial support for the reconstruction of CAMECA SX 100 microprobe from the special fund of the Academy Vice-President, Mr. Jan Šafanda. Other investments were directed to already existing technologies, especially in the Department of Exogenic Geology and Geochemistry, Department of Paleomagnetism and the Department of Analytical Methods.

New analytical procedures were introduced on ICP-MS: U-Pb laser ablation dating on zircons, measurement of ^{206}Pb /^{207}Pb values, and measurements of isotopic values of selected metals of the platinum series. The ICP-MS U-series dating of carbonate samples has been developed in co-operation with the Institute of Geological Sciences of the Polish Academy of Sciences, Warszawa, Poland; the method is more effective (smaller samples, rapid analytical procedure) that the recently used alpha-spectroscopy.

Successful was our participation in the official Week of Science and Technology. A number of visitors, especially from different types of high schools, visited the Institute and its labs. Series of field excursions and lectures were held by the Institute staff on that occasion. A number of Institute employees took part in a broad variety of popular science activities, see special chapter in this volume.

RNDr. Karel Breiter, CSc. defended the title of Doctor of Sciences (DSc.). Some Institute employees were awarded prizes: doc. RNDr. Jaromír Ulrych, DrSc. was awarded the Pošepný Medal of the Czech Academy of Sciences; doc. RNDr. Jindřich Hladil, DrSc. was awarded the Golden Medal of the Masaryk University in Brno, RNDr. Leona Chadimová, PhD. was awarded the Otto Wichterle Premium of the Czech Academy of Sciences; RNDr. Václav Cílek, CSc. was awarded the Kantuta Price and Golden Ribbon for various popularization and publishing activities.

Pavel Bosák

2. General Information

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Information on the Institute is available on the Internet:
http://www.gli.cas.cz

The Institute of Geology of the Czech Academy of Sciences, v. v. i., is a public research institute belonging to the Czech Academy of Sciences (CAS). 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, its activities 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 scales; 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 of the Czech Academy of Sciences, v. v. i., is a broad-scope scientific institute performing 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 the period of 1957 to 1961. During this period, several independent laboratories were constituted: Laboratory of Paleontology, Laboratory of Engineering Geology, Laboratory for 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 within the Geological Institute of the ČSAV in 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 was founded; a successor of the Institute of 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.

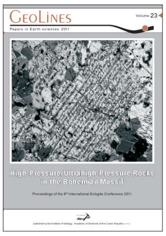
On March 1, 1979, the Geological Institute was united with the Mining Institute of the ČSAV under the Institute of Geology and Geotechnics of the ČSAV, and finally split from the latter on March 1, 1990 again.

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

The economic and scientific concept of the Institute of Geology of the Czech Academy of Sciences, v. v. i., and the evaluation of its results lie within the responsibility of the Executive Board and Supervisory Board which include both internal and external members. Plans of the Institutional Financing are evaluated by the special Committee at the CAS. 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 the spread of the most important scientific results in the public media.

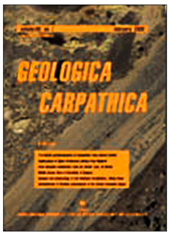
3. Publication activity of the Institute of Geology

3a. Journals



The Institute of Geolomgy CAS, 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 fields of geology (geochemistry, geochronology, geophysics, petrology, stratigraphy, paleontology, environmental geochemistry). Each issue of the 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 of GeoLines was published in the year 2014.



Since 2000, the Institute of Geology of the Czech Academy of Sciences, 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, J. Hladil and L. Lisá).

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 rendered 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 2014, six issues (1 to 6) of Volume 65 were published with 32 scientific papers and short communications. Impact factor for 2014 is 0.761. For the full version see www.geologicacarpathica.sk.

Address of the editorial office: Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, P. O. BOX 106, 840 05 Bratislava 45, Slovak Republic, Phone: +421 2 3229 3209, Fax: +421 2 5477 7097, www.geol.sav.sk
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Pavel BOSÁK – Institute of Geology of the Czech Academy of Sciences, v. v. i., Praha, Czech Republic; bosak@gli.cas.cz

Since 2014, the Institute of Geology of the Czech Academy of Sciences, v. v. i., has become a co-publisher of the international journal **Bulletin of Geosciences** (www.geology.cz/bulletin/scope; bulletin@geology.cz), registered by the Thomson Reuters WoS database. The Institute is represented by several journal co-editors.

The Bulletin of Geosciences is an international journal publishing original research papers, review articles, and short contributions concerning paleoenvironmental geology, including paleontology, stratigraphy, sedimentology, paleogeography, paleoecology, paleoclimatology, geochemistry, mineralogy, geophysics, and related fields. All papers are subject to international peer review, and acceptance is based on quality alone.

Its impact factor for 2014 is 1.515.

The Editorial Board of the Bulletin of Geosciences has decided to reaffirm the status of the Bulletin as an open access journal. The Bulletin of Geosciences is published as a non-profit making journal and the vast majority of people (including members of the editorial board) receive no payment for their work. The budget covers costs for type-setting and printing. Online ISSN 1802-8555 / Print ISSN 1214-1119.

In 2014, four issues (1 to 4) of Volume 89 were published with 43 scientific papers and short communications. For the full version see http://www.geology.cz/bulletin.

3b. Monographs, proceedings, etc.

Bajer A., Buriánek D., Gregor M., **Lisá L.**, Milek K.B., Mroczek P. & Poch, R. M. (2014): *Soil micromorphology in general and archaeological context*. – Mendel University in Brno and Institute of Geology of the CAS, v. v. i.: 1–86 s. Brno. ISBN 978-80-7375-934-6.

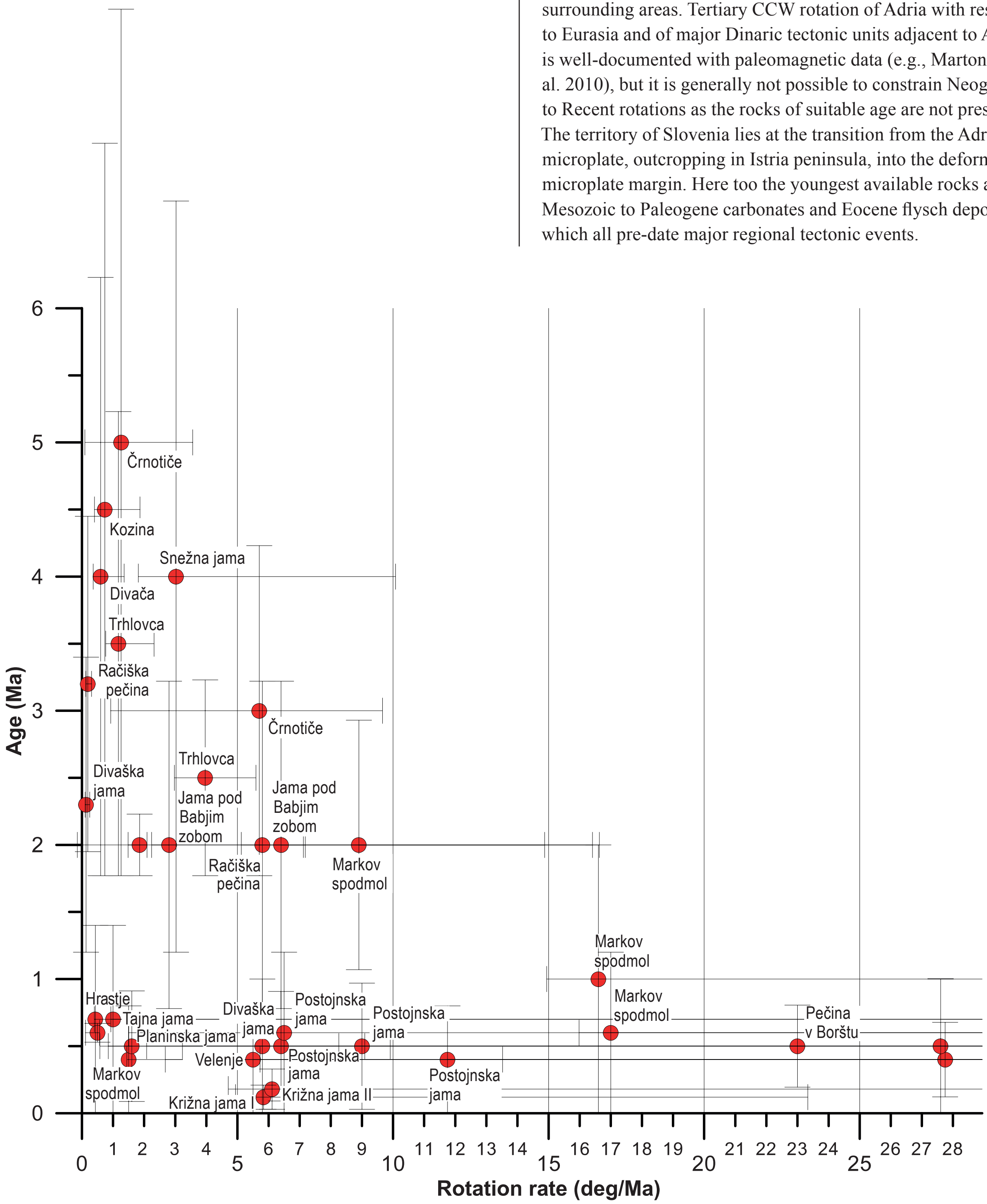
Lisá L. & Bajer A. (2014): *Manuál geoarcheologa aneb jak hodnotit půdy a sedimenty*. – Mendelova univerzita, Geologický ústav AV ČR, v.v.i., Česká geologická společnost: 1–60. Brno, Praha. ISBN 978-80-7509-000-3; ISBN 978-80-87487-09-5; ISBN 978-80-87487-09-9.

4. Research Reports

4a. Foreign Grants, Joint Projects and International Programs

Bilateral co-operation between Institute of Geology of the CAS, v. v. i., and Karst Research Institute, Scientific Research Centre, Slovenian Academy of Sciences and Arts: **Paleomagnetism and magnetostratigraphy of Cenozoic cave sediments in Slovenia** (N. Zupan Hajna, A. Mihevc, Karst Research Institute, ZRC SAZU, Postojna, Slovenia, M. Vrabec, Department of Geology, FNSE, University of Ljubljana, Slovenia, *P. Pruner* & *P. Bosák*; supported by RVO67985831; since 1997)

Quaternary paleomagnetic rotations and tectonics of Slovenia (Adria–Eurasia collision zone): data from cave sediments. Collision of the Adriatic microplate with Eurasia is the principal driving agent of Tertiary to Recent tectonics in the Alps and surrounding areas. Tertiary CCW rotation of Adria with respect to Eurasia and of major Dinaric tectonic units adjacent to Adria is well-documented with paleomagnetic data (e.g., Marton et al. 2010), but it is generally not possible to constrain Neogene to Recent rotations as the rocks of suitable age are not present. The territory of Slovenia lies at the transition from the Adriatic microplate, outcropping in Istria peninsula, into the deformed microplate margin. Here too the youngest available rocks are Mesozoic to Paleogene carbonates and Eocene flysch deposits, which all pre-date major regional tectonic events.



■ **Fig. 1.** Rotation rates versus age detected from paleomagnetic parameters of cave sediments in Slovenia (M. Vrabec, original).

To obtain magnetostratigraphic datings we investigated paleomagnetic properties of 3,000 samples of autochthonous and allochthonous cave sediments at 40 profile sites in the Dinaric and Alpine karst of Slovenia. Although sedimentation in caves is spatially and temporally highly discontinuous, and strongly dependent on local geological, geomorphological and other factors, we were able to establish a consistent chronology that is corroborated by paleontological and radiometric dating methods (Zupan Hajna et al. 2010, Bosák et al. 2003). The sediments, spanning in age from the youngest Quaternary to at least the Pliocene, also exhibit measurable and statistically significant paleomagnetic declinations. Measured declinations reach up to 18° with *á* in the range of 3 to 6° on the average. Rotations are predominately CCW in sense, consistent with the CCW-rotating Adriatic microplate. At sites where longer time-series of measurements could be acquired, rotations get increasingly smaller with decreasing age, also suggesting continuous tectonic rotation. By estimating the average rotation rate from measured declination and inferred sediment age we divided the sites in three groups. First group exhibits rotation rates of ca. 1°.Ma^{-1}, which agrees with the geological-time-scale rotation rate of the Adria microplate, therefore those sites are probably moving with the microplate. Sites from the second group show rotation rates of around 5°.Ma^{-1}. Those sites could be influenced by local tectonic block rotations in active fault zones since the faster rotation rates are viable with respect to active regional deformation rates derived from the GPS studies. The few sites belonging to the third group exhibit anomalously high rates of 10°.Ma^{-1} or higher, which indicates either problems with dating or simply poor data. Our data also suggest an increase in rotation rates that occurred at around 1 Ma (Fig. 1). We presume that this change correlates with the change in regional tectonic regime some time in the Quaternary, which is documented by independent tectonic and geomorphological studies.

Our work demonstrates that it is possible to acquire meaningful paleomagnetic declination data from highly discontinuous and fragmentary continental sedimentary record preserved in karstic caves. These data provide a high-resolution insight into neotectonic evolution of the region, which may be difficult or impossible to establish using other methods, particularly where no alternative rock record exists (Vrabec et al. 2014a, b).

BOSÁK P., PRUNER P. & KADLEC J. (2003): Magnetostratigraphy of cave sediments: Application and limits. – *Studia Geophysica et Geodaetica*, 47: 301–330.

MÁRTON E., ČOSOVIĆ V., BUCKOVIĆ D. & MORO A. (2010): The tectonic development of the Northern Adriatic region constrained by Jurassic and Cretaceous paleomagnetic results. – *Tectonophysics*, 490: 93–102.

VRABEC M., PRUNER P., ZUPAN HAJNA N., MIHEVC A. & BOSÁK P. (2014a): Quaternary paleomagnetic rotations and tectonics of Slovenia (Adria–Eurasia collision zone): data from cave sediments. – *9th ESSEWECA conference, November 5–7, 2014, Smolenice, Slovakia. Environmental, Sedimentary & Structural Evolution of the Western Carpathians. Abstrakt Book*: 69–70. Geophysical Institute, Slovak Academy of Science, Geological Institute, Slovak Academy of Science. Bratislava.

VRABEC M., ZUPAN HAJNA N., MIHEVC A., PRUNER P. & BOSÁK P. (2014b): Paleomagnetizem jamskih sedimentov v Sloveniji - implikacije za neotektoniko ozemlja. – In: KUHAR M. (Ed.): *Raziskave s področja geodezije in geofizike 2013: zbornik del*: 103–104. Fakulteta za gradbeništvo in geodezijo. Ljubljana.

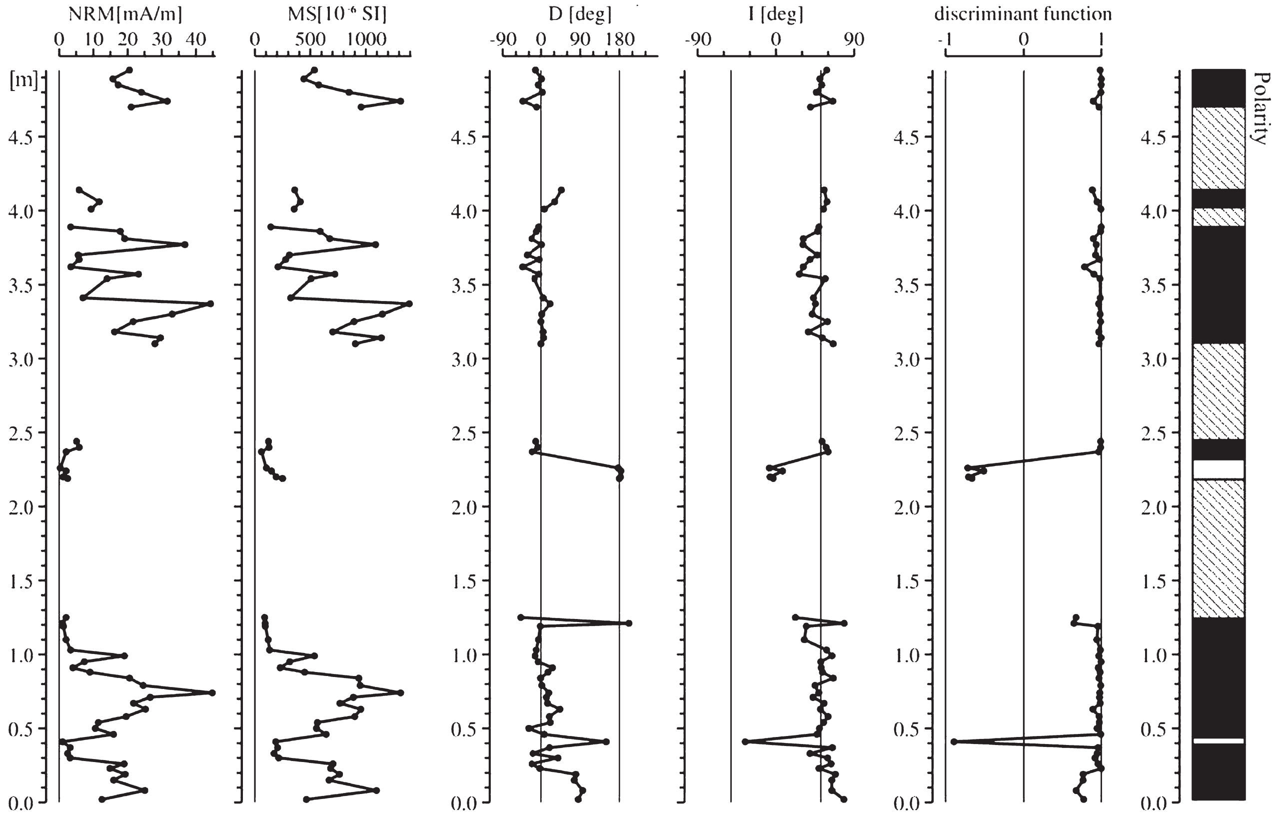
ZUPAN HAJNA N., MIHEVC A., PRUNER P. & BOSÁK P. (2010): Palaeomagnetic research on karst sediments in Slovenia. – *International Journal of Speleology*, 39: 47–60.

Bilateral co-operation between Institute of Geology of the CAS, v. v. i., and Karst and Cave Department of the Museum of Natural History, Wien, Austria: **Magnetostratigraphy of cave sediments in the Hermannshöhle Cave** (L. Plan, A. Schober Karst and Cave Department of the Museum of Natural History, Vienna, Austria, A. Mock, Department of Zoology, Institute of Biological and Ecological Sciences, Faculty of Science, University of Pavel Josef Šafařík, Košice, Slovakia, *P. Pruner* & *P. Bosák*; supported by RVO67985831; 2014)

The Hermannshöhle, located near the village of Kirchberg am Wechsel (Lower Austria), is one of the biggest caves in the Lower Austroalpine tectonic unit. It developed in an isolated block of weakly metamorphic banded marble. Within only 140 × 160 m ground area and 73 m of elevation difference a total of 4.4 km of corridors formed in a 3-D maze. There are three other caves nearby (Mäanderhöhle, Antonshöhle and Rauchspalten) and it is presumed that all four are genetically related, giving a length of almost 5 km (Schober et al. 2013).

Detailed paleomagnetic analysis of a sedimentary section at Teichkluft showed that sediments are characterized by varying magnetic susceptibilities and NRM with increasing tendency of anisotropy parameter with increase of susceptibility. The component analysis identified 2 short R polarity intervals (0.41 m; 2.19–2.26 m) within samples with the N polarity (Fig. 2). Rock magnetic and AMS measurements indicated mostly the presence of oblate, low-coercivity magnetic fraction, presumably magnetite. However, the R polarity interval (2.19–2.26 m) revealed also another, higher-coercivity fraction (maybe due to hematite/goethite content). The identity of this fraction is still unknown. The R polarity interval in 0.41 m represents a geomagnetic excursion without any doubt. The sedimentary profile with the R polarity interval in 0.41 m must be older than 162.7 ± 3.9 ka old topmost speleothem. The paleomagnetic directions (declination, inclination) are very close to the present magnetic field. Therefore we assume deposition of the studied sediments within the Brunhes chron (<780 ka) and the excursion may be correlated with Jamaica-Pringle Falls (205–215 ka) or Calabrian Ridge 1 excursions (315–325 ka; Langereis et al. 1997). Other Th/U date was obtained at the tourist trail opposite to Teichkluft entrance (ca. 495 ka +67/-41 ka) in an altitude corresponding to the top of the Teichkluft profile. This might indicate that the Teichkluft was completely or nearly completely filled twice (before 163 and ca. 495 ka) and once completely excavated (between ca. 205/325 and ca. 495 ka).

The fragments of cuticle of ring-like shape at the level of 2.30 m belong to attemsiid millipedes. The probability that fragments represent *Polyphematia moniliformis* (Diplopoda: Chordeumatida: Attemsiidae) known in the cave is high. It is supposed they are a Tertiary relict (Mock & Tajovský 2008). It has



■ **Fig. 2.** Basic magnetic and paleomagnetic properties, Hermannshöhle Cave, Lower Austria (from Bosák et al. 2014); natural remanent magnetization – NRM; volume magnetic susceptibility – MS; paleomagnetic declination – D; paleomagnetic inclination – I; discriminant function of polarity zones: white – R polarity; black – N polarity; hatched – no samples.

not been detected if fragments represent relics of recent/subrecent animal entering open fractures in brown clays close to cave walls, or if they represent a real fossil older than ca. 163 ka (Bosák et al. 2014).

BOSÁK P., MOCK A., PLAN L., PRUNER P. & SCHOBER A. (2014): Fossil attemsiid millipedes from the Hermannshöhle, Austria: Polyphematia moniliformis (Latzel, 1884)? – *22nd International Karstological School "Classical Karst": Karst and microorganisms. Program, Guide Book and Abstracts*: 47–49. Karst Research Institute SRC SASA. Postojna.

LANGEREIS C. G., DEKKERS M. J., LANGE G. J. de, PATERNE M. & SANTVOORT P. J. M. van (1997): Magnetostratigraphy and astronomical calibration of the last 1.1 Myr from an eastern Mediterranean piston core and dating of short events in the Brunhes. – *Geophysical Journal International*, 129: 75–94.

MOCK A. & TAJOVSKÝ K. (2008): *Mecogonopodium carpathicum* n. sp. (Diplopoda: Chordeumatida: Attemsiidae), a new troglophilic millipede from Slovakia. – *Zootaxa*, 1778: 26–36.

SCHOBER A., PLAN L., SCHULZ D. & SPÖTL CH. (2013): Speleogenesis of a 3d-Maze cave (Hermannshöhle, Lower Austria). – In: FILIPPI M. & BOSÁK P. (Eds.): *Proceedings of the 16th International Congress of Speleology, July 21–28, Brno*, Vol. 3: 408–411. Czech Speleological Society. Praha.

Bilateral co-operation between Czech Geological Survey, Praha and Geologisches Bundesanstalt Wien, Austria: **Palynology of Upper Cretaceous and Paleogene Gosau sediments on map 95 St. Wolfgang** (H. Lobitzer, Geologisches Bundesanstalt, Wien, Austria, L. Švábenická, Czech Geological Survey, Praha, Czech Republic & *M. Svobodová*; 2014)

Relatively frequent angiosperm pollen of the Normapolles group – *Oculopollis* spp., *Semioculopollis, Trudopollis* evidenced the Coniacian-Lower Santonian age of grey sandy marlstones at the exposures of Flieh and Strobl near Wolfgangsee, Upper Gosau Formation, map 95 St. Wolfgang, Northern Calcareous Alps. Rare dinoflagellate cysts and acritarchs, microforaminifers and abundant phytoclasts of terrestrial origin reflected shallow marine depositional conditions. Calcareous nannofossil *Lithastrinus grillii* Zone UC11-?Zone UC12 was documented at both localities the upper part of the Middle Coniacian-Lower Santonian.

Project of Joint Institute for Nuclear Research, Dubna, Russia, No. 04-4-1069–2009/2015: **Investigations of nanosystems and novel materials by neutron scattering methods** (*T. Lokajíček* & T. Ivankina, Joint Institute for Nuclear Research, Frank Laboratory of Neutron Physics, Dubna, Russia; 2009–2015)

Subproject 1: **Experimental and theoretical study of elastic wave field pattern in anisotropic texturized rocks**.

Spherical sample of biotite gneiss from the Outokumpu drill hole was used for ultrasonic testing. It has been shown that both, P- and S-wave velocities, can be measured simultaneously up to 70 MPa. 3D seismic measurements revealed a strong foliation-related directional dependence of P- and S-wave velocities. Ultrasonic measurements, compared with 3D velocity calculations based on neutron diffraction measurements of crystallographic preferred orientation of major minerals showed a very good agreement.

Grant Agency of Ministry of Education of the Slovak Republic and Slovak Academy of Sciences Project No. 1/0032/12: **Hypogene caves in Slovakia: speleogenesis and morphogenic types** (project principal researcher: P. Bella, State Nature Conservation – Slovak Caves Administration, Liptovský Mikuláš and Catholic University in Ružomberok, Slovakia; R. Braucher, Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environment, Européle Méditerranéen de l'Arbois, Aix-en-Provence, France, J. Holec, M. Veselský, Comenius University in Bratislava, Faculty of Natural Sciences, Department of Physical Geography and Geoecology, Bratislava, Slovakia, *P. Bosák* & *P. Pruner*; since 2013)

The multi-levelled Domica–Baradla cave system (Slovak and Aggtelek Karsts; UNESCO World Heritage site) was formed in relation to the incision phases of the Jósva River Valley (Hungary). Two evolution levels, slightly decreasing from 341 to 338 m and 335 to 314 m a. s. l., are identified in the Domica Cave (Slovakia). Also the lower evolution level at 318 m a. s. l. (10 m below the middle level) was distinguished based on the drill hole through floor sediments in the Panenská Passage (Droppa 1972). The large passage of the middle cave level, that forms the main part of the cave system, slightly decreases (with an inclination of about 7.5 ‰) towards the outflow part near Jósvafő Village (at 260–270 m a. s. l. in the terminal part of the Baradla Cave, Hungary). The burial age of cemented quartz gravel in the upper cave level of the Domica Cave is 3.47 ± 0.78 Ma (dated using cosmogenic nuclides ^{10}Be and ^{26}Al). This gravel was transported into the cave by inflow streams from the Poltár Formation (Pontian–Late Pliocene?) covering subsided tectonic blocks of Triassic carbonates at the southwestern edge of the Silica Plateau. The result of cosmogenic nuclide dating shows that the upper evolution level of the cave system originated in (or before) Middle Pliocene. The middle evolution level (located 10–12 m below the upper level) probably also originated in relation to the formation of large pediment (of Pliocene age after Láng 1955) whose remnants (at 250–275 m a. s. l.) are conserved on both slopes of the Jósva River Valley. Within the denudation chronology of the Western Carpathians this pediment probably corresponds to the River level (Late Pliocene–Early Quaternary?). The oldest U-series data from the whole cave system indicates speleothem ages of 130 to 150 ka (Lauritzen & Leél-Őssy 1994, Ford & Zámbó 1997). Data obtained from both U-series dating and paleomagnetism of speleothems and fine-grained siliciclastic sediments from both parts of the system (Pruner et al. 2000, Bosák et al. 2004) are related to the youngest accumulative phases within the whole cave system from the Eemian interglacial, including the Blake Event, and interstadials of the Weichselian glacial stages (Bella et al. 2014). Older sediments, except for those cemented on cave walls and rests of fluvially eroded speleothems, were exhumed during multiple accumulation/exhumation phases in the system. Recently, the system exhibits the erosion phase, when the youngest fills have been gradually exhumed from the system via expressive underground sinkhole in the Baradla part of the system as a consequence of floods and fluctuations of groundwater level operated by capacity of the respective karst springs.

BELLA P., BRAUCHER R., HOLEC J., VESELSKÝ M., PRUNER P. & BOSÁK P. (2014): Geochronology of the Domica–Baradla cave system (Slovakia, Hungary) based on cave sediment dating. – 9th *ESSEWECA conference, November 5–7, 2014, Smolenice, Slovakia. Environmental, Sedimentary & Structural Evolution of the Western Carpathians. Abstrakt Book*: 7–8. Geophysical Institute, Slovak Academy of Science, Geological Institute, Slovak Academy of Science. Bratislava.

BOSÁK P., HERCMAN H., KADLEC J., MÓGA J. & PRUNER P. (2004): Palaeomagnetic and U-series dating of cave sediments in Baradla Cave, Hungary. – *Acta Carsologica*, 33, 2: 219–238.

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Mobility Program supported by the Ministry of Education, Youth and Sports, Project Code: 7AMB 12AR024: **Reconstruction of uplift history in the Fuegian Andes central belt (southern Tierra del Fuego, Argentina)** (*M. Svojtka*, *D. Kořínková*, D. Nývlt, Česká geologická služba, Praha, E.B. Olivero & P.J.T. Carbonell, El Centro Austral de Investigaciones Científicas (CADIC - CONICET), Ushuaia, Argentina; 2014–2015)

The Mobility Program supports activities of international cooperation in research and development to promote the mobility of researchers. The aim of the proposed project is dating of the main tectonometamorphic phases and also reconstruction of low-temperature evolution of the eastern part of the Cordillera Darwin in the Argentine territory of Tierra del Fuego and their comparison and the connection of the available data from the Chilean side. During our joint Czech-Argentinian October fieldwork stay in Argentina (Fig. 3) in first year of the project, we focused on

■ **Fig. 3.** Subvolcanic igneous rocks of Monte Olivia (1326 m a. s. l.) intruded the studied rocks in the Yahgán Formation (unknown age) just below the tectonic contact with the Lemaire Formation (Upper Jurrasic). Photo by M. Svojtka.

traditional geological and petrological field research of Upper Jurassic to Lower Cretaceous samples in the Fuegian Andes. We collected 12 samples of fine- to medium-grained sandstones to conglomerates and also fine-grained schists in the above mentioned stratigraphic sequence. These samples will be prepared in order to define provenance ages of the Austral (or Magallanes) Basin using fission-track analyses. We made a cathodoluminescence imaging of oscillatory zoned zircon from Austral Basin and we prepared this sample for a subsequent laser ablation ICP-MS U-Pb zircon method.

International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 575: **Pennsylvanian terrestrial habitats and biotas in southeastern Europe and northern Asia Minor and their relation to tectonics and climate** (International leader: C. J. Cleal, National Museum Wales, Cardiff, United Kingdom; International co-leaders: S. Opluštil, Charles University, Praha, Czech Republic, I. van Waveren, Naturalis Biodiversity Center, Leiden, Netherlands, M. E. Popa, University of Bucharest, Bucharest, Romania, B. A. Thomas, University of Aberystwyth, Aberystwyth, United Kingdom; Czech national coordinator: S. Opluštil, Charles University, Praha; Czech participants: J. Drábková, Czech Geological Survey, Praha, I. Hradská, West Bohemian Museum Plzeň, J. Prokop, Charles University, Praha, J. Pšenička, West Bohemian Museum, Plzeň, I. Sýkorová, Institute of Rock Structure and Mechanics, Czech Academy of Sciences, Praha, Z. Šimůnek, Czech Geological Survey, Praha, S. Štamberg, Museum of Eastern Bohemia, Hradec Králové & *J. Zajíc*; 2010–2015)

A complete faunal list was compiled for the Early Permian lake deposits of the Krkonoše Piedmont Basin. Fauna-bearing sites and boreholes belong to two local zones of the Bohemian Massif. Sedimentary facies together with the faunal content and taphonomy of the fossil-bearing sites enabled an interpretation of the intrabasinal palaeogeography of both main Early Permian lakes. Stratigraphy, changes within the fish communities and inter-basin correlations were discussed by Zajíc (2014).

ZAJÍC J. (2014): Permian fauna of the Krkonoše Piedmont Basin (Bohemian Massif, Central Europe). – *Acta Musei Nationalis Pragae, Ser. B, Historia Naturalis*, 70: 131–142.

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, Belgium, international co-leaders: M.T. Whalen, USA, *J. Hladil*, D. Chen, China, S. Spassov, F. Boulvain & X. Devleeschouwer, Belgium; Czech group representative and organizer: *L. Chadimová*; 2009–2013, O.E.T. 2014)

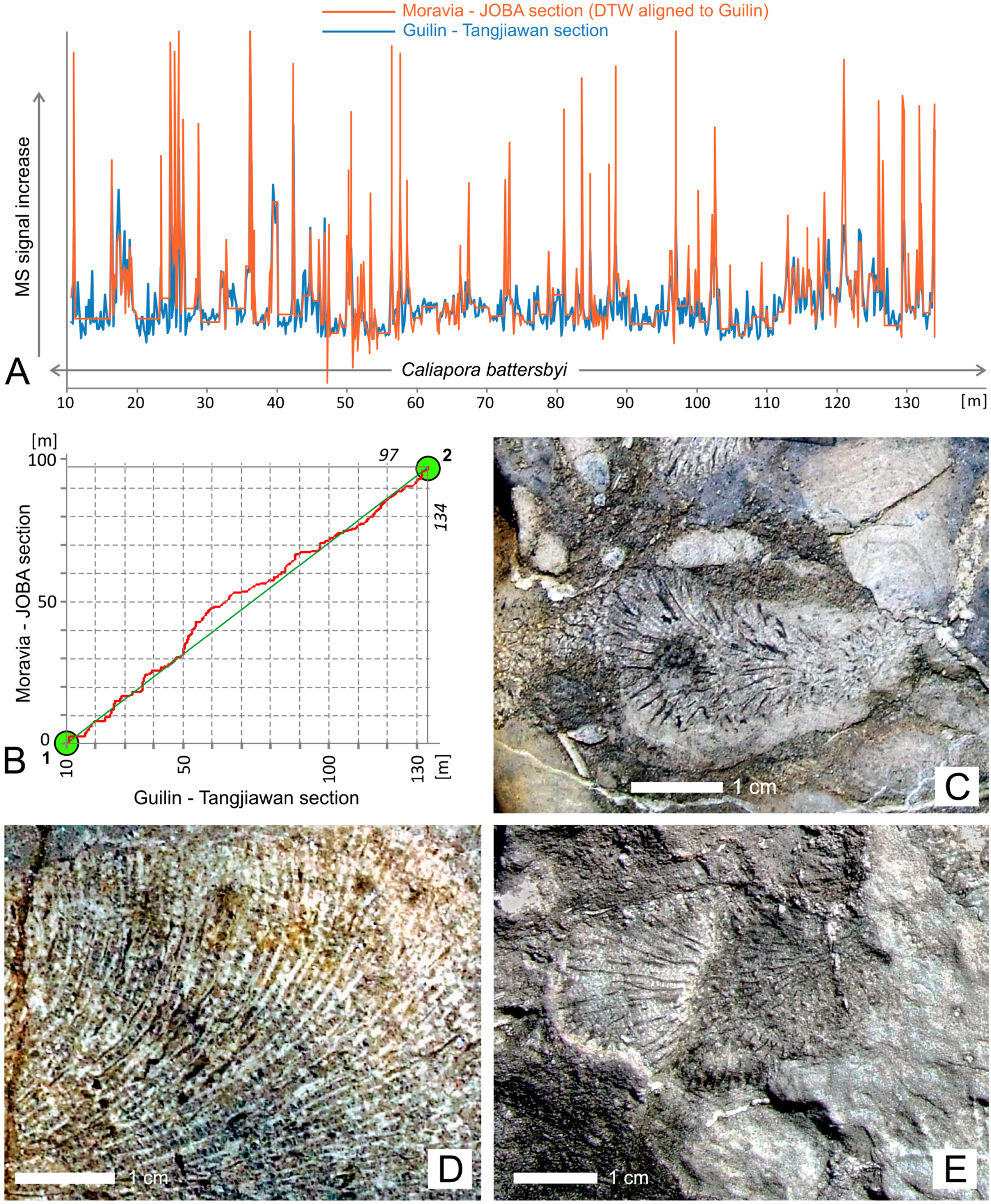
In February 2014, the IGCP Scientific Board in Paris assessed the terminated project with the overall score 5 that means excellent. In this statement the Board emphasizes that the project generated a large amount of data on magnetic susceptibility on Palaeozoic sedimentary rocks by applying a lot of different techniques. It also collected information on the origin of magnetic minerals carrying the MS signal and reconstructed climatic variations. The last year was also a banner year for publications, with 38 refereed papers published and in press in excellent international journals (EPSL, Geological Magazine, Lethaia, Sedimentary Geology, Cretaceous Research, etc.) and a final publication in the special issue of Geological Society of London is in advanced stage of preparation. Considering the scientific and educational impact of the project over the geosciences in general, together with numerous and promising interdisciplinary studies in progress, the Board decided about the continuation the project on extended terms (O.E.T.). Two different insights into the terminal phase of the IGCP project No. 580 were published, the first in the Research Reports 2013 and the second in the IUGS open-access impact factor journal (da Silva et al. 2014) – the latter to make the overall achievements of the project accessible for a broad community of readers.

The 2014 O.E.T. project activity of the Czech participants concentrated on the 14th Castle Meeting in Portugal (Chadimová et al. 2014) and joint IGCP 596 & 580 Meeting in Mongolia (Slavík et al. 2014, Pas et al. 2014). The conference papers selected above were concentrated on **(1)** detailed rock magnetic analysis with frequency-dependent magnetic susceptibility studies (FDMS), **(2)** assessment of combined magnetic susceptibility, gamma-ray spectrometry and microfacies log patterns (MS–GRS–MF), using the detailed biostratigraphic framework, and **(3)** regional to global correlation of the magnetic susceptibility stratigraphy logs (MSS). The preferred objects of the studies were Upper Silurian limestones in the Barrandian area near Prague, Lower Devonian of Spanish Pyrenees and Middle Devonian (Givetian) in Belgium, respectively.

1. In the Late Silurian rocks of mid-Ludfordian age, we studied two sections involving also the Lau Event (LE) records – Požáry and Mušlovka sections. The MS logs, supported by gamma-ray outcrop logging, other petrophysical, facies and biostratigraphic data, provided a good guide for high-resolution stratigraphic correlation and explanation of paleoenvironmental and diagenetic conditions. Due to a considerably different arrangement of common stratigraphic gaps, the solution was grounded on the computation of the dynamic time warping (DTW) alignments between the MS signal records from the above mentioned two sections. The DTW technique allowed us also to understand the triple-peak structure in the MS curves going through the Lau Event-related successions of beds which are biostratigraphically marked by the *Delotaxis* conodont fauna. The elevated triple-peak structure warped and unfolded along the time scale is sinusoidal with c. 110 ± 30 ka period which is close to the 100-ka family of the most discussed cycles (orbital vs. solar or cosmic dust control). Magnetite is the main carrier of the MS signal in these limestones but there is an exception for the lowermost and uppermost parts of the Mušlovka mid-Ludfordian section where extremely low amounts of magnetite pass the control on the MS signal to superparamagnetic (SP) hematite and other minerals with paramagnetic characteristics. The FDMS measurements suggest that significant amounts of SP particles also below, across and above the Lau Event beds. The ultra-small magnetic particles were formed during the early diagenesis, and most of them originated with the major sea-level fall episodes before and in the lower and middle stages of the event. The extremely depressed sea level led to subaerial exposure of limestones on upper carbonate slopes. This was connected with truncation, corrosion and pedogenetic processes on the emerged rocks. The diagnosis of this type is slightly more developed at Požáry compared to Mušlovka, thus coinciding with the interpretation of somewhat shallower set of the Late Silurian facies at the former.

2. The high-resolution stratigraphic correlation of Lochkovian–Pragian boundary successions was primarily financed by the CAS project No. M100131201 on international (Czech–Spanish) scientific cooperation and, therefore, most of the results coming from multifaceted techniques used are summarized in the report related to this project (in this volume). This report can, however, be extended with several additional and more detailed descriptions related to the MS signal patterns. As it can be exemplified with one of the principal sections in the Spanish Central Pyrenees – Segre 2, the Upper Lochkovian rocks show only slight overall trend to increase the MS values (with the exception of the latest beds) and the earliest Pragian beds even show a short period of decrease (return). However, the next 25 m of the section document an extraordinary increase. This elevated part of the Segre-2 MS curve shows, compared with the Czech sections Požár-3 and Pod Barrandovem (Hladil et al. 2010, Hladil et al. 2011), nearly identical structures. Along the scale of millions of years, the Spanish K–Th gamma-ray and MS signals look like being coupled together, but some of the intervals of the c. 50 ka duration or shorter show just the opposite – many of partial K–Th depressions are coupled with elevated MS values. What is the most surprising in this context is that the partial K–Th depletion combined with high MS is connected to high-purity limestone (with neomorphic microsparite overprinting the original ultrafine calcisiltite and "floating" bioclasts, mostly styliolinids and delicate crinoids ossicles), whereas the high Th – low MS rocks are lithoclastic packstones with a small amount of very fine detrital quartz, mica and clay minerals. The latter also typically contain micrometric shards with concave faces and sharp edges, originally high-silica volcanic glass. Pressure dissolution seams and stylolites are abundant and marked by brownish-ochre iron oxyhydroxides. Although the relationships between amounts of non-carbonate impurity in limestone and these signals can often be different (e.g., Whalen & Day 2010, Machado et al. 2010 or Vacek et al. 2010), the Spanish example shows rather unusual than common relationships in the case of longer cycles. However, the explanation of this phenomenon is possible. "High Th – low MS": The terrigenous material of mixed carbonate-silciclastic rocks was delivered from riverine–coastal systems, containing also weathering products and volcanic tuffites, and it increased the amounts of thorium enough. On the other hand, the increased iron concentrations have little effect on MS signal due to nearly an absolute dominance of oxyhydroxide mineral phases. "Low Th – high MS": The high-purity limestone embedded also ultrafine aeolian dust impurity delivered to the basin. In spite of the cumulative effect on the rock composition, the overall contents of Th remained smaller than in the mixed systems. The increased MS corresponds to the fact that high-purity calcite rocks can often provide good conditions for preservation of diagenetic and biogenic magnetites. The rapid embedding into phreatic calcite cements (and/or transformation of polydisperse bioclastic materials into almost impermeable calcite crystal mosaics) can help to the protection of magnetite particles which have a very strong effect on the MS signal, even if they occur in trace amounts.

3. Publication of the first composite MS section through the Eifelian–Frasnian succession of limestone beds (Hladil et al. 2006), which emphasized the possible atmospheric dust and up to global climatic control on the MS signal of limestone, opened the way for inter-regional correlation of long records in the deep geological past. Characterization of impurity in high-purity limestone was an analogue to studies on impurity in ice, but reaching the greater stratigraphic ages. This initiative was followed by proposals and launching of the IGCP Project No. 580, and first inter-regional comparisons were suggested – e.g. between the isolated reef platform of Moravia in the Czech Republic and carbonate ramps of Ardennes in Belgium (Boulvain et al. 2010). A remarkable similarity of records from the Ardennes to those of Moravia is quite a surprising finding, because the sequences in the Ardennes are typical by terrigenous impurity which was delivered in great amounts from the adjacent land areas of elevated parts of the London-Brabant Massif. Concerning the long-term parameters control of MS, we must solve the combination of many factors which correspond to the specific climate-driven mechanisms responsible for the non-carbonate clastic input basinwards, including the regional impact of the atmospheric/ocean system changes, weathering and erosion. Concurrently, we must assess the effects of eustasy, and transgression/regression in general, on shaping of the land, coastal and marine shelf or slope areas. A particularly difficult problem is to correctly merge and interpret data on regional uplift/sinking or tilting of crustal blocks, as well as all the external factors (orbital and cosmic) that could have played a role also in the long-term supra-Milankovitch cycles and variations recorded in the MS signal. For the Givetian, the identification of the correlation details remains ambiguous for some windows in the Belgian composite record which is typical by great variability of facies



■ **Fig. 4.** The DTW alignment of the Givetian MS records between Moravia (JOBA section, Czech Republic) and Guangxi Zhuang Autonomous Region (Tangjiawan section, People's Republic of China). A – details of alignment, B – alignment path: 1 – beginning of the segments aligned (i.e., stratigraphically correlated): JOBA 0 m corresponds to 68.2 m in the Moravian composite section by Hladil et al. (2006), biostratigraphically ~ the lowermost parts of the Lower varcus conodont zone equivalent; 2 – end of the segments: JOBA 97.2 m = 165.4 m in the Moravian composite section, biostratigraphically ~ an approximate equivalent of the boundary between hermanni–cristatus and disparilis conodont zones. C to E – Examples of cosmopolitan and stratigraphically significant Caliapora battersbyi corals from the Guilin–Tangjiawan section; at 25, 27 and 73 m marks, respectively. DTW computation and diagrams by J. Hladil, photo by L. Chadimová.

given by competition between the clastic and bioconstruction parameters of the basin architecture.

Possibly the best long-distance correlation was achieved with the DTW alignment of the detailed Givetian MS records between the Czech section Moravian Karst–Brno and Chinese section Tangjiawan–Guilin. These preliminary results of the Czech team from the Institute of Geology CAS (*) are reported here for the first time. These sections represent huge shallow carbonate platforms in quite continuously and slowly sinking basins, coupled with minimum or none intrusion of aquatic siliciclastics into high-purity carbonate depositional environments but having a good record of the atmospheric dust overall background. The Givetian basins of South China and Moravia were at similar latitudes of around 15–20 degrees South, with good ocean water communication around the platforms mediated by surface currents from east to west, spaced about 9 ± 2 thousands of kilometres, and they show a very similar to identical assemblages of coral and stromatoporoid faunas. Therefore, the ranges of many marker species (e.g. *Caliapora battersbyi*) provided a lot of biostratigraphic proxies to the DTW alignment of these two records from different places on the globe (Fig. 4).

(*) The MS sampling of Chinese section was made by J. Hladil, S. Šlechta, P. Schnabl, P. Lisý, L. Lisá & P. Čejchan in 2010, with significant support by Chen Daizhao, Dong Shaofeng & Zhou Xiqiang, from the Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing. The MS values of rock samples were measured by L. Chadimová.

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SLAVÍK L., VALENZUELA-RÍOS J. I., CHADIMOVÁ L., LIAO J. C., HUŠKOVÁ A. & CALVO H. (2014): Hi-res correlation of the Lochkovian-Pragian (Lower Devonian) sections in the key regions of peri-Gondwana. – In: KIDO E., WATERS J. A., ARIUNCHIMEG Y., GONCHIGDORI S., Da SILVA A. C., WHALEN M., SUTTNER T. J. & KÖNIGSHOF P. (Eds.), IGCP 596 & IGCP 580 Joint Meeting Mongolia, Abstract Volume. – *Berichte des Institutes für Geologie und Paläontologie der Karl-Franzens-Universität Graz*, 19: 46–47.

VACEK F., HLADIL J. & SCHNABL P. (2010): Stratigraphic correlation potential of magnetic susceptibility and gamma-ray spectrometric variations in calciturbiditic facies (Silurian-Devonian boundary, Prague Synclinorium, Czech Republic). – *Geologica Carpathica*, 61, 4: 257–272.

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International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 587: **Identity, Facies and Time: The Ediacaran (Vendian) Puzzle** (International leader: P. Vickers-Rich (Australia); Czech group representative and organizer: *R. Mikuláš*; other Czech workers: *M. Vavrdová* & O. Fatka, Faculty of Science, Charles University, Prague; 2010–2015)

Ediacaran-type taphonomic windows for non-shelly biota could be repeatedly opened in the Palaeozoic, as shown by the field data from the Ordovician of the Barrandian area, Bohemian Massif. In the Neoproterozoic of the Barrandian area, new field data suggest the presence of shallow marine, potentially inhabited settings. Introduction to the topic and preliminary information can be found in Mikuláš (2015) and Vavrdová (2015).

MIKULÁŠ R. (2015): Nejstarší doklad existence svalové tkáně? Nové zkameněliny z konce starohor. – *Vesmír*, 94, 1: 31–34.

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International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 591: **Early to Middle Paleozoic Revolution** (International leader: B.D. Cramer, USA, international co-leaders: T.R.A. Vanderbroucke, France, Renbin Zhan, China, M.J. Melchin, Canada, Z. Zigaite, Lithuania, K. Histon, Italy, G.L. Albanesi, Argentina & M. Calner, Sweden; Czech participants: *L. Slavík*, *P. Štorch*, J. Frýda & Š. Manda, Czech Geological Survey; 2011–2015)

Comprehensive research on faunal dynamics, biostratigraphy and taxonomy of the early-middle Llandovery and Ludlow graptolites continued in the Prague Synform (Frýda & Štorch 2014, Štorch et al. 2014). Gorstian faunas and Wenlock–Ludlow boundary graptolites from Všeradice, Bykoš and Nesvačily sections shed light on so far unknown features of the latest Homerian–Early Gorstian graptolite rediversification and adaptive radiation following the late Homerian *lundgreni* (or Mulde) Event. Apart from a number of graptolite taxa previously known from low-palaeolatitudinal regions (Baltic area, Arctic Canada), lowest occurrences of many biostratigraphically important species refined biozonation and located precisely the Wenlock-Ludlow boundary in the Czech Silurian sedimentary succession.

The regional zonation of the Wenlock/Ludlow boundary was established for the Prague Synform using refined data from updated conodont records (Slavík 2014). The Bohemian conodont zonal scale is correlated with the recently proposed standard. The established conodont biozonation are then integrated with the generalized eustatic and carbon isotope curves into a complex correlation chart.

Thorough revision of late Katian and earliest Hirnantian graptolites of the Králův Dvůr Formation enabled so far the most precise biostratigraphic correlation of peri-Gondwanan terranes with Baltica (Bornholm, southern Sweden) and contributed to current studies on Late Ordovician graptolite palaeobiogeography and faunal dynamics (Kraft et al. in press).

FRÝDA J. & ŠTORCH P. (2014): Carbon isotope chemostratigraphy of the Llandovery in northern peri-Gondwana: new data from the Barrandian area, Czech Republic. – *Estonian Journal of Earth Sciences,* 63, 4: 220–226.

KRAFT P., ŠTORCH P. & MITCHELL C. E. (in press): Graptolites of the late Katian Králův Dvůr Formation (Ordovician, Prague Basin, Czech Republic). – *Bulletin of Geosciences*, 90, 1: 195–225.

ŠTORCH P., MANDA Š. & LOYDELL D. K. (2014): The Early Ludfordian leintwardinensis graptolite Event and the Gorstian-Ludfordian boundary in Bohemia (Silurian, Czech Republic). – *Palaeontology*, 57, 5: 1003–1043.

SLAVÍK L. (2014): Revision of the conodont zonation of the Wenlock-Ludlow boundary in the Prague Synform. – *Estonian Journal of Earth Sciences,* 63, 4: 305–311.

International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 596: **Climate change and biodiversity patterns in the Mid-Palaeozoic** (International leader: P. Koenigshof, Germany, international co-leaders: T. Suttner, I.A. Boncheva, N.G. Izokh, T.H. Phuong, T. Charoentitirat, J. Waters, W. Kiessling & E. Kido M.T.; Czech group representatives *J. Hladil*, *A. Hušková*, *L. Chadimová*, *L. Slavík*; P. Budil, L. Ferrová & S. Vodrážková, Czech Geological Survey; 2011–2015)

The major activities in 2014 were focused on the complex investigation of the Middle and Upper Palaeozoic rocks during the field work in the Baruunhuurai terrane, Western Mongolia (Fig. 5). The field campaign was organized together with the Joint IGCP 596 & 580 Meeting in Ulaanbaatar. Several working groups of the international team (approx. 20 specialists) sampled Devonian and Carboniferous sections for biostratigraphy (conodonts and macrofauna) and other multiproxy techniques (e.g., microfacies analysis, carbon isotopes, and magnetic susceptibility). Especially the preliminary examination of benthic macrofauna has led to different interpretations of the ages of carbonate deposition and especially the dating of expected "Kellwasser Event" and transitional marine-terrestrial deposition. The more detailed results are expected from complete sample processing after evaluation by Mongolian authorities before their export and distribution to the European and North American institutions. During the Ulaanbaatar meeting several contributions with Czech cooperation were presented (Pas et al. 2014 and Slavík et al. 2014)

PAS D., POULAIN G., LABAYE C., Da SILVA A.C., CORNET P., DEVLEESCHOUWER X., De VLEESCHOUWER D., HLADIL J. & BOULVAIN F. (2014): Diversity and correlation of Givetian records in southern Belgium. – In: KIDO E., WATERS J. A., ARIUNCHIMEG Y., GONCHIGDORI S., Da SILVA A. C., WHALEN M., SUTTNER T. J. & KÖNIGSHOF P. (Eds.), IGCP 596 & IGCP 580 Joint Meeting Mongolia, Abstract Volume. – *Berichte des Institutes für Geologie und Paläontologie der Karl-Franzens-Universität Graz*, 19: 38–40.

SLAVÍK L., VALENZUELA-RÍOS J. I., CHADIMOVÁ L., LIAO J. C., HUŠKOVÁ A. & CALVO H. (2014): Hi-res correlation of the Lochkovian-Pragian (Lower Devonian) sec-

■ **Fig. 5.** The camp base during a coming storm, Baruunhuurai terrane (Western Mongolia). Photo by Ladislav Slavík.

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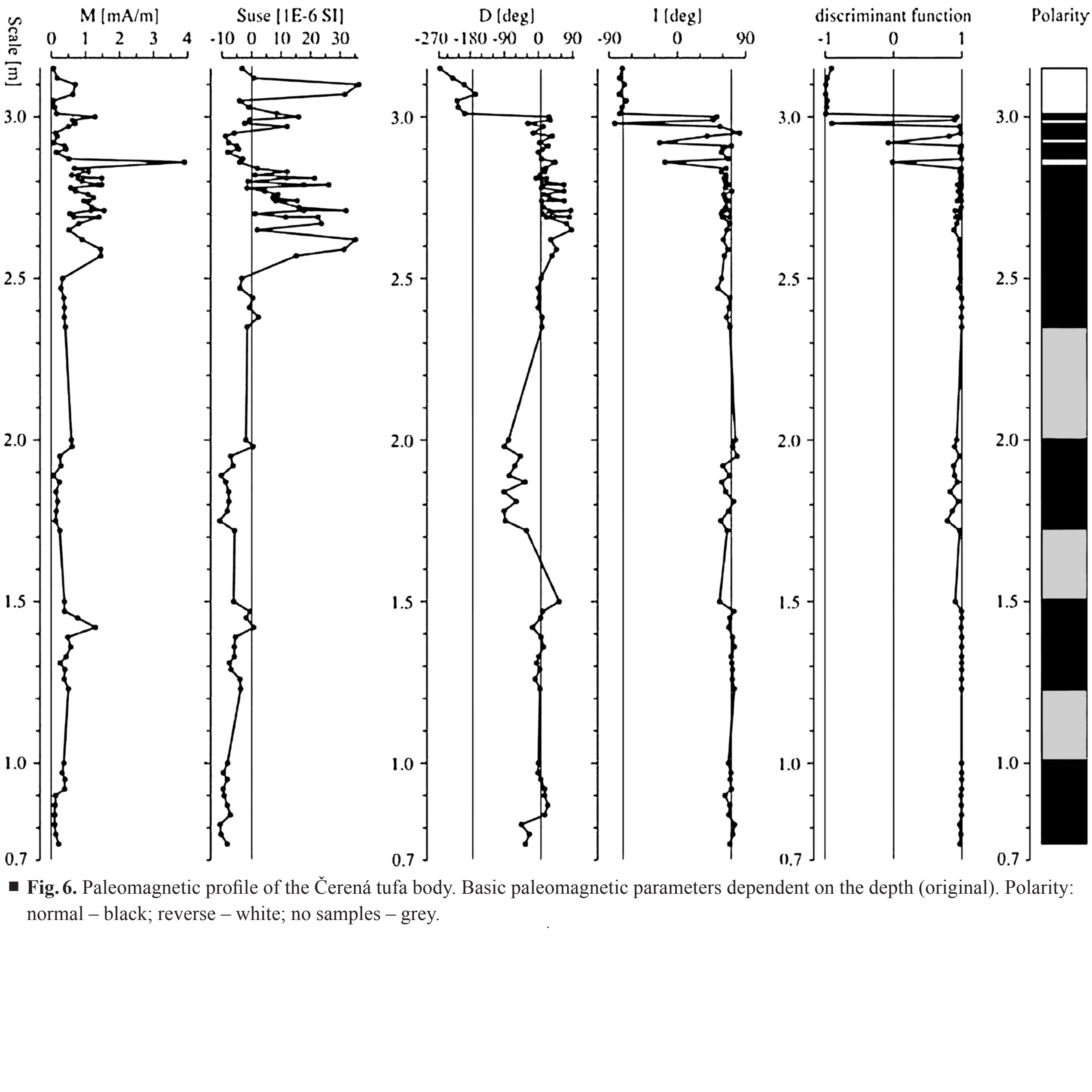
Slovak Research and Development Agency Project No. APVV-0625-11: **New synthesis of relief evolution in the Western Carpathians**. **Subproject U4-7b: Tufa body dating on contacts with river terraces and pediments** (project principal researcher: J. Minár, Faculty of Science, Komenský University, Bratislava, Slovakia; task co-ordinators: J. Soták, Institute of Gelology SAS, Bratislava, Slovakia and P. Bella, State Nature Conservation – Slovak Caves Administration, Liptovský Mikuláš and Catholic University in Ružomberok, Slovakia; H. Hercman, M. Gasiorowski, Institute of Geological Sciences, PAS, Warszawa, Poland; *P. Bosák*, *P. Pruner*, *K. Čížková* & *S. Šlechta*; since 2012)

Four tufa bodies at different locations within the Liptovská kotlina Basin (northern Slovakia = Bešeňová – Drienok, Bešeňová – Záskalie, Čerená /abandoned quarry/, and Liptovské Sliače – Skalie) were sampled by drilling in 2012 (Bosák et al. 2013, Minár et al. 2015). The sites were carefully selected with respect to geological and geomorphic setting of each tufa body. All samples from Bešeňová – Drienok and Bešeňová – Záskalie sites showed normal magnetic polarity. Individual samples from Čerená and Liptovské Sliače–Skalie, indicated reverse or transient/reverse magnetization. Zones containing reverse or transient polarities were sampled in detail by drillings in 2013 (Bosák et al. 2014).

Paleomagnetic research of totally 160 tufa samples finally proved reverse polarity of some samples in two tufa bodies (Fig. 6) and normal polarity of the rest of the profiles. The correlation of reverse polarized zones with the GPTS, without any numerical dating results, is problematic. Nevertheless, reverse zones, most probably, represent short-lived excursions of the magnetic field. Based on the IRSM analysis, the magnetization carrier is represented mostly by magnetite, another carrier of hard magnetization (e.g., hematite) is subordinate. Some of the



■ **Fig. 6.** Paleomagnetic profile of the Čerená tufa body. Basic paleomagnetic parameters dependent on the depth (original). Polarity: normal – black; reverse – white; no samples – grey.

studied tufa segments indicate anomalous values of paleomagnetic parameters, especially of declination, which demands a more detailed additional study.

The results indicate that tufas deposited during the Brunhes normal polarity chron (younger than 0.78 Ma), which is mostly in agreement with geomorphic settings of tufa bodies and expected ages of geomorphic features. The horizons just above the tufa body base in the Čerená site can be dated to 419–283 ka, although the quoted errors are quite large (±37 to 89 ka). The errors are caused by high detrital thorium admixture due to fine-grained siliciclastics taken from dissolution of the underlying Central Carpathian Paleogene rocks by ascending groundwaters and deposited together with carbonate in tufa layers.

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Grant-in-aid internal program of international cooperation projects Czech Academy of Sciences, Project Code: M100131201: **Hi-res correlation and dating of Mid-Paleozoic sedimentary sequences of Peri-Gondwana using integrated biostratigraphy and chemo-physical methods** (*L. Slavík*, J. I. Valenzuela-Ríos, J.-Ch. Liao *L. Chadimová*, *A. Hušková* & H. Sanchíz-Calvo, University of Valéncia, Spain; 2012–2015)

Two key areas of European peri-Gondwana, the Prague Synform (Barrandian area, Czech Republic) and the Spanish Central Pyrenees, show an excellent correlation by means of conodont biostratigraphy during Lochkovian and early Pragian times (for conodont biostratigraphy see e.g., Valenzuela-Ríos 1994a, b, Murphy & Valenzuela-Ríos 1999, Slavík 2004, Valenzuela-Ríos et al. 2005, Slavík et at. 2007, 2012). The number of common guiding taxa enables a very detailed matching that in specific time-intervals (e.g., middle Lochkovian) can reach a resolution of up to tens of ka, i.e., much higher than traditional application of (even refined) biozonations. The beginning of the Pragian is then characterized by an abrupt change both in benthic and pelagic communities. The early Pragian correlation between the two regions based on conodont faunas has been already developed (e.g., Slavík et al. 2007) and its application can be extended also to other regions of peri-Gondwana where cosmopolitan taxa are scarce. In general, the correlation from the middle Pragian onwards begins to be more complicated because of dearth of biostratigraphically significant faunal taxa. With the beginning of the Emsian the global biostratigraphic correlation is easier; it is related to the radiation of early Emsian polygnathids. The Lochkovian/Pragian boundary event (in the sense of Chlupáč & Kukal 1988) is caused by a global fluctuation of sea level (*cf.* Johnson et al. 1985). In many sections the boundary is masked by lower accumulation rates or even gaps in combination with local tectonic disturbances in some sections. Accordingly, the precise identification of the Lochkovian/Pragian boundary at many places of the world is difficult.

The aim of our Czech-Spanish project "Hi-Res correlation and dating of Mid-Palaeozoic sedimentary sequences of Peri-Gondwana using integrated biostratigraphy and chemo-physical methods" is to apply auxiliary correlation tools in intervals where the density of biostratigraphic time-marks is low. The correlation is based on the application of several methods in the sections: the detailed biostratigraphical framework is supplemented by multiple chemo-physical measurements (i.e. gamma-ray spectrometry and magnetic susceptibility) in order to avoid discrepancies in correlation of the peri-Gondwanan successions.

Two field campaigns have been organized: in the Prague Synform we examined classical Lower Devonian sections and sampled conodont faunas. In the Spanish Central Pyrenees we sampled two early Devonian sections (Segre 2 east of Seu d'Urgell and Compte 1 north of Gerri de la Sal, Fig. 7) for magnetic susceptibility and performed gamma-ray spectrometry logging. Especially difficult in the Segre 2 section was the precise location of the Lochkovian/Pragian boundary because of short intervals that provided no biostratigraphic data. We have sampled and measured a 59 m interval in total (328 samples) in the Compte 1 section and 62 m (356 samples) in the Segre 2 section. The laboratory magnetic susceptibility measurements were performed at the Institute of Geology of the CAS, v. v. i. using a kappabridge KLY-2 device, Agico Brno. In addition, we have taken 17 samples from the Segre 2 section for lithological characterization from the thin sections (e.g., microfacies analyses) and carried out field gamma-ray spectrometry measurements using a portable natural radiation detector RS-230 BGO Super-SPEC (Georadis Ltd., Brno, Czech Republic). The GRS logging was applied with the 0.5 m step at both Compte 1 and Segre 2 sections (in total 131 measuring points at the Segre section and 127 measuring points at the Compte section).

Although the evaluation of magnetic susceptibility curves and gamma-ray logs is still in progress, the preliminary matching of the magnetic susceptibility curves (expressed as mass specific magnetic susceptibility) show surprisingly very similar patterns at both sections. These two logs show similar trends and also absolute values which are positive (not negative). It means that paramagnetic and/or ferromagnetic component is present and masks the diamagnetic calcite as major constituent of the carbonates across the entire sections. Low MS values in the lower parts of the sections correspond to the Lochkovian interval (according to conodont biostratigraphy, Valenzuela-Ríos 1994a, 2002, Valenzuela-Ríos et al. 2005). Data show that the Lochkovian/Pragian boundary can be best plotted to very short (less than 1m thick) intervals at corresponding levels of both sections. Pragian interval is marked by elevated MS values at both sections (average 50.7 and 52.8 × $10^{-9}.m^3.kg^{-1}$ for the Segre and Compte sections, respectively). A similar pattern can be seen also for the Lochkovian and Pragian successions in the

■ **Fig. 7.** The Compte I section near Baro in the Spanish Central Pyrenees with the Lochkovian-Pragian boundary. Photo by Leona Chadimová.

Prague Synform (represented by the Lochkov and Praha Fms. and lowermost part of the Zlichov Fm.) In the Prague Synform (Požár 3 section, Koptíková et al. 2010), the MS values in the Praha Fm. (= original Pragian) limestones are five times higher than in the Lochkov Fm. (= Lochkovian). The upper part of the studied sections shows a decrease in MS values; this is more prominent in the Segre section than in the Compte section. The Segre section shows a strong decrease in MS, and average values are lower (average values of 22.8 $10^{-9}.m^3.kg^{-1}$) than those in the Lochkovian interval, whereas the Compte section shows a rapid decrease and then again a gradual increase.

In summary, the integration of biostratigraphic data and magnetic susceptibility logs enable a more precise correlation of the Lochkovian /Pragian boundary. This study also confirmed the general increase of MS values for the Pragian time that has been recognized in the Prague Synform.

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Grant-in-aid internal program of international cooperation projects Academy of Sciences of the Czech Republic, Project Code: M100131203: **Origin and characterization of mantle and crustal rocks: answer for deformation, thermal and geochemical evolution of orogenic zones** (*M. Svojtka*, *J. Sláma*, *L. Ackerman*, T. Hirajima, D. Naemura, K. Yoshida & T. Kobayashi, Kyoto University, Japan; 2012–2015)

In 2014, we presented results (Naemura et al. 2014) from isotopic study focused on pyroxenites and peridotites from Horní Bory, Bohemian Massif. We studied P-T path for the garnet peridotite at quarry Lom pod Libínem in the Prachatice granulite massif in southern Bohemia. We defined four mineral stages: the first stage is defined by megacryst-core coexisting with phlogopite, orthopyroxene and the equilibrium condition was estimated at ~4 GPa and 1,000 °C; stage 2 is defined by the "mantle" coexisting with hornblende, chlorite, orthopyroxene, and andradite, which were equilibrated at ~700 °C, P<2.5 GPa; stage 3 is defined by the core of mm-size pyroxenes, garnet and olivine that were equilibrated at ~3.0 GPa and 1000 °C in the garnet lherzolite facies, and finally, stage 4 is defined by the matrix spinel lherzolite assemblage equilibrated at T ~800 °C at 1–2 GPa.

Our results were presented at the Goldschmidt Conference 2014 (Haluzova et al. 2014), focused on Re-Os geochemistry of mantle pyroxenites from the Bohemian Massif. The studied samples have relatively variable Re and Os concentrations of 0.103–1.45 ppb and 0.18–1.84 ppb, respectively. Radiogenic $^{187}Os/^{188}Os$ ratios lie in the range of 0.1425 to 0.3247. This results in superchondritic γOs values from +3 to +132. The rela-

■ **Fig. 8.** Banded felsic kyanite-bearing granulite, Plešovice quarry in the southern Bohemian Massif. Photo by M. Svojtka

tive high Re contents coupled with radiogenic Os isotopic compositions and these pyroxenites may indicate significant Re and radiogenic Os, which are imported from basaltic melts during subduction (mantle refertilization). Two of the studied samples have only slightly superchondritic $^{187}Os/^{188}Os$ compositions, which is in agreement with their derivation from subcontinental lithospheric mantle. In contrast, most of the pyroxenites display radiogenic γOs suggesting a variable but significant contribution of recycled crustal material (subducted oceanic crust) in the migrating upper mantle melts from which they were crystallized. This enrichment was most likely associated with Variscan subduction processes. Melt–rock reactions between previously depleted peridotite and invading melts with highly radiogenic $^{187}Os/^{188}Os$ composition (γOs up to +132) would lead to mantle refertilization with a significant addition of Re.

Additional results were presented at AGU Fall Meeting in San Francisco (Svojtka et al. 2014), focused on the Bohemian pyroxenites. This suite of rocks exhibit large variations in elemental and isotopic compositions, reflecting their complex origin and evolution. Based on REE compositions of clinopyroxene (cpx), four different types of pyroxenites can be distinguished: (I) LREE–depleted; (II) convex–upward REE pattern, combined with significant enrichment in La; (III) variable, LREE–enriched patterns, and (IV) convex–upward REE pattern. Such REE patterns reflect different compositions of source melts derived from primitive (E–MORB; Type I) and enriched (Types II, III, and IV) mantle sources. For the pyroxenite suite as a whole, a positive correlation between Sr/Nd and Eu/Eu* argues for the presence of a crustal component (oceanic crust), which underwent significant plagioclase fractionation before incorporation in the parental pyroxenite melts. Variations in compatible elements (Ni, Sc, and Co) indicate that parental melts underwent combined fractional crystallization and assimilation of host peridotite at some localities.

In 2014, we carried out joint Czech-Japan field work in the Bohemian Massif including active quarries at Plešovice (Fig. 8) and Horní Bory, and we also collected samples from Mohelno, Hrotovice and Biskupice. These research activities are focused on studies dealing with P-T reconstruction and geochemistry of high-pressure/ultrahigh-pressure rocks from the Bohemian Massif (Czech Republic).

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4b. Czech Science Foundation

Finished projects

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

Palaeomagnetic research was further focused on detailed investigation of the Kosov Quarry, Lištice and Černidla sections. 50 samples were collected during 2014 for palaeomagnetic, rock magnetic and geochemical studies to gain new insights into Paleozoic evolution and its volcanic phases. We completed the determination of effusive and intrusive bodies and finalized the palaeomagnetic and rock magnetic datasets. We also evaluated and integrated geochemical, palaeomagnetic and rock magnetic as well as stratigraphic data from various Devonian, Ordovician and Silurian localities in the Prague Basin. Laboratory experiments included: (a) progressive thermal (TH) demagnetization with a step of 30–40 °C, (b) alternating field (AF) demagnetization with 5 to 20 mT steps, and (c) separation of the remanent magnetization (RM) directions using principle component analysis as outlined in Kirschvink (1980) and Man (2003). To obtain magneto-mineralogical data and support palaeomagnetic results, rock magnetic measurements were carried out on selected samples. Temperature dependence of magnetic susceptibility in an argon atmosphere over a temperature range of –192 °C to 700 °C was used to identify the ferromagnetic fraction. To further verify the identity of magnetic minerals three samples were subjected to 3-axes Lowrie method, where each sample was first saturated in three perpendicular directions: 1–2 T in x-axis, 300 mT in y-axis and 100 mT in z-axis, and then thermally demagnetized. Few samples were also, after AF-demagnetization, progressively magnetized up to 900 mT or 2 T and then stepwise demagnetized (≤100 mT) to obtain information about saturation remanent magnetization. Furthermore, standard geological thin sections were obtained from six samples for magnetic scanning to localize the magnetic minerals and anomalies within the samples. Thin sections were demagnetized with a 100 mT field and then subjected to progressive acquisition of isothermal remanent magnetization (IRM) up to 900 mT and magnetically scanned.

We defined and constituted a new palaeomagnetic database with information of palaeomeridians, latitudes and rotations, and of the approximate ages. Palaeomagnetic pole positions calculated from mean palaeomagnetic directions of C-components of remanence corrected for the dip of strata for the five localities of Silurian (Kosov Quarry, Černidla, Třebaň, Vinařice, Vyskočilka) clearly indicate the mean value of horizontal palaeotectonic rotations either 154° ± 12° counter-clockwise or 206° ± 12° clockwise rotation during the Variscan orogeny. These rotations vary in their magnitude from one locality to another. Experimentally inferred palaeomagnetic pole positions fit well with the theoretical model paths simulating the distribution of pole positions due to horizontal palaeotectonic rotations. The mean palaeolatitude of 22.5°S ± 6.6° calculated from all localities located in the southern hemisphere was computed for the Silurian. The Prague Basin also experienced a substantial palaeolatitudinal drift towards the periequatorial realms. The palaeolatitudes of 43°S and 18°S were obtained for the Middle Ordovician and Middle Devonian rocks of the Barrandian and correlate very well with the values for the Silurian. Palaeomagnetic inclination of B-components of remanence oscillating around 4°S corresponds to the palaeo-equatorial position of these rocks during the Late Variscan overprint. The azimuth values of horizontal palaeotectonic rotations are fossilized in the palaeomagnetic declination of pre-Variscan formations, therefore representing a considerable contribution to the palaeomagnetic declination.

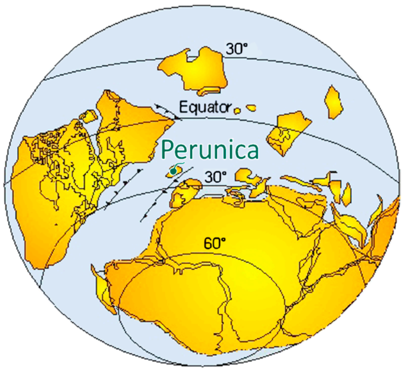
A multidisciplinary palaeomagnetic, geochemical and volcanological study of the latest phase of Silurian volcanism in the Prague Basin was presented at international meeting "14th Castle Meeting: New trends in paleo-, rock- and environmental magnetism" in Évora, Portugal in September 2014 (Pruner et al. 2014). Moreover, correlation of palaeolatitude, geotectonic setting and eruption character of the Suchomasty Volcanic Centre in the western tectonic segment was evaluated for Gorstian stage, e.g., for the latest phase of Silurian volcanism in the Prague Basin and published in journal GFF (Tasáryová et al. 2014). In this paper, the mean palaeomagnetic direction calculated from all samples, a palaeolatitude of 24.4° located in the southern hemisphere was computed for the Suchomasty Volcanic Centre and hence for the western segment of Prague Basin in Gorstian (lower–middle *Scanicus–chimaera* graptolite Biozone). Data from palaeomagnetic and palaeogeographic investigations support the idea that the Prague Basin was a continental rift basin, situated on the presumed Perunica microplate (Fig. 9). This concurs with the model published by Cocks & Torsvik (2006). Moreover, Upper Palaeozoic rocks in the Svatý Jan and Suchomasty volcanic centres were slightly remagnetized and involved either 170° counter-clockwise or 190° clockwise rotation of the Prague Basin during the Variscan orogeny (Schnabl 2012, Tasáryová et al. 2013).

Moreover, we constituted a database of geochemical characteristics of Late Ordovician–Devonian volcanic rocks with 73 whole-rock analyses, 53 Nd isotopic ratios and 6 Sr isotopic ratios. Rb-Sr isotopic system proved open and useful in subaerial lava (Černidla). We studied and analysed lavas, intrusives and pyroclastic rocks of Svatý Jan, Kosov, Řeporyje, Suchomasty and Koněprusy volcanic centres and volcanic rocks from southern tectonic segment and Pankrác segment of the Prague Basin. The age of studied rocks was evaluated on the basis of biostratigraphic graptolite biozones (e.g., age of host rocks for lavas and intrusives). No particular geochemical variability was detected within Late Ordovician–Devonian volcanism. Volcanic products are represented by within-plate alkaline to tholeiitic basalts and their cumulates (meimechites), which erupted under tensional tectonic regime of a continental rift. However, the low degree of partial melting with garnet in residue of two reservoir components (asthenospheric OIB-type and lithospheric mantle EMORB-type) contributed to magma origin. The OIB-type (more alkaline) prevailed during the Wenlock stage and an admixture of EMORB-type (more tholeiitic) increased during the Ludlow stage. Crustal contamination did not influence geochemical characteristics of basalts but low-temperature hydrothermal alteration and sea-floor weathering mobilized alkalis and selected LREE (Tasáryová et al. 2014).

Petrophysical data including magnetic susceptibility measurements, IRM, ARM rock magnetic parameters and gamma-ray spectrometry in deeper-water equivalents of the Požáry and Mušlovka sections in the Kosov section across the Late Silurian Lau Event interval were processed in 2014.The results were summarized in the paper by Chadimová et al. in press. It was submitted at the end of 2013 in the Special issue of Geological Society of London (Magnetic susceptibility – a window onto ancient palaeoenvironments) dedicated to IGCP580 project and the volume will be finished in 2015. J. Hladil and L. Chadimová cooperated as guest editors of the volume.

Sedimentological and petrological studies of the Silurian concretions: The petrology of Silurian (Homerian) concretions was studied in the Kosov Quarry near Beroun (*Cyrtograptus lundgreni* Biozone, Homerian Stage, Wenlock Series, late mid-Silurian ages of about 426 Ma; Liteň Formation, Motol Member). The studies supported the interpretation of rock magnetic and magneto-mineralogical data. XRD analyses were indicative of the different compositions of the concretions, which showed wide difference between the levels with concretion formation. Although these concretions certainly have a potential to be windows into earliest stages of the sedimentary rock diagenesis (showing the original tuffitic sediment thicknesses, without compaction flattening with reduction of the original thicknesses and mass by 87–92 %), their mineral composition was significantly affected by early diagenetic change. Particularly, the presence of clay minerals, smectites and micas vary greatly, and this relates also to the Fe-rich, superparamagnetic inclusions and/or nanometre- to micrometre-sized flocs which originated in these minerals.

Laboratory experiments were conducted of telescoping the tiny conical dacryoconarid shells in Lower Devonian strata. Results of the telescoping of tiny and narrow, hollow conical shells (i.e., the capability of these specific particles to be inserted one into another) were carried out and compared to the mathematical model. The telescoping was most effective in highly turbulent flow with rapidly stirred mud. It is comparable to the conditions at the front and shear zones of mud-laden turbidity currents cannibalizing the mud on the seafloor. The shape and arrangement of dacryoconarid shells (tiny cones in the rocks) formed a pattern



■ **Fig. 9.** Palaeogeographic position of the Perunica microplate in Silurian times on the southern hemisphere (modified from Cocks & Torsvik 2006).

for the distribution of ultra-small ferromagnetic and superparamagnetic particles (along the cone surfaces), following former organic-rich membranes between nanometric-micrometric calcite crystals, and with argillaceous and Fe-rich filling and packing. The paper was published by Hladil et al. (2014).

Supporting the overall mineralogical knowledge about Silurian–Devonian limestones in the Barrandian area: data on mineral composition of Paleozoic limestones found also several applications in the assessment of younger geological processes which were superimposed or material source-dependent on these rocks. This can be exemplified by a study which relates to the characterization of altered materials and soils; and was published in Zigova et al. (2014).

Magnetic and geochemical study of the Lištice volcanics: paleomagnetic data in the Lištice area are different than in the areas mentioned above (except for Černidla). Palaeomagnetic results prove quite a strong remagnetization in the late Carboniferous – early Permian (with no significant rotation). The rock magnetic investigation combined with optical microscopy and magnetic scanning revealed the presence of vesicles with highly magnetic amygdales, which are primarily associated with Silurian late magmatic fluid and seawater. The Ti-magnetite within these amygdales was found to be carrying the ChRM and, thus, the signal in the amygdales was overprinted during Permo-Carboniferous remagnetization hydrothermal event. The whole rock geochemical signature of the Lištice basalt shows distinct anomalies, with the exception of Ti, in NMORB-normalized pattern due to low-temperature stages of alteration and weathering. The enrichment in Cs, Ba, Sr and K suggests syn- or post-intrusional subsolidus open-system processes, most probably due to an interaction with fluids, rather than to an equilibration of crustal material with basaltic magma. The rest of the whole-rock geochemical signature points to a within-plate setting with a character transitional between EMORB and OIB and no prominent crustal contamination. (Elbra et al. 2015 in press).

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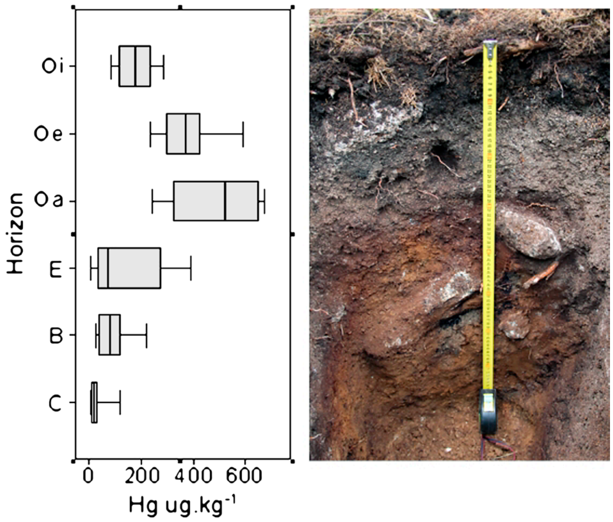
No. GAP210/11/1369: **The fate of legacy mercury in forest ecosystems in the area of the Black Triangle, Czech Republic** (*T. Navrátil*, *J. Rohovec*, *I. Dobešová*, *Š. Matoušková*, P. Krám, J. Hruška, F. Oulehle & O. Myška, Czech Geological Survey, Praha; 2011–2014)

The first part of the project was dedicated to the assessment of Hg deposition to the forest ecosystems of the Czech Republic during the last decades. This was assessed by exploration of Hg accumulation in forest soils at 5 selected contrasting sites. The study sites were subject to previous research and included sites NPBS, LYS and PLB located in the former high-deposition impact area known as the Black Triangle. LES catchment lies in central Czech Republic and LIZ catchment in the Bohemian Forest in the southern part of the Czech Republic, characterized by low historical deposition impact. The catchments from the area of the Black Triangle were expected to contain significantly greater pools of Hg than the others with respect to the difference in deposition. But the results in the paper of Navrátil et al. (2014) indicated that the difference in total Hg pools at the individual catchments depends mainly on the properties of soils. The greatest total Hg pool occurred at the LIZ site with a thick soil cover and stabilized soil organic matter but with the lowest historical Hg deposition. The total Hg soil pool is largely dependent on the mineral soil Hg pool in contrast with typically high concentrations of Hg in the organic soil horizons (Fig. 10). The most recently deposited Hg is stored in organic soil pools, which usually form a minor part of the total soil pool. The organic soil Hg pools were statistically indifferent at all studied sites. Thus we (Navrátil et al. 2014) concluded that the cross site variability of Hg soil pools was not sensitive to the local Hg deposition history but rather related to the capacity of soil to store and stabilize organic matter.

Furthermore, we compared adjacent spruce and beech stand sites in terms of litterfall Hg fluxes and soil Hg pools at the Načetín experimental site (Navratil et al. in review). Coniferous trees – spruce in this case – were reported to deposit more Hg than deciduous trees to the soil beneath via litterfall and throughfall fluxes due to their evergreen foliage and greater specific surface of the foliage. But the total and mineral Hg pools in the spruce stand were smaller than those in the beech stand. This can be explained by greater soil organic matter pool in beech stand soils. This is due to the better ability of beech stand soils to store and stabilize soil organic matter. Another compelling result from the Načetín site is the litterfall flux. Due to the archiving of samples we were able to reconstruct litterfall fluxes in the spruce stand since the year 1994. The jumpy trend of spruce Hg litterfall deposition fluxes ranging from 10 to 25 $\mu g\,m^{-2}\,year^{-1}$ in the period of 1994 to 2012 reflects before all the differences in annual litterfall mass fluxes. The highest spruce litterfall Hg fluxes in years 1995 and 2003 caused by the high litterfall mass were due to needle damage by accumulation of acidic rime in 1995 and in 2003 due to extreme drought. The changes in Hg deposition in spruce litterfall did not reflect the pattern of decreasing Hg emissions in the Czech Republic since year 1994. This was in contrast to the trend of S concentration in Načetín needles, which reflected the decrease in S emissions due to desulphurization of coal power plants emissions.

The second part of the project was aimed on the assessment of Hg concentrations and Hg output fluxes from the forest ecosystems (Navratil et al. 2015). Similar to the assessment of the soil Hg pools, the greatest output fluxes were expected at sites found within the Black Triangle area due to the high historical Hg deposition known from peat core archives. At the JEZ site, the highest Hg deposition site, the median stream water Hg concentration was only 2.5 $ng.l^{-1}$, which is a typical value for unpolluted streams. On the other hand, LYS and especially PLB, seven km apart in a somewhat less impacted setting but still within the Black Triangle, had strikingly high filtered Hg concentrations: 5.0 $ng.l^{-1}$ at LYS and 18.0 $ng.l^{-1}$ at PLB, among the highest reported filtered median total Hg concentrations in headwater forest streams worldwide. The other two sites, LES and LIZ with Hg concentration medians of 2.8 and 1.3 $ng.l^{-1}$ are outside the Black Triangle and presumably had lower Hg deposition rates. The Hg concentrations at the selection of our sites followed the concentrations of DOC thus we suggest that the Hg concentrations did not depend on historical pollution but on the level of local DOC export (Navratil et al. in review). The stream water concentrations at all sites correlated with DOC and UV absorbance. These support the possibility that DOC and UV absorbance can be used as proxies for Hg export in future studies.



■ **Fig. 10.** The left panel of the figure describes mercury concentrations in individual soil horizons of 5 Czech forest sites, the right panel illustrates the Albic Podzol at Lysina catchment with organic soil horizons Oi, Oe, Oa and mineral soil horizons E, B and C.

Similar to Hg concentrations, the filtered dissolved Hg annual output fluxes (4.5 and 11 $\mu g\,m^{-2}\,year^{-1}$) were the highest at sites LYS and PLB. The output fluxes from JEZ, LES and LIZ generally lie within the range of 0.3 to 6.8 $\mu g\,m^{-2}\,year^{-1}$, which is typical for European and North American sites. But the Hg output fluxes were proportional to DOC output fluxes underscoring the fact that the major driver of Hg export was the export of DOC, not the historical pollution. Based on the deposition measured at site LES we evaluated Hg retention at 96.3–99.5 % within the catchment. Assuming the same Hg deposition rate as at the LES site, Hg retention at JEZ, LIZ and LYS sites will range from 72.0 to 98.7 %. Due to very low levels of methylated Hg compounds in stream water of the selected sites we were not able to quantify the Me Hg output fluxes.

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No. P405-11-1729: **Veselí nad Moravou – Medieval Castle in alluvial plain** (*L. Lisá*, M. Plaček, Archaia Brno o.p.s., Brno, M. Rybníček, Mendel University, Brno & L. Petr, University of Western Bohemia, Plzeň; 2010–2014)

The project titled "Veselí nad Moravou – Medieval Castle in alluvial plain" is a multidisciplinary task to obtain maximum information from uniquely preserved Medieval wooden bailey located in the alluvial plain of the Morava River. A number of specialists took part in this project: methodological approach included sedimentology, petrography, micromorphology, pollen analyses, macroremain analyses, anthracological analyses, phytolith analyses, isotope analyses, dendrochronology and a set of archaeological methods. The unique occasion to study medieval bailey appeared during the rescue excavations at Veselí nad Moravou in 2009 when occupation deposits from the early phase of the castle construction were found (Dejmal & Merta 2009). Due to the wet anaerobic conditions of the Morava River alluvial plain, organic layers with files of artefacts and ecofacts composed of organic material were preserved across the area of 0.09 ha (Fig. 11). Veselí nad Moravou is situated in southeastern part of the Czech Republic in the South Moravian Region. The study site is located on the right bank of the Morava River in its close proximity. Due to the renovation of the castle in 2008–2010 the archaeological rescue research was performed (Dejmal & Merta 2009). During rescue excavations in 2008–2010, a nobleman residence and a wooden bailey of the castle were found within the castle area, divided from the castle itself by a ditch. Well preserved occupational deposits covering the area of 500 m^2 were found during the archaeological research of the bailey. These deposits 1.6 m thick were composed mainly of wooden chips and organomineral material. Only the uppermost part of the occupational deposits was destructed by decomposition so typical for dry open-air settings. In total, 16 wooden objects were detected within the bailey of the castle (Dejmal & Merta 2009).

The project outputs include a number of papers and a prepared monograph. The main paper showing the results of the interdisciplinary approach in archaeological research is Dejmal et al. (2014) published in Plos one. The paper is concerned with the study of a Medieval horse stable. Conclusions from the paper are:

1. Wood found at Veselí nad Moravou Medieval bailey was dated to the year 1228 on average. The studied stable had two construction phases, while the older phase is simpler, a part of the younger stable was covered by a wooden floor.
2. The infilling of the stable reflects maintenance practices. Ashy material was deposited to provide remediation effects and its aggradation also served to reduce the difference between the interior and the exterior of the stables.
3. Well preserved horse stabling in the uppermost part of the horse stable structure infilling was aggregated within a few months at the end of summer. The stabling material was composed mainly of wetland grasses and wooden annual shoots. Horse breeding identified within stabling varies probably due to the difference between individuals. Horses were fed on meadow grasses as well as on woody vegetation and on millet, oat, less commonly on hemp, wheat and rye.
5. According to the results of isotope analyses the horse population staying in the stable was quite different. This suggests three possible explanations of the stable usage. It should be used as a temporary stable for the horses of tenants who were asked to work for the castle, as a stable for messenger horses or as a stable for military horses.
6. Within medieval surroundings of Veselí nad Moravou we can reconstruct communities of wet meadow/pastures (floodplain of the Morava River), commonly types of mesic meadows, but types of dry and very dry grasslands were marginally recorded as well. Woody vegetation is composed of oak forests and oak-hornbeam forests including hardwood forests of lowland rivers (*Quercus robur*, *Fraxinus angustifolia* subsp. *danubialis*, *Fraxinus excelsior*, *Acer campestre*, *Ulmus laevis*). Low forests (*Quercus robur*, *Carpinus betulus*) were probably cultivated.

The following general results from different tasks were achieved within the project:

1. Results related to the locality itself, its building development and history. Within the project, we contributed to the clarification of the building development and history of the castle at Veselí nad Moravou itself. We managed to delimit the location and partially explore the original castle core and bailey. Further, its building development was clarified and the history of the site and its owners was newly processed. These results are mainly summarized in the monograph and also in partial articles (Dejmal & Merta 2009).
2. Findings during the processing of found artefacts – contribution to the development of material culture. The analysis of found artefacts achieved a range of important findings. For example within the medieval pottery, a file related to dendrodata was processed, which enables its use for dating of other sights from the region. Also a thought was outlined that the castle environment in eastern Moravia in the 13th century used pottery clay sources the origin of which followed the late-castle traditions, unlike the towns where the colonization goods had already been used. Interesting is also the fact that statistical evaluation commonly used with files from reservoirs or objects did not prove successful for the processing of artefacts of surface settlement layers from saturated environment. Interesting results were also gained from the analyses of jug glaze from the 13th century. Important results were obtained during the analysis of metal artefacts. Apart from other import finds, a hunting knife was found which is, according to dendrodata, the as yet absolutely oldest dated piece of this weapon. Natural science analyses of the metal objects brought important pieces of knowledge about the technology and about corrosions during the post-deposition processes.
   The processing of glass artefacts proved, for example, the use of glass window panelling already in the 13th century.

Natural science analyses of the glass brought information on the technology and origin. Unique is the file of artefacts from organic materials, mainly from leather and wood. Among the wooden artefact stands out the handle with a coat of arms of the founding family of the castle, which was, according to the analyses, coloured. Of interest among leather finds are especially parts of clothing and shoes. Parts of furniture, doors etc. represent a separate chapter. These finds were also published in partial studies (Dejmal & Hoch 2014). New Age pottery from the 17th century, which was collected in a large lime pit, turned out to be a very interesting file as well. A great share of haban pottery clay links to the sources of the castle surroundings and gives an interesting picture of the equipment of the castle settlement before the Thirty Years' War.

3. Medieval Ages settlement of Veselí – contribution to the history of settlement. Within the grant project, questions of wider high medieval settlement were also investigated. The appearance of high medieval settlement at Veselí and the respective role of the castle were reconstructed. Study of the history of the castle and its owners brought important knowledge for the surrounding region as well. Apart from the monograph, these results were also published in partial studies.
4. The process of formation and appearance of castles in 13th century – the contribution to the seldom studied topic of original form and process of formation of nobility castles. The research also brought important information on the appearance of nobility castles in the Czech region. We managed to prove that the locality consisted of two parts from the very beginning, namely 1240s – the castle core and the bailey, which was gradually expanded. The publication of the appearance of the castle in its initial phase enables to look at the little known appearance of the 13th century nobility castles.
5. The appearance of unwalled agricultural building in the Middle Ages. The research managed to gain very important pieces of knowledge about the appearance of unwalled agricultural building. Sixteen documented buildings in total provided information about the appearance of cobwork, wattlework and columnar buildings. The most complete investigated object is represented by the stables (described in detail above). Many results were contributed by natural science analyses. Partial pieces of knowledge or individual buildings were published in separate studies (Bajer et. al. 2013, Dejmal et. al. 2014) and are discussed in detail in the monograph.
6. Depositional and post-depositional processes in waterlogged or wet areas. Exceptional natural conditions influenced the character of the studied setting to a great extent. An already demanding orientation in the high medieval stratigraphy was made even more difficult by specific influences. Apart from that, the natural conditions and related depositional and post-depositional processes also influenced the relevance level of the found artefacts to a great extent. In some cases this was in a positive way (e.g., finds from organic materials), in other in a negative one (ceramics – possibilities of statistical processing are very limited in this case due to its deposition in flat housing layers).
7. Results of natural science analyses in relation to inner processes in the area. One of the main parts of the project was a multi-field cooperation with natural scientists. During this cooperation many important discoveries were achieved, not only as far as the locality itself is concerned, but also for 13th century phenomena in general. Of the important findings, let us just mention the worldwide first historical horse hair isotope analysis for the purpose of realizing nutritional ratios. Another important discovery included an insight into the diet of 13th century castle inhabitants. A surprisingly great portion was represented by game and, thanks to a great number of floated samples, an extensive consumption of river fish was proved. Dendrology and xylotomary analyses then managed to find the origin of the wood used, and petrographic analyses showed that the stone for ramparts was transported from 16 km distant Skalice. Macroresidue analyses provided an insight into the inner ecology of the settlement and its immediate surroundings. Micromorphology clarified many details about floors of individual buildings and their formation and proved recurring periodical floods in a part of the area. Pollen analyses managed to reconstruct the natural environment in the surroundings of the castle.
8. Results of natural science analyses also relate to the natural environment in the area of Veselí. The analyses yielded not only information on the castle itself but also on the appearance of the surrounding countryside in the Middle Ages. The contribution was made not only with the help of data from the castle itself, but also with the help of samples taken from the alluvial plain of the river near Bzenec. We managed to get a record from the Neolithic period to the Middle Ages. Apart from the reconstruction of the countryside and climate of the 13th century, the occurrence of unexpected kinds of plants was proved. A great set of samples from the research itself helped to broaden the historical dendrological source basis. These pieces of information, which are only partially connected to the castle itself and are valid for other scientific fields, are gradually being published with the appropriate dedication to the project (Rybníček et al. 2012, Kolář et al. 2012, 2014, Filková et al. 2014).

■ **Fig. 11.** The bird-eye's view from the roof of Veselí nad Moravou Castle to the uniquely preserved Medieval wooden bailey located in the alluvial plain of the Morava River. Structures of wooden buildings are well visible inside the patio of the castle. Sixteen documented buildings in total provided information about the appearance of cobwork, wattlework and columnar buildings. Photo by P. Lisý.

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Continued projects

No. GA13-13967S: **Experimental study of crack initiation and crack damage stress thresholds as critical parameters influencing the durability of natural porous stone** (R. Přikryl, A. Šťastná, Faculty of Science, Charles University, Praha, Z. Weishauptová, I. Sýkorová, M. Švábová, Institute of Rock Structuree and Mechanics, Praha, *T. Lokajíček* & L. Zamrazilová, Academy of Fine Arts, Praha; 2013–2016)

A significant progress has been achieved for the following five specific research topics during the second year 2014: (1) interpretation of stress-strain behaviour, (2) hydric behaviour as an indirect measure of durability, (3) evaluation of durability by using limited amount of material (from rock mechanical test of drill cores), (4) employment of alternative non-destructive methods in the evaluation of specimen's deterioration during long-term laboratory durability tests, and (5) full waveform analysis of ultrasonic signal as a possible measure of material's integrity and its resistance to weathering.

No. GA13-15390S: **Re-Os geochronology of ore mineralizations from the Bohemian Massif with possible metallogenic implications** (*L. Ackerman*, *K. Žák*, *M. Svojtka*, *J. Ďurišová*, J. Pašava, F. Veselovský & V. Erban Czech Geological Survey, Praha; 2013–2016)

Within the framework of this project, new Re-Os data were obtained for a suite of molybdenite samples from 11 different localities occurring in granitoids and/or related hydrothermal systems of Variscan (~370–280 Ma) and Cadomian (~580–520 Ma) ages. This sample set includes molybdenite dispersed in magmatic rock matrix, thin quartz veinlets and/or located in fissures of the parental granitic bodies (Krupka, Padrť, Central Bohemian pluton, Žulová, Čistá, Dyje massif) as well as molybdenite associated with Sn-W-bearing and/or barren greisens (Krásno, Moldanubian batholith). The samples have highly variable Re–Os concentrations (Re = ~3–602 ppm, ^{187}Os = ~11–2,133 ppb) with the highest contents found in molybdenite hosted in granites and associated quartz veins. In contrast, molybdenites associated with highly evolved greisens are characterized by very low Re and ^{187}Os concentrations (< 2 ppm and < 5.8 ppb, respectively). The Re–Os ages for the studied molybdenites associated with Variscan granitoids (Žulová pluton, Moldanubian batholith, Central Bohemian pluton, Padrť, Krásno, Krupka, Čistá) yielded variable dates from ~298 to 377 Ma while the molybdenite enclosed in the Neoproterozoic (Cadomian) Dyje massif yielded 584 ± 4 Ma. These ages are similar and/or slightly lower than the U-Pb and/or Pb-Pb zircon ages of associated granites, suggesting (semi)contemporaneous magmatism and Mo-mineralization.

Complex mineralogical, geochemical, geochronological and fluid inclusion study was performed on the previously poorly described Padrť Stock intrusion located near the SE margin of the Teplá–Barrandian Unit, Bohemian Massif, several kilometres away from the NW periphery of the Central Bohemian Plutonic Complex. In outcrops located close to the contact of the stock with Neoproterozoic sedimentary rocks, two types of granitoids were detected: fine- to medium-grained hornblende–biotite Padrť granodiorite, and, along its SW margin, fine- to medium-grained partly porphyritic biotite Teslíny leucogranite. U–Pb zircon dating of the more voluminous Padrť granodiorite by laser ablation ICP-MS yielded a magmatic age of 342.8 ± 1.1 Ma, which is slightly lower than the published age data for the nearby Blatná suite granitoids of the Central Bohemian Plutonic Complex. Re–Os dating of molybdenite from quartz veins within a quartzite lens in close exocontact yielded ages of 337.2 ± 2.4 Ma and 339.8 ± 2.5 Ma (two samples). Data indicate that the formation of molybdenite post-dated that of the magmatic rock. This is in agreement with the relatively low-temperature deposition of quartz related to the formation of molybdenite, as indicated by the fluid inclusions (280 to 300 °C). The results were summarized in Žák et al. (2014).

The accurate trace element analyses of molybdenites were performed using laser ablation ICP-MS system. We addressed our study in 2014 for a set of 26 samples from molybdenite mineralization associated with different types of igneous rocks and processes. These include Variscan localities in the Bohemian Massif and Kalmakyr Cu-Mo deposit (Uzbekistan). Differences of these localities also reflect different morphological types of molybdenites (needle aggregates vs. complex oval or elongated grains). We studied molybdenites originated from (a) greisenized granites and related quartz veins (e.g., Krupka, Cínovec, Jáchymov), (b) base metal mineralization associations (Obří důl, Staré Ransko), (c) molybdenites disseminated in Variscan and

Cadomian granitoids and/or related quartz and pegmatite veins (e.g., Harrachov, Bohutín, Moldava) and (d) Cu-Mo(Au) porphyry-type deposit (Kalmakyr). Trace element geochemistry in these different molybdenite types reveals some unique correlations between certain elements (e.g., Cu-Re, Bi-Te) which seem to be characteristic for individual molybdenite mineralization types. This would be an excellent tracer, which can be used in future studies for the mineralization type discrimination. Our study also revealed the presence of nano- to micro-scale inclusions within molybdenite grains. Their compositions are also different for specific mineralization types.

To provide additional insights in the distribution of highly siderophile elements, especially Re-Os among individual base metal sulphides, *in situ* laser ablation analyses of pyrite, chalcopyrite, pentlandite and millerite were conducted on selected samples of Ni-Cu-(PGE) ores and Mo-Ni-(PGE) black shales from South Africa and China, respectively.

During the latter half of 2014, the work on Re-Os dating methodology of low-Os level sulphides (arsenopyrite, pyrite, chalcopyrite) was initiated. Several experiments with sample decomposition and Re-Os separation from matrix were tested. This reveals some important details for future work. To provide much more effort to the analyses and to learn the essentials of this type of analyses, a 6–8 week stay at University of Alberta, in the lab of Robert A. Creaser, will be completed by our project PhD. student (Eva Haluzova). For this stay, collection of four samples (4–6 arsenopyrite/pyrite separates per one sample) from some of the important base metal mineralization (see below) was analysed for their Re contents and therefore, the suitability for Re-Os dating.

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No. GA13-22351S: **Combined use of novel and traditional stable isotope systems in identifying source components and processes of moldavite formation** (T. Magna, J. Farkaš, V. Chrastný, Czech Geological Survey, Praha, *K. Žák*, *R. Skála*, *L. Ackerman*, Z. Řanda, J. Mizera, & J. Kučera, Institute of Nuclear Physics, Praha; 2013–2016)

Moldavites, tektites of the Central European Strewn Field, genetically related to the Ries Impact Structure in Germany, are studied using a set traditional and novel isotope systems (triple oxygen isotopes, isotopes of Mg, Ca, Si, Zn, Cu and other). Simlutaneously, the distribution of highly siderophile elements is studied in tektites and other impact glasses. The scope of the study was widened to the Zhanmanshin Impact Structure (Kazakhstan), where promising results have been obtained indicating incorporation of the impactor matter into the impact glasses. The ongoing studies revealed that the formation of tektites, high-speed distant ejecta of an early phase of the impact process, was accompanied by distinct chemical and isotopic fractionation. While elements like oxygen, carbon, zinc and copper are strongly isotopically fractionated during the tektite formation, some other elements like Sr or Ca do not show any changes in their isotope ratios. The obtained data will be incorporated in a new model of moldavite formation. Preliminary results have been presented on several international conferences and results of the study of moldavite porosity were published (Pratesi et al. 2014).

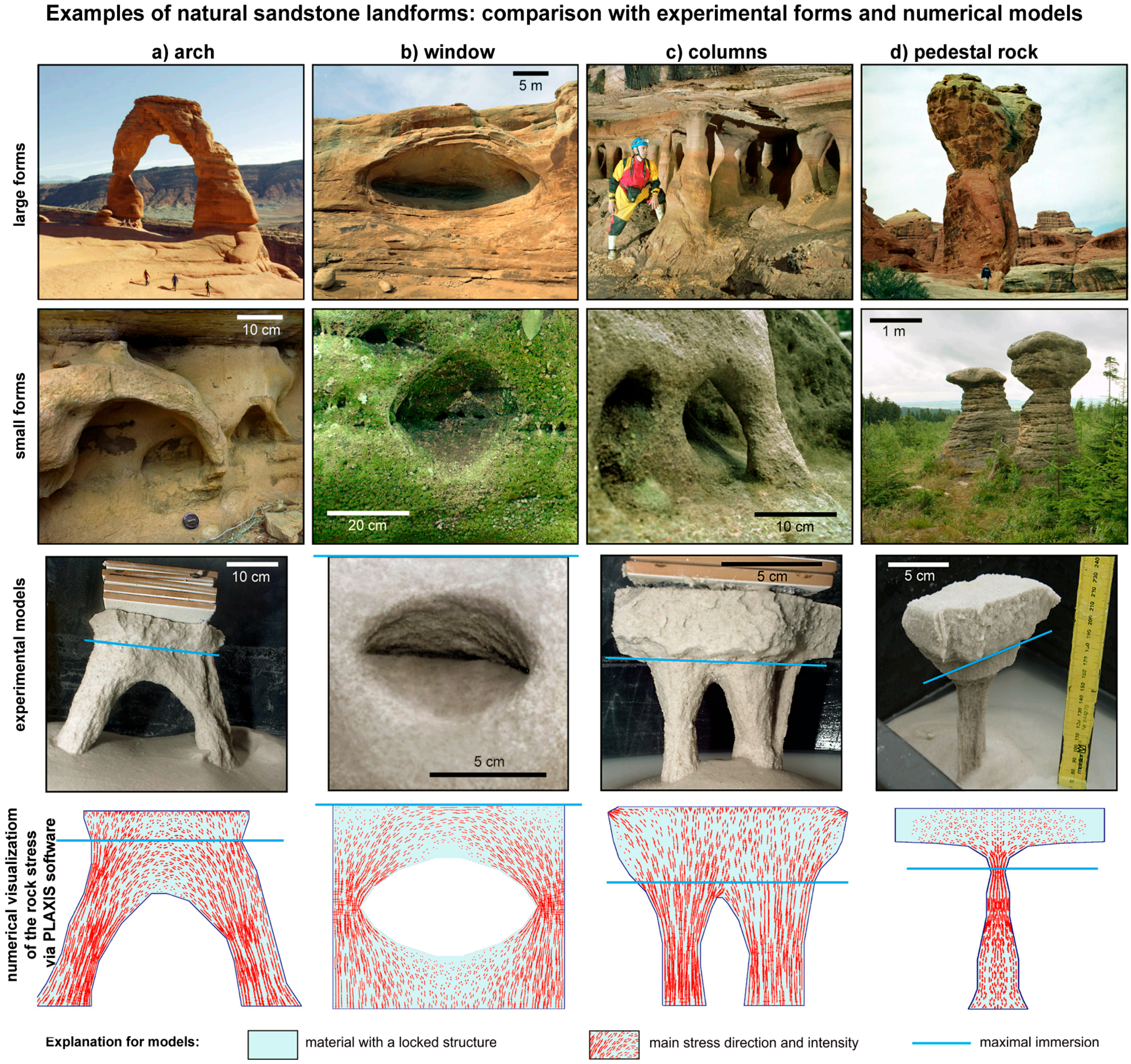
PRATESI G., CAPORALI S., LOGLIO F., GIULI G. DZIKOVÁ L. & SKÁLA R. (2014): Quantitative study of porosity and pore features in moldavites by means of X-ray Micro-CT. – *Materials*, 7: 3319–3336.

No. GA13-28040S: **Multi-approach study of processes in sandstone exposures: new view on study and interpretation of selected sandstone landforms** (J. Bruthans, Faculty of Science, Charles University in Praha, *M. Filippi* & J. Schweigstillová, Institute of Rock Structure and Mechanics of the CAS, v.v.i., Praha; 2013–2015)

During 2014 we continued monitoring of selected parameters at four localities: active Střeleč Quarry; natural sites Mladějov I and II; natural site Malobratřice I and II. Beside these localities we sampled material from a recently collapsed (January 2014) sandstone pillar in the Kokořín area and for comparison we also measured the sandstone cliff in the Plzeň area. Sandstone exposures protected from direct insolation by forest canopy have mean annual relative humidity (RH) 80–90 % (Mladějov I, Malobratřice II), while those with direct sunlight (Mladějov II, Střeleč Quarry) have mean annual relative humidity 70 % and elevated mean annual temperature. The rock moisture content (by TDR method), suction pressure (microtensiometers) and potential evaporation are measured on roughly monthly basis. *In situ* moisture varies between 1 and 10 vol. %. Suction pressure varies between –3 and –7 kPa in wet sandstone and surfaces and up to –180 kPa in dried sandstone with temporal variation.

Salt content and composition were studied by means of leaching, XRD and SEM methods. Tests with a fluorescent dye were performed at selected localities to visualize the capillary moisture transport. Transport is very slow under high field RH, and the dyes were therefore applied also to 15 cores (6 cm in diameter) in a lab for up to 90 days. Preliminary results indicate that capillary flow follows the theory of Huinink et al. (2004) in sandstone without crusts. In the case of cores with crusts the capillary flow pattern is far more complex.

The saturated hydraulic conductivity of Hrubá Skála Sandstone was measured at cores and varies between 2.1×10^{-6} and 9×10^{-5} $m.s^{-1}$. The vapour diffusion coefficient was measured at cores using the method of wet cups with values of water vapour diffusion coefficient varying from 1.4×10^{-11} s to 6.3×10^{-11} s. Surface crust has no measurable effect on water vapour permeability. Capillary water absorption was measured at cores. The Hrubá Skála Sandstone is classified as medium or highly absorbing material with water absorption coefficient between 1.7 and 18.9 $kg.m^2$. Rates of capillary water absorption are strongly reduced by surface crusts. Several cores obtained from the Střeleč Quarry were sealed by epoxy resin over all sides except the original rock surface. They were saturated and then they were placed to drill holes at localities to measure the potential evaporation rate under natural microclimate. The highest evapo-



■ **Fig. 12.** Descriptions of the used photos: column a): the large, world-known Delicate Arch, Arches, Utah, USA; a small rock arch in Glen Canyon area, USA; column b): a large blind rock window (alcove) in Navajo Bluff area, USA (photos by Jiří Bruthans); a small blind rock window in the Chyddinglye wood area, UK (photo by Michal Filippi); column c): cave rock pillars in Cueva Eladio Cave, Churi Tepui, Venezuela (photo by Marek Audy); a rock pillar from Bohemian Switzerland area (photo by M. Filippi); column d): a large pedestal rock (mushroom rock) by the Angel Arch, Canyonlands, Utah, USA (photo by Václav Cílek); two smaller pedestal rocks in the Broumovské stěny area, Czech Republic (photo by M. Filippi).

ration rate was found in Mladějov II with values 94–191 mm per year which is an equivalent to 16–32 % of precipitation. Cores sealed by epoxy were also evaporated under defined humidity and temperature in climate chamber in the laboratory. We found that evaporation from porous medium can be approximated by exponential function $y = \theta.e-\alpha.t$ where y is the actual weight of water in material, θ is moisture of material (in wt. %), t is time and α is coefficient of evaporation rate. This means that evaporation rate is defined by a single parameter (α) for each core type and microclimate. Results indicate that the higher the relative humidity, the lower the differences of evaporation rate for different materials, i.e., the degree of differences in evaporation rate is controlled by climatic conditions.

Between June and September a considerable time was consumed with the process of publication and subsequent popularization of our results concerning sandstone arches (and other landforms) presented in the Nature Geosciences journal (see Fig. 12). After the publication of the paper we were flooded by tens of requests for interviews and contributions for TV, broadcast and especially press media. We prepared materials or directly contributed to such media like Nature News and Comment, BBC News, New Scientist, Independent, Scientific

American, Discovery News, Science News, Financial Times and many others (totally over 100 media across the world, besides the Czech and Slovak media).
HUININK H.P., PEL L. & KOPINGA K. (2004): Simulating the growth of tafoni. – *Earth Surface Processes and Landforms*, 29: 1225–1233.

No. GP13-19250P: **Palaeobiological study of marine fossil fishes from the Oligocene of the Hermanowa locality (Poland)** (*T. Přikryl*; 2013–2015)

Excavation at the Hermanowa locality continued and provided numerous specimens of fish fossils within different age groups. Newly collected specimens, together with selected previously collected material, were prepared, conserved, classified and catalogued. Interpretation of the material is based on literature data, comparison with extant close representatives and specimens housed in different museums (very productive was the study trip to the Hessisches Landesmuseum in Darmstadt which houses a collection of specimens from the Frauenweiler locality).

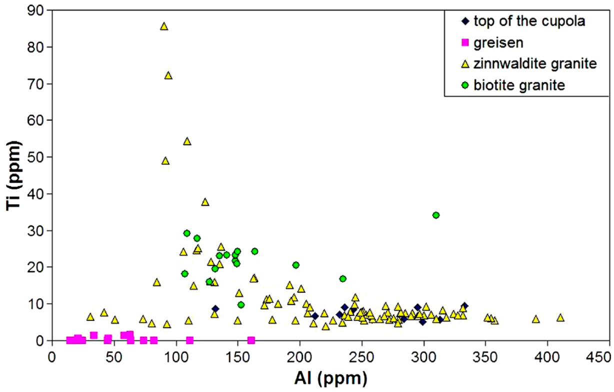
A new species of the genus *Propercarina* (Perciformes, Stromateoidei, Propercarinidae) was described on the basis of a newly collected specimen from Hermanowa locality (Přikryl et al. 2014). This well preserved specimen represents the third species of this genus, while previous were originally described from Oligocene deposits of Romania. Available material on these species was revised. The morphology of Propercarinidae was compared with that of extant stromateoids revealing a mixture of primitive and relatively advanced features in the family Propercarinidae. Although the newly described species is represented by a small fish (body length about 100 mm), propercarinid adults can reach a length over one metre, as suggested by material studied in the Darmstadt museum (collected from the Frauenweiler locality).

Furthermore, a detailed study regarding morphological changes during ontogeny of fossil trachinid species *Trachinus minutus* (Perciformes, Trachinidae) was finished. These changes are connected with the origin and changes in the morphology of selected skull bones, the origin of fins and the number of fin rays. These data are compared with (rather limited) knowledge on Recent trachinids, and were submitted for publication.

PŘIKRYL T., BANNIKOV A.F., GRĂDIANU I., KANIA I. & KRZEMINSKI W. (2014): Revision of the family Propercarinidae (Perciformes, Stromateoidei) with description of a new species from the Oligocene of the Carpathians. – *Comptes Rendus Palevol*, 13, 8: 691–700.

No. 14-13600S: **Rock textures and mineral zoning: Insights into open system processes in granitoids** (*K. Breiter*, *J. Ďurišová*, *Z. Korbelová*, V. Kanický, M. Vašinová Galiová, T. Vaculovič & J. Leichmann, Faculty of Science, Masaryk University, Brno; 2014–2016)

Our activities in the first year of the project were focused on the optimization of analytical technologies (LA-ICP MS of micas, feldspars and quartz, microprobe analyses) and evaluation of a vertical profile through the Cínovec granite cupola in order to establish a relation between magmatic and hydrothermal processes leading to the formation of Sn-W mineralization. The core of the 1,596 m deep borehole CS-1 (realized in 1961–1963) was inspected, newly petrographically described, and evaluated from the viewpoint of rock textures. 26 representative samples were analysed for major and trace elements.



■ **Fig. 13.** Contents of Al and Ti in quartz from borehole CS-1. Original.

First information about internal texture of individual mineral grains of quartz and Li-bearing mica was obtained using BSE (back-scattered electrons), in case of quartz also using colour cathodoluminescence.

The trace element concentrations in quartz were then determined using an Element 2 sector field ICP-MS (Thermo-Finnigan) coupled to a 213 nm Nd:YAG laser (New Wave Research, UP-213) housed at the Institute of Geology CAS. Results of the first part of spot analyses are shown in Figure 13. At the same time, Li-bearing mica from the same samples was analysed at the Masaryk University in Brno.

We formulated a working model of vertical evolution of the Cínovec granite pluton, which significantly differs from the models published before:

1. From the surface down, the pluton is composed of the following units:
   (i) fine-grained albite-lepidolite granite at a depth of 0–100 m,
   (ii) fine- to medium-grained albite-zinnwaldite granite with some K-feldspar at a depth of 100–260 m. Rocks sub (i) and (ii) are intercalated with flat quartz veins and bodies of greisen,
   (iii) medium-grained mica-poor to mica-free albite-orthoclase granite at a depth of 260–370 m with several thin intercalation of feldspathite in the interval of 270–370 m,
   (iv) fine-grained albite-orthoclase-zinnwaldite granite at a depth of 370–520 m,
   (v) medium-grained albite-orthoclase-zinnwaldite granite at a depth of 520–750 m,
   (vi) medium- to coarse-grained orthoclase-albite-biotite granite at a depth of 750–820 m and 900–1596 m,
   (vii) fine-grained porphyritic orthoclase-albite-biotite granite at a depth of 820–900 m.
2. We suppose than the pluton is composed of two intrusions: upper zinnwaldite granite and lower biotite granite with the border near 750 m.
3. Both types of microgranites are chemically nearly identical with their medium- to coarse-grained surrounding rocks.

Contacts between the microgranites and their host rock are complex, the coarse-grained rocks often invaded into microgranites.

4. The medium-grained albite-orthoclase-zinnwaldite granite at a depth of 520–750 m is preserved in its primary magmatic stage without any later hydrothermal/metasomatic overprint. and represents the initial composition of the "upper" intrusion.
5. All late- to post-magmatic metasomatic/hydrothermal processes are restricted to the uppermost 370 m thick rock interval. In this interval, an admixture of water in the final stage of crystallization caused overpressurization and explosive escape of fluids. Alkalis were preferentially concentrated in the lower part of this domain at a depth of 260–370 m, while Si, F, Li, and ore elements migrated upwards forming several flat bodies of metasomatic greisens at a depth of 34–215 m.

No. 14-16124S: **Refinement of lower Silurian chronostratigraphy: proposal of new GSSPs of the Aeronian and Homerian stages** (*P. Štorch*, *L. Slavík*, *L. Koptíková-Chadimová*, Š. Manda, J. Frýda & Z. Tasáryová, Czech Geological Survey, Praha; 2014–2016)

Detailed studies of the Rhuddanian–Aeronian boundary strata in the Barrandian area gained extensive datasets, necessary for pending decision on a new Aeronian boundary stratotype. The most complete, best accessible and the least thermally and tectonically affected Rhuddanian–Aeronian sedimentary succession crops out at the hillside high above the road from Hlásná Třebaň to Lety.

The section was systematically sampled, bed by bed, for graptolites and – in regular intervals (10 cm and 5 cm) – for organic-walled microfossils, magnetic susceptibility, TOC, major and trace element geochemistry and carbon and nitrogen isotopes to supplement data from preliminary sampling (Frýda & Štorch 2014).

Graptolite fauna from the Hlásná Třebaň section comprises 69 species recovered from *Akidograptus ascensus*–lowermost *Demirastrites simulans* biozones, including several previously unrecorded taxa (Štorch et al. 2014). Systematic revision of the graptolite fauna utilizes also particularly well preserved specimens from loose blocks of bleached shale from the Rhuddanian–Aeronian boundary interval at Všeradice.

The Rhuddanian–Aeronian boundary occurs in a uniform succession of black shales with some laminae rich in fine siliciclastics. The base of the Aeronian coincides with the base of the *triangulatus* Zone. Early *triangulatus* Zone clearly exhibits a rapid graptolite diversification containing sudden successive appearance of several new lineages: monograptids with isolated and hooked thecae (genera *Demirastrites, Rastrites* and *Campograptus*) and *Petalolithus* with biserial rhabdosome. In turn, *Coronograptus cyphus*, *Pernerograptus difformis* and *Pseudorthograptus obuti* made their highest occurrence in the boundary interval. The graptolite succession at Hlásná Třebaň is well correlatable with sections in the current stratotype area (Anglo-Wales Basin), nevertheless its graptolite record across the boundary is more complete, and sedimentary and palaeoenvironmental settings are more uniform across the boundary interval as suggested by C and N isotope analyses.

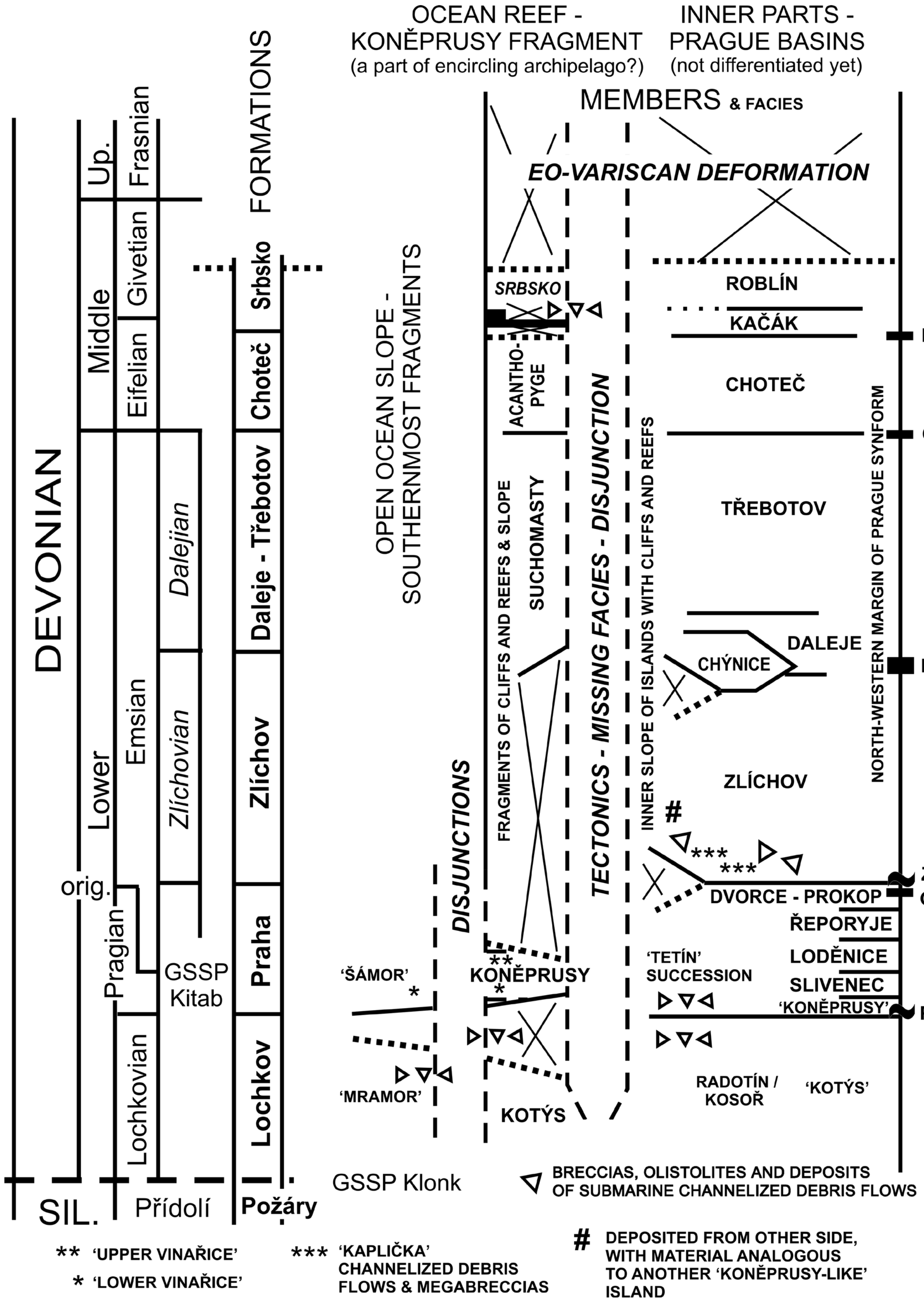
A new section through the Homerian–Gorstian boundary interval discovered near Nesvačily belongs among the best Wenlock–Ludlow boundary sections in the World. Offshore shale-dominated succession, 8 m in thickness, comprises upper *Colonograptus ludensis* and lower and middle *Neodiversograptus nilssoni* biozones. This interval is notorious for its rather low diversity of the graptolite fauna. Despite this precaution, we identified 16 species along with subordinate shell fauna. Some graptolite taxa are new, unknown or little known from the Prague Basin. The section, sampled also for conodonts and carbon isotopes has a potential to serve as one of the most important reference sections in the ongoing search for new GSSP of the Ludlow Series (and Gorstian Stage).

FRÝDA J. & ŠTORCH P. (2014): Carbon isotope chemostratigraphy of the Llandovery in northern peri-Gondwana: new data from the Barrandian area, Czech Republic. – *Estonian Journal of Earth Sciences,* 63, 4: 220–226.

ŠTORCH P., MANDA Š. & TASÁRYOVÁ Z. (2014): Rhuddanian-Aeronian boundary strata in graptolite-bearing black shale succession of the Barrandian area (Czech Republic). – In: RENBIN Z. & BING H. (Eds.): *IGCP 591 Field Workshop 2014, Kunming China, 12-21 August 2014, Extended Summary*: 148–151. Nanjing University Press, Nanjing.

No. GA14-18183S: **Sequence stratigraphy of Devonian bioevents – sea level changes at the transition from greenhouse to icehouse world** (O. Bábek, M. Faměra, Palacký University in Olomouc, *J. Hladil*, *L. Chadimová*, *L. Slavík*, J. Kalvoda & T. Kumpan, Masaryk University in Brno; 2014–2016)

The project has been focused on understanding the sequence stratigraphy, facies and basin reconstruction aspects of the Devonian rocks in the terranes of the Bohemian Massif. The first year of the project was mainly devoted to extensive field work. In the Prague Synform of the Teplá–Barrandian Unit, fourteen different sections showing the Lochkovian–Pragian, Pragian and Pragian–Emsian successions were measured and/or sampled. The methods embrace the fields of magnetic susceptibility and gamma-ray logging together with thin-sectioning and quantitative microfacies analysis and other, multifaceted sedimentology-oriented techniques. As far as the biota is concerned, preference was given to conodont faunas due to their broad interregional biostratigraphic, paleobiogeographic and paleoenvironmental use. The inter-regional understanding of early polygnathid evolution mosaics, dispersals, migration routes, and paleogeographic and environmental barriers, together with their correlation with icriodontid faunas in the Barrandian area, provided a necessary framework that was used for correlations with the Northeast Asian regions (Baranov et al. 2014). Lithological studies remained mostly in progress, but preliminary results were reported at the occasion of several scientific meetings. This can be exemplified by a study which compares the characteristics of rapidly deposited and extremely polymodal sedimentary materials with the experiments using various amounts of 5 size fractions of the grains (Kulaviak et al. 2014). This study identifies the reasons for variable inner structure of the beds which



■ **Fig. 14.** A simplified stratigraphic column of the Devonian units and facies in the Prague Synform, seeing things in more realistic light and correcting some points neglected in other contemporaneously published charts. Letters on the right side: P – Basal Pragian Event, G – Bohemian Graptolite Event, Z – Basal Zlíchov Event, D – Daleje Event, C – Basal Choteč Event, K – Kačák Event. Diagram by J. Hladil.

occur typically with the early but not the earliest deposits of the transgressive systems tracts and, thus, allows us for an easier and a more unequivocal interpretation of such sequence markers in the carbonate mid-slope conditions. According to present-day models, the fall-out of relevant particulate mixtures is possible over the levees, lobes or as a fall-out from formerly elutriated, separated and then collapsing turbidity clouds delayed after the main turbidity flows.

The first phases of the works suggest that we shall solve many problems with the Devonian stratigraphy of the "Prague Basin". It is most likely that the present-day practice of rather superficial than exact differentiation of the stratigraphic members/lithofacies (based mainly on colour, grain size or arrangement of beds) is in shear contrast to detailed information on sedimentary processes, paleobasin positions as well as biostratigraphic correlation data. These problems are often disregarded or lead to very different versions of the regional stratigraphic columns (e.g., Budil et al. 2014, Vaškaninová & Kraft 2014). Particularly the "members or lithofacies" of the Praha Formation have steep or subvertical boundaries connecting mostly the beginning and end of the "classical Pragian" time interval. This is in contradiction with the individual stratigraphic sections in the Prague Synform which have been shown by I. Chlupáč in 1950s–1960s and more recently in Chlupáč et al. (1992: fig. 58 on p. 157), where the entire belt in the NW margin of this synform shows subhorizontal boundaries of the succession of "Koněprusy", Slivenec, Loděnice, Řeporyje and Dvorce–Prokop limestones. And both are in contradiction to many details about biofacies and biostratigraphy which were indicated by Havlíček & Vaněk (1998) as well as tectonic belts and blocks *vs.* facies as indicated by Melichar & Hladil (1999). A simplified preliminary line drawing characterizes the possible stratigraphic situation here (Fig. 14), although there is still an enormous amount of work to be done for the exact sequence stratigraphic model and definition of the real sedimentary bodies.

BARANOV V.V., SLAVÍK L. & BLODGETT R.B. (2014). Early Devonian polygnathids of Northeast Asia and correlation of Pragian/Emsian strata of the marginal seas of Angarida. – *Bulletin of Geosciences*, 89, 3: 645–678.

BUDIL P., FATKA O., RAK Š. & HÖRBINGER F. (2014): Unusual occurrence of dalmanitid trilobites in the Lochkovian of the Prague Basin (Czech Republic). – *Bulletin of Geosciences*, 89, 2: 325–334.

HAVLÍČEK V. & VANĚK J. (1998): Pragian brachiopods, trilobites and principal biofacies in the Prague Basin (Lower Devonian, Bohemia). – *Sborník geologických věd, Paleontologie*, 34: 27–109.

CHLUPÁČ J., HAVLÍČEK V., KŘÍŽ J., KUKAL Z. & ŠTORCH P. (1992): *Paleozoikum Barrandienu (kambrium – devon)*. Český geologický ústav: 1–292. Praha.

KULAVIAK L., HLADIL J., RŮŽIČKA M., CHADIMOVÁ L. & SLAVÍK L. (2014): Towards the structures of the carbonate beds rapidly deposited from high-density suspensions: Experiments with five fractions of angular grains in a settling column. – In: BÁBEK O., MATYS GRYGAR T. & ULIČNÝ D. (Eds.): *Central European Meeting of Sedimentary Geology, Abstracts*: 47–48. Palacký University. Olomouc.

MELICHAR R. & HLADIL J. (1999): Resurrection of the Barrandian Nappe Structures (Central Bohemia). – *Geolines*, 8: 48–50.

VAŠKANINOVÁ V. & KRAFT P. (2014): The largest Lower Devonian placoderm – *Antineosteus rufus* sp. nov. from the Barrandian area (Czech Republic). – *Bulletin of Geosciences*, 89, 3: 635–644.

No. GAP104/12/0915: **Quantitative analysis of quartz deformation affecting ASR in concrete** (A. Šťastná, Š. Šachlová, R. Přikryl, Z. Pertold, Z. Seidlová, Faculty of Science, Charles University in Praha & *T. Lokajíček*; 2012–2015)

During 2014, four different mortar bars (different types of aggregates) were tested by two different measuring cycles. Four different pairs of mortar bars were heated in 80 °C of 1 M NaOH solution (each pair for 40 days). During the test, semi-continuous P-wave ultrasonic testing with simultaneous monitoring of AE was carried out. Four new mortar bars with the same aggregates were again heated in 80 °C of 1 M NaOH solution for 40 days. These bars were regularly subjected (with a 1 day time interval) to ultrasonic sounding by P and S-waves, together with the expansion measurements. A manuscript with the interpretation of the data obtained in 2013 was prepared.

No. GAP210/12/2053: **High-resolution floristic changes as a response to climatic dynamics during the Late Palaeozoic ice age recorded in the basins of the Bohemian Massif** (*J. Bek*, J. Pšenička, West Bohemian Museum, Plzeň, S. Opluštil, Faculty of Science, Charles University in Praha, M. Libertín, National Museum, Praha & Z. Šimůnek, Czech Geological Survey, Praha; 2012–2015)

A Middle Pennsylvanian tuff bed (the Bělka bed) in the roof of the Lower Radnice Coal bears T0 peat-forming vegetation preserved in growth position. This vegetation has been studied in detail at the 12 hectares large Ovčín coal deposit in the southern part of the Radnice Basin. Documentation of the fossil record in six excavations and that previously collected in the former opencast mine allowed for a detailed reconstruction of the local peat-forming lepidodendrid–cordaitalean forest structured into well-developed stories. It consists of about 33 species, which colonized the occasionally flooded planar peat swamp precursor of the Lower Radnice Coal. The canopy story of this vegetation was dominated by *Lepidodendron* (*Paralycopodites*) *simile*, *L. lycopodioides*, *Lepidophloios acerosus* and *Cordaites borassifolius* (Opluštil et al. 2014). They formed a relatively dense canopy, locally interrupted with significant gaps allowing the development of a rich groundcover that together with liana-like plants represents the most diverse part of the forest. A less diverse understory composed of calamites, medullosan pteridosperms and *Psaronius* tree ferns displays a patchy distribution pattern presumably related to the density of the canopy. The minimal area that sufficiently represents the pattern of this forest phytocoenosis is estimated to be about 200 m^2, although lower stories are well represented even within much smaller areas of about 60 m^2. A slight heterogeneity in the population density of dominant taxa (*Cordaites* vs. lepidodendrid lycopsids) was documented across the Ovčín coal deposit. The fossil record of the Bělka tuff bed also indicates that the coal-forest colonizing the peat swamp prior the generation of forest killed by volcanic ash fall, was destroyed, presumably due to long-lasting flooding. This suggests that catastrophic events were probably a relatively common part of the evolution of peat-forming Pennsylvanian successions.

OPLUŠTIL S., PŠENIČKA J., BEK J., WANG J., FENG Z., LIBERTÍN M., ŠIMŮNEK Z., BUREŠ J. & DRÁBKOVÁ J. (2014): T0 peat-forming plant assemblage preserved in growth position by volcanic ash-fall: A case study from the Middle Pennsylvanian of the Czech Republic. – *Bulletin of Geosciences*, 89, 4: 773–818.

4c. Technology Agency of the Czech Republic

No. TA03021289: **Measurement of migratory properties of rocks with fracture permeability using fluorescent solutions** (*J. Rohovec*, V. Lachman, R. Kovářová, P. Bílý, P. Novák, ISATech, Ltd., Praha, R. Vašíček, Czech Technical University in Praha, V. Frydrych, Z. Patzelt, R. Šigut, L. Vachudová, M. Durajová, K. Koděrová, Geomedia, Ltd., Praha; 2013–2016)

Laboratory research results obtained in the last year were transformed to a larger scale and tested on a more realistic setup. Migration parameters of fluorescein and fluorescein-related tracers were studied on model granite blocks this year. The plan-parallel granite blocks 40 × 60 × 15 cm in size were assembled in the URC (Underground Research Centre) Josef facility. The model fracture of known opening was filled with glass micropearls of chosen diameter (100 μm, 500 μm). Fluorescent tracer solutions were applied in a continuous flow mode realised by HPLC pump with the flow parameter of 5 ml.min^{-1}. Fluorescent tracer concentrations on various position of the test block as well as total concentration in eluted solution were followed by UV VIS spectral technique, using a set of UV VIS probes inserted into observation channels bored into the block, and Cintra 202 spectrometer, respectively.

This way, time dependences of tracer concentrations in various positions in the block were obtained. It was possible to quantify the concentration, because of known calibration of UV VIS probes. The obtained data represent a base for mathematical modelling of the fluorescent tracer passage through the block. The sorption characteristics of the fluorescent tracer were incorporated in the model, and migration parameters were optimised.

4d. University Grant Agencies

Finished projects

GAUK No. 243-253370: **Formulation of stiffness cross-anisotropy of clayey soils in the small-strain range and implementation into hypoplastic constitutive model** (principal researcher: J. Rott, Faculty of Science of the Charles University in Praha, Czech Republic; *P. Pruner* & *P. Bosák*; 2014)

Paleomagnetic research of accidentally taken 5 piston cores from 57 m-deep V1 borehole in the city district of Slatina (Brno City, central Moravia) was carried out on 10 pilot samples (Fig. 15). The samples were oriented only in the direction of the *z* axis, therefore only inclination values and polarities were obtained. Unconsolidated samples of Lower Badenian (Middle Miocene) calcareous clays (known as *Tegel* in the Carpathian Foredeep; e.g., Buday 1963) were demagnetized by alternating field (AF) in 14 steps. The clays are characterized by very low natural remanence magnetization values. All samples, except for one, indicated normal polarity. The only reverse-polarized sample had low inclination value indicating a short reversal episode (short-lived excursion) rather than regular reverse polarity magnetozone (subchron). The accidental sampling mode represents the principal problem for magnetostratigraphy interpretation as no magnetozone boundaries were detected, although Lower Badenian magnetic history is characterized by several changes of the magnetic paleofield (*cf.* e.g., Kováč et al. 2007, Piller et al. 2007).

Owing to the fact that paleomagnetic and magnetostratigraphic interpretations are speculative, micropaleontology has to be taken into account. The *Tegel* was deposited within the M6 biozone of planktonic foraminifers (*Orbulina suturalis* zone; base at 15.1 or 14.74 Ma) and NN5 biozone of nannoplankton (base at 14.91 Ma; e.g., Kováč et al. 2007). The interpretation of transgression-regression cycles (*sensu* Hardebol et al. 1998) indicates the *Tegel* deposition within cycle TB2.4 (14.8 to 13.6 Ma). Paleontological and cyclic data indicate, with a high probability, that *Tegel* deposition started within normal-polarized C5Bn.1n subchron (14.870–14.775 Ma). If the reverse-polarized sample represents a short-lived excursion of magnetic paleofield, it means that the *Tegel* deposition in the sampled borehole started and terminated within this basal magnetozone (C5Bn.1n). If the reverse sample indicates the succession of N–R–N magnetozones, a correlation with the GPTS segment dated to C5Bn.1n (14.870–14.775 Ma), C5ADr (14.775–14.609 Ma) and C5ADn (14.609–14.163 Ma) magnetozones is the most probable, also taking in account the fact that the *Tegel* deposition is characterized by fauna of the highest Lagenide biozone. If this interpretation is accepted, the *Tegel* deposition started within the basal normal-polarized magnetozone C5Bn.1n, between 14.870 and 14.775 Ma, and terminated within upper normal-polarized magnetozone C5ADn, i.e., above 14.609 Ma and deeply below its upper boundary at 14.163 Ma. Both variants meet at one point – the *Tegel* deposition started within the normal-polarized C5Bn.1n subchron (14.870–14.775 Ma; Bosák & Pruner 2014).

Magnetostratigraphy should also help to estimate the eroded thickness of *Tegel* at the locality. Previous studies and estimates varied, according to different sources, from 25.25 m (Pavlová 2011) to 300 m (Boháč & Pavlová 2012) of eroded *Tegel*. Some values were obtained by special geotechnical analyses (25.25 and 75 m). The highest *Tegel* thickness in the Slatina site surroundings is 345 m (HJ-105 Dvorská borehole 2.5 km to the south of the Slatina site; Brzobohatý in Tomanová Petrová

■ **Fig. 15.** Piston core of Lower Badenian calcareous clay (Tegel) from 4.5–4.7 m (V 1 Slatina borehole) with plastic boxes of paleomagnetic samples. Photo by J. Rott.

2013). Nevertheless, it occurs in the Carpathian Foredeep depocentre with high synsedimentary subsidence rate separated from our location by the marginal foredeep fault. The original *Tegel* thickness in the nearby Boskovice Graben was 120 to 150 m with increasing thickness from N to S (Cícha & Dornič 1960). The situation in the Moravian Karst (N of the site) with preserved 119 m of *Tegel* in the Lažánky Valley and altitude of karst plateau at ca. 480 a. s. l., which was completely covered by *Tegel*, indicates post-depositional erosion of at least 60–80 m of *Tegel*. So, *Tegel* was at least 180–200 m thick here. According to geomorphic similarities between the settings in the Moravian Karst and at our site, we can expect that the minimum *Tegel* thickness at the Slatina locality was similar, i.e. around 180 m – so ca. 135 m of *Tegel* is missing. Nevertheless, geotechnical models indicate an erosion of only 75 m of *Tegel* here. The difference can be explained by (1) condensed nature of *Tegel* profile at our site at elevated morphological position, and/or (2) syn-sedimentary erosion of deposited soft material into deeper depocentres by submarine currents, and/or (3) the post-depositional secondary disturbances by weathering (permafrost) due to expansion of smectite (montmorillonite; *cf.* Růžičková & Zeman 1992) and/or tectonization (*cf.* Pavlík et al. 2004), and/or (4) constant values used in the geotechnical model. The third possibility can stay, most probably, behind the failure of extensive paleomagnetic research in the Carpathian Foredeep in Brno suburbs by Márton et al. (2011).

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GAUK No. 742213: **Dentition of vertebrates: mineralogical and crystallographic characteristics** (*A. Kallistová*, *R. Skála*, I. Horáček, & P. Hanousková, Faculty of Science, Charles University in Prague; 2013–2015)

One of the main reasons of phylogenetic expansion of vertebrates is the formation of permanent teeth. Their unique features and high resistance are ensured mainly by the surface layer – enamel – which is the hardest material in animal bodies. Enamel in all organisms is formed by the hydroxyapatite aggregates. However, the inner mutual organization of hydroxyapatite crystallites in enamel coat varies for different classes of vertebrates. We can find the most complex and compact arrangement of hydroxyapatite units in the mammal group which has reached the most extensive food diversity and efficiency in specializations of individual mammal species and in individual longevity. Morphology, mutual arrangement, chemical composition, structure and microstructure (size, micro-strain) and other physical and chemical properties of hydroxyapatite crystallites were studied using various analytical methods (SEM, X-ray diffraction, TEM, micro-indentation). All the mentioned features of enamel can influence biomechanical qualities of hydroxyapatite aggregates and enamel coat, and consequently the animal species themselves.

4e. Grants of the State Departments

Ministry of Education, Youth and Sports, "KONTAKT II", Project No. LH12079: **Laboratory simulations of space weathering – the role of iron nanoparticles in the reflectance spectra of asteroids** (*T. Kohout*, *G. Kletetschka*, *R. Skála*, J. Čuda, J. Filip, R. Zbořil & J. Tuček, Palacký University in Olomouc; 2012–2015)

The project focuses on optical effects of asteroid surface space weathering associated with micrometeorite and solar wind bombardment and related occurrence of nanosized metallic iron. A method of space weathering simulation developed last year was applied on minerals olivine, pyroxene, and chondritic meteorite. The changes in mineral and meteorite reflectance spectra related to the presence of nanosized metallic iron, its concentration and grain size were evaluated. These results provide us with a better understanding of the reflectance spectra of silicate-rich asteroids.

Ministry of Education, Youth and Sports, "KONTAKT II", Project No. LH13102: **Kinematic and dynamic anisotropy of sedimentary and crystalline rocks: Ultrasonic, synchrotron and neutron diffraction study** (*T. Lokajíček*, *T. Svitek*, *M. Petružálek* & H.R. Wenk, University of California, Berkeley, Earth & Planetary Science, USA; 2013–2015)

A new high-pressure measuring head was designed and constructed for longitudinal and transversal ultrasonic sounding of spherical rock samples in 132 independent directions under hydrostatic pressure up to 100 MPa. The velocity is measured using a pair of P-wave sensors and two pairs of S-wave sensors with perpendicular polarization. The measuring head testing proved to be useful in investigating of LPO and SPO for the bulk elastic anisotropy of anisotropic rocks subjected to hydrostatic pressure. Ultrasonic sounding on spheres by P and S waves enables to determine elastic parameters of the studied material. According to the regular distribution of measured data, it is possible to calculate all 21 elastic parameters of the stiffness tensor. Results of synthetic tests revealed that for correct determination of full stiffness tensor parameters, knowledge of P, S1 and S2 velocities must be determined in sufficient numbers of regularly distributed directions.

4f. Industrial Grants and Projects

Physics Institute, ASCR; Czech Geological Survey, Praha; Project No. 7001: **External orders for ICP-MS analyses** (*J. Ďurišová*)

The ICP-MS facility provided analytical services including determinations of trace elements in quartz using laser ablation ICP-MS for Geological Survey of Denmark and Greenland, Copenhagen, Denmark; trace elements in clinopyroxene and orthopyroxene using laser ablation ICP-MS for Institute of Geological Sciences, University of Wrocław, trace elements and lead isotopic ratios in soil extracts for Nuclear Physics Institute of the CAS, Řež; trace elements in digested samples of basalts for Czech Geological Survey, Praha.

Energoprůzkum Praha, Ltd., Praha; Project No. 7005: **Laboratory tests of rocks on samples from the new nuclear source of the Dukovany power plant** (*M. Petružálek* & *M. Tejnecká Englmaierová*)

As a part of the engineering geological survey for the location of a new nuclear source, mechanical (uniaxial and triaxial compressive strength, static and dynamic elastic modulus, P and S wave velocity) and descriptive (water content, bulk and grain density, porosity) properties of rocks were determined for specimens from survey area of Dukovany, Czech Republic.

Czech Geological Survey, Praha; Project No. 7012: **U-Pb zircon dating of igneous and metasedimentary rocks from the Central Asian Orogenic Belt (western Mongolia)** (*M. Svojtka*)

The studied samples for laser ablation U-Pb zircon dating were collected in the Central Asian Orogenic Belt (western Mongolia). Two samples represent Devonian granites from the Altai Plutonic Complex, while metamorphic rocks are represented by orthogneiss from the Altai Zone dated to the Ordovician (ca. 470 Ma). Before U-Pb dating, internal structures of zircons were studied using cathodoluminescence imaging.

Czech Geological Survey, Prague; Project No. 7025: **External orders for Fission-track laboratory** (*J. Filip*)

In cooperation with the Czech Geological Survey ages and time-temperature paths of samples from Central Bohemian Pluton (Mokrsko locality) were determined by using apatite fission track analysis (AFTA).

Departamento de Estratigrafía y Paleontología Facultad de Ciencias - Universidad de Granada, Spain; Project No. 7272: **Paleoenvironmental comparison of south and north-west-Tethyan margins, paleomagnetic and magnetostratigraphic studies** (*P. Pruner*, *P. Schnabl*, *K. Čížková*, *J. Petráček*, *P. Petráček* & F. Olóriz Sáez, Departamento de Estratigrafía y Paleontología Facultad de Ciencias – Universidad de Granada, Spain)

The project is focused on: (1) sampling for paleomagnetic, paleontological and mineralogical studies, (2) special analyses for determination of magnetic minerals, (3) interpretation of thermal (TD) and alternate field (AF) demagnetization, (4) measurement of temperature-dependent susceptibility and Curie temperature determination, (5) the acquisition of the remanent magnetization (RM) component analysis, interpretation of main carriers of RM, (6) the final interpretation of paleomagnetic, rock-magnetic methods, calculation of paleomagnetic polarity and directions variations (7) data interpretation for detailed wide-regional biostratigraphic-palaeomagnetic correlation.

Orientated hand or drilled samples for magnetic measurements were collected from a condensed section embracing the Middle/Upper Jurassic transition in sections far eastward from Granada (Carcabuey, Puerto Nuevo, Cańada) and northward from Murcia (Fortuna, Corque Sierra) at the end of 2013.

In the first stage of laboratory studies, pilot samples were subjected to the analysis of RM acquisition and AF demagnetization curves with the aim to establish magnetic hardness of the magnetically active minerals contained in the limestones. The natural remanent magnetization (NRM) measurements were carried out using Liquid Helium-free Superconducting Rock Magnetometer type 755 4 K SRM (2G ENTERPRISES). In order to resolve the components of NRM, the latter equipment used the AF demagnetization up to the peak field of 100 mT, while the former was mostly combined with the TD demagnetization in the field-free space produced by the MAVACS equipment. Processing of the output data, including of the multicomponent analysis of the demagnetization path, was carried out by Remasoft 3.0 software. Magnetic susceptibility was measured by the KLY-4 Kappabridge (AGICO Brno). Mean paleomagnetic directions will be calculated for each locality from the individual components. These directions can be recalculated to Virtual geomagnetic pole (VGP) and magnetostratigraphic polarity variation for the studied locality.

Velkolom Čertovy schody, Inc.; Project No. 7302: **Documentation of progress of quarry walls – reclamation of the Quarry–West** (*P. Bosák*)

The reclamation exploitation of the Koněprusy Limestone (Pragian, Lower Devonian) was highly limited to two benches in the quarry also in 2014 (Bosák 2014). The evaluation of walls after each blasting showed the continuation of calcite veins from past years and proved the pinching out and branching of thick calcite veins towards SSW at a distance of several tens to hundreds of metres. Unfortunately, no cavities of the thermomineral paleokarst were discovered due to low progress of quarry benches.

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State Office for the Safety of Nuclear Facilities, Praha; Project No. 7403: **The evaluation of safety report for a new nuclear site Temelín 2. Final report** (*V. Cílek* & *J. Adamovič*)

A construction of a new nuclear site is accompanied by 1–2 years lasting evaluations carried by independent sources. ČEZ general report about new Temelín site contains more than 1000 pages of the description of safety risks where geological, geomorphological, hydrological and other Earth science discipline factors are described on approximately 300 pages. During the process of evaluation, the team of the Institute of Geology provided constant support to the State Office for Nuclear Safety, SÚJB (D. Drábová). A number of problems had to be answered during mutual meetings with ČEZ and SÚJB: e.g., seismic models, the presence of active faults, hydrological model of the site. The result of this continuous activity was then evaluated and approved or conditionally approved by the final report that asked for new geological mapping of the whole area, the correction of the seismic modelling and measurements, and verification of the tectonic situation.

Czech Geological Survey, Praha; Project No. 7406: **Regional geology and geological mapping – zoopalaeontological explanatory texts to geological maps 1 : 25 000** (*J. Zajíc*)

Chapter Permo-Carboniferous zoopalaeontology and ichnology was compiled for the explanatory text to the Geological map No. 03-432 Nová Paka (1 : 25,000). The older known fauna (uppermost Carboniferous) from this area comes from the Middle Semily Formation from the Ploužnice Horizon (Stephanian C; *Sphaerolepis-Elonichthys* local bio/ecozone) from an old outcrop. Younger faunas come from the Kalná Horizon of the Upper Prosečné Formation (Upper Rotliegend; *Xenacanthus decheni* local bio/ecozone). Five outcrops contain representative animal fossils and ichnofossils of the horizon (Zajíc 2014).

ZAJÍC J. (2014): *Zoopaleontologie a ichnologie permokarbonu pro vysvětlivky ke geologické mapě list Nová Paka (03-432) Závěrečná zpráva*. – Inst. Geology CAS, v. v. i.: 1–11. Praha.

Bohemian Switzerland National Park Administration, Krásná Lípa; Project No. 7407: **Monitoring of atmospheric precipitation in the Bohemian Switzerland National Park** (*T. Navrátil*, *I. Dobešová*, *J. Rohovec*, *Š. Matoušková*, *S. Hubičková*)

Monitoring of chemical composition of bulk precipitation proceeded in 2014 at the Kuní vrch locality in the territory of the Bohemian Switzerland National Park and followed the monitoring from 2008 to 2013.

The monthly bulk precipitations significantly differ according to the climatic conditions. According to the bulk precipitation, the hydrological year 2014 can be assessed as below-average, the bulk precipitation at the Kuní vrch locality reached 728 mm. The lower values of precipitation also manifested at the spruce forest.

The value of pH is an important measured parameter of atmospheric deposition. The low values of pH are caused predominantly by anthropogenic factors. The pH of the precipitation on an open place at KV-dkx is between 4.3 and 6.0, which is comparable with the values of pH in the hydrological years 2011–2013. The values of pH of throughfall at KV-thsf locality range from 3.7 to 5.9.

The terrigenous dust contains soil and rock particles and influences the deposition fluxes of Al, Ca, K, Mn, Sr, Mg, and Fe elements. The values of deposition fluxes in the hydrological year 2014 of most of these elements are lower or comparable (Mn, Fe) with the past years.

A decrease in annual deposition flux of SO_4^{2-} at the open place was found compared to the last hydrological year. In contrast, the annual deposition flux of SO_4^{2-} of throughfall was comparable with the previous year 2013. A decrease in annual deposition flux of NO_3^- was measured at both types of precipitation. The NO_x emissions generated mostly from the anthropogenic burning processes, predominantly from traffic.

The higher values of deposition fluxes of throughfall confirm the washing effect of the forest trees and the leaching of metabolites. In particular, K, Mg, Mn, and Rb are the elements metabolized by the forest vegetation.

The annual deposition fluxes of trace elements Cu, Zn, Sr, Pb, Rb, and Cd reached lower values in the hydrological year 2014 than in the year 2013.

4g. Programmes of Institutional Research Plan

Project No. 9330: **Mechanical and thermal effects of dyke intrusions on porous host rocks** (*J. Adamovič*)

Several newly discovered dykes emplaced in quartzose sandstone have been sampled and their host rocks were subjected to microscopic study. The most important site was the outlet ditch of the Máchovo jezero Reservoir at Staré Splavy, Česká Lípa area, where a dyke swarm was perfectly exposed during construction works. Pore space reduction due to quartz overgrowths of sand grains and due to goethite cementation was confirmed.

Project No. 9332: **Laramide and Pyrenean phases of the Alpine Orogeny – the most forceful pulses towards the orogen foreland** (*M. Coubal* & *M. Šťastný*)

Kinematic and paleostress history of the Lusatian Fault was studied. The defined paleostress patterns were dated using the observed superposition relative to geochronologically dated neovolcanic bodies. At the site of Doubice, a detailed study of fault rocks of the exposed fault core was conducted with special attention to clay fraction. Different illite polytypes were identified and the 1Md polytype was dated using K-Ar method, thereby providing the timing of the movement on the fault plane.

Project No. 9333: **The most ancient lagomorphs of Sardinia** (*S. Čermák*)

The project was focused on the systematic revision of the published and unpublished lagomorphs (pikas and hares) from Capo Mannu D1 (Early/Late Pliocene boundary, central-western Sardinia, Italy), one of the key sites for the reconstruction of Sardinian Neogene. The analysed material represents the most ancient lagomorph of Sardinia. The *Prolagus* remains from Capo Mannu D1 described here as *Prolagus* aff. *P. figaro* show a very incipient degree of endemisation. The genus arrived in Sardinia just before the accumulation of the Capo Mannu D1 sediments, together with other components of the Capo Mannu D1 assemblage (the insectivores and the murid *Rhagapodemus azzarolii*). The "pilgrim fathers" probably came from mainland Italy and reached Sardinia at the Early/Late Pliocene boundary taking advantage of an emerged land connection, a condition necessary for the displacement of lagomorphs. Relatively numerous and rather well-preserved material of *Prolagus* allowed to include it in a cladistic analysis aimed to discover its phylogenetic relationships and to update the state-of-the-art of genus phylogeny. A cladistic analysis indicates that (1) *P.* aff. *P. figaro* is closely related with *P. sorbinii* and is the ancestor of endemic Sardinian *Prolagus* species; (2) *P.* aff. *P. figaro* and *P. figaro* are not related to *P. depereti* as previously supposed; (3) Italian *Prolagus* species (insular endemic and continental ones) originated from a eastern European branch, as well as the Gargano insular endemic species *P. apricenicus* and *P. imperialis*; (4) the isolation of central-eastern European populations of *Prolagus* from western ones preceded the earliest Late Miocene, confirming a hypothesis raised in the latest years on the basis of several lines of taxonomic evidence. The sole, poorly preserved remain of a leporid does not allow any inference about its continental ancestor or about the epoch of its arrival in Sardinia. Neither is it possible to speculate about its relationships with the Monte Tuttavista leporid (Early Pleistocene). Nevertheless, Leporidae gen. et sp. indet. represents an important finding because it shifts the first presence of leporids in Sardinia by about 1 My.

Project No. 9334: **Lithogeochemistry and Sr-Nd isotopic composition of Neoproterozoic metasedimentary rocks of the Teplá Crystalline Complex, western Bohemian Massif: a geotectonic interpretation** (*J. Fiala*)

Clastic metasedimentary rocks from the Teplá Crystalline Complex (western Bohemian Massif) were analysed for major and trace elements, Sr and Nd isotopes. The metamorphic grade of these rocks of presumed Neoproterozoic protolith age increases from SE to NW from very low-grade to amphibolite-facies conditions. Geochemistry indicates that the sedimentary protoliths for the whole sequence consisted of immature (pelitic) greywackes chiefly derived from an ensialic island arc. No significant changes in composition from the lowest to the highest grade or across the strike of isograds were observed. Chemical variations between original slates and greywackes within a single locality often considerably exceed the variation among samples of different metamorphic grades or of different geographic positions. The prevailing REE spectra with distinct negative Eu anomalies show a close similarity with those of modern turbidites from ensialic island arcs. Several samples without any Eu anomaly resemble the REE patterns of less differentiated island arc andesites. LREE leaching under oxidizing conditions is suggested by several REE patterns with positive Ce anomalies. The Sm-Nd model ages T-DM of samples with Ce positive anomalies are higher (T-DM = 1.8–2.0 Ga) than those of all other samples (T-DM = 1.1–1.5 Ga). Initial Sr isotopic ratios for all samples are fairly constant and compatible with an assumed dominance of isotopically less evolved detrital material. Geochemical characteristics of the clastic metasediments of the Teplá Crystalline Complex are thus consistent with a model of incorporation and preservation of arc-derived sediments in a Cadomian accretionary wedge.

Project No. 9338: **Reconstruction of post-Variscan time-temperature evolution of sedimentary basins and their source areas along Lusatian Fault (Bohemian Massif) using apatite fission-track analysis** (D. Kořínková)

The aims of this project are to 1) reconstruct the time-(low)temperature evolution of basinal and source areas (i.e., uplifted blocks along the Lusatian Fault from NW/N and NE/E Bohemia, Saxony and Silesia) related to tectonic-erosion activity in the Lusatian Fault Zone and 2) bring new data about the tectonic subsidence/uplift (cooling rate) in the studied area using apatite fission track analysis. In 2014, all fission-track analyses and microprobe analyses were completed. Thermal evolution of the studied area was modelled based on these data.

Project No. 9339: **The use of ICP-MS for U series dating of cave carbonates** (*Š. Matoušková*, *J. Rohovec* & H. Hercman, Institute of Geological Sciences, Polish Academy of Sciences, Warszawa)

The continued methodological project is based on a dating method which is frequently used to determine the age of cave carbonates. This method works with the radioactive disequilibrium of some members of decay series. It is performed by measuring activity ratios of different uranium and thorium isotopes using alpha spectrometry. There are some disadvantages of the alpha spectrometry (high sample weight, overlap of emitted energy of key isotopes, time question, troubles with the detection of low concentration samples). The TIMS is also used, but this method is arduous, the preparation of samples is very difficult and time-consuming and the measurement is relatively expensive. These are the reasons why we decided to find a new possibility of the measurement of activity ratios – the Sector Field Mass Spectrometer with Inductive Coupled Plasma, Element II Thermo Scientific.

Last year the ICP-MS measurement was optimized on artificial (prepared from standards) samples, now the method is being verified on natural samples prepared specifically for the ICP-MS. A really big and laborious issue is the sample preparation using column separation – this step is performed in a cooperative institution in Warsaw, Poland (H. Hercman). Within this cooperation, a computer programme for data recalculation was created and the age of measured samples is being compared with data from the same parts of cave carbonate formerly measured using alpha spectrometry. The next step will be the measurement of many different (age/locality) natural samples.

After the development of this method is finished, its implementation at our institute will be beneficial for many of its scientific departments.

Project No. 9340: **The study and interpretation of ichnofabric** (*R. Mikuláš*)

Large star-like trace fossil was found on the upper bedding plane of nodular limestone of the Praha Formation (Pragian, Devonian) in Prague. It was tentatively placed to the ichnogenus *Capodistria*. The trace fossil partly intersects nodules that cover surfaces of most bedding planes of the Praha Formation, demonstrating that the nodules formed during the earliest stages of diagenesis.

Project No. 9341: **Revision of extinct frogs of the family Palaeobatrachidae** (*Z. Roček*)

Frogs of the family Palaeobatrachidae are among the most frequent finds of amphibians in European Oligocene through Pliocene fossil sites. In spite of that, their taxonomy is still equivocal, mainly because some taxa are based on articulated but compressed skeletons whereas others on 3D preserved, disarticulated bones, which prevents reliable comparisons. This is the reason why a thorough revision of all available palaeobatrachid material is needed, although several authors made similar attempts earlier (Špinar 1972 was the last of them). A significant progress made within the scope of this project was a re-discovery of the holotype of *Palaeobatrachus diluvianus*, which is a type species of *Palaeobatrachus* and a name-bearing type; it was found as uncatalogued specimen lent from the collections of the Steinmann-Institut (Paläontologie) of the University of Bonn to the University of Manchester. All other material of Palaeobatrachidae must be compared and derived from this type specimen. This is why the main effort in 2014 was focused on the description and photographic documentation of the palaeobatrachid material in various collections, mainly in Germany (Museum für Mineralogie und Geologie Dresden, Senckenberg Forschungsinstitut und Naturmuseum Frankfurt am Main, Museum für Naturkunde Berlin, Steinmann-Institut (Paläontologie) of the University of Bonn, Geiseltalmuseum Halle (Saale), and Section Geological History of the Earth, Department of Archaeology, General Department of Cultural Heritage Rhineland Palatinate, Mainz). Additional material from the collections of the Ţării Crişurilor Museum in Oradea, Romania, Université de Poitiers, France, Museum of Comparative Zoology, Harvard University, Institute of Earth Sciences, Utrecht University, and of the National Museum, Prague was also investigated. The first publication, which was prepared in 2014 and published in 2015 (Roček et al. 2015) solved the problem of taxonomic identity of the palaeobatrachid genus *Albionbatrachus* (known exclusively from disarticulated bones, mainly frontoparietal) and its relations to *Palaeobatrachus,* by means of X-ray high-resolution computer tomography (micro-CT). The independent status of *Albionbatrachus* was confirmed both on internal and external features. Besides, one of the last palaeobatrachids from the Early Pleistocene (Villanyian) of Tegelen, The Netherlands, was described based on disarticulated bones as an independent species of *Palaeobatrachus*, and the manuscript was submitted (Villa et al., in press). Finally, a large sample of disarticulated bones, unfortunately restricted to fragmentary and incomplete sphenethmoids, angulars, humeri and ilia, from several localities in Anatolia, was investigated in cooperation with Dr. Leon Claessens, but it does not permit reliable taxonomic comparisons because of limited number of skeletal elements. Nevertheless, it represents a significant piece of evidence on Oligocene–Miocene palaeobatrachids from insular periphery of their main area of distribution.

ROČEK Z., BOISTEL R, LENOIR N., MAZURIER A., PIERCE S. E., RAGE J-C., SMIRNOV S. V., SCHWERMANN A. H., VALENTIN X., VENCZEL M., WUTTKE M. & ZIKMUND T. (2015) Frontoparietal bone in extinct Palaeobatrachidae

(Anura): Its variation and taxonomic value. – *The Anatomical Record*, 298: 1848–1863.
ŠPINAR Z. V. (1972): *Tertiary frogs from Central Europe*. Academia. Praha.
VILLA A., ROČEK Z., EMANUEL TSCHOPP E., van den HOEK OSTENDE L. W. & DELFINO M. (submitted): *Palaeobatrachus eurydices* n. sp. (Amphibia, Anura), the last Western European palaeobatrachid. – *Journal of Vertebrate Paleontology*.

Project No. 9342: **Magnetostratigraphy and rock-magnetism of the Jurassic–Cretaceous boundary** (*P. Schnabl* & *P. Pruner*)

The main result of the project is the publication of the Grabowski et al. (2014) paper. The paper refers to the Barlya section: its lithologies, facies, magnetic properties and fossil record (calpionellids). Data obtained were applied to determine precise biostratigraphy for this carbonate sequence and to provide a paleoenvironmental reconstruction. The investigated interval, 24 m thick, covers the top of *the Calpionella elliptica*, *Calpionellopsis simplex* and *Calpionellopsis oblonga* subzones. Magnetozones from the upper part of M17r up to M16n were identified. The boundary between the *elliptica* and *simplex* subzones correlates with the lower part of M16r, while the boundary between the *simplex* and *oblonga* subzones is situated in the lower part of M16n. Magnetic susceptibility shows an increasing trend from the middle part of M16r upwards, which accounts for the increasing supply of fine clastic sediments to the basin.

Hundreds of samples were measured from the sites of Barlya (Bulgaria), St. Bertrans (France) and Kurovice (Czech Republic). Reconnaissance and pilot sampling was performed at several sites in California and Mexico.

GRABOWSKI J., LAKOVA I., SCHNABL P., SOBIEŃ K., PETROVA S. (2014): Berriasian bio- and magnetostratigraphy and magnetic susceptibility of the Barlya section (Western Balkan Unit, Bulgaria) – preliminary results. – *Volumina Jurassica*, XII, 1: 185–194.

Project No. 9343: **The use of palynology in palaeoenvironmental interpretation and stratigraphy of the Middle Cenomanian deposits of the Horoušany quarries (Bohemian Cretaceous Basin)** (*M. Svobodová*)

Palynological data presented in this study were collected with the aim of supplementing the sedimentological database for palaeoenvironmental interpretation. An important finding is the occurrence of prasinophytes and acritarchs in units previously regarded as fully fluvial and sedimentologically not showing any signs of tidal influence. Finds of the biostratigraphically important angiosperm pollen *Complexiopollis* deep in in CEN 2 sequence in the Central Palaeodrainage System demonstrate that the Normapolles in the Peruc Member palaeovalley fills occur in lower parts of the Middle Cenomanian and their relevance as a chronostratigraphic marker is lower than previously believed.

Project No. 9344: **Sources and differentiation development of Cenozoic volcanic series in western Bohemia: geochemical and isotopic characteristic** (*J. Ulrych*, *L. Krmíček*, *L. Ackerman*, Č. Tomek, Institute of Geophysics, Slovak Academy of Sciences, Bratislava, F.E. Lloyd, Department of Earth Sciences, University of Bristol, Bristol, Great Britain, A. Ladenberger, Geological Survey of Sweden, Uppsala, E. Hegner, Department of Geowissenschaften, Universität München, München, Germany & K. Balogh, Institute of Nuclear Research, Hungarian Academy of Sciences, Debrecen)

Principal conclusions of the study of two cogenetic (i) silica-undersaturated to silica-oversaturated and (ii) silica-undersaturated volcanic suites of western Bohemia can be summarized as follows:

The Mid to Late Miocene intraplate alkaline volcanic series of western Bohemia is a relict of intensive voluminous volcanism (Ulrych et al. 2000). This volcanic event is accompanied by large-scale crustal uplift and updoming, the association with the uplift of the NE flank of the Cheb–Domažlice Graben (CDG) remains unclear. Two cogenetic volcanic suites (Ulrych et al. 2003) have been recognised: (i) the silica-undersaturated to silica-oversaturated suite consist of basanite – olivine basalt – trachybasalt – (basaltic) trachyandesite – trachyte – rhyolite (13.5 to 10.2 Ma) and (ii) the silica-undersaturated suite consists of melilite-bearing olivine nephelinite – basanite – tephrite (18.3 to 6.25 Ma). Similar primitive mantle-normalized incompatible element patterns of olivine basalt and olivine nephelinite and Sr-Nd-Pb isotopic compositions of the assumed near-primary mantle-derived compositions of both suites suggest a common mantle source. Apparently, they were generated by different degrees of partial melting of a common mantle source with garnet, olivine and clinopyroxene in the residuum. Negative Rb and K anomalies indicate a residual K-phase (amphibole/phlogopite) and potential and significant melting of metasomatized mantle lithosphere. The evolution of the basanite – olivine basalt – trachybasalt – (basaltic) trachyandesite – trachyte – rhyolite is associated with a substantial fractionation of olivine, clinopyroxene, Fe-Ti oxide, plagioclase/alkali feldspar and apatite accompanied by some assimilation of crustal material. The source of magmas was probably represented by both sub-lithospheric and lithospheric mantle metasomatized by plume-like material. Crustal contamination of the partial melts *en route* to the surface is assumed to be significant for the WAS magmatites only. The evolution of the melilite-bearing olivine nephelinite – basanite – tephrite suite is rather unclear because it is of limited differentiation *en route* extent only. Parental magma of all these rock series is inferred to have originated by low-grade melting of the mantle source initiated at ca. 18 Ma. The older Oligocene alkaline rocks (29.5–25.8 Ma) occur within the CDG locally but are significant in the closely adjacent western Ohře Rift. The Sr-Nd isotope composition of primitive volcanic rocks of both series is similar to that of the European asthenospheric reservoir (EAR). First $^{207}Pb/^{204}Pb$ data on Cenozoic volcanic rocks from western part of the Bohemian Massif (Ulrych et al. after revision) plot above the northern hemisphere reference line at radiogenic $^{206}Pb/^{204}Pb$ ratios of ~19 to 20 (Table 1) and indicate an old crustal component in the samples (Ulrych et al. 2006).

The study presents complex geological, geochemical, mineralogical, K-Ar and Sr-Nd isotope (Table 2) data of the Late Cretaceous to Pleistocene melilitic volcanic rocks of the Bohemian Massif.

Rock	Locality	Age	Th	U	Pb	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	$(^{206}Pb/^{204}Pb)_i$	$(^{207}Pb/^{204}Pb)_i$	$(^{208}Pb/^{204}Pb)_i$
type		(Ma)	(ppm)	(ppm)	(ppm)						
MIOCENE SILICA – UNDERSATURATED TO OVERSATURATED SUITE											
TR	Špičák	12.5	19.1	4.89	29.4	18.857	15.638	38.932	18.84	15.64	38.91
TRA	Zbraslavský kopec	11.4	16.2	6.4	27.2	19.397	15.643	39.319	19.37	15.64	39.30
TRA	Třebouňský vrch	12.1	13.1	3.37	11.4	19.265	15.652	39.240	19.23	15.65	39.19
BTRA	Doubravický kopec	12.9	11.2	2.76	10.6	19.093	15.628	39.088	19.06	15.63	39.04
MIOCENE SILICA – UNDERSATURATED SUITE											
TE	Pekelský vrch	13.0	7.36	2.08	5.32	19.450	15.640	39.301	19.40	15.64	39.24
TE	Preitenštejn	10.2	9.05	2.43	7.18	19.389	15.640	39.298	19.35	15.64	39.25
TE	Polínský vrch	10.0	9.37	2.54	5.49	19.831	15.656	39.607	19.78	15.65	39.55

BA – basanite, TE – tephrite, TRB – trachybasalt, TRA – trachyandesite, BTRA – basaltic trachyandesite, TR – trachyte

■ **Tab. 1.** Pb isotope data for the Cenozoic volcanic rocks from western Bohemia.

Sample	Locality	Rock	Age	Rb	Sr	$(^{87}Sr/^{86}Sr)_t$	$(^{87}Sr/^{86}Sr)_t$	Nd	Sm	$(^{143}Nd/^{144}Nd)_t$	$(\varepsilon Nd)_t$
			(Ma)	(ppm)	(ppm)			(ppm)	(ppm)		
EARLY T O LATE PLIOCENE EPISODE											
11.1.	Komorní hůrka	SOM	0.43	59	953	0.70350	0.703500	57.6	10.1	0.512864	4.4
12.2.	Železná hůrka	NOM	1.01	67.9	1183	0.70344	0.703440	68.3	11.6	0.512867	4.5
MID EOCENE TO LATE MIOCENE PERIOD											
5/13	Český Chloumek	MON-ON	16.5	65.4	955	0.70336	0.703363	51.1	9.65	0.512815	5.1
10.2.	Příšovská homolka	MON-ON	7.23	11.6	124	0.70355	0.703550	11.8	18.1	0.512825	3.8
3/13	Krkavčí skála	MON	26.9	28.6	1773	0.70338	0.703378	102	15.8	0.512796	3.7
13.1.	Pohoř Hill at Odry	MON	32.3	30.5	1396	0.70378	0.703782	79.7	13.1	0.512843	4.8
LATE CREATACEOUS TO LATE PALEOCENE PERIOD											
POL-119	Osečná borehole	OME	65	89.0	2210	0.70417	0.704170	83.06	14.6	0.512778	4.4
POL-37	Děvín Hill at Hamr	POL-V	68	83.0	2050	0.70330	0.703300	115	18.2	0.512756	3.9
POL-4	Zlatá výšina	POL-M	63	67.0	1040	0.70417	0.704170	81.57	13.4	0.512789	4.6
POL-9	Suchý Janův Důl	CPOL-L	63	21.0	1470	0.70421	0.704210	87.57	12.9	0.512716	3.2
POL-28	Great Devil's Dyke	MON	62	48.0	710	0.70335	0.703350	45.97	8.48	0.51282	5.2
POL-181	Jiřetín	POL	68.8	44.3	1102	0.70337	0.703368	85.3	14.3	0.512738	3.7
POL-182	Stožec Hill	POL	60.5	24.9	1709	0.70337	0.703373	105	16.1	0.512729	3.3

HOM – haüyne olivine melilitite, NOM – nepheline olivine melilitite, MON – melilite olivine nephelinite, ON – olivine nephelinite, OME – olivine melilitolite, POL – ultramafic clinopyroxene-free lamprophyre – polzenite, CPOL – clinopyroxene ultramafic lamprophyre – „polzenite", POL – polzenite: V – Vesecite type, M – Modlibovite type, L – Luhite type.

■ **Tab. 2.** Rb-Sr and Sm-Nd isotopic data for melilitic rocks of the Bohemian Massif.

Late Cretaceous to Pleistocene volcanic rocks of the Bohemian Massif represent (Ulrych et al. 2011) the easternmost part of the Central European Volcanic Province. These alkaline volcanic series include rare melilitic rocks occurring as dykes, sills, scoria cones and flows. They occur in three volcanic periods: (i) the Late Cretaceous to Paleocene period (80–59 Ma) in northern Bohemia including adjacent territories of Saxony and Lusatia (Ulrych et al. 2008), (ii) the Mid Eocene to Late Miocene (32.3–5.9 Ma) period disseminated in the Ohře Rift, the Cheb–Domažlice Graben, Vogtland, and Silesia and (iii) the Early to Late Pleistocene period (1.0–0.26 Ma) in western Bohemia (Ulrych et al. 2013). Melilitic magmas of the Eocene to Miocene and Pleistocene periods show a primitive mantle source [$(^{143}Nd/^{144}Nd)_t = 0.51280–0.51287$; $(^{87}Sr/^{86}Sr)_t = 0.7034–0.7038$)] while those of the Late Cretaceous to Paleocene period display a broad scatter of Sr–Nd ratios. The $(^{143}Nd/^{144}Nd)_t$ ratios (0.51272–0.51282) of the Late Cretaceous to Paleocene rocks suggest a partly heterogeneous mantle source, and their $(^{87}Sr/^{86}Sr)_t$ ratios (0.7033–0.7049) point to an additional late- to postmagmatic hydrothermal contribution. Major rock-forming minerals include forsterite, diopside, melilite, nepheline, sodalite group minerals, phlogopite, Cr- and Ti-bearing spinels. Crystallization pressures and temperatures of clinopyroxene vary widely between ~10 to 20 kbar and between 1,000 to 1,200 °C, respectively. Nepheline crystallized at about 500 to 770 °C. Geochemical and isotopic similarities of these rocks occurring from the Late Cretaceous to Pleistocene suggest their similar mantle sources and processes of magma development by partial melting of a heterogeneous carbonatized mantle source.

Macrocrysts of corundum, ilmenite, and spinel-group minerals from some alluvial deposits of the Ohře/Eger Rift (*cf.*

Seifert et al. 2012) were studied for their composition, texture, and mineral inclusions. All these minerals show magmatic corrosion textures indicating disequilibrium with the transported magma. Corundum grains, exclusively sapphires, are classified as of magmatic and metamorphic origins based on trace element signatures. The latter shows ambiguities, thus a metasomatic genesis is quite conceivable. The inclusion inventory of definite magmatic corundum suggests crystallization from a highly differentiated alkaline silicate melt. Supposed carbonatite-indicative inclusions in corundum are very rare. Corundum itself is never observed as an inclusion mineral. That means that it crystallized as the latest phase of the magma solidification. Magnesian-ferrian ilmenite, typical for the upper mantle-derived species, is the dominant heavy mineral in almost all alluvial deposits of the Ohře/Eger Rift. It is similar in appearance and composition to kimberlite- and basanite-related ilmenite described in the literature but tends to slightly lower MgO and higher Fe_2O_3 contents. The absence of kimberlites in the Ohře/Eger Rift lets conclude that the ilmenite macrocrysts were transported from the upper mantle to the surface by alkali basalt magma, very likely explosively indicated by demonstrable basaltic pipe breccias right next to some placer deposits. Major project outputs were published by Seifert et al. (2014) and Ulrych et al. (2014).

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Project No. 9346: **Characteristics of recent soils on loess in selected regions of the Czech Republic** (*A. Žigová* & *M. Šťastný*)

The development of soils on loess may differ depending on local geological basement. This study was focused on the analysis of soil development on loess in various regions of the Czech Republic.

The present research was conducted in agricultural landscapes and protected areas. Representative soil sequences were sampled in selected districts of Beroun, Prague, Pardubice and Olomouc. The study was performed in areas covered with Luvic Chernozem, Haplic Luvisol and Albic Luvisol. Examination and description of soil profiles in the field were performed to provide reliable information on the morphology of soil profiles. Quantification processes of soil development were performed on the basis of particle size distribution, chemical analyses, content of soil organic matter, and mineralogy of clay fraction of soils.

Ploughing influenced upper 22–30 cm of the soil profiles in agricultural landscape. The small thickness of the Ah horizon and the presence of E horizon are characteristic for Albic Luvisol in the protected areas. The occurrence of brown clay coatings is common in the Bt horizons of Haplic Luvisol and Albic Luvisol. Greyish brown coatings in the Bth horizons are characteristic for Luvic Chernozem. Haplic Luvisol and Albic Luvisol have a higher degree of texture differentiation by clay particles than Luvic Chernozem. The results of chemical analyses indicate that the soil development of Haplic Luvisol and Albic Luvisol proceeded in more acid conditions than the development of Luvic Chernozem. The content of organic matter decreases gradually down the profiles of Luvic Chernozems. Haplic Luvisol and Albic Luvisol are characterized by a rapidly decreasing content of organic matter in soil profiles. Mineral composition of soils on loess reflects geological setting in the individual regions. Quartz, illite and kaolinite are the most characteristic minerals of clay fraction of the studied soil sequences. Small amounts of chlorite are present in all profiles. Albic Luvisol with most pronounced process of pedogenic clay differentiation has elevated illite content in the Bt horizon.

Project No. 9347: **Earliest representatives of Ursus thibetanus (Ursidae, Carnivora, Mammalia) – their morphometric characteristic, phylogenetic position, and geographic distribution** (*J. Wagner*)

The project deals with the problem of early evolutionary history of *Ursus thibetanus*-clade. Dental material from 9 Chinese Early Pleistocene (Gelasian and Calabrian) localities (ca.

235 specimens) was studied in detail and compared with Middle Pleistocene (Chinese as well as European) and Recent *U. thibetanus*. The following results can be concluded. (1) The Chinese Gelasian ursids, previously determined as *Ursus* aff. *thibetanus* or *U. t. primitinus*, were recognized as the earliest known representatives of the exclusive *U. thibetanus*-clade. They still bear several plesiomorphic characters, missing in later forms, such as (a) weakly developed enamel crest between metaconid and hypoconid on m1 or (b) weakly developed styles (especially parastyle) on M1. (2) It is possible to observe gradual changes in selected dental characters from the Gelasian to the Calabrian and the Middle Pleistocene Asiatic black bear. The phenotypical dental arrangement present in recent *U. thibetanus* was probably reached around the beginning of Middle Pleistocene. (3) These early thibetanoid forms were restricted to the Oriental zoogeographic region in China during the Gelasian. (4) Specimens from the Late Gelasian locality of Villány 3 (Hungary), previously determined as *Ursus* aff. *thibetanus*, were compared to the contemporary Chinese thibetanoid bears. Despite the general similarity between these forms, the present differences (especially in morphology of m1) exclude the conspecificity of these taxa.

Project No. 9348: **Revision of the genus Boweria** (*J. Frojdová*)

Ferns belong to the most common Carboniferous plants. The genus *Boweria* belongs among leptosporangiate ferns. Leptosporangiate ferns have a specialized mechanism, the annulus for opening the sporangium, in which the spores are made. Their sporangia arise from a single epidermal cell. Leptosporangiate ferns are characterized by reproductive organs which are represented by a sporangium organized into a synangium, a sorus or a solitary. Leptosporangiate ferns with sphenopterid type of leaves were studied including their sporangia and *in situ* spores (*Granulatisporites, Anapiculatisporites* and *Leiotriletes*-type) and morphological details. Principal genus of the research is *Boweria* which comprises *Boweria schatzlarensis* with a shield-lateral annulus, *Boweria neurodensis* sp. nov. with a lateral annulus, and a new genus *Kidstoniopteris minor* comb. nov. with a semi-equatorial type of annulus. The specimens were studied on the basis of Kidston's type collection housed in the British Geological Survey in Keyworth and Stur's type collection housed in the Geologische Bundesanstalt in Vienna, and a part is kept in the Museum für Naturkunde in Berlin.

Project No. 9350: **Optimization of analytical conditions for U-Pb dating of zircon using LA-ICP-MS** (*J. Ďurišová* & *M. Svojtka*)

The aim of the project was to establish a quality methodology for U-Pb dating of zircons by the use of the *Element2* ICP-MS (Thermo Scientific) coupled to a 213 nm Nd:YAG laser ablation (UP-213, New Wave Research). A specifically designed low-volume ablation cell was introduced into the laser ablation system to improve the speed of analysis by improving the promptness of analytical response. Several types of signal smoothing devices ("squid") were tested to achieve a better precision of measurements, and a glass cyclone-type was found to provide the best results with the relative standard deviation lower than 1 %. Laser ablation parameters were tested with respect to signal intensity, analytical precision and size of available zircon grains. The optimal laser setting is spot ablation with a laser beam size of 30 μm, a repetition rate 5 Hz and a laser fluence of 4–5 $J.cm^{-2}$. Several international zircon standards (OD3, Plešovice, GJ-1, Mud Tank, 91,500, GQNG) were tested to select a suitable calibration standard for different samples. The age and uranium concentration in a standard were found most important with respect to calibration accuracy. *Iolite* software for laser ablation data evaluation was purchased and implemented to calculate U-Pb ages from measured data. This newly developed methodology was first used for U-Pb dating of the Padrť granodiorite from the Teplá–Barrandian Unit (Žák et al. 2014).

ŽÁK K., SVOJTKA M., BREITER K., ACKERMAN L., ZACHARIÁŠ J., PAŠAVA J., VESELOVSKÝ F., LITOCHLEB J., ĎURIŠOVÁ J. & HALUZOVÁ E. (2014): Padrť Stock (Teplá–Barrandian Unit, Bohemian Massif): petrology, geochemistry, U–Pb zircon dating of granodiorite, and Re–Os age and origin of related molybdenite mineralization. – *Journal of Geosciences,* 59, 4: 351–366.

Project No. 9351: **Temperature dependence of magnetic susceptibility: implications for volcanism in the Prague Basin** (*T. Elbra*, *P. Pruner*, *K. Čížková* & *P. Schnabl*)

The temperature dependence of magnetic susceptibility (χ-T) of Lištice samples clearly showed the presence of magnetite. In addition, data suggested some goethite and traces of hematite to occur within the samples. The vesicles with highly magnetic amygdales were detected in magnetic scanning, and magnetite residing there was found to carry the characteristic remanence component (ChRM) which corresponds to the Permo-Carboniferous remagnetization of volcanic phases. The results of Lištice were compiled to the publication by Elbra et al. (2015).

Traces of goethite and hematite were also detected in the samples from Černidla and Kosov. Moreover, data indicated 2 transitions above 500 °C, suggesting the presence of magnetite with varying amounts of Ti. In most cases the samples from all localities displayed no significant frequency (minor amount of SP particles) or field dependence. These data together with other results will be presented at the 26th IUGG 2015 General Assembly: Elbra, T., Pruner, P., Čížková, K., Schnabl, P., Tasáryová, Z. (2015): Paleozoic volcanic phases in the Prague Basin – What do paleomagnetic and rock magnetic data reveal; and are compiled to publication: Paleomagnetism of volcanic rocks – its implications to paleosetting and development of the Prague Basin.

ELBRA T., SCHNABL P., TASÁRYOVÁ Z., ČÍŽKOVÁ K. & PRUNER P. (2015): New results for Palaeozoic volcanic phases in the Prague Basin – magnetic and geochemical studies of Lištice, Czech Republic. – *Estonian Journal of Earth Sciences*, 64, 1: 31–35.

Project No. 9352: **Malacocoenological and malacostratigraphical evidence in Quaternary sediments in the Czech Republic (West Carpathians and karst regions)** (*J. Hlaváč*)

The project was focused on the determination and revision of molluscan thanatocoenoses in selected new calcareous profiles in the Czech Republic.

In the western part of flysch West Carpathians, in the Vsetínská hornatina Upland near Malenov village, a Holocene calcareous tufa cascade was studied from the viewpoint of lithology and malacozoology in order to explain the conditions of palaeoenvironmental development. Rich molluscan thanatocoenoses were determined in a relatively thin tufa cascade. It consists of some important species of malacogeographical point of view. The most important discovery is the find of the prosobranch *Acicula parcelineata*, the first fossil record in the Czech Republic that shows westernmost occurrence through its whole distributional area. The fossil malacocoenosis with the occurrence of *A. parcelineata* and other index species enables the tufa horizon to be stratified to the Holocene climatic optimum, indicating fully developed woodland habitats surrounding the tufa deposit. The site is located in a region with no previous finds of fossil molluscan assemblages consisting of European, Carpathian and partly Alpine molluscan species.

Important data on molluscan assemblages were achieved in a tufa cascade close to the Javoříčko village. This tufa formation has been evidenced for the first time in the area of Javoříčko Karst, enabling a comparison to the modern malacofauna of the surrounding sites and determination of changes in environmental conditions. Typically developed *Discus ruderatus* malacofauna in the lower parts of the tufa section consists Boreo-montane and Boreo-Alpine species such as *Vertigo alpestris*, *Perpolita petronella* and *Vertigo substriata*, being fully replaced by thanatocoenoses of the climatic optimum with the occurrence of Carpathian, Alpine-Carpathian and partly Alpine mollusc species (*Monachoides vicinus*, *Discus perspectivus*, *Petasina unidentata*). The youngest part of the tufa is characterized by the disappearance of several woodland species such as *Ruthenica filograna*, *Vertigo pusilla* and *Sphyradium doliolum*, indicating a slight deforestation.

Rich fossil molluscan fauna was determined in a section of foot-step sediments in the Šipka NNM in the Štramberk Karst, consisting of some index species and showing this site as a potential refuge during the Late Glacial for climatically and habitat-demanding mollusc species.

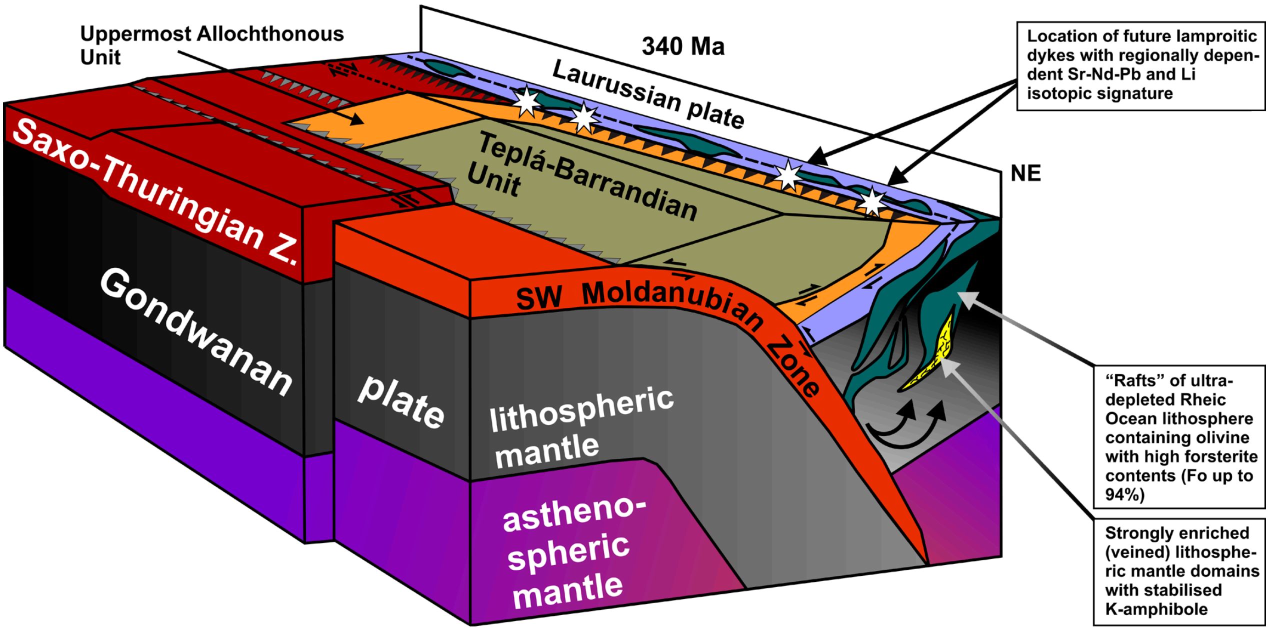
The final determination of the shell remains in sediments of the Mechová Cave (Týnčany Karst) provided a rich set of data on the presence of molluscs during the Late Glacial and Holocene in this area. Most mollusc species became locally extinct, for example *Petasina unidentata*, *Macrogastra plicatula*, *Vitrea diaphana* and *Cochlodina orthostoma*, while only a fragment of the woodland species level richness remained to the present day. Molluscan thanatocoenoses were accompanied by rich small vertebrate fauna (Amphibia, Reptilia and Mammalia).

Project No. 9353: **Application of cathodoluminescence imaging in the characterization of crystals in glass material** (*Š. Jonášová*)

Cathodoluminescence (CL) spectroscopy and imaging represent techniques allowing characterization of zoning structures, micro-fractures, deformations etc. The aim of this project was to apply the CL imaging to the study of zoning structures in crystals occurring in archaeological as well as modern glass materials. Application of the technique to crystalline phases in glass matrix demonstrated that the CL detector installed at the Institute is not well suited for the study of particles smaller than 5 µm.

Project No. 9354: **Trace element compositional variation of olivine as an important petrogenetic indicator** (*L. Krmíček*)

Principal conclusions of the combined study of olivine, whole-rock and isotopic compositional variations of orogenic lamproites (including the first Li isotope data determined in peralkaline mantle-derived rocks) from the eastern termination of the European Variscides (Moldanubian and Saxo-Thuringian zones of Austria, Czech Republic and Poland) point to the presence of a highly heterogeneous lithospheric mantle beneath the Bohemian Massif. Orogenic lamproites sampled this lithospheric mantle, which has a chemical signature reflecting an extreme depletion (low CaO and Al_2O_3 contents and high Mg-number)



■ **Fig. 16.** An orogenic wedge model of the Bohemian Massif. Original.

followed by a strong metasomatic enrichment, giving rise to a crust-like trace element pattern, variably radiogenic $^{87}Sr/^{86}Sr_{(i)}$ and unradiogenic Nd isotopic compositions, crustal Pb isotopic compositions, and a wide range of δ^7Li values. This metasomatic signature is variably prominent in the lamproites, depending on the extent of melting and the nature of the source of the metasomatic component. Preferential melting of the metasomatically enriched (veined) lithospheric mantle with K-rich amphibole resulted in lamproitic melts with very negative, crust-like δ^7Li values, which correlate positively with peralkalinity, HFSE contents and lower εNd. Both the higher degree of melting and progressive consumption of the metasomatic component reduce the chemical and isotopic imprint of the metasomatic end member. The very positive δ^7Li values of some lamproites indicate that the subducted oceanic lithosphere may have modified the source of these lamproites. Compositional variation of olivine shows very high Fo (up to 94 %) and very high Li contents (up to 25 ppm), demonstrating that the extremely depleted and later enriched lithospheric mantle may contribute significantly to the Li budget of lamproites. The regional distribution of lamproites with contrasting chemical and isotopic fingerprints mimics the distribution of the different Variscan subduction zones (Fig. 16).

Project No. 9355: **Magnetic characteristics of a space body** (*L. Nábělek*)

The main result of the project is the publication by Nabelek et al. (submitted). Data were presented at the AGU Fall meeting San Francisco 2014.

The paper below describes the detection of magnetic anomalies and shows how we can detect coercivity of remanence of individual mineral sources responsible for these anomalies (a new technique for *in situ* determination of remanent coercivity of separate magnetic grains). This contribution is innovative and significant for a number of reasons. We applied magnetic scanning technique for the first time on the Chelyabinsk meteorite and obtained robust magnetic signatures caused by taenite and kamacite. 79 magnetic scans were used for the estimation of coercivity of remanence for the magnetic minerals causing major magnetic anomalies in this fragment of meteorite. We showed that a magnetic reversal is associated with dipole rotation that allows a precise estimate of the coercivity of remanence. All the magnetic anomalies are associated with thin veins composed of darker lithology. The magnetic sources revealed *in situ* magnetic characteristics. They contain magnetic coercivity near 1 mT, and coercivity of remanence between 4 and 7 mT. This paper addresses a new approach for the recovery of *in situ* information on magnetic minerals within the meteorite, and its results are of potential interest for future space missions.

NABELEK L., MAZANEC M., KDYR S. & KLETETSCHKA G. (submitted): Magnetic, in situ, mineral characterization of Chelyabinsk meteorite thin section. – *Meteoritics & Planetary Science*.

Project No. 9356: **Magma flow and deformation through a radial dyke complex in the Roztoky Intrusive Centre, České Středohoří Mts.** (*F. Tomek*)

A sub-volcanic, bubble-bearing felsic dyke of the radial dyke swarm in the Roztoky Intrusive Centre was sampled for detailed structural, textural and geochemical analyses. The new, integrated image textural analysis in the ImageJ program with structural analysis in Matlab-based PolyLX toolbox was applied to study the spatial and textural relations of bubbles in the dyke. Based on the anisotropy of magnetic susceptibility study and image analysis in a margin-to-centre cross-section, we revealed a complex magma flow pattern and structural zonation across the dyke.

Project No. 9357: **Distribution and fractionation of platinum group minerals and gold in sulphides of the Uitkomst Complex, South Africa** (*J. Trubač*)

Ultramafic layered intrusions represent one of the most important sources of PGE worldwide. The Uitkomst Complex is a Ni-Cu-PGE-Cr-Co-mineralised layered ultrabasic to basic intrusion, situated approximately 250 km east of Pretoria and 20 km north of Badplaas in the Mpumalanga Province, South Africa. The present study examines the PGE contents of base metal sulphides and associated platinum-group minerals from the main mineralised zones and the massive sulphide body which has not been reported yet.

Project No. 9358: **Tethyan planktonic ecosystems from the Jurassic/Cretaceous boundary interval (calcareous nannoplankton, calpionellids)** (*A. Svobodová*)

The Jurassic–Cretaceous (J/K) boundary interval is currently one of the most studied periods because no appropriate stratotype for the base of the Cretaceous has been defined yet, even despite the extensive research performed in the past.

Globally, specific plankton assemblages with rock-forming potential developed during this period. A remarkable radiation of the most important groups (nannoconids, calpionellids) significantly increases their biostratigraphical value.

The study of the J/K boundary deals with multiple geoscientific disciplines (e.g., magnetostratigraphy, sequence stratigraphy, biostratigraphy based on macrofossils such as ammonites etc.) but the biostratigraphical analysis based on calcareous nannofossils and calpionellids within the above interval is an essential part of this multidisciplinary form of research.

Project No. 9363: **The development of an external detector method of fission track dating analysis by using titanite** (*J. Filip*)

The development of a new external detector method of fission track dating analysis for titanite was continued second year in cooperation with Nuclear Physics Institute of the CAS (Řež). Processing and measuring of samples were performed by two independent observers with a good agreement. The obtained results revealed the necessity of processing and measuring of rocks with different and sufficient titanite amounts.

Project No. 9364: **Study of selected ichthyolith groups from the Líně Formation (Stephanian C) of the Central and Western Bohemian Basins** (*J. Zajíc*)

A wide range of ichthyoliths (isolated scales, teeth, and bones of various aquatic vertebrates) was separated from marlstones of the Líně Formation (Uppermost Carboniferous). Most of them originate from the Klobuky localities but some specimens were separated also from a few boreholes. Remains of both xenacanthid and hybodontid sharks, acanthodians, actinopterygians, dipnoans, crossopterygians and amphibians were recognized. The first step of the study is the dissolution of the fossil-bearing sediment and subsequent separation of ichthyoliths. The second step is a precise documentation with the aid of SEM (Tescan). Description and palaeoecological and palaeogeographical evaluations of the fossil remains will be the final aim of the study.

4h. Defended theses

Breiter K. (2014): A-type granitoids in the Bohemian Massif. DSc. Thesis.

The chemical character of igneous rocks results from many factors, of which the most important are: the composition of the protolith, the tectonic setting in which melting took place, and the degree of fractionation of the magma. This applies to all types of magmas, although in the case of acidic rocks (granitoids) the relationship between environmental parameters and the resulting magma is less obvious than in the basic rocks.

Nevertheless, a few principal types of granite occupy a specific position during the temporal-spatial evolution of an orogeny. When classifying, in a first approach, the granites into the I, S and A groups (in terms of Chappell & White 1974, Loiselle & Wones 1979), the I-type granites are believed to have been extracted from igneous protoliths, whereas S-type granites originated from sedimentary protoliths, both in temporal-spatial relationship to collisional tectonics and metamorphism. The A-type rocks (Bonin 2007) can be derived from water-undersaturated felsic continental crust or originated directly through fractionation of basaltic magma, typically in tensional tectonic settings.

The granites of Krušné Hory/Erzgebirge have been, for their obvious association with tin mineralization, investigated in detail petrographically and chemically since the mid-19th century and belong to one of the classical regions of ore-bearing granites (rare-metal granites) in the world (Hochstetter 1856, Laube 1876). Geochemical studies after 1970 brought forth new ideas on the nature of granitic plutons of Krušné Hory/ Erzgebirge Mts. Breccias cemented by granites were found at many localities (Seltmann et al. 1987; Jarchovský & Pavlů 1991) and their magmatic origin was proven. Geochemically, two types of tin-bearing granites were distinguished, namely high-phosphorus, strongly peraluminous, typical S-type granites, and low-phosphorus, HFSE-enriched, weakly peraluminous, A-type granites (Breiter et al. 1991, Breiter 2012).

The A-type granitoids are relatively rare within the Variscan Europe. Except the ore-bearing A-type granites in the Krušné Hory/Erzgebirge, only a few minor occurrences are incorporated into the Alpine orogen in Western Carpathians (Uher & Broska 1996) and Corsica (Bonin 2007) were found and described during last 20 years. A-type granites of the Krušné Hory/Erzgebirge are unique because of its close relationship to roughly the same old S-type granites, with who bear in essentially the same Sn-W mineralization.

The present dissertation is a summary of the author's research of A-type rocks in the Krušné Hory since 1990, especially in the last 10 years. A-type granites and rhyolites in the Erzgebirge have never been investigated systematically. Existing and herein presented textural, geochemical and mineralogical data were obtained during various projects aimed primarily to applied geology (prospection for mineral deposits, hydrogeology). Therefore, the existing knowledge about various aspects of A-granitoids is unbalanced. However, in summary, a fairly detailed picture of the geology, geochemistry and mineralogy of this interesting group of rocks is provided.

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

5a. Papers published in 2014

*publications in journals included in the ISI Web of Science (IF value according to a list from 2014)

11.740* BRUTHANS J., SOUKUP J., VACULIKOVA J., *FILIPPI M.*, SCHWEIGSTILLOVA J., MAYO A. L., MASIN D., KLETETSCHKA G. & RIHOSEK J. (2014): Sandstone landforms shaped by negative feedback between stress and erosion. – *NATURE Geoscience*, 7, 8: 597–601.
8.235* KONOPÁSEK J., KOŠLER J., *SLÁMA J.* & JANOUŠEK V. (2014): Timing and sources of pre-collisional

Neoproterozoic sedimentation along the SW margin of the Congo Craton (Kaoko Belt, NW Namibia). – *Gondwana Research*, 26, 1: 386–401.

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4.734* LAURIN J., ČECH S., ULIČNÝ D., ŠTAFFEN Z. & *SVOBODOVÁ M*. (2014): Astrochronology of the Late Turonian: implications for behavior of the carbon cycle at the demise of peak greenhouse. – *Earth and Planetary Science Letters*, 394: 254–269.

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4.482* *BREITER K.*, LAMARAO C. N., BORGES R. M. K. & DALL'AGNOL R. (2014): Chemical characteristic of zircon from A-type granites and comparison to zircon of S-type granites. – *Lithos*, 192–195: 208–225.

4.256* FLYNN L. J., WINKLER A. J., ERBAEVA M., ALEXEEVA N., ANDERS U., ANGELONE C., *ČERMÁK S.*, FLADERER F. A., KRAATZ B., RUEDAS L. A., RUF I., TOMIDA Y., VEITSCHEGGER V. & ZHANG Z. (2014): The Leporid Datum: A Late Miocene Biotic Marker. – *Mammal Review,* 44, 3–4: 164–176.

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3.234* DEJMAL M., *LISÁ L.*, NÝVLTOVÁ FIŠÁKOVÁ M., BAJER A., PETR L., KOČÁR P., KOČÁROVÁ R., NEJMAN L., RYBNÍČEK M., SŮVOVÁ Z., CULP R. & VAVRČÍK H. (2014): Medieval horse stable; The Results of Multi Proxy Interdisciplinary Research. – *Plos One,* 9, 3: e89273.

3.208* CHRASTNÝ V., *ROHOVEC J.*, ČADKOVÁ E., PAŠAVA J., FARKAŠ J. & NOVÁK M. (2014): A New Method for Low-Temperature Decomposition of Chromites and Dichromium Trioxide using Bromic Acid Evaluated by Chromium Isotope Measurements. – *Geostandards and Geoanalytical Research*, 38, 1: 103–110.

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3.038* *KOHOUT T.*, ČUDA J., FILIP J., BRITT D., BRADLEY T., TUČEK J., *SKÁLA R.*, *KLETETSCHKA G.*, KAŠLÍK J., MALINA O., ŠIŠKOVÁ K. & ZBOŘIL R. (2014): Space weathering simulations through controlled growth of iron nanoparticles on olivine. – *Icarus,* 237: 75–83.

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2.639* KOŠLER J., KONOPÁSEK J., *SLÁMA J.* & VRÁNA S. (2014): U-Pb zircon provenance of Moldanubian metasediments in the Bohemian Massif. – *Journal of the Geological Society London*, 171, 1: 83–95.

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2.519* *TOMEK F.,* ŽÁK J. & *CHADIMA M.* (2014): Magma flow paths and strain patterns in magma chambers growing by floor subsidence: a model based on magnetic fabric study of shallow-level plutons in the Štiavnica volcano-plutonic complex, Western Carpathians. – *Bulletin of Volcanology*, 76: 873.

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2.268* *BOROVIČKA J.*, MIHALJEVIČ M., GRYNDLER M., KUBROVÁ J., *ŽIGOVÁ A.*, HRŠELOVÁ H. & ŘANDA Z. (2014): Lead isotopic signatures of saprotrophic macrofungi of various origins: Tracing for lead sources and possible applications in geomycology. – *Applied Geochemistry*, 43: 114–120.

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2.093* *SKÁLA R.*, *ULRYCH J.*, *ACKERMAN L.*, JELÍNEK E., DOSTÁL J., HEGNER E. & ŘANDA Z. (2014): Tertiary alkaline Roztoky Intrusive Complex, Ceske stredohori Mts., Czech Republic: petrogenetic characteristics. – *International Journal of Earth Sciences*, 103, 5: 1233–1262.

2.062* KRAJCARZ M.T., *BOSÁK P.*, *ŠLECHTA S.*, *PRUNER P.*, KOMAR M., DRESLER J. & MADEYSKA T. (2014): Sediments of the Biśnik Cave (Poland): lithology and stratigraphy of the Middle Palaeolithic site. – *Quaternary International*, 326–327: 9–15.

2.062* REKOVETS L., *ČERMÁK S.*, KOVALCHUK O., PRISYAZHNIUK V. & NOWAKOWSKI D. (2014): Vertebrates from the Middle Pleistocene locality Lysa Gora 1 in Ukraine. – *Quaternary International,* 326–327: 481–491.

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2.026* *BREITER K.*, *ACKERMAN L.*, *ĎURIŠOVÁ J.*, *SVOJTKA M.* & NOVÁK M. (2014): Trace element composition of quartz from different types of pegmatites: A case study from the Moldanubian Zone of the Bohemian Massif (Czech Republic). – *Mineralogical Magazine*, 78, 3: 703–722.

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CÍLEK V.: O světě a jeho konci. *Radio Wave, 2. 6. 2014.* Praha.

CÍLEK V.: Řeka Dyje a její povodí. *Český rozhlas Leonardo. Vinohradská, 30. 1. 2014.* Praha.

FILIPPI M. & MAŠÍN D.: Tajemství pískovců odhaleno. *Česká televize, ČT2, Studio 6, 21. 7. 2014*. Praha.

FILIPPI M. & ŘIHOŠEK J.: Geopark český ráj – vznik pískovcových tvarů. *Česká televize, ČT2, Nedej se, 1. 2. 2014*. Praha.

FILIPPI M.: Pravčická brána vznikla díky tomu, že se sama zbavovala zbytečné váhy. *Český Rozhlas, Radiožurnál, 21. 7. 2014*. Praha.

KLETETSCHKA G. & KRMELOVÁ P. (ed.): První planeta o velikosti Země. *ČT 24, Studio 6, 19. 4. 2014,* Praha.

KLETETSCHKA G. & ŠEVČÍKOVÁ M. (ed.): Ranní plus. *Český Rozhlas plus, 22. 7. 2014*. Praha.

KLETETSCHKA G. & VÁCLAVEK J. (ed.): NASA vyzkouší přistávací talíř pro lety na Mars. *Česká televize, ČT 24/ SVĚT VIDEO, 3. 6. 2014*. Praha.

KRMÍČEK L.: Vědci z Brna budou na polární stanici v Antarktidě zkoumat, jak rychle stárnou plasty – *Český Rozhlas, 10. 12. 2014*. Brno.

VESELKOVÁ I., SCHMELZOVÁ R., ŠUBRTOVÁ D. & *MIKULÁŠ R.*: Vyšel průvodce současným uměním v české krajině. *Český Rozhlas, 27. 5 2014*. Praha.

Other media and blogs

FILIPPI M. (2014): Vědomostní kvíz: Konkurz do týmu speleologické expedice. – *Kamenožrout – Geologický korespondenční seminář pro středoškoláky, PřF UK Praha, 5. kolo*. Praha.

BRUTHANS J., MAŠÍN D. & *FILIPPI M.* (2014): Úspěch českých geologů měl obrovský mezinárodní ohlas. – *iForum, časopis Univerziry Karlovy. July 29, 2014. PřF UK Praha. http://iforum.cuni.cz/IFORUM-15301.html*

FILIPPI M. & BRUTHANS J. (2014): NAMAK – Czech-Iranian Geological Project (Research of the salt karst in Iran). – *web presentation. http://home.gli.cas.cz/namak/*

CHADIMOVÁ L. (2014): Vědomostní kvíz: Když jde geolog na pláž. – *Kamenožrout – Geologický korespondenční seminář pro středoškoláky*, *PřF UK Praha, 5. kolo*. Praha.

MAŠÍN D., *FILIPPI M.* & BRUTHANS J. (2014): Media response for: Bruthans J., Soukup J., Vaculikova J., Filippi M., Schweigstillova J., Mayo A., Masin D., Kletetschka G. & Rihosek J. (2014). Sandstone landforms shaped by negative feedback between stress and erosion. *Nature Geoscience*, 7, 8, 597–601. – *web presentation. http://web.natur.cuni.cz/uhigug/masin/bib/mediaNG.htm*

MIKULÁŠ R. & HUDEČEK, M. (2014): Neúspěch a věda. – *HR Kavárna, online, November 3, 2014. http://www.hrkavarna.cz/tema-mesice/neuspech-jako-fitness-sily-a-vydrze/radek-mikulas-neuspech-a-veda/#.VFnfAU0tCRs*

MIKULÁŠ R. & SKÁLOVÁ A. (2014): Praha má své Makču Pikču a další „umělé“ kopce i kopečky. Jak změnily reliéf města velké stavby? – *Pražský Patriot, Kategorie: Pražský život; September 23, 2014. http://www.prazskypatriot.cz/praha-ma-sve-makcu-pikcu-a-dalsi-umele-kopce-i-kopecky-jak-zmenily-relief-mesta-velke-stavby/*

Lectures for popular audience

ADAMOVIČ J.: Historické vozové cesty v pískovcích mezi Mšenem a Kokořínským dolem. *Lecture and field excursion. Přednáškový cyklus pořádaný Městem Mšeno a Okrašlovacím spolkem pro Mšeno a okolí, o.s., April 6, 2014*. Mšeno.

ADAMOVIČ J.: Vozové cesty v kokořínských pískovcích. *Lecture. Přednáškový cyklus organizovaný Emeran 1791, s.r.o., February 1, 2014*. Kokořín.

BOROVIČKA J.: Houby na hadcích. *Lecture. Přednáškový cyklus České mykologické společnosti, Praha 1, November 11, 2014*. Praha.

BOROVIČKA J.: Lysohlávky a jiné halucinogenní houby. *Lecture. Přednáškový cyklus ČSOP Podorlicko, Česká Třebová, October 13, 2014*. Česká Třebová.

BOROVIČKA J.: Těžké kovy a radioaktivní prvky v houbách. *Lecture. Otevřená věda. Gymnázium J. S. Machara, Brandýs nad Labem, April 28, 2014*. Brandýs nad Labem.

BOROVIČKA J.: Těžké kovy a radioaktivní prvky v houbách. *Lecture. Týden vědy a techniky, AV ČR, Praha 1, November 3, 2014*. Praha.

FRIDRICHOVÁ M.: Čtenářská gramotnost v chemii. *Lecture. Cyklus workshopů o vědě pro studenty Arcibiskupského gymnázia v rámci projektu OPPA, Praha 2, April 9, 2014*. Praha.

CHADIMOVÁ L.: Prach kolem nás: stopování prachových částic v geologickém záznamu a pohyb prachu v dnešní atmosféře. *Lecture. Přednáškový cyklus "Spořilovské expedice: nové a významné poznatky ve vědách o Zemi", Geofyzikální ústav AVČR, October 30, 2014*. Praha.

KLETETSCHKA G. & PAVLÍČEK T.: Na UP s Gűntherem Kletetschkou. *Lecture. Projekt studentské televize, Palacky University, Olomouc, 5. června, 2014*. Olomouc.

MIKULÁŠ R.: Geologie Prahy. – Seminář Pražské krajiny a jejich ochrana. *Lecture. Oddělení přírody a krajiny Odboru životního prostředí Magistrátu Hlavního města Prahy, September 23, 2014*. Praha

PIPEK J., JEŽEK P., SEDLÁČEK O. & *MIKULÁŠ R.*: Současné hodnoty a budoucí využití Středních Brd. *Lecture. Akademická kavárna, Rada pro popularizaci vědy AV, June 18, 2014*. Praha

SCHMELZOVÁ R., ŠUBRTOVÁ D. & *MIKULÁŠ R.*: Prezentace publikace Současná umělecká díla v krajině. *Lecture. Landscape Festival Praha, Galerie Jaroslava Fragnera, September 3, 2014*. Praha.

SCHMELZOVÁ R., ŠUBRTOVÁ D. & *MIKULÁŠ R.*: Současná umělecká díla v krajině. *Lecture. Galerie města Loun, November 11, 2014*. Louny

SCHMELZOVÁ R., ŠUBRTOVÁ D. & *MIKULÁŠ R.*: Současná umělecká díla v krajině. *Lecture. Galerie Rudolfinum, December 3, 2014*. Praha

ŽÁK K. & MAJER M.: Český kras, klíč k české krajině. *Lecture and book presentation. Městská knihovna Beroun, September 3, 2014*. Beroun.

Exhibitions

MIKULÁŠ R. in the collective of staff of the Veltrusy State Castle: Ze života včely (On the Life of a Bee). Zámek Veltrusy (Veltrusy Castle), 21st June to 3rd August, 2014.

5h. Unpublished reports 2014

BOROVIČKA J. (2014): *Mykologický průzkum NPP Hadce u Želivky, závěrečná zpráva.* – Institute of Geology of the CAS, v. v. i. for ČSOP Vlašim: 1–17. Praha.

BOSÁK P. & *PRUNER P.* (2014): *Magnetostratigrafie badenských téglů z vrtu V 1 Brno – Slatina. Závěrečná zpráva.* – Institute of Geology of the CAS, v. v. i. for PřF UK: 1–32. Praha.

BOSÁK P. (2014): *Postup těžebních stěn Velkolomu Čertovy schody–západ. Akce sanace a rekultivace severní stěny. Posudek. Období: leden až prosinec 2013.* – Institute of Geology of the CAS, v. v. i. for Velkolom Čertovy schody, a. s.: 1–23 + 1–159. Praha.

BOSÁK P., *PRUNER P.* & BELLA P. (2014): *Paleomagnetický výzkum profilu v Oválnej chodbe, Ochtinská aragonitová jaskyňa. Záverečná zpráva.* – Institute of Geology of the CAS, v. v. i. for Katolickou univerzitu v Ružomberoku: 1–53. Praha.

BOSÁK P., *PRUNER P.* & BELLA P. (Red., 2014): *Výzkum vybraných travertinů na Slovensku – Liptov. Závěrečná zpráva.* – Institute of Geology of the CAS, v. v. i. for Katolickou univerzitu v Ružomberoku: 1–145. Praha.

BOSÁK P., *PRUNER P.* & MOCK A. (2014): *Paleomagnetic research of cave fill in Hermannshöhle, Austria. Final Report.* – Institute of Geology of the CAS, v. v. i. for Hermanshöhle: 1–35. Praha.

BOSÁK P., *SKÁLA R.*, ZUPAN HAJNA N., *ŠŤASTNÝ M.* & *KALLISTOVÁ A.* (2014): *Mineralogic analyses of samples from karst sediments in Slovenia, 5. Final Report.* – Institute of Geology of the CAS, v. v. i. and IZRK ZRC SAZU: 1–17. Praha–Postojna.

CÍLEK V., ADAMOVIČ J., COUBAL M. & BROKEŠOVÁ J. P. (2014): *Závěrečná odborná hodnotící zpráva. Posouzení části kapitoly 2 aktualizované Zadávací bezpečnostní zprávy nového jaderného zdroje Temelín 3,4 z roku 2014.* – Institute of Geology of the CAS, v. v. i. for Státní ústav pro jadernou bezpečnost: 1–78. Praha.

JONÁŠOVÁ Š. (2014): *The chemical survey of archaeological glass finds at Prague Castle and Hradčany.* – Institute of Geology of the CAS, v. v. i. for Institute of archeology CAS: 1–50. Praha.

LISÁ L. (2014): *Geoarcheologický posudek výplně středověké zemnice, Litomyšl* – Institute of Geology of the CAS, v. v. i. for Labrys o.p.s.: 1–21. Praha.

NAVRÁTIL T., DOBEŠOVÁ I., ROHOVEC J., MATOUŠKOVÁ Š & *HUBIČKOVÁ S.* (2014): *Monitoring chemismu srážkových vod na území NPČŠ – Závěrečná zpráva.* – Institute of Geology of the CAS, v. v. i.: 1–18. Praha.

ROHOVEC J., MATOUŠKOVÁ Š. & *HLADIL J.* (2014): *Research on Chemical and Morphological Features of Carbonates Originated in Vřídlo, Karlovy Vary.* – Institute of Geology of the CAS, v. v. i. for Muzeum Karlovy Vary: 1–7. Praha.

SKÁLA R. (2014): *Verification of Asbestos Content in Rocks of Quarry at Želešice. Part II. Final Report.* – Institute of Geology of the CAS, v. v. i. for RNDr. Bohuslav Svoboda, CSc.: 1–92. Praha.

ZAJÍC J. (2014): *Zoopaleontologie a ichnologie permokarbonu pro vysvětlivky ke geologické mapě list Nová Paka (03-432) Závěrečná zpráva.* – Institute of Geology of the CAS, v. v. i.: 1–11. Praha.

6. Organization of conferences and scientific meetings

International workshop: **Soil Micromorphology in General and Archaeological Context, January 29th – 31st, 2014, Brno**. Organized by Mendel University in Brno, Institute of Geology of the CAS, v. v. i. and Czech Geological Society, Praha, Czech Republic. Organizing Committee: *Lisá L.* & Bajer A.

This workshop was organized under the Platform for landscape formation Reg. No. CZ.1.07/2.4.00/31.0032 and supported by the European Social Fund and the state budget of the Czech Republic, Project and therefore designated mainly for Czech students. Finally 22 persons from 2 countries joined for three days of microscopy and received an introduction to soil micromorphology as well as micromorphology in archaeological context. The workshop was divided into blocks and each of them started by a specific key lecture and was followed by a microscopy session. The introduction to the basics of microscopy and general mineralogy was given by Dr. Buriánek from Brno and followed by the introduction to the methods of micromorphology which was given by Dr. Lisá and Dr. Bajer. At the end of the day, students received the basics of petroarchaeology by Dr. Gregor from Bratislava. The next day started by the introduction to soil micromorphology given by Rosa Maria Poch from Lleida, Spain followed by a lecture on micromorphology of paleosol given by Dr. Mroczek from Lublin, Poland. The last lecture concentrated on micromorphology of cave deposits and was given by Dr. Lisá. The last day of the workshop was focused to micromorphology of archaeological deposits and the lecture was given by Dr. Karen Milek, from Aberdeen, Scotland. Study texts for each of the given lectures were published for the purpose of this workshop; they are available under this reference: Bajer A., Buriánek D., Gregor M., Lisá L., Milek K. B., Mroczek P. & Poch R.M. (2014): Soil micromorphology in general and archaeological context. – Mendel University in Brno and Institute of Geology of the CAS, v. v. i.: 1–86. Brno

International Conference: **CPC-2014 Field Meeting on Carboniferous and Permian Nonmarine-Marine Correlation, Freiberg and excursions in Germany and the Czech Republic, July 21–27, 2014.** Organized by the Technische Universität Bergakademie Freiberg. Co-organizers and local excursion guides: Schneider J. W., Elicky O., Scholze F., Spindler F., Werneburg R., Rößler R., Brauner S., Opluštil S., Štamberg S., Lojka R., Martínek K., Kerp H., Šimůnek Z., *Zajíc J.* & Lucas S. G.

64 specialists from 15 countries took part in the conference. The volume with 47 contributions of the authors from17 countries presents abstracts concerning a wide range of themes (Carboniferous to Triassic age). The presented results deal with sedimentology, geochemistry, palaeogeography, palaeontology (in-

sects, sharks, plants, ostracods, conodonts, pelecypods, reptiles, actinopterygians), palaeoecology, ichnology, radiometric dating, planetology, stratigraphy and correlations, palaeoclimatology and magnetostratigraphy.

7. Undergraduate and Graduate Education

7a. Undergraduate and Graduate Courses at Universities given by Staff Members of the Institute of Geology of the CAS, v. v. i.

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

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

BREITER K.: *Magmatic and metamorphic processes* (G9801). Undergraduate and graduate (optional) Course, Faculty of Science, Masaryk University, Brno.

ČERNÝ J.: Recognition of fossils and structures (G3131). Undergraduate Course, Faculty of Science, Masaryk University, Brno.

ČERNÝ J.: Structural geology and geotectonics (G4101). Undergraduate Course, Faculty of Science, Masaryk University, Brno.

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

CHADIMA M.: *Physics of the Earth and Geodynamics* (G8311). Undergraduate Course, Faculty of Science, Masaryk University, Brno.

CHADIMOVÁ L.: *Carbonate sedimentology* (MG421P16). Graduate (optional) and Undergraduate Course, Faculty of Science, Charles University in Prague, Praha.

CÍLEK V.: *City environment*. 5-day excursion in Prague, Vienna, Budapest and Bratislava, USAC Praha.

CÍLEK V.: *Landscape and history*. Undergraduate Course, Collegium Hieronymi Pragense, Praha.

CÍLEK V.: *Landscape, society and architecture*. Undergraduate and Graduate Seminary, School of Architecture of Academy of Fine Arts in Prague (AVU), Praha.

DATEL J.V. & *MIKULÁŠ R.: Principles of Geology* (APA100054 and APA550047). Undergraduate (compulsory) Course, Faculty of Philosophy, 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, Pilsen.

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

KLETETSCHKA G.: *Physics of the Earth* (MG452P04G). Graduate and Postgraduate Course, Faculty of Science, Charles University, Praha.

KLETETSCHKA G.: *Satellite magnetometry* (MG452P82). Undergraduate, Graduate and Postgraduate Course, Faculty of Science, Charles University, Praha.

KLETETSCHKA G.: *Unusual ideas in geology and geophysics* (MG452P83). Undergraduate, Graduate and Postgraduate Course, Faculty of Science, Charles University, Praha.

KOHOUT T.: *Laboratory Exercises in Solid Earth Geophysics* (535020). Undergraduate and Graduate Course, Faculty of Science, University of Helsinki, Helsinki.

KRMÍČEK L.: *Geology* (BF01). Undergraduate Course, Faculty of Civil Engineering, Brno University of Technology, Brno.

KRMÍČEK L.: *Principles of regional geology of the Czech Republic for civil engineers* (BF92). Undergraduate (optional) Course, Faculty of Civil Engineering, Brno University of Technology, Brno.

LISÁ L.: *Geoarchaeology* (AEB_133). Graduate (optional) Course, Faculty of Philosophy, Masaryk University, Brno.

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

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

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

NAVRÁTIL T. & *HOJDOVÁ M.*: *Heavy metals in the environment* (MG431P92). Undergraduate (optional) Course, Faculty of Science, Charles University, 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.: *Comparative anatomy of vertebrates* (MB170P47). Undergraduate (optional) Course and Practical Study, Faculty of Science, Charles University, Praha.

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

SKÁLA R.: *Impact and Shock Metamorphism* (GA581). Undergraduate and Graduate (optional) course, Faculty of Science, Masaryk University, Brno.

SKÁLA R.: *Chemical crystallography* (MG431P64). Undergraduate and 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). Undergraduate and Graduate (optional) course, Faculty of Science, Charles University, Praha.

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

ŠTORCH P.: *Principles and methods of stratigraphy* (MG421P25). Untergraduate (optional) Course, Faculty of Science, Charles University, Prague.

TOMEK F.: *Laboratory course in physical geology I* (MG421C21A). Undergraduate (obligatory) Course, Faculty of Science, Charles University, Praha.

TRUBAČ J.: *Informational services in geosciences* (MG422P42). Undergraduate (optional) Course, Faculty of Science, Charles University, Praha.

TRUBAČ J.: *Laboratory course in physical geology II* (MG421C21B). Undergraduate (obligatory) Course, Faculty of Science, Charles University, Praha.

ULRYCH J.: Systematic mineralogy (D 108003). Graduate (optional) Course, Faculty of Chemical Technology, University of Chemical Technology, Praha.

7b. Supervision in Undergraduate Studies

Open Science

TAISLOVA I., Gymnázium Karla Čapka, Dobříš, Czech Republic (*supervisor P. Schnabl, since 2013*)

BC. Theses

BAŘINA T., Faculty of Civil Engineering, Brno University of Technology, Brno (*supervisor L. Krmíček, since 2014*)

BOSÁK F., Faculty of Civil Engineering, Brno University of Technology, Brno (*supervisor L. Krmíček, since 2014*)

FIKAR L., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2012, defended 2014*)

HAISLOVÁ R., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2011*)

HLADÍKOVÁ E., Czech University of Life Sciences, Praha (*supervisor P. Schnabl, since 2013*)

HUŠKOVÁ A., Faculty of Science, Charles University, Praha (*supervisor L. Slavík, since 2013*)

KOTEK J., Faculty of Science, Charles University, Praha (*co-supervisor/advisor P. Štorch, since 2014*)

MAZANEC M., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2011*)

MIČKAL P., Faculty of Civil Engineering, Brno University of Technology, Brno (*supervisor L. Krmíček, since 2014*)

NÁBĚLEK L., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2011*)

OLŠANSKÁ I., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2014*)

TAKÁČ M., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2011*)

VRBICKÝ T., Faculty of Science, Charles University, Praha (*supervisor R. Mikuláš, defended 2014*)

ZAŤKO P., Faculty of Civil Engineering, Brno University of Technology, Brno (*supervisor L. Krmíček, since 2014*)

MSc. Theses

BOJDOVÁ L., Faculty of Science, Charles University, Praha (co-*supervisor J. Bek, since 2014*)

CHMELOVÁ K., Faculty of Science, Charles University, Praha (*supervisor T. Přikryl, since 2013*)

GREŇOVÁ I., Faculty of Environmental Sciences, Czech University of Life Sciences, Praha (*supervisor J. Borovička, since 2012*)

HALUZOVÁ E., Faculty of Science, Charles University, Praha (*supervisor L. Ackerman, since 2012, defended in 2014*)

JANKO J., Faculty of Science, Charles University, Praha (*supervisor T. Navrátil, co-supervisor/advisor J. Rohovec since 2013*)

MARKOVÁ A., Faculty of Science, Charles University, Praha (*supervisor I. Horáček, co-supervisor/advisor J. Wagner, since 2011*)

MAZANEC M., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2014*)

MÉSZÁROSOVÁ N., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2013*)

NÁBĚLEK L., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2014*)

NEDREBØ H., Department of Earth Science, University of Bergen, Norway (*co-supervisor/advisor J. Sláma, defended 2014*)

NEPOMUCKÁ Z., Faculty of Science, Charles University, Praha (*supervisor T.Navrátil, since 2013*)

OBERSTEINOVÁ T., Faculty of Science, Charles University, Praha (*advisor J. Kadlec, since 2011*)

ŠNELLEROVÁ Z., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2012*)

TAKÁČ M., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2014*)

ULRYCH M., Faculty of Mechanical Engineering, Czech Technical University, Praha (*co-supervisor/advisor T. Svitek, since 2014*)

VALA V., Faculty of Science, Charles University, Praha (*supervisor T. Přikryl, since 2013*)

7c. Supervision in Graduate Studies

Ph.D. Theses

DRÁBKOVÁ J., Faculty of Science, Charles University, Praha (c*o-supervisor/advisor J. Bek, since 2005*)

DZIKOVÁ L., Faculty of Science, Masaryk University, Brno (*supervisor R. Skála, since 2007, temporarily suspended in 2013*)

GREŇOVÁ I., Department of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles

HALUZOVÁ E., Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles University, Praha (*supervisor L. Ackerman, since 2014*)

HERICHOVÁ I., Faculty of Arts, Charles University, Praha (*supervisor V. Cílek, since 2010*)

HOŠEK J., Faculty of Science, Charles University, Praha (*supervisor L. Lisá, since 2010*)

HRUBÁ J., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2013*)

JONÁŠOVÁ Š., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2014*)

KALLISTOVÁ A., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2010*)

KOCHERGINA Y., Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles University, Praha (*co-supervisor L. Ackerman, since 2014*)
KOŘÍNKOVÁ D., Faculty of Science, Charles University, Praha (*supervisor J. Adamovič, since 2014*)
KUBROVÁ J., Faculty of Science, Charles University, Praha (*supervisor J. Borovička, since 2011*)
MARKLEY M., Faculty of Science, Charles University, Praha (*supervisor G. Kletetschka, since 2014*)
PETRUŽÁLEK M., Faculty of Science, Charles University, Praha (*co-supervisor T. Lokajíček, since 2006*)
SIDORINOVÁ T., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2009, temporarily suspended in 2013*)
SOUMAR J., Faculty of Science, Charles University, Praha (*supervisor R. Skála, since 2011*)
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*)
URBÁNKOVÁ A., Faculty of Science, Charles University, Praha (*co-supervisor L. Slavík, since 2013*)
VAŠKANINOVÁ V., Faculty of Science, Charles University, Praha (*co-supervisor J. Zajíc, since 2010*)
VEJROSTOVÁ L., Faculty of Science, Charles University, Praha (*supervisor L. Lisá, since 2013*)

7d. Membership in scientific and academic boards

ACKERMAN L.
Member, Committee for Finals of Doctoral Students in Geology, Faculty of Science, Charles University, Praha

BOROVIČKA J.
Member, Presidium, Scientific Secretary, Czech Mycological Society, Praha
Member, Committee for Finals of Doctoral Students in Botany, Faculty of Science, Charles University, Praha

BOSÁK P.
Member of the Executive Board of Institute of Geology of the CAS, v. v. i., Praha
Member, Academic Assembly of the Czech Academy of Sciences, Praha
Member, the International Advisory Board, Research Potential Programme of the EU FP7-REGPOT-2011-1 Action towards laboratories enhancement and know-how exchange for advanced research on geosystem – ATLAB (Institute of Geological Sciences PAS, Warszawa, Poland; October 2011–April 2015)
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
Chairman, Committee for degree of Doctor of Sciences (DSc.) in geological sciences at Czech Academy of Sciences, Praha
Member, Academic Assembly of the Czech Academy of Sciences, 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 Ph.D. 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, Ph.D. Study Program of Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Defenses of Dissertations, Ph.D. Study Program of Applied Geology, Faculty of Science, Charles University, Praha
Member, Committee for Defenses of Dissertations, Ph.D. Study Program of Physical Geography and Geoecology, Faculty of Science, Charles University, Praha
Member, Committee for State Doctoral Examinations, Ph.D. 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

FILIPPI M.
Vice-Chairman, Executive Board of the Institute of Geology of the CAS, v. v. i.

HLADIL J.
Member, Committee for Degree of Doctor of Sciences (DSc.) in Geological Sciences at Czech Academy of Sciences, Praha.
Member, Executive Board of the Institute of Geology CAS, v. v. i.
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, Czech Commission on Stratigraphy, Praha

KLETETSCHKA G.
Member of the Board of the Ministry of Education, Youth and Sports for Space Research

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

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

MIKULÁŠ R.
Vice-Chairman, Advisory Board of the Institute of Geology of the CAS, v. v. i.
Alternating Member of the Doctoral Examination Committee in Geology, Faculty of Science, Charles University, Praha

Member, Editorial Board of the Czech Academy of Sciences, Praha
Member, Advisory Board of the Czech Academy of Sciences for Science Communication, Praha
Member, Academy of Sciences – Chamber of Deputies, Parliament of the Czech Republic Co-operation Committee, Praha
Chair, IGCP-UNESCO National Committee, Praha

NAVRÁTIL T.
Member of the Committee for Finals of Doctoral Students in Applied Geology, Faculty of Science, Charles University, Praha
Member of the 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 Scienc, Charles University, Praha
Member, Earth Science Panel (geophysics, geochemistry, geology mineralogy and hydrogeology) of Czech Science Foundation, Praha

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

ROČEK Z.
Member, Committee for degree of Doctor of Sciences (DSc.) in zoological sciences at Czech Academy of Sciences, 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

SLAVÍK, L.
Alternating Member of the Doctoral Examination Committee in Geology, Faculty of Science, Charles University, Praha
Member, Executive Board of the Institute of Geology CAS, v. v. i.
Member of the Undergraduate (MSc.) and Doctoral Committee in Geology-specialization Geobiology, Faculty of Science, Charles University, Praha

ŠTORCH P.
Chairman, Executive Board of the Institute of Geology CAS, v. v. i.
Alternating Member, Committee for Degree of Doctor of Sciences in Geological Sciences, Czech Academy of Sciences, Praha
Vice-chair / Secretary, Czech Commission on Stratigraphy, Praha
Member of the Exoert Panel 06 (Earth Sciences) for Evaluation of Results of Research and Development. Office of the Government of the Czech Republic, Research, Development and Innovation Council, Praha. (*since 2013*)

SVOJTKA M.
Member, Committee for Finals of Undergraduate and Doctoral Students in Geology, Faculty of Science, Charles University, Praha
Member, Committee for Finals of Doctoral Thesis Defense in Geology, Faculty of Science, Charles University, Praha

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

ZAJÍC J.
Alternating Member, Committee for the Ph.D. Examination and Defence of Theses in Geology, Faculty of Science, Charles University, Praha
Alternating Member, Committee for the Master's and RNDr. Doctoral Examination in Paleontology, Faculty of Science, Charles University, Praha

ŽIGOVÁ A.
Member of the Committee of Soil Science and Soil Conservation of Scientific Council of Research Institute for Soil and Water Conservation, v.v.i., Praha.
Member of the Committee of the Czech Society of Soil Science, Praha.
Member of the Board of the Doctoral Examination Committee in Physical Geography and Geoecology, 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.: Foreign Member, Polish Academy of Arts and Sciences (election approved by the Polish President in 2007)

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

7f. Degrees obtained by the staff of the Institute of Geology CAS

DSc.

BREITER K. (2013): *A-type granitoids in the Bohemian Massif.* – D.Sc. Thesis, Institute of Geology CAS, v. v. i.: 1–52. Praha (defended on February 11, 2014).

7g. Awards

CÍLEK V.: Kantuta Award, Zlín.
CÍLEK V.: Zlatá stuha, Památník Národního písemnictví, Praha.
FRIDRICHOVÁ M.: 3rd place in a photographic contest Věda fotogenická 2014 with a SEM microphotography.
HLADIL J.: Gold Medal of the Masaryk University. Brno. (Fig. 17)
CHADIMOVÁ L.: Otto Wichterle Award – Czech Academy of Sciences, Praha, award for the best young scientists.
ULRYCH J.: The Pošepný Medal, Czech Academy of Sciences, Praha.

■ **Fig. 17.** Jindřich Hladil received the Gold Medal of the Masaryk University from hands of the University Rector Mikuláš Bek. He was recognized for his outstanding contribution to the development of theory and practice in geology, especially in stratigraphy, as well as in recognition of numerous innovative interdisciplinary studies and extensive work across the sciences, education and technology, having significant impacts in international, Czech and Brno academic environments. The Masaryk University Gold Medals are awarded to leading representatives of science, culture and public life. Photo by J. S. Sláma.

7h. Institute staff on Fellowships and Stages

KOŘÍNKOVÁ D.: June 2014: Centre of Geosciences, Georg-August-University of Göttingen, Germany, Sedimentary Provenance Analysis short course 2014 led by Dr. István Dunkl, Dr. Hilmar von Eynatten and Dr. Guido Meinhold, Study internship

SLÁMA J.: September 1, 2014–February 28, 2015: Department of Earth Science, University of Bergen, Norway, Associate Professor in Geochemistry

8. Positions in Editorial Boards and International Organizations

8a. Editorial Boards

ADAMOVIČ J.
Příroda, Member of Editorial Board, Nature Conservation Agency of the 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, (Co-editor 2001–2005 and since 2012; Member of the Executive Committee 2005–2012), Official journal of the Carpathian-Balkan Geological Association, Bratislava, Slovak Republic.
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, Czech Academy of Sciences (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).

BREITER K.
Zprávy o geologických výzkumech (Geoscience Research Reports), Member of Editorial Board, Czech Geological Survey, Praha.

CÍLEK, V.
Slovenský kras, Member of Editorial Board, Slovak Museum of Speleology, Liptovský Mikuláš, Slovak Republic (since 2004).
Vesmír, Member of Editorial Board, Vesmír Ltd, Praha (since 1998).

ČERNÝ J.
Přírodovědné Studie Muzea Prostějovska, Technical Editor (Typography – LaTeX), Museum and Gallery in Prostějov, Prostějov, Czech Republic (since 2014).

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

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

KRMÍČEK L.
Acta Musei Moraviae – Scientiae geologicae, Member of Editorial Board, Moravian museum, Brno (since 2013).

LISÁ L.
Geologica Carpatica, Member of Editorial Board, Geological Institute of the Slovak Academy of Sciences, Bratislava, Slovakia (since 2013).

MIKULÁŠ R.
Geolines, Member of Editorial Board, Institute of Geology CAS, v. v. i., Praha (since 1998).
Acta Musei Nationalis Pragae, Series B, Historia Naturalis, Member of Editorial Board, National Museum, Praha (since 2008).

NAVRÁTIL T.
Journal of Geology & Geosciences, Member of Editorial Board, OMICS Publishing Group, Los Angeles (since 2013).

PRUNER P.
Geolines, Member of Editorial Board, Institute of Geology of the CAS, v. v. i., Praha (since 1997).
Research Journal of Earth Sciences, Member of Editorial Board, IDOSI Publications, Dubai, UAE (since 2009).
Journal of Hydrocarbons Mines and Environmental Research, Member of Editorial Advisory Board, Rennes, France (since 2010).

PŘIKRYL T.
Research Reports of the Institute of Geology, Editor, Czech Academy of Sciences (since 2009).

ROČEK Z.
Palaeodiversity & Palaeoenvironments, Member of Editorial Board, Senckenberg Gesellschaft für Naturforschung, Frankfurt a. M. (since 2010).

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

SLAVÍK L.
Bulletin of Geosciences, Member of Editorial Board, Czech Geological Survey, Praha (since 2013).

SVOJTKA M.
Geolines and Research Reports, Editor-in-chief, Institute of Geology of the CAS, v. v. i., Praha (since 1996).

ŠŤASTNÝ M.
Acta geodynamica et geomateralia, Member of Editorial Board, Institute of Rock Structure and Mechanics of the CAS, v. v. i., Praha (since 1998)
Informátor, Editor, Česká společnost pro výzkum a využití jílů, Praha (since 1995)

ŠTORCH P.
Bulletin of Geosciences, Co-editor, Czech Geological Survey, Praha (since 2011)
Geolines, Member of Editorial Board, Institute of Geology CAS, v. v. i., Praha (since 1995)
*Paleontological Contribution*s, Member of Editorial Board, Electronic Journal, University of Kansas, Lawrence (since 2008)
Northwestern Geology, Member of Editorial Board, Xi'an Centre of Geological Survey, China Geological Survey, Xian (since 2012)

WAGNER J.
Bulletin of Geosciences, Member of Editorial Board, Czech Geological Survey, Praha (since 2011)

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

ŽÁK K.
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).
National Delegate of the Czech Republic in the International Union of Speleology for 2012–2016 (elected by the General Assembly, Czech Speleological Society on October 13, 2012).

CHADIMOVÁ L.
Secretary, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 2013).
Committee Member and Secretary, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 2010).
Corresponding Member, Subcommission on Devonian Stratigraphy of the ICS and IUGS (since 2012).

KADLEC J.
IGBP-PAGES – National Co-ordinator.

MIKULÁŠ R.
Czech Representative, International Paleontological Association (since 2005).
Chairman of the Czech National Committee, International Geoscience Programme (IGCP) of UNESCO & IUGS (since 2013).

SLAVÍK L.
Corresponding Member, Subcommission on Silurian Stratigraphy of the IUGS (since 2011).
Secretary and Titular Member, Subcommission on Devonian Stratigraphy of the IUGS (since 2012).

SVOBODOVÁ A.
Secretary of the Czech IGCP National Committee; joined as Co-Opted Member in December 2014.

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

ZAJÍC J.
Committee Member, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 2003).

9. Institute structure and staff

9a. Organization units

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

1. *Department 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. *Department 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, amphibians and mammals), palynology of Carboniferous and Cretaceous sediments, and paleoichnology in a broad stratigraphic range from the Ordovician to the Recent.
3. *Department 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. *Department 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.

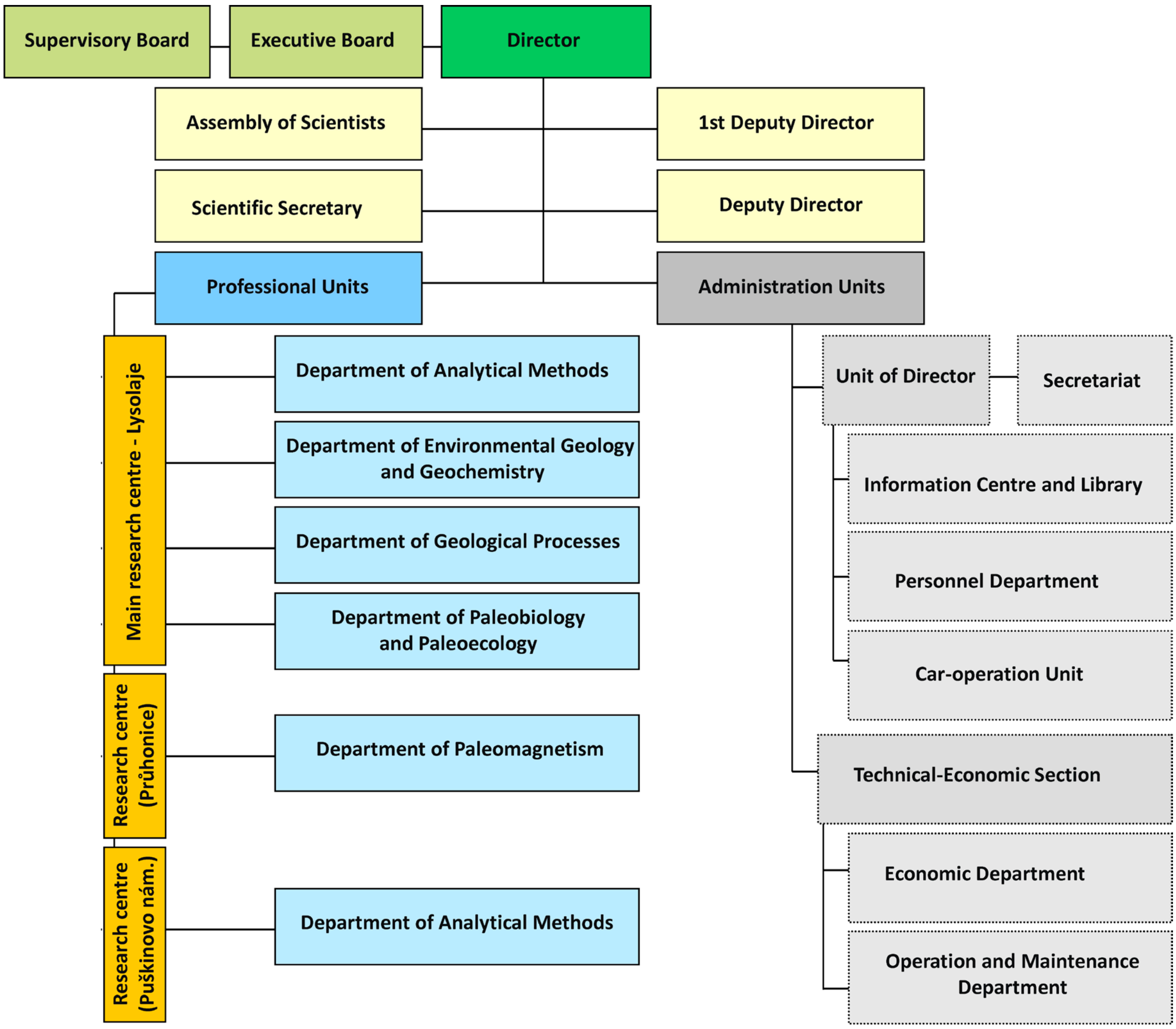
5. *Laboratory of Physical Properties of Rocks* concentrates on the study of strain response of ultrabasic rocks to a dual regime of loading and the analysis of changes of acoustic emission and ultrasound permeability during sample loading. Ultrasonic sounding of rocks and changes in their elastic anisotropy 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. Ladislav Slavík, CSc. & Pavel Lisý).
3. X-ray powder diffraction laboratory (Head: RNDr. Roman Skála, Ph.D.).
4. Scanning electron microscope and electron microprobe laboratory (Supervised by RNDr. Roman Skála, Ph.D.).
5. Laboratory of rock processing and mineral separation (Head: RNDr. Martin Šťastný, CSc.).
6. Laboratory for thin and polished sections (Head: RNDr. Roman Skála, Ph.D.).
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, Ph.D.).
11. Mercury analysis laboratory (Head: RNDr. Tomáš Navrátil, Ph.D.).
12. LA-ICP-MS Laboratory (Supervised by ing. Jana Ďurišová, Ph.D. & Mgr. Šárka Matoušková, Ph.D.)
13. Clean Chemistry Laboratory (Supervised by Mgr. Lukáš Ackerman, Ph.D.)
14. Laboratory of rock behavior under high pressure (Head: Ing. Tomáš Lokajíček, CSc.).
15. 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 the presentation of the most important scientific results in the public media.



9b. Contact information

Information on the Institute of Geology is available on the Internet: http://www.gli.cas.cz
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* emeritus employee – academical
** emeritus employee – institutional

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9c. Staff (as of December 31, 2014)

Advisory Board

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Věra Štěrbová (human resources)

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Eva Petráčková (accountant)

Operation and Maintenance Department
Jaroslav Kratochvíl (technical service)

Scientific laboratories

Laboratory of Geological Processes

Scientific Staff:
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RNDr. Leona Koptíková-Chadimová, Ph.D. – Deputy Head (sedimentary petrology, metasediments, magnetic susceptibility)
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Mgr. Jiří Filip, CSc. (technician, fission track dating)
Bc. Haluzová Eva (analyst, mass spectrometry)
Mgr. Dagmar Kořínková (Ph.D. student, fission track methods)
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Ing. Jaroslava Pavková (secretary, technician)
Jana Rajlichová (technician)
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Laboratory of Paleobiology and Paleoecology

Scientific Staff:
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RNDr. Marcela Svobodová, CSc. – Deputy Head (Cretaceous palynology)
RNDr. Jiří Bek, CSc. (Devonian and Carboniferous spores)
RNDr. Stanislav Čermák, Ph.D. (Cenozoic vertebrate paleontology, small mammals)
Mgr. Jana Frojdová (Carboniferous spores)
RNDr. Radek Mikuláš, CSc. (ichnofossils)
RNDr. Tomáš Přikryl, Ph.D. (vertebrate paleontology, fishes)
Prof. RNDr. Zbyněk Roček, DrSc. (origin and evolution of the Amphibia, Tertiary Anura and Sauria)
RNDr. Petr Štorch, DrSc. (graptolite stratigraphy, stratigraphy in general, sedimentary sequences, paleogeography)
Mgr. Andrea Svobodová (Cretaceous palynology)
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:
RNDr. Petr Čejchan, CSc. (paleoecology, Radiolaria, mazuelloids)
Pavel Lisý (technician)

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RNDr. Anna Žigová, CSc. (pedology, paleopedology)

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Světlana Hubičková (technician)
Michaela Uldrychová (secretary)

Laboratory of Paleomagnetism

Scientific Staff:
Ing. Petr Pruner, DrSc. – Head (geophysics, paleomagnetism)
Mgr. Petr Schnabl (geophysics)
M.Sc. Tiiu Elbra, Ph.D. (paleomagnetism, geophysics)
Mgr. Martin Chadima, Ph.D. (geophysics, paleomagnetism)
RNDr. Günter Kletetschka, Ph.D. (paleomagnetism, geophysics)
Mgr. Tomáš Kohout, Ph.D. (physical properties of meteorites)

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Mgr. Kristýna Šifnerová – Čížková (geophysics)
Jiří Petráček (technician)
Bc. Nábělek Ladislav (geophysics)

Laboratory of Analytical Methods and Physical Properties of Rocks

RNDr. Roman Skála, Ph.D. – Head (X-ray powder diffraction)
RNDr. Zuzana Korbelová – Deputy Head (microprobe and scanning microscope analyst)
Ing. Tomáš Lokajíček, CSc. – Deputy Head (rock elastic anisotropy)
Ing. Vlasta Böhmová – Mocová, Ph.D. (microprobe and scanning microscope analyst)
Mgr. Anna Kallistová (X-ray powder diffraction analyst)
Ing. Jonášová Šárka (microprobe and scanning microscope analyst)
Mgr. Fridrichová Michaela, Ph.D. (microprobe and scanning microscope analyst)
Mgr. Matěj Petružálek (geophysics, acoustic emission analysis)
Mgr. Tomáš Svitek (geophysics)
Julie Erdingerová (technician)
Vlastimil Filler (technician, electrician)
Jaroslava Jabůrková (technician, grinding, preparation of thin/polished sections)
Vlastimil Nemejovský (mechanic, technician, rock cutter)

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, Potsdam, Germany)
Prof. dr hab. Ryszard Kryza (Institute of Geological Sciences, Wroclaw University, Poland)
Prof. Henri Maluski (Université Montpelier II, Montpelier, France)
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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.	Ph.D.
DrSc.	DSc
Doc.	Assoc. Prof.
Ing.	Dipl.-Ing.

Staff News

Left the Institute:

Čejchan Petr	December 31
Juskovičová Klára	July 31
Kadlec Jaroslav	March 31
Momado Farid	October 31
Nábělek Ladislav	December 31
Vilhelm Jan	February 28

Joined the Institute:

Černý Jan	January 1
Elbra Tiiu	January 6
Engelmaierová Martina	January 1
Frojdová Jana	January 1
Krmíček Lukáš	January 1
Petráček Petr	January 1
Pick Bohumil	September 1
Svoboda Libor	August 1
Svobodová Andrea	January 1
Tomek Filip	January 1
Trubač Jakub	January 1

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. Ladislav Slavík, CSc. & Pavel Lisý)

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.

3D scanner (Head: RNDr. Jaroslav Zajíc, CSc.)

Two devices enable to collect and evaluate 3D data (as spatial data clouds) of the real geologic or paleontological objects. The utility software allows many ways of measurements. With help of the additional software solution is subsequently possible to model the virtual surfaces, virtual closed objects and any cross-sections. All virtual objects can be visualised and rotated with help of 3D modeling programs.

The *MicroScribe® MX* is a portable measurements system with metrology-level accuracy in six degrees of freedom. This system enables the 3D data collection efficiency of coordinate measurement systems at an affordable price. The counter-balanced and intuitive articulation of the arm allows to quickly position the stylus into even tight spaces. The arm can reach up to 63 cm and the work sphere diameter is 1.27 m. The device works with precision up to 0.0508 mm and its weight is 5.4 kg.

MicroScribe Utility Software (MUS) allows data acquisition for some applications that do not provide native support.

The *Kreon Skiron* is a very compact, light and ergonomic 3D laser scanner. Fully integrated on the MicroScribe® desktop digitizer (MX series), this laser scanner dramatically reduces digitizing time. Laser of the class II can scan at speed up to 45 000 points/second with accuracy of 50 µm. Maximum laser line is 75 mm, the measuring field is 65 mm, and stand-off distance is 50 mm. The line resolution is 83 µm and vertical resolution (sub-pixel) is 16 µm. Dimensions of the device are 112 × 61 × 76 mm and its weight is only 260 g.

Scantools 3D software gives access to the functionalities of the Skiron scanner. This easy to use software allows data collection in a very short time as well as processing them.

The data processing is solved with help of the *3D NURBS modeling software Rhinoceros®*. Two plug-ins are applied with the Rhinoceros: the *Flamingo* to raytrace rendering and the *Bongo* to animation creation.

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

X-ray powder diffractometer Bruker D-8 DISCOVER is a multipurpose powder X-ray diffraction instrument with a variable measuring radius designed to study powder samples or solid polycrystalline blocks (polished (thin)sections, rock chips etc.). Diffractometer is of the θ-2θ design and allows studying materials in both reflection and transmission (either foil or capillary) geometries. Optional focusing primary asymmetric monochromator of Johansson type produces spectrally pure Kα1 radiation. Diffracted radiation is collected with a position sensitive 1D silicon strip detector LynxEye. In the microdiffraction setup used for bulk samples, the primary monochromator is replaced by polycapillary optics (i.e., Kα1,2 radiation is used) and beam limited with a collimator and a sample is placed on a special motorized xyz-stage. For routine analytical work also a compact X-ray powder diffractometer *Philips X'Pert* with fixed divergence and receiving optics, secondary graphite monochromator and a point proportional counter can be used.To carry out phase analysis, the International Centre for Diffraction Data Powder Diffraction File (ICDD PDF-2) database is available. Data manipulation and processing is realized through proprietary software products of individual diffractometer producers.

Scanning electron microscope and electron microprobe laboratory (Head: RNDr. Roman Skála, Ph.D.)
Scanning electron microscope (SEM) TESCAN VEGA3XMU is an SEM of a variable pressure construction and allows observation and analysis of not only carbon-coated or gold-sputtered materials but also of uncoated specimens including biological materials. It is equipped with detectors of secondary and back-scatted electrons as well as energy-dispersive (ED) spectrometer Bruker QUANTAX 200. Also available are low vacuum secondary electron (LVSTD) and color cathodoluminescence (detection range 350 nm–850 nm) detectors. The source of electrons is a tungsten heated cathode.

Electron probe microanalyzer (EPMA) CAMECA SX-100 is used mainly for non-destructive quantitative analysis of solid-state materials on the micrometer scale from selected spots down to a few microns across. The instrument is equipped with four wave-dispersive crystal spectrometers. Two of them carry 4 individual standard crystals each (LIF; PET; TAP; PC0 and PC1, respectively), two other house two so-called large crystals each (i.e., crystals with lower detection limits; LLIF; LTAP; LPET; LPC2). Instrument allows analysis of specimens for elements from B to U. To image studied samples, the back-scattered-electron (BSE) and secondary-electron (SE) detectors are used.

Reliable quantitative local chemical analysis and/or acquisition of element distribution maps using EPMA/SEM require planar polished conductive surfaces. To make the specimens conductive for EPMA/SEM chemical analyses, a coating by carbon is used. For imaging of rough surfaces using secondary electrons in high vacuum, samples are sputtered with gold or its alloys to prevent sample charging. The laboratory owns necessary instruments to carbon-coat or gold-sputter the specimens. In 2014, a new instrument for carbon-coating and metal-sputtering (Quorum Q150T ES) was purchased to allow controlled deposition of conducting media on samples to be investigated.

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)
Muffle oven LAC LMH 11/12 (2011)
Hydraulic slab cutter 4H HYDROTRONK MONTOLIT (2011)

Laboratory for thin and polished sections (Head: RNDr. Roman Skála, Ph.D.)

To prepare the samples for optical microscopic, SEM and/or EPMA studies a suite *of cutting, grinding, lapping and polishing machines* to manufacture polished sections or thin sections is available.

Laboratory of microscopy (Head: Mgr. Michal Filippi, Ph.D.)

Laboratory of microscopy is used for the first identification of the studied samples and for a detailed

preparation for other more sophisticated methods. The equipment of the laboratory enables a photographic documentation of samples and also basic image analyses (for example in case of the thin sections).

Polarization microscope OLYMPUS BX51 with digital camera OLYMPUS DP70 equipped by X-ray fluorescence with wavelength 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)

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)
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, Ph.D.)

ICP-EOS spectrometer Thermo Iris Intrepid XSP (2004)
HPLC system (Knauer 2010): anion analysis in aqueous samples using ion-exchanging column and conductivity detector.
Microwave digestion unit Mars (2009) – with 8 fully equipped PTFE digestion vessels.
Microwave digestion unit Milestone mls 1200 mega (2009) – with 6 fully equipped PTFE digestion vessels.
UV-VIS Spectrometer CINTRA 303
AAS 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 Mettler-Toledo (2011)
Analytical weights BALANCE 2000G (1999)

Mercury analysis laboratory (Head: RNDr. Tomáš Navrátil, Ph.D.)

Mercury analyser AMA 254 (2008) – mercury analysis in solid and liquid samples on CV-AAS principle.
PSA Millennium Merlin (2009) – ultra low mercury analysis in liquid samples on CV-AFS principle. Extension of this analytical procedure with a single-purpose HPLC enables mercury species separation and analysis.
DOC/TOC analyzer Shimadzu (2010): Dissolved organic carbon content, total organic carbon content, inorganic carbon in aqueous samples.

LA ICP-MS Laboratory (Supervised by ing. Jana Ďurišová, Ph.D. & Mgr. Šárka Matoušková, Ph.D.)

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 analysing solid samples and backup power system *UPS PW9355 POWERWARE* (Eaton).

Clean Chemistry Laboratory (Supervised by Mgr. Lukáš Ackerman, Ph.D.)

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 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 the CAS	34 640
2.	From the Czech Science Foundation (accepted research projects)	9 331
3.	From the Technological Agency CR (accepted research projects)	687
4.	From the internal research projects of the CAS	2 209
5.	From other public sources	991
6.	Applied research	3 688
7.	Investment (instruments)	4 517
8.	Investment (constructions)	0
TOTAL INCOMES		56 063

B. EXPENSES		
1.	Scientific staff (wages, insurances)	31 072
2.	Research and scientific activities	11 305
3.	Administration and technical staff (wages, insurances)	5 488
4.	General expenses (postage shipping, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc.)	2 481
5.	Library	831
6.	Editorial activities	183
7.	Investment (instruments)	4 703
8.	Investment (constructions)	0
TOTAL EXPENSES		56 063

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Institute of Geology of the Czech Academy of Sciences, v. v. i.

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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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