RESEARCH REPORTS 2017

Institute of Geology of the Czech Academy of Sciences

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Cover photo: Base of the Fish Canyon Tuff, an Oligocence ignimbrite of the La Garita Caldera supereruption, Southern Rocky Mountain volcanic field. Outcrop photo from South Fork, Colorado. Photo by Filip Tomek.

2017

Research Reports

The contents and scientific quality of the contributions of individual authors lie within the responsibility thereof.

The report was compiled by J. Dašková and P. Bosák and English was revised by J. Adamovič.

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Contents

Introduction

The year 2017 was filled with outstanding scientific work. A change in position of the Institute Director occurred on May 31: Prof. RNDr. Pavel Bosák, DSc. was replaced by RNDr. Tomáš Přikryl, Ph.D. The selection of new director is always a complicated procedure, governed by the Act on Public Research Institutions and by the Statute of the Czech Academy of Sciences. A special committee for the tender was elected by the Institute Board on January 2017. The committee collected information on 2 candidates and evaluated it at its meeting at the beginning of April. One week later, the Institute Board in a secret ballot finally elected the new director, who was later approved by the Academic Board of the Czech Academy of Sciences. Furthermore, new Institute Board and Supervisory Board have been established.

Publication activity of the Institute staff highly improved, also thanks to new investments. As was already mentioned in 2016, the *Department of Geological Processes* succeeded in the Academic tender for high-cost scientific equipment and purchased an excimer laser (193 nm, Cetac/Teledyne company). It was introduced in the LA-ICP-MS laboratory in a combination with the previously acquired ICP-MS (Element2) mass spectrometer. This department was also successful in the Academic tender for high-cost scientific equipment for 2017 and 2018: the thermal ionization mass spectrometer (TIMS) was purchased in 2017 and installed in a specially equipped laboratory. It is now in full operation and will contribute to the development of the most advanced analytical methods used in geology. In addition, the Thermo ScientificNicolet iS-50 Fourier-transform infra-red spectrometer (FTIR) has been acquired to the *Department of Analytical Methods* in 2017.

The Institute personnel succeeded in a tender for grant projects in the Czech Science Foundation (GAČR), obtaining funding for three projects (2018–2020). The increase in institutional financing for 2017 enabled to increase salaries by 10 % on average.

International cooperation in research and development of new methods continued successfully and intensively. Popular science, especially within the complex project Strategy 21 of the Czech Academy of Sciences, was expanding rapidly again.

Pavel Bosák
Head of the Executive Board

2. General Information

Up-to-date information on the Institute is available on the Internet:
http://www.gli.cas.cz.

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The Institute of Geology is a public research institute belonging to the Czech Academy of Sciences. 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 possible sense) or regionally balanced geological studies, its activities span a relatively broad range 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 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; exogenous geochemistry; exogenous geology, geomorphology; Quaternary geology and landscape evolution; karstology and paleokarstology; paleomagnetism, magnetostratigraphy and petromagnetism, and 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.

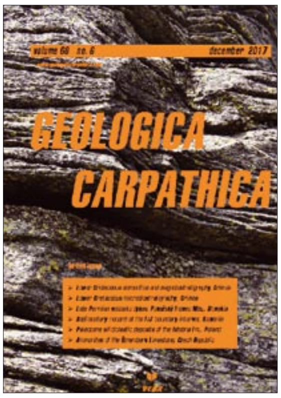
On March 1, 1979, the Geological Institute was united with the Mining Institute of the ČSAV under the Institute of Geology and Geotechnics of the ČSAV, and finally split from the latter on March 1, 1990 again.

On January 1, 1993 the Academy of Sciences of the Czech Republic 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 and the evaluation of its results lie within the responsibility of the Executive Board and the Supervisory Board which include both internal and external members. Plans of the Institutional Financing are evaluated by the special Committee at the Czech Academy of Sciences. 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. Publicantion Activity of the Institute of Geology

3a. Journals



Since 2000, the Institute of Geology of the Czech Academy of Sciences 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, *P. BOSÁK* until May 2017, *T. PŘIKRYL* later) 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, Slovak Academy of Sciences. Online publishing is also possible through Versita on MetaPress platform with rich reference linking. Online ISSN 1336-8052 / Print ISSN 1335-0552. Details concerning the journal are on journal web page.

In 2017, six issues (1 to 6) of Volume 68 were published with 38 scientific papers and short communications. Impact factor for 2017 has been set at 1.169. 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, www.geol.sav.sk.

Published by: Veda, Publishing House of the Slovak Academy of Sciences, Dúbravská cesta 9, 845 02 Bratislava 45, Slovak Republic, www.veda.sav.sk.

Electronic version: De Gruyter Open, www.degruyter.com.

Co-publishers: Polish Geological Institute – National Research Institute, Warszawa, Poland & Institute of Geology of the Czech Academy of Sciences, Prague, Czech Republic.

3b. Monographs, Proceedings, etc.

BOSÁK P. (Ed., 2017): *Research Reports 2016*. – Institute of Geology of the Czech Academy of Sciences: 1–89. Prague. ISBN 978-80-87443-14-9.

4. Research Reports

4a. Foreign Grants, Joint Projects and International Programmes

Finished Projects

Bilateral co-operation between Czech Geological Survey, Praha and Geologische Bundesanstalt Wien, Austria: **Palynology of Gosau Group sediments on the geological maps (GK 50) St. Wolfgang and 97 Bad Mitterndorf** (H. Lobitzer, Geologische Bundesanstalt, Wien, Austria; L. Švábenická, Czech Geological Survey, Prague, Czech Republic & *M. Svobodová*; 2017)

Black coaly claystones from the coal accumulations at the locality of Stoderzinken (near Gröbming) from intramontane basins of the Noric depression of the Enns Valley (Steiermark, Austria) contain very rare but important plant palynomorphs. The findings of 4-, 5- and 6-porate forms of the *Alnus* pollen, i. e. *Alnipollenites verus* R. Pot. 1931 emend. R. Pot. 1960 as well as other angiosperm pollen *Intratriporopollenites* sp. (Tiliaceae), conifers of Taxodiaceae-Cupressaceae family *Inaperturopollenites concedipites* (Wode. 1993) W. Kr. 1971 *Inaperturopollenites hiatus* (R. Pot. 1931b) Th. & Pf. 1953 allow to solve the question if the deposits are of Upper Cretaceous or Tertiary age. The palynological assemblage corresponds to their Tertiary age. The environment corresponds to coal-forming swamps because no marine specimens appear. Samples from Wörschacher Gosau (Schneckengrabenschichten) contain Normapolles pollen with prevailing *Complexiopollis* as well as *Oculopollis*, corresponding to the Coniacian age. Palynomorph assemblage of the Valanginian-Hauterivian age was found in the Traxleck samples in the vicinity of Bad Ischl.

Bilateral co-operation between Senckenberg Museum für Naturkunde Görlitz (Germany) and Institute of Geology of the Czech Academy of Sciences: **Palynology of selected samples of the coal seam of Waltersdorf near the Lusatian Fault (Lausitzer Überschiebung, the Zittau Mts.)** (O. Tietz, Senckenberg Museum für Naturkunde Görlitz, Germany & *M. Svobodová*; 2017)

Palynomorphs from dark brownish shale were strongly affected by thermal alteration due to the proximity of a phonolite intrusion. Therefore, the colour of extremely rare palynomorphs was dark brown to black and the specimens were strongly corroded. The palynofacies was dominated by fusinite-inertinite particles (carbonized plant remains), some coniferous tracheids with bordered pits, foraminiferal chitinous inner tests (microforaminifera), and single specimens of bryophyte and pteridophyte spores (*Stereisporites* sp., *Gleicheniidites* cf. *senonicus* Ross, *Cyathidites* sp., *Cicatricosisporites* sp.), monoporate multicellate hyphae of chitinous-walled fungal spores, non-marine algae and gymnosperm pollen grains of *Taxodiaceaepollenites* sp. and *Vitreisporites pallidus* (Reissinger) Nilsson. No angiosperm pollen were found. Foraminiferal chitinous linings together with non-marine plankton indicate marine depositional environment of variable salinity, i. e. estuarine marshes or shallow-marine conditions. All palynomorph species found in this sample represent typical long-ranging Cretaceous species. The age cannot be stated more precisely due to the absence of angiosperm pollen.

Czech Academy of Sciences grant promoting development of international cooperation for early-career scientist – Project No. 6501: **Rock-magnetic and paleomagnetic studies of volcano plumbing systems: implications for magma flow dynamics beneath composite volcanoes** (*F. Tomek*; October 2016–December 2017)

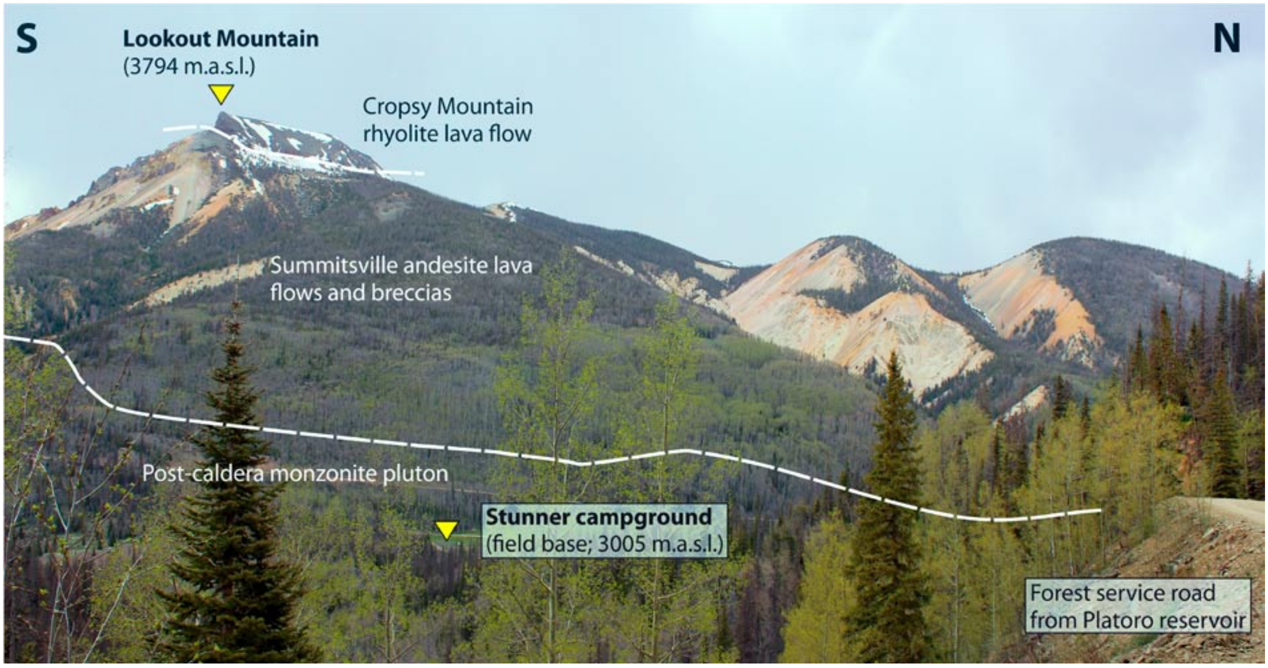
The project deals with a complex architecture of volcano plumbing systems in order to decipher magma flow and ascent beneath calderas and stratovolcanoes. Three volcano-plutonic complexes were selected for field studies – the Altenberg-Teplice caldera (Bohemian Massif), Platoro caldera and Galisteo basin volcano; San Juan Mts., New Mexico and Colorado, USA (Fig. 1). Anisotropy of magnetic susceptibility (AMS) and paleomagnetism was used to track the emplacement processes in dikes, sills and plutons. Geochronology zircon U/Pb data (LA-ICP-MS, SIMS) were employed in order to decipher the magmatic history of selected volcano-plutonic complexes. The main part of the project was a 6-month fellowship at the New Mexico Highlands University, USA, during April–September 2017.

Ongoing Projects

State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology (NIGPAS), Chinese Academy of Sciences, Project No. 16302: **Graptolite marker species of Rhuddanian/Aeronian boundary interval of the Czech Republic and China** (*P. Štorch* & Z. Y. Sun, NIGPAS; 2017–2018)

The project is focused on detailed morphological and morphometric analyses and a comparison of selected graptolite taxa of major importance for the identification and high-resolution correlation of the Rhuddanian/Aeronian boundary strata in the Czech Republic (Hlásná Třebaň, Karlík and Radotín tunnel sections in the Prague Synform) and Yangtze Platform of South China (Shennongjia and Yuxian). Key issues to be addressed are as follows: (1) which stratigraphically important graptolite species recorded in the Rhuddanian-Aeronian boundary strata in both European and Chinese sections are truly identical, which are closely morphologically similar twins, and how many classic European graptolite species are actually present in the Rhuddanian-Aeronian boundary strata in China?; (2) what degree of intraspecific diversity occurs in these taxa, and (3) which closely similar twin-taxa may bear a single name in a high-resolution quantitative correlation of the European and Chinese sections? The present study works with stratigraphically distinct populations of early rastritids (*R. longispinus* Perner, *R. peregrinus* Barrande, *R. approximatus* Perner, *R. guizhouensis* Chen and Lin) and petalolithids (*P. ovatoelongatus* (Kurck), *P. ankyratus* Mu *et al.*, *P. palmeus* (Barrande) *sensu* Chen and Lin (1978), *P. elacatus* Ni). Populations of the respective species were taken from specific samples available from sections sampled in 2014–2016. Preliminary results were presented at ICOS 4 International conference in Valencia (Sun *et al.* 2017). Morphological and morphometric differences between Czech and Chinese populations, their taxonomic interpretation and comparison with published data enabled taxonomic revision and biostratigraphic and palaeobiogeographic analysis of early rastritid graptolites world-wide (paper under preparation). A similar study will follow on early petalolithids.

SUN Z. Y., *ŠTORCH P.* & FAN J. X. (2017): Earliest rastritids and petalolithids (graptolites) in China and the Czech Republic: comparison and palaeobiogeographic implications. – *Cuadernos del Museo Geominero,* 22 (LIAO J.-C. & VALENZUE-



■ **Fig. 1.** A photo of the central portion of the Platoro caldera, San Juan Mts., Southern Rocky Mountains, Colorado. The monzonite pluton was mapped and sampled for an AMS analysis. Photo by F. Tomek was taken from sampling station PC18B (WGS coordinates: N37.370384°, W106.567274°).

LA-RÍOS J. I., Eds.: *Fourth International Conodont Symposium ICOS IV: Progress on Conodont Investigation*): 87–89. Valencia, Spain.

International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 653: **The onset of the Great Ordovician Biodiversification Event** (International Leader: T. Servais, French National Centre for Scientific Research, France; Czech representative: O. Fatka, Faculty of Science, Charles University in Prague; other Czech workers: *R. Mikuláš* & P. Budil, Czech Geological Survey, Prague; 2016–2020)

Fossil sites of the Šárka Formation were re-visited, and a newly obtained material from fossil collectors was studied with the aim to find, describe and interpret interactions between body fossils and trace fossils. The example of a gastropod shell reached by a vertical shaft belongs to intriguing ones; it provides several proposed scenarios showing an excellent ability of in-faunal scavengers to search for a food. The poorly known ichnogenus of *Brdichnus* Mikuláš, 1992 was found at contact with common shell fragments; this points to its interpretation as the recently established ethological category, sequestrichnia.

MOBILITY SAZU/CAS No. SAZU-16-03: **Analyses of karst sediments for dating morphogenetic and environmental changes in karst areas of Slovenia** (N. Zupan Hajna, A. Mihevc, P. Gostinčar, Karst Research Institute, ZRC SAZU, Postojna, Slovenia; *P. Pruner* & *P. Bosák*; internal code 7448; supported by RVO67985831; 2016–2018)

The Quaternary is one of the most intensively studied parts of the geologic record because it is well preserved compared to other periods of geologic time. Quaternary terrestrial sediments are important for unraveling environments, climate and tectonic evolution. There are well defined glacials and interglacials, sea level changes connected with climate changes. Most of them have been dated by different methods. In spite of the fact that karst landscapes mostly lack surface sediments, karst serves as a unique source of paleoenvironmental information due to multi-proxy record in cave fills. Sediments from diversified environments preserved on the surface and in the subsurface of karst landscapes are the only sediments recording the terrestrial phase of landscape evolution and they indirectly indicate the dynamics and age of various geologic/geomorphic processes, speleogenesis and karst evolution.

Systematic research of sediments in Slovenian caves in the last 20 years applied different analytical and especially dating methods (e. g., paleomagnetic studies and magnetostratigraphy, U-series dating, zoopaleontology, phytopaleontology). It clearly proved that cave fills are much older than was originally expected (Zupan Hajna *et al.* 2017). The identified ages cover not only the Quaternary (Pleistocene and Holocene), but also Pliocene and even reach to the Miocene. Pliocene/Pleistocene or Early/Middle Pleistocene boundaries were detected in some of the studied sections. Depositional phases in the underground suggest a strong influence of climatic changes on the surface with possible flood events and/or changes in the tectonic regimes during the Cenozoic.

ZUPAN HAJNA N., MIHEVC A., *PRUNER P.* & *BOSÁK P.* (2017): Multi-proxy study of karst sediments in Slovenia: the contribution to the Quaternary geologic and geomorphic processes. – 5th *Regional Scientific Meeting on the Quaternary Geology dedicated to Geohazards and Final Conference of the LoLADRIA Project "Submerged Pleistocene landscapes of the Adriatic Sea", 9 – 10 November 2017, Starigrad-Paklenica, Croatia. Abstracts*: 74–75. Croatian Academy of Sciences and Arts. Zagreb.

MOBILITY PAS/CAS No. PAS -17-22: **Reconstruction of paleoenvironment in Middle and Late Pleistocene based on cave deposits from Poland and Czech Republic** (H. Hercman, M. Gąsiorowski, J. Pawlak, M. Błasczyk, Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland; *P. Bosák*, *P. Pruner*, *Š. Kdýr*, *Š. Matoušková & J. Rohovec*; internal code 7448; supported by RVO67985831; 2017–2019)

The "quality" of palaeoenvironmental reconstruction, based on speleothem records, depends on the accuracy of used proxies and chronology of the studied record. Among dating methods, in most cases the best solution is to use the U-series method to obtain precise chronology. But for periods older than 0.5 Ma, dating becomes a serious challenge. Theoretically, older material can be dated with U-Pb dating method. However, this method requires relatively high uranium contents (minimum a few ppm), whereas speleothems from Poland (and entire Central Europe) usually have uranium concentrations below 0.1 ppm. Facing this problem in one of the Polish caves, we applied Oxygen Isotope Stratigraphy (OIS) as a tool for speleothem dating.

The Głęboka Cave is currently the largest known cave form karst of the Mt. Zborów Nature Reserve (Cracow-Częstochowa Upland, southern Poland). The cave is developed in massive rocky limestones and poorly bedded limestones (Oxfordian, Upper Jurassic). The cave consists of two major parts, northern and southern, connected by a narrow passage. The cave is relatively rich in cave deposits. The SE wall of the Esso Corridor is covered with about 0.5 m thick flowstone. Here, a continuous 52 cm long flowstone sequence was sampled in 2012. U-series dating, oxygen and carbon stable isotope compositions and calcite fabrics analyses were carried out to provide paleoenvironmental data.

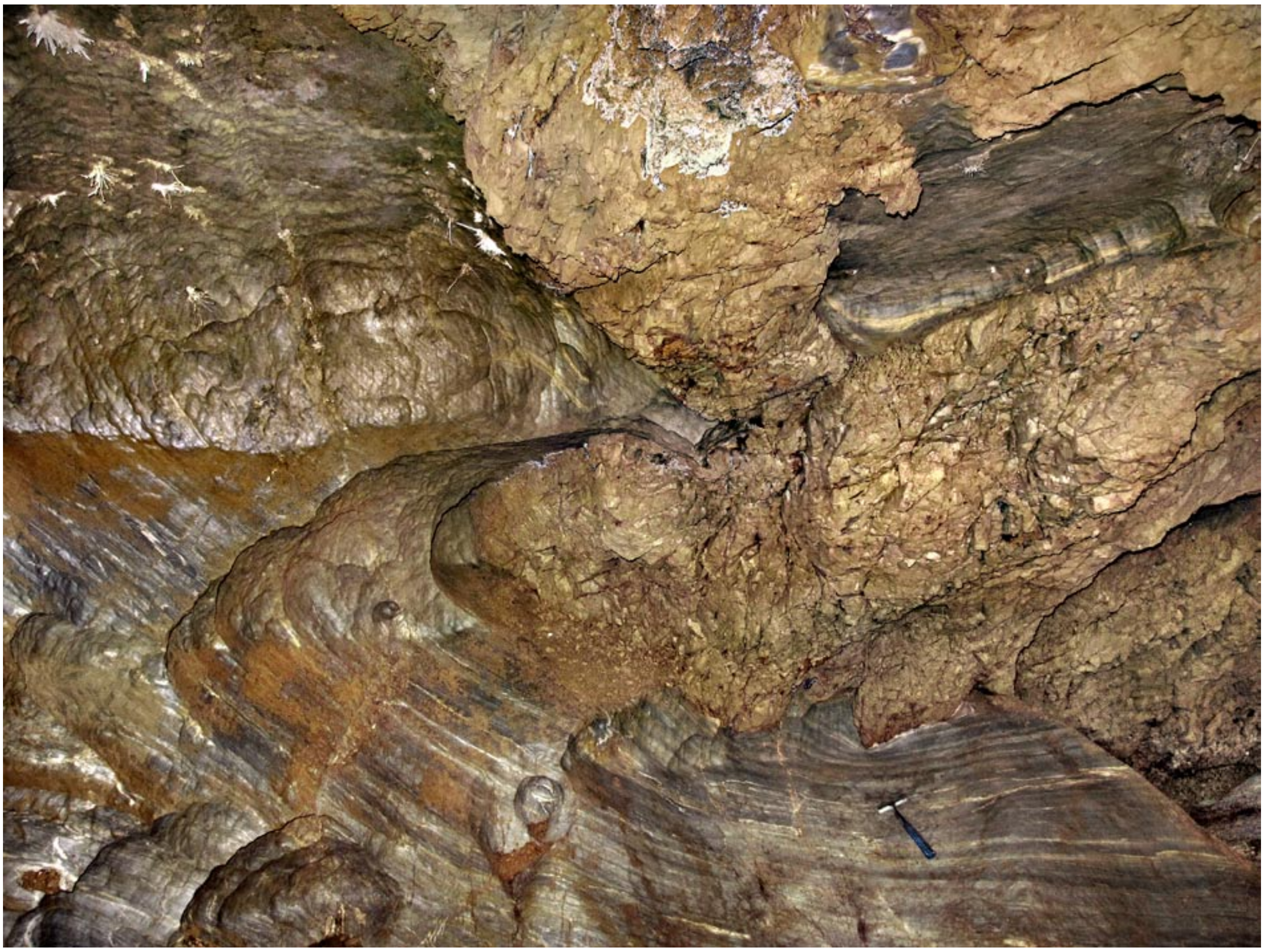
The result of U-series dating allows to suggest only that studied flowstone crystallized in the time interval between 500 and 1,200 ka (U-series ages were beyond the method limit but ^{234}U and ^{238}U were still in disequilibrium state). Facing all these difficulties we decided to use the OIS as an alternative tool to investigate flowstone chronology. Global stack curve LR04 (Lisiecki & Raymo 2005) was used as a reference record for correlation. This curve is composed of 57 different marine records. The local record from the cave was numerically correlated with the reference isotope curve using genetic algorithms. This study proved that the flowstone from Głęboka Cave crystallized between 975 and 500 ka with three major breaks in deposition (hiatuses). The detected hiatuses in flowstone from the Głęboka Cave correspond to Marine Isotope Stage (MIS) 20, MIS 16 and MIS 14, and speleothem deposition was finished at the beginning of MIS 12. The continuous growth with the highest growth rate took place between MIS 19 and MIS 17. This suggests a mild climate during the potentially cold MIS 18 (Błaszyk *et al*. 2017). In summary, the results of our work prove that the OIS method can be a useful tool in chronology studies in speleothems, especially when other conventional dating methods are difficult to use. This way, the use of the OIS method should enable paleoenvironmental reconstruction also for older periods recorded in cave speleothems.

BŁASZCZYK M., HERCMAN H., PAWLAK J., GĄSIOROWSKI M., *MATOUŠKOVÁ Š.*, ANINOWSKA M., KICIŃSKA D. & TYC A. (2017): Oxygen isotopic stratigraphy as a tool for chronology establishing of Early and Middle Pleistocéne speleothems – a case study from Głęboka Cave (Kraków-Częstochowa Upland, Poland). – *in*: SCZYGIEŁ J. & KICIŃSKA D. (Eds.): *Materiały 51. Sympozjum speleologicznego, Zakopane 05-08.10.2017*: 67. Sekcja Speleologiczna Polskiego Towarzystwa Przyrodników im. Kopernika. Kraków.

LISIECKI L. E. & RAYMO M. E. (2005): A Pliocene-Pleistocene stack of 57 globally distributed benthic $\delta^{18}O$ records. – *Paleoceanography*, 20, 1: PA1003.

Bilateral co-operation between Institute of Geology of the Czech Academy of Sciences and Slovak Caves Administration, Litovský Mikuláš: **Paleomagnetism and magnetostratigraphy of Cenozic cave sediments and speleogenesis of selected caves in Slovakia** (P. Bella, Slovak Caves Administration, Liptovský Mikuláš and Catholic University in Ružomberok, Slovakia; *P. Pruner* & *P. Bosák*; internal code 7448; supported by RVO67985831; since 1997)

Caves formed by the effect of carbon dioxide released by the oxidation of siderite by percolating oxygen-rich atmospheric precipitation at shallow depths are classified as hypogenic caves by Kempe (2009) and Kempe, Bauer & Krause (2016). We are dealing with a specific type of hypogenic speleogenesis without *per ascending* waters. These are different from those originated by sulfuric speleogenesis (activity of sufuric acid) in shallow parts of karst aquifers by oxidation of sulfidic minerals, especially of pyrite in carbonate rocks, by percolating precipitation or due to hydrogen sulfide in hydrothermal settings (Bella & Bosák 2017). Caves corroded by sulfuric speleogenesis have not been known in Slovakia yet. Nevertheless, Rajman *et al*. (1990, 1993), explaining the genesis of the Ochtiná Aragonite Cave (Fig. 2), expected that, besides ankerite and siderite oxidation, sulfidic (pyrite) mineralization of carbonates could have also influenced chemical composition of water and corrosivity. The absence of gypsum in the cave however excludes the role of sulfide oxidation and indicates the principal role of oxida-



■ **Fig. 2.** Ochtinská Aragonitová Cave (Slovakia) – space relationship of phreatic speleogens in marbles, "ochres" and aragonite. Photo by P. Bella (2013).

tion of large bodies of metasomatic ankerite [Ca (Fe, Mn, Mg) $(CaCO_3)_2$] or siderite ($FeCO_3$) causing a release of carbon dioxide, which supports intensive limestone corrosion (Bella *et al*. 2017). This hypothesis is supported also by waters in the cave, which are slightly alkaline (pH 6.5 to 8.08), less mineralized and of calcium-magnesium composition (Rajman *et al*. 1990; Peško 2002; Haviarova & Peško 2004).

BELLA P. & *BOSÁK P*. (2017): Sulfurické jaskyne vytvorené v dôsledku oxidácie pyritu – špecifický typ hypogénej speleogenézy. – *Aragonit*, 22, 2: 57–58. Liptovský Mikuláš. [in Slovak]

BELLA P., *BOSÁK P*., GAÁL Ľ., *PRUNER P*., HERCMAN H. & HAVIAROVÁ D. (2017): Ochtinská aragonitová jaskyňa – špecifický typ hypogénnej jaskyne? – *Aragonit*, 22, 2: 65–66. Liptovský Mikuláš. [in Slovak]

HAVIAROVA D. & PEŠKO M. (2004): Základná charakteristika vôd Ochtinskej aragonitovej jaskyne. – *Slovenský kras*, 42: 99–107. [in Slovak]

KEMPE S. (2009): Siderite weathering as a reaction causing hypogene speleogenesis: The example of the Iberg/Harz/Germany. – *Ukrainian Institute of Speleology and Karstology. Special Paper*, 1 (KLIMCHOUK A. B. & FORD D. C. (Eds.): *Hypogene Speleogenesis and Karst Hydrogeology of Artesian Basins*): 59–60. Simferopol.

KEMPE S., BAUER I. & KRAUSE, O. (2016): Iberger Tropfsteinhohle, Iberg, Harz Mountains, Germany: Hypogene morphology and origin by siderite weathering. – *NCKRI Symposium*, 6 (CHAVEZ T. & REEHLING P. (Eds.): *Proceedings of DeepKarst 2016: Origins, Resources, and Management of Hypogene Karst (April 11 – 14, 2016, Carlsbad, New Mexico*): 35–44. National Cave and Karst Research Institute. Carlsbad.

PEŠKO M. (2002): Fyzikalno-chemicke vlastnosti priesakovych vod v Ochtinskej aragonitovej jaskyni. – *in:* BELLA P. (Red.): *Výskum, využívanie a ochrana jaskýň. Zborník referátov z 3. vedeckej konferencie (Stára Lesná 14.–16. 11. 2001)*: 108–111. Správa Slovenských jaskýň. Liptovský Mikuláš. [in Slovak]

RAJMAN L., RODA Š., RODA Š. jun. & ŠČUKA J. (1990): *Fyzikálno-chemický výskum krasového fenoménu Ochtinskej aragonitovej jaskyne*. – Unpublished final report. Slovak Museum of Nature Protection and Speleology. Liptovský Mikuláš. [in Slovak]

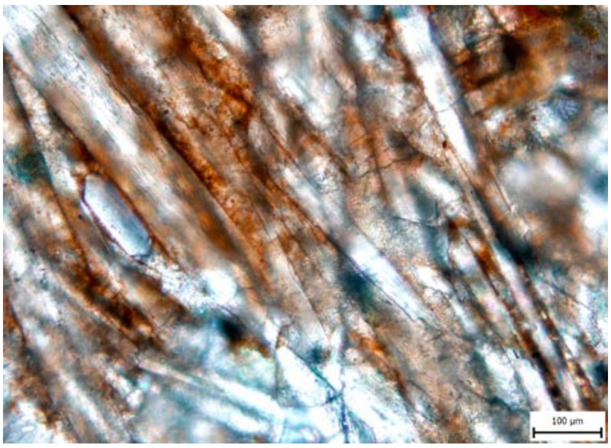
RAJMAN L., RODA Š., RODA Š. jun. & ŠČUKA J. (1993): Untersuchungen über die Genese der Aragonithöhle von Ochtina (Slowakei). – *Die Höhle*, 44, 1: 1–8.

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

Within the cooperation we have been studying not only Cenozoic cave/karst sediments and speleogenesis in Slovenian karst areas, but also speleogentically intereresting paleokarstic macroporosity in Ras-al-Khaimakh Emirates in the United Arab Emirates (see Zupan Hajna *et al*. 2016). Some interesting and important results are briefly reported below.

Palygorskite in caves and karst: a review. Palygorskite is fibrous mineral representing the transitional phase between chain silicates and layer silicates with modulated phyllosilicate structure. Although often found in carbonate environments, it forms a quite uncommon constituent of cave fills. Palygorskite occurs in two forms in cave fills: (1) allogenic palygorskite in arid and semiarid conditions can represent a substantial portion of cave fills, often associated with smectite, gypsum, calcite and halite; it is wind-blown-in or transported by surface run-off to caves from desert soils and paleosols, calcretes, dolocretes and related deposits; (2) autogenic palygorskite occurs as an *in situ* precipitate in cave fills from percolating solutions and/or transformation of smectite and kaolinite in cave fills under dry evaporative conditions and in the case of favorable geochemical composition of solutions. In carbonate host-rocks, palygorskite fills fissures and faults and is often found in cave walls. It occurs commonly as “mountain leather” as a result of hydrothermal and/or weathering processes, or represents a product of *in situ* chemical precipitation from percolating meteoric solutions with suitable pH and redox conditions and chemical composition (Zupan Hajna & Bosák 2018).

Bat urea-derived minerals in arid environment. Allantoin was described for the first time from a cave environment from United Arab Emirates. The Kahf Kharrat Najem Cave is a small cave hosting a bat colony producing guano deposits and peculiar centimeter-long yellowish stalactites. Mineralogy and geochemistry of these deposits were analyzed using XRD, EDX, SEM, and stable isotope composition ($\delta^{13}C$ and $\delta^{15}N$). In these stalactites, urea $CO(NH_2)_2$ was found to be the main compound, while allantoin $C_4H_6N_4O_3$ was found to be an accessory urea byproduct. We also identified rare sulfate minerals (aphthitalite, alunite) and phosphates that probably correspond to the archerite-biphosphammite series (Fig. 3). The occurrence of these bat-related rare minerals is due to the extreme dry conditions in the cave, which accounts for the extraordinary preservation of the guano deposits and allows for the crystallization of these very soluble minerals (Audra *et al*. 2017).



■ **Fig. 3.** Thin tabular urea crystals in needle-like sulfate/phosphate matrix in urea-composed stalactite (Kahf Kharrat Najem Cave, the UAE; plane polarized light. Photo by L. Lisá.

AUDRA P., *BOSÁK P.*, GÁZQUEZ F., CAILHOL D., *SKÁLA R.*, *LISÁ L.*, *JONÁŠOVÁ Š.*, FRUMKIN A., KNEZ M., SLABE T., ZUPAN HAJNA N. & AL-FARRAJ A. (2017): Bat urea-derived minerals in arid environment. First identification of allantoin, $C_4H_6N_4O_3$, in Kahf Kharrat Najem, United Arab Emirates. – *International Journal of Speleology*, 46, 1: 81–92.

ZUPAN HAJNA N. & *BOSÁK P.* (2018): Palygorskite in caves and karsts: a review. – *Acta Carsologica*, 47, 2–3: 97–108.

ZUPAN HAJNA N., *SKÁLA R.*, AL-FARRAJ A., *ŠŤASTNÝ M.* & *BOSÁK P.* (2016): Palygorskite from cave sediments: case study from Wadi Haqil, United Arab Emirates. – *Arabian Journal of Geosciences*, 9, 17: 689.

V17 CHINA MOBILITY between Institute of Geology of the Czech Academy of Sciences and Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences: **Integrated biostratigraphic and magnetostratigraphic correlation of the Jurassic-Cretaceous boundary in marine and non-marine sequences: contribution to global boundary definition** (G. Li, J. Sha, H. Zhang, Department of Invertebrate Paleontology, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences; X. Wan, School of Earth Sciences and Resources, China University of Geosciences (Beijing); *P. Schnabl*, *P. Pruner*, *G. Kletetschka* & *Š. Kdýr*; internal code 4068, supported by the Ministry of Education, Youth and Sports of the Czech Republic project No. 8H17050; 2017–2018)

The principal aim the project is to supplement and evaluate data for the global definition of the Jurassic-Cretaceous (J/K) boundary by integrating magnetostratigraphy, biostratigraphy and sedimentology, and to obtain the most accurate high-resolution stratigraphy with a high potential for multi-proxy correlation of selected marine and non-marine sections earlier studied in other regions. The data will be used to create an integrated stratigraphic database. Research is carried out in cooperation with the Berriasian Working Group (International Subcommission on Cretaceous Stratigraphy) and thus contributes to the definition of the J/K boundary, which remains the last system boundary without global stratotype (GSSP). Cooperation between the Czech and Chinese groups will help to compare palaeoecological conditions between these distant areas. The results will be presented during the Berriasian Working Group meeting in 2018, which will be held in the town of Kroměříž.

J/K boundary sections in western Liaoning and in Moravia were compared. Western Liaoning is famous for its Lower Cretaceous non-marine units (and fossils) including the Tuchengzi Formation. These strata contain volcanic material which is actively being used for radiometric dating. Current palaeomagnetic and magnetostratigraphic investigation should increase the precision of interpretations of the J/K time interval. The Štramberk Limestone formed in the northernmost margin of European Tethys. The rocks are of shallow marine origin with reef fauna. At some places farther from the J/K boundary interval, ammonite species comparable with fauna of the boreal regions can be found. The Kurovice section lies 70 km south of the town of Štramberk and consists of normal marine Tethyan carbonate sediments. Microscopic biota (especially calpionellids, nannoplankton, palynomorphs) is abundant in the sections. Shark teeth and ichnofossils can be also found. High-resolution stratigraphy at these localities allows a comparison and correlation with the sections in Liaoning.

Project of Joint Institute for Nuclear Research, Dubna, Russia, No. 04-4-1121-2015/2020: **Investigations of condensed matter by modern neutron scattering methods** (T. I. Ivankina, Joint Institute for Nuclear Research, Frank Laboratory of Neutron Physics, Dubna, Russia & *T. Lokajíček*; 2015–2020)

Subproject 1: Comprehensive analysis of the lithosphere elastic anisotropy and properties of lithosphere materials using neutron diffraction and ultrasonic sounding. Surface seismic measurements in the field at a rock outcrop (peridotite) and laboratory high-frequency seismic measurements of spherical rock samples were carried out. Both the field and the laboratory velocities of P- and S-waves were determined using the pulse-transmission technique. Special conditions at the field site enabled multi-directional measurement in three mutually orthogonal planes. The anisotropy of seismic P- and S-wave propagation was estimated. Special measurements using neutron diffraction were carried out making it possible to establish the influence of mineral crystallographic preferred orientations (CPOs) of a bulk-rock sample on elastic wave propagation and its anisotropy. It was determined that the deep peridotite rocks exhibit weak anisotropy. A good directional correspondence for different seismic waves (field/laboratory) even for 3D velocity calculated based on neutron diffraction was found. Seismic anisotropy of the Tambo gneiss from Central Alps has been assessed with two different ultrasonic methods and texture based self-consistent modelling. Stiffness coefficients for Tambo gneiss were obtained without making any assumptions about sample symmetry by inverting ultrasonic wave velocities data at pressures of 0.1 and 100 MPa, and from the self-consistent averaging that relied on measured mineral composition, textures and microstructures. The deviations of the symmetry of elastic properties of the Tambo gneiss from transversely isotropic could only be recorded with the experiment on the sphere, though this method currently has pressure limitations for S-wave velocities measurements. The limited pressure range should be expanded to record intrinsic anisotropy of rocks in Earth's interior. Also, in the future it may become possible to measure S velocities in arbitrary directions on the sphere to properly account for polarization. The microstructure-based modelling of the elastic properties of the Tambo gneiss reproduced results of ultrasonic measurements at increased pressures. A comparison of symmetries of measured and modelled velocity distributions lead to the conclusion that at a pressure of 100 MPa two systems of cracks should be present in the model to match measured velocity distributions. It is evidence that systems of low-aspect ratio cracks or pores could still be present in metamorphic rocks in the Earth's crust at depths corresponding to 100 MPa pressure (~3–4 km).

Subproject 2: Elastic anisotropy of layered rocks: ultrasonic measurements and texture-based theoretical predictions. We performed experimental and theoretical studies on a highly anisotropic layered gneiss rock sample characterized by alternating layers of biotite, muscovite and sillimanite, and plagioclase and quartz, respectively. We applied two different experimental methods for the determination of seismic anisotropy at pressures up to 400 MPa: (1) measurements of *P*-wave ray velocities on a sphere in 132 directions, and (2) complementary measurements of *P*- and *S*-wave phase velocities on a cube in three orthogonal directions. The combination of the spatial distribution of *P*-wave velocity on a sphere with *S*-wave velocities of three orthogonal structural directions on a cube allowed to calculate the bulk elastic moduli of the anisotropic rock sample. Based on the crystallographic preferred orientations (CPOs) of major minerals obtained by time-of-flight neutron diffraction goniometry, effective media modeling was performed using different inclusion methods and averaging procedures. The implementation of a nonlinear approximation of the *P*-wave velocity-pressure relation was applied for estimation of mineral skeleton properties and orientation distribution of microcracks. The comparison of theoretical calculations of elastic properties of mineral skeleton with those derived from the nonlinear approximation showed discrepancies in elastic moduli and *P*-wave velocities of about 10 %. The observed discrepancies between the effective media modeling and ultrasonic velocity data are a consequence of the inhomogeneous structure of the sample and followed by incompetence of long-wave approximation. Furthermore, the differences between elastic moduli predicted by the different theoretical models, including specific fabric characteristics such as crystallographic texture, grain shape and layering, are almost negligible. It is shown that the bulk elastic anisotropy of the sample is basically controlled by the crystal preferred orientation (CPO) of biotite and muscovite and their volume proportions in the layers dominated by the phyllosicate minerals.

4b. Czech Science Foundation

Finsished Projects

No. 13-13967S: **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 in Prague; Z. Weishauptová, I. Sýkorová, M. Švábová, Czech Acad Sci, Inst Rock Struct & Mech, Prague; L. Zamrazilová, Academy of Fine Arts, Prague & *T. Lokajíček*; 2013–2017)

Brittle character of damage to porous natural stone from various physical/mechanical weathering processes and the possible link between some rock mechanical characteristics and durability are the basis for the research project the results of which are presented below. To meet the main research goals and to verify working hypothesis on the direct effect of rock mechanical properties on durability, the following major achievements were reached: (1) formulation, testing, and verification of the procedure for the determination of critical stress/strain thresholds during uniaxial compression, which might affect estimates of durability; (2) detection of the relevant part(s) of stress-strain behaviour that reflect the same microstructural changes (formation of mode I – i. e. tensile microcracks) as those accompanying material damage due to major physical weathering processes (e. g., freezing/thawing, wetting/drying, salt crystallization, etc.); (3) definition and computation of energetic parameters from relevant parts of stress-strain diagrams as measures of material's resistance to brittle damage, and (4) testing of wide range of materials (different types of natural stone) and verification of our approach for materials from various heritage objects.

The experimental approach in durability prognosis from laboratory rock mechanical data is based on recording of stress-strain in uniaxial compression and on the computation of energetic parameters of deformational process. In contrast to previous studies published, e. g., for various biomaterials, lateral strains and energetic parameters related to the resistance in the formation of mode I – tensile microcracks seem to be more appropriate than energetic parameters computed from the axial part of stress-strain behaviour. The key point in the interpretation of stress-strain curves is the detection of "crack initiation stress-strain threshold", i. e. the level of stress (or strain) at which the brittle material subjected to uniaxial stress conditions starts to develop new "axial microcracks" (microcracks parallel to the applied load). Based on the research program conducted in this study, it is advised to use lateral strain in uniaxial compression instead of axial strain in uniaxial tension. The main reason for this is the fact that porous brittle materials such as natural stone hardly exhibit any clearly detectable elastic part in uniaxial tension; therefore it is unrealistic to satisfactorily detect "crack initiation stress-strain threshold" in such a test. The results obtained from the extensive laboratory tests proved that durability assessment of porous natural stone can be done from the detailed analysis of selected parts of stress-strain curves. The major advantages of the current approach are: (1) the use of the experimental rock mechanical test during which tested specimens are affected by stresses of similar magnitude and orientation as those acting in natural conditions, and (2) obtaining of experimental data (stress-strain curves) that reflect microstructural changes of the material of the same nature as in-situ and which can be used for computation of parameters (moduli) being absolute measures of material's mechanical resistance.

Along with the above mentioned major results, the following outputs were achieved. The sequence of laboratory investigations and analytical procedures was set, allowing a precise petrographic study and classification of some rocks under study. This specifically concerns silicites (opuka stone) for which modern classification is still missing. The complex procedure consists from series of microscopic examinations (optical microscopy, cathodoluminescence, scanning electron microscopy with energy dispersive microanalysis and X-ray elemental mapping for quantitative analysis of extremely fine-grained material) followed with image analysis (for modal and rock microfabric analysis) and X-ray diffraction of insoluble matter (part of phase analysis). The novelty of our approach in silicite classification is in recognition of importance of intra- and extrabasinal components, and of rockforming minerals related to the cementation phase of the rock. The obtained data are correlated with experimentally derived mechanical properties and durability parameters supplemented with accelerated decay test in a climatic chamber.

Porosimetric data were used for a textural analysis of the pore space and for the interpretation of durability by various durability indices. From the analysis of the obtained data and their correlation to other durability tests, it seems that macropores and part of mesopores (following the classification of IUPAC 1976) are the most critical ones in terms of resistance to weathering, specifically due to their role in the mode of retention of water in pore space. This aspect has been discussed in detail by Přikryl (2013). Our recent understanding on the importance of rock mechanical behavior on durability of porous natural stone was also employed for the interpretation of a long-term field measurements of a real object – a natural monument (Pravčice Rock Arch) – composed of very low-strength sandstone. Very low residual strength, rock microstructure, and modes of its loading in different parts (compression, tension, bending, and torsion) are key factors contributing to the long-term stability of the arch, which itself exhibits very complex long-term behaviour in rock mass movement and mechanical stability (Vařilová *et al*. 2015).

A part of research activities focused on the usefulness of non-destructive characterisation of test specimens by ultrasonic sounding (both P- and S-waves), recording of full waveforms, and analysis of temporal and spatial attenuation. Based on the analysis of results, elastic wave attenuation cannot be solely used as single parameter for durability prediction (as was reported by some previous studies), and other factors such as lithology, mineralogical composition, and specifically physical/mechanical properties must be considered as well. The basic principle of full waveform analysis has been employed during the evaluation of experimental measurements of spherical rock specimens tested for P- and S-wave propagation. The full stiffness tensor of the sample and its changes with acting hydrostatic pressure were calculated from these data. For low-porosity rocks, the data were also used for computation of 3D distribution of pore space (flat microcracks); however, for high-porosity rocks the procedure of specimen preparation must be further developed in order to find solution how to protect pore space from hydrostatic media.

IVANKINA T. I., ZEL I. Y., *LOKAJÍČEK T.*, KERN H., LOBANOV K. V. & ZHARIKOV A. V. (2017): Elastic anisotropy of layered rocks: Ultrasonic measurements of plagioclase-biotite-muscovite (sillimanite) gneiss versus texture-based theoretical predictions (effective media modeling). – *Tectonophysics,* 712/713: 82–94.

KRUTILOVÁ K. & *PŘIKRYL R*. (2017): Relationship between Polished Stone Value (PSV) and Nordic abrasion value (AN) of volcanic rocks. – *Bulletin of Engineering Geology and the Environment*, 76, 1: 85–99.

LOKAJÍČEK T., KERN H., *SVITEK T.* & IVANKINA T. I. (2014): 3D velocity distribution of P- and S-waves in a biotite gneiss, measured in oil as the pressure medium: Comparison with velocity measurements in a multi-anvil pressure pparatus and with texture-based calculated data. – *Physics of the Earth and Planetary Interiors*, 241: 1–15.

LOKAJÍČEK T. & *SVITEK T.* (2015): Laboratory approach to the study of elastic anisotropy in spheres by simultaneous longitudinal and transverse sounding under confining pressure. – *Ultrasonics*, 56: 294–302.

LOKAJÍČEK T., *SVITEK T.***,** KERN H. & WENK H.-R. (2017): Rock Elastic Anisotropy Study by X-ray Synchrotron, Neutron Diffraction and Ultrasonic Methods. – *Procedia Engineering,* 191: 467–475.

PŘIKRYL R. (2013): Durability assessment of natural stone. – *Quarterly Journal of Engineering Geology and Hydrogeology*, 46: 377–390.

SVITEK T., VAVRYČUK V., *LOKAJÍČEK T.* & *PETRUŽÁLEK M.* (2014): Determination of elastic anisotropy of rocks from P- and P-wave velocities: Numerical modeling and lab measurements. – *GEOPHYSICAL JOURNAL INTERNATIONAL*, 199, 3: 1682–1697.

VAŘILOVÁ Z., PŘIKRYL R. & ZVELEBIL J. (2015): Factors and processes in deterioration of a sandstone rock form (Pravčická brána Arch, Bohemian Switzerland NP, Czech Republic). – *Zeitschrift für Geomorphologie*, N. F., 59, 1: 81–101.

VASIN R. N., KERN H., *LOKAJÍČEK T.*, *SVITEK T.***,** LEHMANN E., MANNES D. C., CHAOUCHE M. & WENK H.-R. (2017): Elastic anisotropy of Tambo gneiss from Promontogno, Switzerland: a comparison of crystal orientation and microstructure-based modelling and experimental measurements. – *Geophysical Journal International,* 209, 1: 1–20.

VILHELM J., IVANKINA T., *LOKAJÍČEK T.* & *RUDAJEV V.* (2016): Comparison of laboratory and field measurements of P and S wave velocities of a peridotite rock. – *International Journal of Rock Mechanics and Mining Sciences*, 88: 235–241.

ZEL I. Y., IVANKINA T. I., LEVIN D. M. & *LOKAJÍČEK T.* (2016): P-wave ray velocities and the inverse acoustic problem for anisotropic media. – *Crystallography Reports*, 61, 4: 633–639.

Ongoing Projects

No. 16-00800S: **Reference climate curve for the beginning of the Miocene Climatic Optimum in Central Europe** (T. Matys Grygar, M. Fáměra, M. Hošek, M. Martinez, K. Mach, Czech Acad Sci, Inst Inorg Chem, Prague; *P. Schnabl*, *P. Pruner*, *T. Elbra*, *K. Čížková* & *Š. Kdýr*; 2016–2018)

The drill coring schedule by the VODAMIN project was not adhered to in 2017 (with no chance for us to affect that delay), which was perfectly substituted by drill cores provided by mining companies (in higher numbers than planned in the project). Definitely, the number of samples for laboratory analyses was more than sufficient to achieve the project goals. The drill were subjected to rock magnetic/polarity analyses, element analysis, and cation exchange capacity determination as planned.

Sampling and analyses: We finished processing of core LB432 sampled in 2016 (in sum 432 samples for element analysis using X-ray fluorescence (XRF) and 189 samples for analysis of cation exchange capacity (CEC). Measurement settings for the XRF analysis were considerably improved in 2017. We sampled and analysed new cores OS17 (140 m, 650 samples for XRF and 131 samples for CEC) and DO565 (106 m, 433 samples for XRF and 105 samples for CEC), both provided by the North Bohemian Mines company, and AL505 provided by the Czech Coal company (105 m, 459 samples for XRF, analyses will continue in 2018). Rock magnetic analyses in 2017 included AF demagnetization and anisotropy of magnetic susceptibility in 231 samples from OS17, 142 samples from DO565, and 140 samples from AL505. Polarity analysis was finished for OS17 and will be finished for DO565 and AL505 during the production of this report.

Interpretation of results: We confirmed the age model published in 2014 (valid for the Bílina Mine area and 17.4–16.6 Ma) and extended it in time (now 17.8–15.9 Ma). We provisionally dated LB432 to 18.5–18.0 Ma, which must be confirmed by a special drill core in 2018. We also spatially extended the chemostratigraphic correlation scheme by including the cores from Ústí nad Labem and Háj u Duchcova. These works started in 2016 and their results were published in 2017.

The biggest achievement of 2017 was the successful correlation of our record from the Most Basin with (1) calculated eccentricity and caloric precession curves (astronomical solution) for the target time interval, and (2) $\delta^{13}C$ and $\delta^{18}O$ curves (marine sediments, standard isotope stratigraphy) for the target time interval from detailed data published in 2016 and 2017. This correlation work will be a part of a manuscript to be submitted in 2018.

In 2017 we recognized a possible imprecision in the ASTNTS2012 polarity timescale for the lower Miocene (the most widely used Neogene timescale). We have tested the hypotheses that (1) the polarity timescale published by Kochhann *et al*. (2016) is better fitting the Most Basin geochemical record than ATNTS2012, and (2) that the Most Basin sedimentary record is of sufficient quality to prove this. That work required more spectral analyses (analyses of orbital forcing) and particular care to the quality of our datasets and correctness of the core correlation because the misfit occurred in the early stages of the basin filling by clastics, i. e. an interval of possible tectonic/paleogeographic disturbances.

KOCHHANN K. G. D., HOLBOURN A., KUHNT W., CHANNELL J. E.T., LYLE M., SHACKFORD J. K., WILKENS R. H. & ANDERSEN N. (2016): Eccentricity pacing of eastern equatorial Pacific carbonate dissolution cycles during the Miocene Climatic Optimum. – *Paleoceanography*, 31, 9: 1176–1192

MATYS GRYGAR T., HOŠEK M., MACH K., *SCHNABL P.* & MARTINEZ M. (2017): Climatic instability before the Miocene Climatic Optimum reflected in a Central European lacustrine record from the Most Basin in a Central European lacustrine record from the Most Basin in the Czech Republic. – *Palaeogeography, Palaeoclimatology, Palaeoecology*, 485: 930–945.

MATYS GRYGAR T., MACH K., HOŠEK M., *SCHNABL P.*, MARTINEZ M. & KOUBOVÁ M. (2017): Early stages of clastic deposition in the Most Basin (Ohre Rift, Czech Republic, Early Miocene): timing and possible controls. – *Bulletin of Geosciences*, 92, 3: 337–355.

NO. 16-03950S: **Solid body fracturing mode by shear-tensile source model: acoustic emission laboratory study** (*T. Lokajíček*, *M. Petružálek*, *T. Svitek*; J. Šílený, Z. Jechumtálová, P. Kolář & P. Adamová, Czech Acad Sci, Inst Geophys, Prague; 2016–2018)

Two kinds of data sets for four different granitic rock types with different size of grains were measured and evaluated in 2017. The first measurements were obtained on quasi-cubic samples which were heated up to 100 °C, 200 °C, 400 °C, 600 °C, 800 °C and 1,000 °C. After each heating cycle, every sample was measured in several directions by ultrasonic P and S waves to evaluate changes in their velocities and potential shear wave splitting as a consequence of cracks improvement caused by rising temperature. These data served as a trial to evaluate to what temperature can we heat individual materials in order to be able to prepare spherical samples that were supposed to be tested under the confining pressures up to 400 MPa. The set of spherical samples consists of the same four rock types; four spherical samples were prepared from each material. Samples named A, B, C, D were heated up to 100 °C, 200 °C, 400 °C and 600 °C, respectively. The logic of the heating process was as follows: samples A, B, C, D heated up to 100 °C, sample A measured up to 400 MPa, samples B, C and D measured only at 5 MPa. Samples B, C, D heated up to 200 °C, sample B measured up to 400 MPa, samples C and D measured only at 5 MPa. Samples C, D heated up to 400 °C, sample C measured up to 400 MPa, sample D measured only at 5 MPa. Sample D heated up to 600 °C and measured up to 400 MPa. A detail ultrasonic sounding of spherical samples with increasing pressure up to 400 MPa was performed to describe thermally induced microcrack systems. The pre-heated specimens (200 °C, 400 °C and 600 °C) of four granitic rocks were tested. The experimental data were processed and are ready to be published. Uniaxial loading experiments were performed with AE monitoring on the set of 4 granitic rocks of different grain size. The experimental results, measured on preheated specimens (200 °C, 400 °C and 600 °C), are currently being processed to determine the influence of microcrack density on the fracturing. When the fracturing localizes around failure plane, the orientation of shear AE source types should in general correlate with the orientation of this plane. Only in the rare cases the uniaxial loading of isotropic specimens results in the formationof a single failure plane. To predispose the single failure plane, a specimen with preexisted crack, anisotropic (foliation) rock material or asymmetric loading will be used. These experiments are planned to evaluate the validity of the acoustic emission source mechanism models (moment tensor and shear-tensile crack). This point has been moved from the 2017 plan due to time-consuming experimental and data processing work. The specimens for laboratory testing were prepared. A significant influence was found of the near field zone on the determination of source-type mechanism measured on standard-size specimens (5 cm diameter, 10 cm long). To test the near field effect, large scale specimens (10 cm diameter, 20 cm long) were manufactured. The specimens will be uniaxially loaded in the same experimental setup as the already tested standard-size specimens. However, due to time-demanding data processing of experimental results, this point may not be finished in 2018. Sample processing of acoustic emission (AE) data from a uniaxial compression test with a Westerly granite specimen was performed, aimed to demonstrate capabilities of two alternative processing methods and two alternative source models. The two methods were designed to yield different levels of detail of the processing: (i) the basic one including the mechanism and optionally a rough estimate of its uncertainty by noise contamination trials, and (ii) the detailed one incorporating the construction of probabilistic confidence regions. The former approach is suitable for a quick, possibly online processing providing an early but rough insight into the sample fracturing, the latter yields a detailed ex-post information. The two source models are (1) the traditional unconstrained moment tensor (MT), and (2) one type of its constraint, namely Shear-Tensile Crack (STC). Performing a parallel evaluation, we demonstrated that the STC is much more prospective for the AE data processing, as it yielded markedly smaller confidence regions for both the orientation of the mechanism and its decomposition, i. e. a more certain information on the rock sample fracturing. As compared to the MT, the STC proved to be a more reliable source mechanism model for AE data.

16-09979S: **Integrated multi-proxy study of the Jurassic-Cretaceous boundary in marine sequences: contribution to global boundary definition** (*P. Pruner*, *P. Schnabl*, *T. Elbra, K. Čížková*, *J. Hladil, A. Svobodová*; M. Košťák, M. Mazuch, Faculty of Science, Charles University, Prague; P. Skupien, Institute of Geological Engineering, Faculty of Mining and Geology, VŠB-TU Ostrava; M. Bubík & L. Švábenická, Czech Geological Survey, Prague; 2016–2018)

We studied, evaluated and integrated paleomagnetic, rock-magnetic, magneto- and biostratigraphic methods, geochemistry and sedimentology methods from different localities at the Jurassic-Cretaceous (J/K) boundary. Several field campaigns to Czech (Kurovice, Štramberk, Vigantice), French (e. g., St Bertrand, Tre Maroua, Belvedere) and U. K. (e. g., Swanage, Peveril Point, Chief Beef, Portland, Jordans, Bowers, Fresh Water Bay) localities were completed in 2017. Additionally, a new locality in Slovakia (Snežnica) was sampled. The main focus of the paleomagnetic team of the Institute was devoted to rock-magnetic and paleomagnetic measurements of samples from Czech, French and Ukrainian localities. The results of these measurements helped to produce new magnetostratigraphic charts. Magnetostratigraphy of the Kurovice site indicates six normal/reversed polarity sequences; possibly representing ages between the early Tithonian (M21n) and late early Berriasian (to M17r). The studied samples revealed very low remanent magnetization (NRM) and susceptibility (MS). Acquisition of the NRM suggests the presence of weak (magnetite) and strong (goethite or hematite) coercivity fractions. The preliminary Tithonian/Berriasian mean paleomagnetic direction from the Kurovice section (Fig. 4) is counterclockwise rotated if compared with the expected European reference directions by about 150° and is in agreement with that obtained from the Brodno section. Conversely, a clockwise rotation was recorded from the Tatra Mountains in Poland. Inclination of paleomagnetic directions around the J/K boundary from Western Carpathians are in good agreement (44–49°N) which indicates a 26–30°N paleolatitude. The rotations were interpreted as the result of tectonic escape of the Western Carpathians from the domain of the Alpine collision. Magnetostratigraphy was correlated with calpionellid, dinocyst and nannofossil biostratigraphy.

■ **Fig. 4.** The Kurovice locality with indicated J/K boundary. Photo by K. Čížková.

Three sections in the Vocontian basin were studied for magnetostratigraphy and biostratigraphy: Le Chouet, Belvedere (Haute Beaume) and St Bertrand Spring. Magnetostratigraphy of the St Bertrand section documents three normal/reversed polarity zones which have upper Tithonian (M19r) to middle Berriasian (M17n) ages. Magnetic susceptibility shows an increasing trend from the Tithonian to the Berriasian, contrary to other Tethyan sections. Based on rock-magnetic measurements, magnetite is shown to be the main magnetic mineral and carrier of characteristic remanence components throughout the sequence. Goethite and/or traces of hematite are also found. New data obtained within this study, in combination with biostratigraphy (4 major markers of the J/K boundary: magnetostratigraphy, calpionellids, nannoplankton, and ammonites), give new insights into the J/K boundary in the Vocontian Basin and, this way, contribute to the dataset for the definition of a global J/K boundary. All the sections show magnetostratigraphic normal and reverse polarity zones. The base of the *C. alpina* zone and the FAD of *Nannoconus wintereri* fall within a normal polarity zone, thus identified as M19n. The span of the studied sections is: (i) M19n to M17r (Intermedia to Ferasini Subzones) for Belvedere; (ii) M19n to M17n (Intermedia to Elliptica Subzones) for St Bertrand Spring, and (iii) M20n to M19n (Remanei to Alpina Subzones) for Le Chouet. MS shows negative values due to the dominance of diamagnetic calcium carbonate. However, MS values slightly increase in the upper interval (in M17r), which is probably caused by an increase of terrigeneous material.

The team of the *Faculty of Science, Charles University* sampled more than 230 additional probes of carbonates (Kurovice) for the stable isotope analysis ($\delta^{13}C$ and $\delta^{18}O$), thin sections and for dissolving in acid (macro- and meso-fauna record). Diversificated belemnites as well as new rhyncholite and elasmobranch fauna were systematically (using SEM and optical microscope imaging) and biostratigraphically evaluated and correlated with calpionellid zonation and stable isotope curves in the J/K boundary interval. About 60 carbonate samples were used for establishing $\delta^{13}C$ and $\delta^{18}O$ isotope values and micropalaeontological study. These samples were taken from the extended lower part of the Kurovice Quarry section. A total of 45 belemnite rostra from the J/K boundary of Štramberk interval were taxonomically evaluated, analysed ($^{87}Sr/^{86}Sr$) and prepared for $\delta^{18}O$ analysis. Additionaly, 17 belemnite rostra (collected by geophysical team) from Velikij Kamenets (Ukraine) were used for polished thin sections and are currently prepared for the $^{87}Sr/^{86}Sr$ and $\delta^{13}C$ and $\delta^{18}O$ analyses. Pilot belemnite records from a new locality of Snežnica are prepared for preliminary stable isotope analysis.

The team of the *VŠB-Technical University* focused on fieldwork at the sites of Bruzovice, Štramberk and Snežnica (near Žilina city). The section (thickness of 50 m) at Snežnica near Žilina was documented in detail with collection samples for noncalcareous dinoflagellate cysts. A correlation of ammonites deposited in museums and recently collected in the Kotouč Quarry with microfossil content was prepared in cooperation with D. Reháková (Bratislava, Slovakia; Vašíček *et al*. 2017). Current knowledge of the ammonite association from the Štramberk Limestone in the Kotouč Quarry was summarized by Vašíček & Skupien (2017). A study of limestones from the Silesian Unit wascompleted in a new section at Bruzovice near Frýdek Místek. The limestones represent deep-water sedimentation around Jurassic/Cretaceous boundary (Skupien *et al*. 2016). The section allows a correlation of calpionellids and non-calcareous dinoflagellate cysts. Laboratory work comprised palynological maceration of next 25 samples of marlstones from the Kurovice Quarry. Preliminary results show a low content of organic matter and determinable pollen, spores and non-calcareous dinoflagellate cysts.

The *Czech Geological Survey* team finished field documentation (lithological log) of the J/K Kurovice section. The final log represents a thickness of 77 m and comprises 177 beds of marlstones and limestones. The additional J/K section 26 m thick but tectonically disturbed was measured in a distant part of the Kurovice Quarry. Other known occurrences of the Kurovice Formation in the Western Carpathians (Vigantice, Na Tesáku) were studied for comparison with the Kurovice section to achieve better understanding of their paleogeographic relations. Micropaleontological work on the Kurovice section samples included calcareous nannofossil study and interpretation, picking of foraminifers from acetolytic residues and documentation of foraminifers and radiolarians in thin sections.

SKUPIEN P., RYBA J. & DOUPOVCOVÁ P. (2016): The study of deep marine sediments of Jurrasic and Cretaceous boundary interval on Bruzovice profile. – *Geoscience Research Reports*, 49: 209–213.

VAŠÍČEK Z., REHÁKOVÁ D. & SKUPIEN P. (2017): Some perisphinctoid ammonites of the Štramberk Limestone and their dating with associated microfossils (Tithonian to Lower Berriasian, Outer Western Carpathians, Czech Republic). – *Geologica Carpathica*, 68, 6: 583–605.

No. 16-14762S: **Mercury and methylmercury in surface waters and soils at two sites with contrasting deposition histories** (*T. Navrátil*, *J. Rohovec*, *Š. Matoušková*, *I. Dobešová, S. Hubičková*, *T. Nováková* & *M. Roll*; 2016–2018)

According to the project schedule, bulk precipitation data were collected at sampling sites of Plešné jezero (PL; Fig. 5) and Červík catchment (CER). Mercury concentrations in the bulk precipitation at these sites averaged at 2.7 and 2.8 $ng \cdot L^{-1}$. The reference site of Lesní potok (LES) was characterized by mean concentration of 5.2 $ng \cdot L^{-1}$ in wet precipitation over the same period (Navrátil *et al.* 2017b). Higher Hg concentrations in bulk precipitation at LES, with respect to more remote and mountainous sites of PL and CER, result from lower precipitation amounts and a higher number of emission sources nearby. The mean concentrations from other studied sites such as Načetín (NAC) and the Bohemian Switzerland National Park (NPCS) with mean Hg 4.7 and 2.1 $ng \cdot L^{-1}$, respectively, in wet precipitation indicate that the differences between Hg in wet deposition at the individual sites were not high. Summary of data on Hg in bulk precipitation and related deposition fluxes from this small network can provide a base for a publication because the data on Hg deposition in the Czech Republic and/or in Central Europe are lacking. The calculated wet deposition Hg fluxes ranged from 2.6 to 4.9 $\mu g \cdot m^{-2}$.

Major pathway for Hg to forest ecosystems was the dry deposition through litterfall, which usually represents more than 80 % of the total Hg deposition flux. This notion was confirmed by up-to-date results from the sites of CER, LES, PL and CT. The litterfall fluxes from these sites, ranging from 15 to 55 µg·m^{-2}, were nearly one order of magnitude greater than Hg wet deposition fluxes (Navrátil *et al.* 2017a). Infestation and subsequent forest death such as at PL lake catchment in 2004 may increase the litterfall flux for a short period of time by an order of magnitude up to 350 µg·m^{-2}. At the same time an analysis of archive litterfall samples from the sites of PL and CT showed a significant (20 to 75 %) decrease in Hg in the period from 2003 to 2015. These findings, together with the distribution of Hg concentration within the individual litterfall components, represent a solid base for publication in 2018. The litterfall data from the sites of CER, LES and NAC will represent necessary background for comparison. Importance of the decrease in Hg deposition indicates that the changes in Hg emissions directly affecting atmospheric Hg are reprinted very rapidly into the litterfall. Thus we decided to make an attempt to estimate changes in atmospheric Hg in history by analyzing tree rings of larch trees. The trend of Hg concentration variations from larch tree rings will serve as a scenario of changes for the model.

■ **Fig. 5.** Bulk precipitation sampler installed at Plešné Lake catchment in year 2016. Photo by T Navrátil.

Streamwater Hg concentrations have been determined by DOC concentration. Mercury concentrations in lake and stream water at all the studied sites ranged from 0.7 to 21.1 ng·L^{-1}. The present results indicate that streamwater Hg was not significantly different with contrasting Hg deposition levels at PL and CER. Therefore, mercury release from soil is the governing process of Hg output from forest ecosystems at contrasting sites. We focused on the analysis of Hg trends in stream water at PL but two years of measurement are not sufficient to make solid conclusions due to the strong effects of seasonal patterns on stream chemistry. In contrast, Hg concentration in PL lake water decreased significantly during years 2016 and 2017. Identification of the precise reasons of this decrease will be one of our further tasks. Suboxic parts of the water column of both PL and CT lakes were characterized by elevated Hg and MeHg concentrations during the anoxia.

NAVRÁTIL T., *ROHOVEC J.*, *MATOUŠKOVÁ Š.*, *NOVÁKOVÁ T.*, KOPÁČEK J. & KAŇA J. (2017a): Mercury distribution and fluxes in the central European mountainous lake ecosystem severely damaged by the bark beetle infestation. – *The 13th International Conference on Mercury as a Global Pollutant (ICMGP)*, July 16-21, 2017, *Abstract Volume WO-053*: 107. Providence.

NAVRÁTIL T., ŠIMEČEK M., SHANLEY J. B., *ROHOVEC J.*, *HOJDOVÁ M.* & HOUŠKA J. (2017b): The history of mercury pollution near the Spolana chlor-alkali plant (Neratovice, Czech Republic) as recorded by Scots pine tree rings and other bioindicators. – *Science of the Total Environment*, 586: 1182–1192.

No. 16-15065S: **Factors affecting heavy metal accumulation in macrofungi** (P. Kotrba, T. Leonhardt, J. Sácký, V. Beneš, University of Chemistry and Technology, Prague; *J. Borovička & A. Žigová*; 2016–2018)

The problem of contrasting metal accumulation in *Amanita strobiliformis* was investigated at Klíčov and Jinonice sites in Prague. The first step in 2017 was focused on the distribution of mycelia of *A. strobiliformis* in the soil profile at both localities. DNA was extracted from lyophilized soil samples representing the soil profile below fruit-bodies at both sites (2 cm subhorizons to 30 cm depth). qRT-PCR with specific primers revealed that the mycelium of *A. strobiliformis* was mainly distributed in the topsoil (0–10 cm depth), with concentrations up to 250 µg dry mass per gram soil. We therefore focused on topsoils and collected 10 representative topsoil samples from each site and compared them thoroughly with respect to the extractability of metals (BCR extraction, 1M HCl extraction, 1M HNO_3 extraction, 1M thiourea extraction). Total element concentrations of metals (Ag, Cd, Cu, Pb, Zn) and Pb isotopic compositions were also measured in these soil samples. Total concentrations of Ag in topsoils at both Jinonice and Klíčov were generally below 0.7 mg·kg^{-1}. Significantly higher amounts ($p<0.01$) of Ag were extracted from Klíčov soils by all extractants. On the other hand, total Cu soil concentrations and extractable Cu were similar at both sites, with no significant difference. The Pb isotopic composition in 1M HNO_3 extract of the topsoil matched that of the sporocarps of *A. strobiliformis*. The present data on mycelium distribution in soil and the Pb isotopic fingerprints thus indicate that *A. strobiliformis* mainly accumulates metals from the topsoil. The higher levels of Ag in soils at Klíčov, followed by higher Ag extractability, may explain the higher levels of Ag in sporocarps from Klíčov. However, the higher accumulation of Cu in sporocarps from Klíčov (when compared to those from Jinonice) cannot be explained either by total Cu in soils or by its bioavailability.

For the purpose of investigation of metal accumulation in *Hebeloma mesophaeum*, organic and organomineral soils were collected at the study sites Řež near Prague and Lhota near Příbram. Concentrations of metals were measured in 1M HNO_3, 1M HCl, and 0.05M EDTA extracts. In the Ah soil horizon, the 112×, 116×, 8×, 263× and 13× enriched concentrations of Ag, Cd, Cu, Pb and Zn (respectively) were determined in the 1M HCl soil extracts from the polluted site at Lhota near Příbram.

The study of zinc accumulation in *Russula* species continued by data evaluation. According to the maximum likelihood phylogenetic analysis conducted in 2017 (involving 99 *Russula* species), one Zn-rich and two Zn-poor clades were identified. Zn-accumulating species are *R. atropurpurea*, *R. ochroleuca*, *R. viscida*, *R. pumila*, and *R. alnetorum*. Two American species belonging to this clade were also found to accumulate Zn: *Russula vinacea* and one unrecognized, possibly undescribed species, related to *R. atropurpurea*. *Russula* species with the lowest Zn accumulation ability belong to the sections *Nigricantinae* and *Compactae*.

Ten collections of *Cystoderma carcharias* from clean sites were analyzed for Ag, Cd, Cu, Pb, Zn, Se, and As. The concentrations were compared to those measured in collections from the smelter-polluted area at Lhota near Příbram. On the average, concentrations of the elements were 19×, 20×, 4×, 136×, 3×, 20×, and 28× higher in samples from the polluted area, respectively. As concentrations of arsenic were markedly elevated in samples from Lhota near Příbram, we also performed an analysis of arsenic species (conducted at University of Graz). The major As compound in *C. carcharias* was arsenobetaine, and arsenic speciation profile was similar in all collections, with no striking difference in samples from the polluted area. The isotopic composition of C and N conducted in 2017 in *Cystoderma* sporocarps from Lhota near Příbram supports the saprotrophic status of *C. carcharias*. We have therefore focused on the organic soil horizon Oe and compared the extractability of the selected elements by 1M HNO_3, 1M HCL and 0.05M EDTA. Bioaccumulation factors were calculated for particular sites. The Cd concentrations in *C. carcharias* reaching 600 $mg \cdot kg^{-1}$ are the highest ever found in mushrooms.

Phaeocollybia species are typically found in July/August in South Bohemia, Czech Republic, where we know their sites. Unfortunately, the growing season of 2017 was very dry at all sampling sites, which resulted in a low number of additional collections to be harvested. Preliminary analyses of our collections revealed unusual concentrations of Na (*P. lugubris* and others) and elevated levels of Cd and As (*P. jennyae*). *P. ardunnensis* could not be analyzed for the lack of material. Additional collections were sequenced and data also for RPB2 molecular marker were obtained. Despite the dry season, we collected a representative number of ectomycorrhizal mushrooms at the Malonty site: these will be used for a comparison with *Phaeocollybia* (C/N isotopic composition). According to preliminary results, the Pb isotopic fingerprints of *Phaeocollybia lugubris* fruit-bodies do not match those of rock-derived Pb but agree with those detected in organic topsoil which is the exact opposite of what we expected. This would mean that *Phaeocollybia lugubris* accumulates Pb from organic soil, despite its long rooting stipe.

No. 16-19459S: **Effect of gravity-induced stress on sandstone erosion: physical and numerical modelling** (J. Bruthans, Faculty of Science, Charles University, Prague; *M. Filippi* & J. Schweigstillová, Czech Acad Sci, Inst Rock Struct & Mech, Prague; 2016–2018)

According to the project schedule, advanced physical experiments of erosion of natural landforms were performed at the Střeleč Quarry (Bohemian Paradise). Application of water by different ways was found a useful tool for erosion experiments on locked sands and friable sandstone. These experiments resulted in spontaneous creation of various weathering forms (small-scale pillars, arches and arcades) known from nature. The process of forming, maturing and destruction of these artificial micro- and meso-scale forms helped to understand the natural long-term processes.

Detailed aerial photo-documentation performed by a drone device was another useful approach, used especially for the study of sandstone pillars in the Teplické Skály Rock City (Teplice-Adršpach area), Tisá Rock City and Prachov Rock City. Several hundreds of photos with a resolution better than 1 cm (vertical and inclined views) were obtained in each area. The photographs were processed by Agisoft and Blender software to obtain 3D shapes of the landforms. This was performed to compare obtained field data with numerical models and calculations (Plaxis 3D software) of gravity-induced stress.

To determine the effect of gravity-induced stress on weathering rate, sets of stainless steel frames were used. Using various settings, salt and frost weathering were performed in compression, and also in a slight tension. The obtained results are complex. In general, however, the weaker quartz-rich sandstone is strongly affected by stress-controlled weathering, while strongly cemented sandstone is less affected. The data have been processed and prepared for publication. Beside the above listed procedures, salt concentrations in leachates were measured in natural sandstone samples to identify the salts. In addition, porosimetry and mechanical properties were measured for selected samples obtained from different sandstone areas newly including the Berlin Cave area, Nelspruit, South Africa (Fig. 6).

A physically-based numerical model for sandstone disintegration by water action was developed. This model explains the effect of slaking and the change of Bishop effective stress control to disintegration process. The previously used numerical modelling was expanded from 2D to 3D using the Tochnog

■ **Fig. 6.** A mushroom rock (pedestal rock) formed in quartzites of the Berlin Cave area, Nelspruit, South Africa. Photo by M. Filippi.

Professional finite element software. The Plaxis 3D software was used to model the stress state in sandstone arches, arcades and other landforms during their evolution.

No. 16-21523S: **Changes of the Paratethys fish fauna during Oligocene to Lower Miocene – evidence on selected groups from sites in Moravia (Czech Republic)** (*T. Přikryl*; 2016–2018)

The Oligocene (Rupelian; regional stage Kiscellian) ichthyofauna from the Moravia region (Czech Republic) was described from several sites, such as Nikolčice, Mouchnice, Litenčice, Kelč, Špičky u Hranic na Moravě, Rožnov pod Radhoštěm etc. The assemblage is composed of abundant sharks (e. g., cetorhinids, odontaspids, lamnids, mitsukurinids, squalids, alopiids; Gregorová 2011, 2014) and teleosts (e. g., clupeids, argentinids, gonostomatids, phosichthyids, sternoptychids, mycthophids, centriscids, syngnathids, trachichthyids, merlucciids, zeids, brotulids, echeneids, trichiurids, scophthalmids, trachinids; e. g., Gregorová 1988, 2011, 2014; Přikryl, 2009, 2013). On the other hand, fauna from localities that represent a time interval close to the transition of Chattian to Aquitanian (regional stage Egerian) is far less diversified, represented by only one group of sharks (carcharhinids, Brzobohatý *et al*. 1975) and eleven groups of teleosts (clupeids, phosichthyids, ?myctophids, syngnathids, echeneids, merlucciids, caproids, leiognathids, ophidiids, trichiurids, gobioids; Jaroš 1936; Kalabis 1966; Brzobohatý *et al*. 1975; Gregorová 2014).

The works follow the plan and progress of the project, and first results can be briefly summarized as follows: 1. Oligocene fishes. (1a) The semi-articulated skeleton discovered at the Loučka locality represents the oldest record of toadfish (Batrachoidiformes, Batrachoididae). The new genus and species, named *Louckaichthys novosadi*, was described and published in the Bulletin of Geosciences (Přikryl & Carnevale 2017); (1b) Another type of toadfish was recently described from the Early Oligocene deposits of the Romania – the fossil is not complete and its early developmental stage prevents its precise species classification, but clearly represents a separate type from *Louckaichthys* *novosadi*. This result shows a much higher record and diversity of the toadfishes (based on skeletal record) within the Paratethys than previously expected. The result was accepted for publication in the Neues Jahrbuch fur Geologie und Paläontologie (Přikryl *et at*. 2018); (1c) Gonostomatid fishes represent an important group of deep-water fish assemblages. In the Eocene-Oligocene, they were represented mainly by extinct genera (e. g., *Scopeloides*), while the origin of the contemporary genus *Gonostoma* was expected during the Miocene. A detailed anatomical analysis and comparison of well-preserved specimens from Romanian parts of the Paratethys revealed the existence of the genus *Gonostoma* during the Oligocene (although probably not present in all parts of the Paratethys basin). The new species was named *Gonostoma dracula*, described and published in the Bulletin of Geosciences (Grădianu *et at*. 2017), and (1d) A single paracanthopterygian fossil specimen (a part and a counterpart) from the Kelč locality (preliminarily determined as trisopterid in the previous progress report) in fact represents a remain of the *Lotella*-like morid fish. As such, this record shows the distribution of the Moridae (represented by genus *Eophycis* in other parts of the Paratethys) in Moravia and an elevated diversity of gadiform fishes described from this region and time interval. The results were published in the Comptes Rendus Palevol (Přikryl 2018).

2. Miocene fishes. The locality of Vážany nad Litavou has been set as Burdigalian in age, which means a stratigraphically higher position than that of the Krumvíř locality. The locality provided the oldest known skeletal record of the genus *Gobius*. The results were published in the prestigious Journal of Systematic Palaeontology (Reichenbacher *et al*. 2018).

Ongoing research is carried out on other fish remains of selected groups from both time intervals before the final consideration of complex changes at the localities included in the project.

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PŘIKRYL T. (2018): A morid cod (Gadiformes, Moridae) from the early Oligocene deposits of the Czech Republic. – *Comptes Rendus Palevol*, 17, 8: 536–544.

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PŘIKRYL T., GRĂDIANU I., GEORGESCU V. & CARNEVALE G. (2018): A toadfish (Batrachoidiformes) from the Oligocene of the Eastern Carpathians (Piatra Neamt, Romania). – *Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen*, 287, 2: 241–248.

REICHENBACHER B., GREGOROVÁ R., HOLCOVÁ K., ŠANDA R., VUKIĆ J. & *PŘIKRYL T*. (2018): Discovery of the oldest *Gobius* (Teleostei, Gobiiformes) from a marine ecosystem of Early Miocene age. – *Journal of Systematic Palaeontology*, 16, 6: 493–513.

No. 17-03211S: **Coupled solid-phase speciation and isotopic record of thallium in soils: A novel insight into metal dynamics** (A. Vaněk, Czech University of Life Sciences, Prague; M. Mihaljevič, Faculty of Science, Charles University, Prague; *J. Rohovec*; 2017–2019)

In 2017, the activities of the Inst Geol, Czech Acad Sci (co-operating institution) concentrated on the development and verification of the method of thallium thermal desorption (TD; Vaněk *et al*. 2017). For this purpose, an experimental apparatus was further developed in order to reach the best reproducibility of experiments and recoveries of Tl species. Several model phases were studied to get a better insight into the behavior of Tl-bearing materials in the course of TD experiments (birnesite, calcite, illite, goethite, ferrihydrite and jarosite $KFe_3(OH)_6(SO_4)_2$ – all of them bearing Tl(I)). The studied samples of natural origin (sphalerite, pyrite and coal /Bogatynia, Poland/) arose from the field collection of the principal investigator. TD analyses were carried out in the temperature range of 25–850 °C in a dynamic atmosphere of synthetic air. In all cases, a desorption of Tl species was found. Thermal desorption of Tl from various samples occurred at characteristic temperatures, and the TD curves also differ in appearance. Consequently, thermal desorption could be applied for the identification of Tl bearing phases. Thallium release was quantitatively described by TD curves (dependences of Tl amount desorbed *vs.* temperature). TD curves were typical for (at least, groups) of mineral phases. Thermal desorption as a method offered required information regarding Tl speciation. This was demonstrated by comparing the TD record of mineral pyrite and TD of Bogatynia coal. The method of the TD experiment was adapted for collection of Tl samples for Tl isotopic ratios measurement.

VANĚK A., GRÖSSLOVÁ Z., MIHALJEVIČ M., ETTLER V., TRUBAČ J., TEPER L., CABALA J., *ROHOVEC J*.,

PENÍŽEK V., ZÁDOROVÁ T., PAVLŮ L., HOLUBÍK O., DRÁBEK O., NĚMEČEK K., HOUŠKA J. & ASH C. (2017): Tracing thallium contamination in soils using isotopes. – *Geophysical Research Abstracts*, 19 (19th *EGU General Assembly 2017, Vienna, April 23–28, 2017*): 2986-4. European Geosciences Union. Kaltenburg-Lindau.

17-06700S: **Přídolí Series in the Prague Synform – proposal for chronostratigraphic subdivision** (*L. Slavík*, *P. Štorch*; Š. Manda, Z. Tasáryová & P. Čáp, Czech Geological Survey, Prague; 2017–2019)

Several Pridolian sections were subjected to detailed multiproxy studies. Most of the 16 samples from the section in the Velkolom Čertovy schody Quarry near Koněprusy (VCS) contained conodont elements and the fauna was particularly rich in spathognathodontids – the most promising clade for prospective subdivision of the Přídolí Series. The inteval of 26 m includes also other biostratigraphic markers and conodont fauna will be of critical value for a comparison with other sections. Conodont fauna from the Požáry section – the Přídolí GSSP – is very promising and enabled the first basic conodont-based subdivision of the Přídolí Series. The relation of conodont zones with graptolite zones still has to be tested. The basic subdivision includes five units that will have to be formally defined. This basic subdivision and the ranges of the tentative index taxa will be compared with data from the VCS, Hvížďalka and other sections.

Detailed sampling through the lower and middle parts of the Přídolí Series at Hvížďalka section in the Radotín Valley was completed. A succession of the Požáry Formation, over 11 m thick, comprising black laminated calcareous shales interchanging with beds and lenses of laminated lime mudstones, was sampled bed by bed. Four graptolite biozones were recognized in the section studied. The whole succession was sampled for macroscopically visible fauna bed by bed. Graptolites and other fauna were collected from shale intervals and from several beds of graptolite-bearing, diagenetic lime mudstones. The material yielded several hundreds of prepared and determined graptolites. Along with the dominant pelagic graptolites (*Pristiograptus dubius* s.l., *Istrograptus transgrediens*, *Neocolonograptus ultimus*, *Neocolonograptus branikensis*, *Neocolonograptus lochkovensis*, *Monograptus bouceki*, *Monograptus perneri*, *Slovinograptus beatus* and *Linograptus posthumus*), less common dendroids, scyphocrinid columnals, ceratiocarids, rare nautiloids, brachiopods and bivalves were recorded. Cephalopods from the part collected during new fieldwork were also studied. The observed early ontogenetic development in an early nautilid and the disruptive colour pattern in oncocerids represent still unknown aspects of cephalopod faunas in the Přídolí. Previously collected faunal data were also evaluated in order to define faunal development across the Přídolí and identified possible important fossils for correlation to support a prospective subdivision of the Přídolí Series. Preliminary data show that faunas of lower (Stage 1) and middle/upper Přídolí (Stage 2) differ in several aspects. The FAD of cephalopod *Kopaninoceras fluminese* known from several areas (Bohemia, Sardinia, Florida and Spain) coincides with the FAD of *M. bouceki*.

17-10233S: **The oldest vascular land plants and palynomorphs from the Silurian-Lower Devonian of the Barrandian area, Czech Republic** (*J. Bek*, *M. Libertín*; P. Tonarová**,** Czech Geology Survey; J. Kvaček, National Museum, Prague & J. Pšenička, West-Bohemian Museum, Pilsen; 2017–2019)

The colonization of land by plants is an extremely important phase in Earth's life history. This key evolutionary process is thought to have started during the Ordovician and continued through the end of the Early Devonian interval (470–393 Ma) of the Palaeozoic Era. Newly recognized fossil cooksonioid plants with *in situ* spores from the Barrandian area, Czech Republic, reported here, are therefore of the highest importance because they represent the oldest known macrofossil evidence of land plant diploid generation – sporophytes (~432 Ma). The robust size of these plants places them among the largest known early polysporangiate land plants, and it is probable that they had attained adequate size for both aeration and effective photosynthetic competence. This would mean not only that they were photosynthetically autonomous, but that the sporophytes might have been able to sustain a relatively gametophyte-independent existence.

17-15700S: **Black shale formations as geochemical markers of paleoenvironmental changes and tectonic setting along active continental margins** (*L. Ackerman*, *M. Svojtka*, *E. Haluzová*, *J. Ďurišová*; J. Pašava, F. Veselovský, V. Erban, O. Šebek, Czech Geological Survey, Praha, Czech Republic; J. Žák, J. Hajná & J. Trubač, Faculty of Science, Charles University, Prague, Czech Republic; 2017–2019)

This new project combines tectonic and structural analysis with geochronology, major/trace and Os-Nd-Cr-Mo-S isotope geochemistry to unravel the influence of tectonic setting on the composition of black shale formations and explore their potential as stratigraphic markers in accretionary systems at convergent plate margins. Furthermore, the project contributes to better understanding of processes causing variable oxygen levels throughout the Earth's history, with a particular emphasis on the Neoproterozoic–Cambrian boundary associated with the Great Explosion of life on the Earth. The results for the first year of the project are summarized in the following paragraphs.

Fieldwork and sample acquisition. Preliminary screening of possible suitable outcrops resulted in sampling of 5 key sections from four different tectonic settings within the Teplá-Barrandian Unit (TBU; e. g., Jílové Belt, Blovice accretionary complex; Fig. 7). Such sample set was combined with the samples acquired from boreholes (e. g., Hromnice, Kamenec, Chynín) resulting in a complex sample collection with more than 150 samples of black shale, shale, greywacke and chert, which may represent different depositional environments. In addition, the field campaign was focused on the Teplá-Barrandian ocean-floor volcanic rocks (basalt, andesite) from 3 different belts acquiring more than 40 samples and detailed sampling of the Jílové volcanic arc (basalt, andesite, dacite, rhyolite) to provide constraints on the mantle sources and type of volcanism in the studied tectonic settings. Finally, the sampling strategy was also focused on cherts of variable composition, carbon amount and

■ **Fig. 7.** An outcrop of silicified black shale ("Lečice bed") near Břežany, south of Prague. Photo by M. Svojtka.

petrography throughout the TBU to reveal their nature and relationship to the associated sedimentary and volcanic rocks.

Major, TOC and trace element analyses and petrography of the TBU rocks. For all samples gathered within this project (201 samples), major element/TOC as well as trace element concentrations were determined. The analyses revealed a high variation of TOC in the sampled sedimentary sections (e. g., up to 4.6 wt. % in the Chynín borehole, southern part of TBU) and extensive silicification at some places (e. g., Jílové Belt setting). This is paralleled by a wide variation in redox-sensitive metal contents (e. g., Mo, Cr, V) with the highest values correlated with high TOC and S expressed by the overabundance of pyrite and/or pyrrhotite. Sets of polished and/or thin sections were prepared from all key sections and some other localities, and examined by optical microscopy with special emphasis to sulphides and different shale types.

Os-Mo-Cr-Fe-Cu-Zn isotopic analyses. A subset of 46 samples of metal-rich black shales and greywackes from sedimentary lithologies with (Hromnice, Kamenec) and without an input (Liblín) of volcanic material was selected for detailed Os-Cr-Cu-Zn and Os-Mo-Cr-Fe, respectively, isotopic studies. A setup of Mo analytical protocol in the Czech Academy of Sciences lab was initiated resulting in a successful Mo double spike calibration, Mo measurements on MC-ICP-MS (Czech Geological Survey) and analyses of a suite of reference materials with well-defined Mo isotopic composition (e. g., USGS basalt, in-house shale etc.).

Petrography and trace element geochemistry of pyrite from black shales. Petrography and laser ablation ICP-MS concentration analyses of pyrites from Kamenec and Hromnice identified three main textural types of pyrites within these rocks: (a) rare, but large cubic grains; (b) recrystallized pyrite in the matrix, and (c) framboidal, small grains. Laser ablation trace element analyses (in ppm) yielded a relatively wide range of contents with the highest values predominantly found in the framboidal genetic type. Group 1 elements (As, Ni, Se, Mn, and Sb) are uniformly distributed throughout the pyrite (~50–3,000 ppm) and have highly variable abundances of micro-inclusions evenly distributed within pyrite, and Group 2 elements (Cr, Se, Mo, Ag, Bi, Mn and Pb) generally yielded a wide range of concentrations between 0.5 and 500 ppm.

U–Pb zircon geochronology. Altogether 6 samples of greywacke-shale from different tectonic settings within the TBU were collected for U-Pb zircon age determinations to improve chronostratigraphy of different sedimentary units. After mineral separation and CL imaging, the samples were dated by the LA-ICP-MS method. Data were as yet acquired for 4 samples (greywacke, shale, rhyolite): the detrital zircon age of the studied samples yielded Paleoproterozoic/Mesoarchean component between ca 1.6 Ga and 2.9 Ga and significant Neoproterozoic age populations (ca 570–650 Ma). Furthermore, leaching experiments of well-defined zircon populations were performed to test how using of different reagents can possibly alter U-Pb age precision and accuracy.

17-23836S: **Transformation of the Burgher House in the 13th Century (Brno-Prague-Wroclaw)** (M. Peška, Archaia Brno, o.p.s., Brno; *L. Lisá* & T. Cymbalak, Ústav archeologické památkové péče, Prague; 2017–2019)

Geoarcheological investigations linked with the ongoing project included the collection of samples taken in the past seasons and their preparation into the form of thin sections or bulk samples. During the last few years, when the project was in preparation, a certain amount of samples was collected and stored in the freezer to make it available for this project. Finally, samples from at least five main localities were prepared for the analyses and some of them sent to Gent or to Reach for thin sectioning. The thin sections from some of these medieval localities are already prepared for the study.

The other aspect of geoarchaeological research included geo-ethno-archeology. The principal aim of this sub-project was to collect reference samples to be compared with the medieval ones. The former maintenance practices can still be detected in museums or in living landscape as for example on the Romania-Moldova border, where a number of houses from mudbricks and with trampled floors are still standing (Fig. 8). We therefore decided to choose, according to certain type of architecture, sets of houses and to sample their trampled floor to detect the sedimentological/micromorphological structure given by certain maintenance processes. The samples are ready for observations and the publication is in progress. Another geo-ethno-archeological works took place at Dolní Němčí near Uherské Hradiště. The mill founded at the end of the 19th century provided us layers of ancient floors. The floors were in use until 1975. Since 1992 the locals started to maintain the floors according to the old habits. We had a possibility to sample the "recent" floor with a well-known technology and the "ancient" floor.

■ **Fig. 8.** Documentation and sampling of the floor layers in an abandoned house on the Romania/Moldova border. Photo by P. Lisý.

No. 17-27099S: **Variability of the Australasian tektites in wider vicinity of Muong Nong in Laos - Constraints on their source rocks and a parent crater location** (*R. Skála*, *Š. Křížová*, *K. Žák* & *L. Ackerman*; 2017–2019)

The conducted research activities addressed several topics: (1) during the field trip to Laos and Cambodia in January/February 2017, a set of more than 50 Australasian tektites (further AAT; both splash forms and Muong Nong types; Fig. 9) was acquired with full data on their geographic and geological positions. A set of already available samples of Quaternary clastics (known to contain tektites probably in their original fall positions) and Cenozoic and Mesozoic sediments from the possible impact areas (together 18 samples) in Indochina were supplemented by additional 10 samples of sediments of Cenozoic and Mesozoic age collected within a narrow area around Muang Phin and Muong Nong in Laos during this field trip.

(2) The total of 28 samples of sandstones, siltstones, soils and laterites, representing probable source materials of the studied AAT, were first dried and described under a binocular microscope. Polished thin sections were manufactured from the Mes-

■ **Fig. 9.** Roman Skála inspects samples of Muong Nong-type Australasian tektites collected in the surroundings of Toumlan settlement in Laos. The largest samples are up to 1 kg in mass. Photo by Š. Křížová.

ozoic sediments and polished grain mounts from loose materials and are ready to be further studied petrographically. X-ray powder diffraction data were used for mineral determinations in all sediment samples. For the chemical analyses, the sediment samples were homogenized in a corundum ball mill. Complete bulk chemical analyses of the major components were done in the Czech Geological Survey, Prague. Aliquots of the samples were also decomposed using a standard decomposition procedure at the Inst Geol, Czech Acad Sci, and analyzed for 42 trace elements using ICP-MS. All data were recalculated to volatile-free compositions (without water, CO_2 and recalculation of Fe^{3+} to Fe^{2+}). The data show a wide range of concentrations, nevertheless the obtained dataset allows a selection of a subset of 15 sediments that can be considered to compositionally match the potential end-members of parental tektite mixture. This subset is a subject of ongoing Sr-Nd-Pb isotopic determinations. Due to the new TIMS installation at the Inst Geol, Czech Acad Sci in late October, these analyses are in progress.

(3) All AAT samples were first described in the lab and photographed, then polished thin sections were manufactured and studied using an optical microscope and SEM with a back-scattered electron (BSE) detector. The BSE imaging allowed to identify chemically and/or structurally different components of the samples. Subsequently, minor and trace elements were determined by LA-ICP-MS in these components separately where dimensionally possible. Then, electron microprobe analyses were carried out close to the craters after laser ablation to determine major element compositions. Both major and minor/trace element contents were found to be highly variable not only among individual samples but also within single pieces. In layered Muong Nong-type tektites, two different compositions can be typically distinguished, corresponding to individual glass types forming separate layers in the sample. On the other hand, splash form tektites usually display more or less unimodal data distribution. The appearance and geochemical data were then used to reduce the sample set to 15 AAT samples, some of them representing parts of a single piece (i. e. some pieces were split to two chemically/structurally different samples). This les to the reduction of the sample set used for detailed HSE and isotope geochemistry studies.

(4) Selected 15 samples of AAT were first cleaned by repeated procedure using ultrasonic bath and mechanical and chemical removal of impurities on their surfaces, followed by a complete removal of a thin surface layer by dissolution in diluted HF. After that, the AAT samples were homogenized in a corundum ball mill and stored in glass containers. From this material, aliquots were used for HSE analyses and Os isotope determination, for Li isotope determination (T. Magna; Czech Geological Survey), for triple oxygen isotope analyses (A. Pack; Univ. Göttingen), Cr isotope determination (F. Moynier; Univ. Paris Diderot, the set was reduced to 6 samples based on the total determined Cr content). HSE and Re-Os isotopic analyses were performed for 9 samples so far. They display wide variations in their HSE contents with some anomalous peaks in I-PGE (Os-Ir-Ru) contents (e. g., up to 78 ppt of Ir) combined with highly variable $^{187}Os/^{188}Os$ ratios from nearly chondritic (0.1357) to crustal-like (1.85). This clearly indicates mixing of variable proportion of terrestrial and extra-terrestrial matter, and (5) in 5 AAT samples unusual mineral (?) inclusions a few microns across were observed. These are enriched in some minor/trace elements including Ti, Cr, Fe and Ni, in some cases also S or P are present. These inclusions sometimes cluster or rim small droplets (?) in the tektite glass. These rims can be potentially interpreted as a sort of condensation sheaths of the droplets, perhaps analogous to the features already reported from irghizites. The samples containing these domains were included in the sample set for detailed HSE analyses and isotope geochemistry.

4c. University Grant Agencies

Finished Projects

GAUK No. 704216: **The revision of some sphenopterid types of ferns from Carboniferous coal basins of the Bohemian Massif, Czech Republic** (*J. Frojdová* & J. Pšenička, Faculty of Science, Charles University, Prague; 2016–2017)

The project was focused on „sphenopterid“ true ferns from Czech Carboniferous basins. This group of ferns comprises tens of genera. Unfortunately, the „sphenopterid“ ferns stand on the edge of interest of paleobotanists during the last twenty years although ferns could play an important role for the whole forest ecosystem. During this project, two genera (*Dendraena* Němejc and *Sturia* Němejc; Frojdová *et al.* 2017a, b) and one species (*Myriotheca anglica* Kidston) were examined. Tha main manuscript of this project was the review of the sphenopterid species of *Myriotheca anglica* Kidston which brings new information between sphenopteroid and pecopteroid type of ferns and for the first time compares the genera of *Myriotheca* Zeiller, *Pecopteris* Brongniart and *Senftenbergia* Corda. Based on new evidence of the morphology of the reproductive structures and *in situ* spores, we demonstrate that the rare species of "*Myriotheca*" *anglica* should be more correctly placed in the fossil genus of *Pecopteris*, and therefore propose a new combination *Pecopteris anglica.* A study of the holotype of *Senftenbergia* also revealed that it yielded quite different *in situ* spores compared with other *Pecopteris* species (*P. penniformis*, *P. anglica*, *P. plumosa*, *P. saxonica*, *P. sturi* and possible *P. aspera*). There may, therefore, be two distinct fossil genera of fronds within the *Tedeleaceae* (*Pecopteris* and *Senftenbergia*).

FROJDOVÁ J., PŠENIČKA J., *BEK J.* & MARTÍNEK K. (2017a): Revision of *Dendraena pinnatilobata* (Němejc) emend. from the Pennsylvanian of the Czech Republic. – *Bulletin of Geosciences*, 92, 1: 75–94.

FROJDOVÁ J., PŠENIČKA J. & *BEK J.* (2017b): Revision of Pennsylvanian genus *Sturia* Němejc and its spores (Duckmantian, Czech Republic). – *Acta Palaeobotanica*, 57, 2: 153–163.

4d. Grants of the State Departments

Finished Projects

Nature Conservation Agency of the Czech Republic: **Specification of geological setting along basaltic dykes functioning as barriers for groundwater and surface water in the Kokořínsko–Máchův kraj Protected Landscape Area** (*J. Adamovič*; internal code 7464; 2016–2017)

The study on the effects of Tertiary basaltic dykes on groundwater circulation and surficial drainage in the area of the Kokořínsko–Máchův kraj Protected Landscape Area (PLA) was completed (Adamovič *et al*. 2017). This area is formed by sedimentary rocks of the Bohemian Cretaceous Basin, where groundwater is concentrated to the sandstone body of the Jizera Formation, locally exceeding 250 m in thickness. This body accommodates considerable groundwater reserves. Segmentation of this aquifer could be expected by previous studies on hydraulic effects of basaltic bodies, especially dykes, conducted elsewhere. The real effects in this area have not been previously demonstrated, although they have great bearing on groundwater management and on environmental protection. Hydrothermal alteration effects of basaltic and phonolitic dykes on ambient sandstone were documented in outcrops, and a surface geomagnetic survey was undertaken at all sites studied to reveal the course and the geometry of basaltic bodies at shallow depths. In the final report, seven sites are presented where volcanic bodies function as barriers for groundwater, and eight sites are presented where these bodies function as barriers for surface water. Groundwater barriers are usually demonstrated by the occurrence of springs at sites where piezometric groundwater levels are elevated in front of the dykes. The studied sites included the Stříbrník spring at Vojtěchov, the V Pramínku spring at Sedlec, the Pšovka Stream spring at Dolní Houska, the spring on N slopes of Bezděz Hill, the U Flesla spring at Břehyně, the spring at Hradčany, and the Jordán spring at Břehyně. Volcanic bodies were found to be involved at all sites. Surface-water barriers along volcanic dykes were mostly used as natural dams of water reservoirs in the Kokořínsko–Máchův kraj PLA. Such reservoirs were founded since Medieval times, and some of them still exist. In these cases, the dykes always define areas with wide occurrence of marsh vegetation including many protected plant species. The studied sites included the dams of the Máchovo jezero Reservoir, the Břehyňský rybník Reservoir, the Novozámecký rybník Reservoir, the former Okřešický rybník Reservoir, the Heřmanický rybník Reservoir, the former Baronský rybník Reservoir at Staré Splavy, the Mariánský rybník Reservoir at Bezděz, and the former Litický rybník Reservoir at Holany. With the exception of the Mariánský rybník, all the dams were found to benefit from volcanic dykes and zones of hydrothermal alteration in sandstone. Water from twenty springs was sampled and subjected to chemical analyses. Temperatures and pH values were also measured for all the springs. Water from all springs is issued from Aquifer C (sandstones of the Jizera Formation), with the exception of the Bezděz spring which is derived from phonolite talus cones. The contents of Ca and bicarbonate ion, as well as TDS values, generally increase from N to S, which is in line with the groundwater flow direction. Strongly mineralized water with a temperature of 14 °C in the mouth of the Peklo Valley S of Česká Lípa ascends from a depth of ca 250 m along a regional fault. The anomalous chemistry and temperature of spring waters yielded new information on geological setting at many sites; for example, water feeding the Pšovka Stream spring at Dolní Houska is probably derived from Aquifer A and rises along a fault to the level of Aquifer C.

New protected measures are recommended for several wells/springs, which supply drinking water for local communities and whose yield depends on the uninterrupted course of the basaltic dykes functioning as groundwater barriers. Drilling and construction works should be also reduced around dykes which guarantee sustainable presence of water reservoirs, peat bogs and marshes.

ADAMOVIČ J., *ULRYCH J*., *ROHOVEC J*., *RAJLICHOVÁ J*. & PEROUTKA J. (2017): *Ověření geologických poměrů podél čedičových žil zadržujících povrchové a podzemní vody na území CHKO Kokořínsko-Máchův kraj. Závěrečná zpráva*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Nature Conservation Agency of the Czech Republic: 1–100. Praha. [in Czech]

Nature Conservation Agency of the Czech Republic: **Evaluation of the current conditions of paleontological and geomorphological localities in the Brdy Protected Landscape Area** (*K. Žák*, *L. Laibl*, *R. Mikuláš* & O. Fatka, Faculty of Science, Charles University, Prague; internal code 7454: 2016–2017)

The Brdy Protected Landscape Area (PLA) is a large territory (345 km^2), declared as a nature-protected area since January 1, 2016, after the termination of its use as a military training ground. The geological structure of the Brdy PLA consists of sedimentary and volcanic rocks of Neoproterozoic, Cambrian, Ordovician and Carboniferous age. These sedimentary sequences were intruded in the SW part of the area by minor granitic stocks of Carboniferous age. The Brdy PLA is rich in paleontological sites including the oldest (lower Cambrian) macrofossils of the Czech Republic. Also the geomorphology of the Brdy Mountains is valuable, bearing clear evidence of geomorphological processes which operated in the periglacial zone of Quaternary glacials. The main purpose of the project was to select the most valuable paleontological sites and the most spectacular geomorphological features of the area and prepare the data for their declaration as nature reserves or nature monuments. Altogether 30 sites were evaluated, 6 of which were proposed as suitable for formal protection (Žák *et al*. 2017).

ŽÁK K., FATKA O., *LAIBL L*. & *MIKULÁŠ R*. (2017): *Revize stavu paleontologických a geomorfologických lokalit na území CHKO Brdy*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Nature Conservation Agency of the Czech Republic: 1–36 + 1–134. Praha. [in Czech]

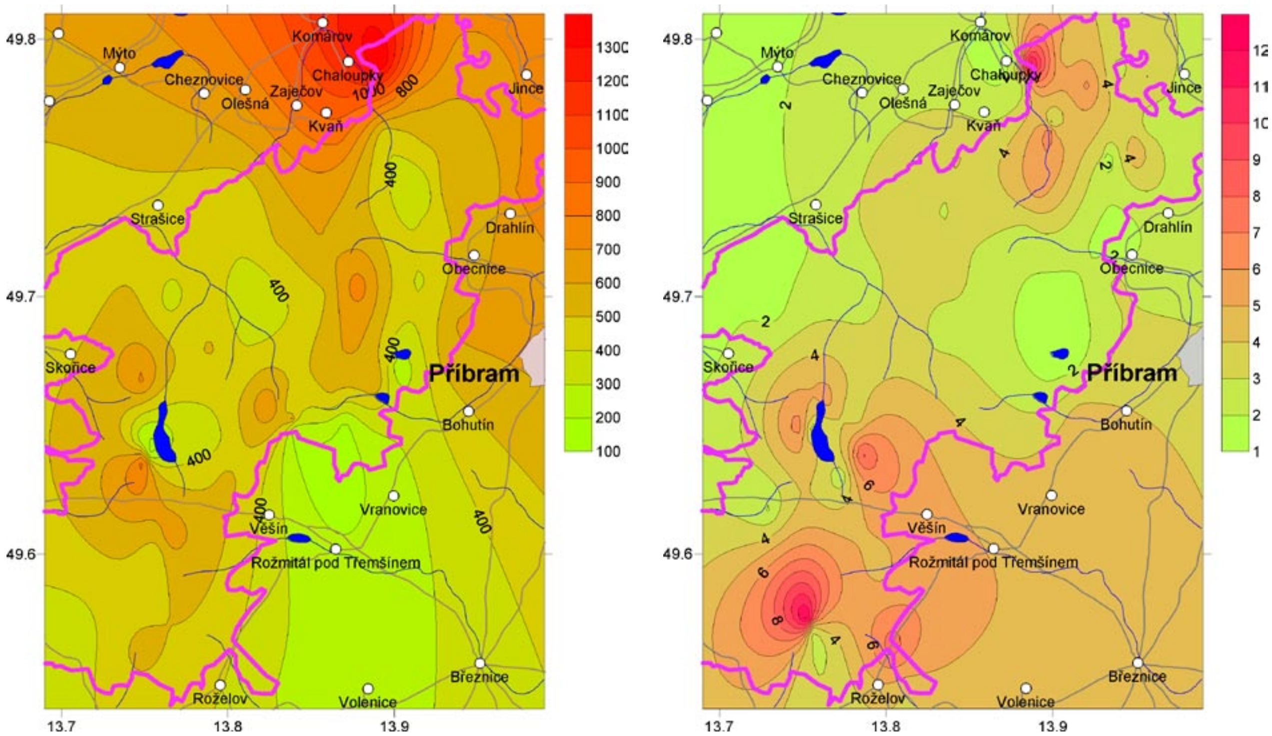
Nature Conservation Agency of the Czech Republic: **Contamination of the forest and aquatic ecosystems within the Brdy**

Protected Landscape Area with mercury and speciation of aluminum in the surface waters (*T. Navrátil, T. Nováková, K. Žák, J. Rohovec, Š. Matoušková, M. Roll, S. Hubičková* & *I. Dobešová*; internal code 7465; 2016–2017)

Issues connected with environmental contamination of protected landscapes with toxic elements such as mercury (Hg) are topical in areas impacted directly or indirectly by ore mining and processing activities. The Brdy Protected Landscape Area (PLA) established in 2016 is a typical example. Therefore, this study focused on mapping of the contamination and mobility of Hg within the forest and aquatic ecosystems of the Brdy protected area. Furthermore, this study yielded new knowledge on the occurrence of ionic aluminum in the surface waters (Navrátil *et al*. 2017).

All the studied components of the forest ecosystems indicate a significant effect of the geological situation in the vicinity of the former mining area at Jedová hora (Poison Mountain) and somewhat surprisingly around the Padrť ponds (Fig. 10). The overall mean Hg concentration in sediments of the Brdy PLA was 512 $\mu g \cdot kg^{-1}$, which was not very far from the country-wide average Hg concentration for fores O-horizons of 676 $\mu g \cdot kg^{-1}$ from 1995. But the anomalies of elevated Hg concentrations were noticed around Jedová hora in O-horizon soils (max. 1,408 $\mu g \cdot kg^{-1}$), stream waters (max. 19.7 $ng \cdot L^{-1}$), sediments (max. 8,366 $\mu g \cdot kg^{-1}$) and bedrock substrates (max. 120,000 $\mu g \cdot kg^{-1}$). The Jedová hora anomaly is very significant due to the occurrence of cinnabar (HgS) as an admixture in the oolitic Ordovician iron ores. The less evident anomaly around the Padrť ponds is very likely connected to the occurrence of bedrock with elevated Hg concentrations such as Neoproterozoic shales-wackes, Cambrian or Ordovician conglomerates, Carboniferous arkoses and bone coal or Variscan iron mineralization.

Mobilization of Hg in surface waters dominates during high-flow periods due to its relation to dissolved organic carbon (DOC). Concentrations of DOC in the surface waters increase with increasing episodic discharge due to penetration of soil solutions on the way to the stream through the topmost soil O-horizons rich in organic material–humus. With respect to low-flow periods with mean concentration of 3.6 $ng \cdot L^{-1}$, high-flow Hg concentrations (overall mean of 5.4 $ng \cdot L^{-1}$) on the surface increased virtually at all sites due to increases in mean DOC concentrations from 5.7 to 9.7 $mg \cdot L^{-1}$. As a result, the Hg/DOC ratio appeared as a good tool to observe the differences between the contamination of exported dissolved organic material. Areas with elevated Hg concentrations in surface waters were significantly wider during the highflow but the central hotspots remained noticeable even during the low flows. Similarly, the occurrence of the toxic form of aluminum ionic Al^{n+} during high-flow periods spread from 2 sites in the central high-elevation area to more than 14 sites due to temporal acidification, i. e. a decrease in pH. The areas of the highest Hg values and areas of high Hg/DOC were coincident and copied the results of O-horizon contamination around Jedová hora and Padrť ponds. Finally, very similar trends and results were observed in the contamination of stream sediments with Hg, which averaged at 400 $\mu g \cdot kg^{-1}$. The spread of high contamination of toxic elements such as Hg



■ **Fig. 10.** Contour maps of Hg concentrations in forest humus (left panel, units for legend $\mu g \cdot kg^{-1}$) and in surface water (right panel, unit for legend $ng \cdot L^{-1}$) in the Brdy Protected Landscape Area. The area of protected landscape is outlined by a purple line. Mapping of the forest humus contamination was performed at 55 sites in a single campaign and the mapping of the surface water contamination was repeated three times under low, high and descending discharge at 60 sampling sites.

and Al can be critical for management strategies and conservation plans concerning sensitive aquatic life.

NAVRÁTIL T., NOVÁKOVÁ T., ŽÁK K., ROHOVEC J., MATOUŠKOVÁ Š., ROLL M., HUBIČKOVÁ S. & DOBEŠOVÁ I. (2017): *Kontaminace lesních a vodních ekosystémů CHKO Brdy rtutí a speciace hliníku v povrchových vodách.* – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Nature Conservation Agency of the Czech Republic: 1–81. Praha. [in Czech]

Ministry of Industry and Trade of the Czech Republic, CZ.01.1.02/0.0/0.0/15_019/0004643: **Multigeneration strongly sorbent fluorescent tracers. Development of strongly sorbent fluorescent tracers set applicable as markers for the study of multigeneration fracture formation in granitic rocks. Stepwise introduction of fluorescent tracers into the fracture system will facilitate description of the genesis and geometrical parameters of fractures** (Watrad, s. r. o. Prague, Progeo, s. r. o. Prague & *J. Rohovec*; internal code 7801; 2016–2019)

Analytical and research activities were performed at the Inst Geol., Czech Acad Sci as a supply for the Watrad Ltd. company. The aim of this project is focused on selection of non-radioactive tracers, based on organic fluorescent dyes, which are able strongly and selectively mark open fractures in granite and similar rocks. Several tracers chosen (Auramin O, Rhodamin B, Nile blue) were tested practically, and their sorption parameters were quantified. Sorption ability and performance in consecutive higher-order experiments on a granite block were tested. As a result, optimized inlet concentration, flow rates, application sequence and concentration development were obtained. The experimental results were subjected to mathematical modelling procedures by Progeo, Ltd.

4e. Industrial Grants and Projects

Czech Geological Survey, Prague, Internal code No. 7001: **Determination of trace elements in garnet by in situ laser ablation ICP-MS** (*J. Ďurišová*).

In co-operation with Dr. J. Kotková (Czech Geological Survey), *in situ* trace element analyses of garnets from some eclogites and garnet peridotites of the Bohemian Massif were carried out to provide information of the possible zoning of garnets with respect to their suitability for Lu-Hf geochronology.

University of Leeds, Leeds, United Kingdom, Internal code No. 7004: **Re-Os and highly siderophile element analyses of pyroxenite xenoliths from Kilbourne Hole (USA) and ultramafic rocks from the Atlantic Ocean setting** (*L. Ackerman, E. Haluzová & J. Ďurišová*).

This joint project with University of Leeds (Dr. Harvey) focused on the determination of highly siderophile elements and $^{187}Os/^{188}Os$ compositions of selected Earth's mantle-derived rocks such as pyroxenites, peridotites and gabbros.

Czech Geological Survey, Prague, Internal code No. 7004: **Re-Os and highly siderophile element systematics of carbonatites** (*L. Ackerman, L. Polák & J. Ďurišová*).

This project represents an external project connected with the project of the Czech Science Foundation held at the Czech Geological Survey (T. Magna). Within this long-term project, determination of highly siderophile elements paralleled by $^{187}Os/^{188}Os$ compositions of carbonatites from India was completed. Additionally, fieldwork on Ambadongar carbonatitites-alkaline rocks (central India; Fig. 11) and participation in the Internal Seminar on "Carbonatites-alkaline rocks, and associated economic mineral deposits" held in Vadodara, India were realized.

■ **Fig. 11.** Layered, coarse-grained calcite carbonatite (sövite), forming a discontinuous ring in the Ambadongar carbonatite complex, India. Photo by L. Ackerman.

Charles University, Prague, Internal code No. 7012: **Detrital zircon and monazite geochronology in post-collisional coal basins using U-Pb laser ablation ICP-MS technique** (*M. Svojtka*)

We studied new U-Pb detrital zircon and monazite ages to reconstruct possible source areas and thus to define uplifted and subsided portions of the orogen during the onset of basin development. Sixteen samples, taken from the lowermost successions (ca 314–306 Ma Kladno Formation), indicate several main, both local and distant, sources of the basin fill. The local sources are characterized by Ediacaran (ca 620–540 Ma), late Cambrian to early Ordovican (ca 520–480 Ma), and Late Devonian (ca 380 Ma) age peaks whereas the distant sources are defined by Archean to Paleoproterozoic and early Carboniferous ages. An important (and the youngest) age population is mid-Carboniferous in age (ca 330–320 Ma).

Bibracte E.P.C.C. – Centre Archéologiquie Européen, Autun, France, Internal code No. 7020: **Analyse micromorphologique échantillons sources de l´Yonne** (*L. Lisá* & *P. Lisý*)

The research includes geoarchaeological prospection of the area within the Bibracte Neolithic site where the Czech team led by P. Goláňová (Philosophical Faculty of the Masaryk University in Brno) worked in the 2017 season. Micromorphological samples were taken additionally (Fig. 12) with the aim to detect the formation processes of the infill of ditch structure.

Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Internal code No. 7042: **Pre-Variscan history of the Sudety Mts. based on U-Pb dating of zircon** (*J. Sláma*, M. Jastrzebski & B. Budzyn)

This joint project with the Institute of Geological Sciences, Polish Academy of Sciences, focused on age determination of various magmatic and metasedimentary rocks from the NE part of the Bohemian Massif. Data will be used for the reconstruction of the pre-Variscan evolution of this part of the Variscan orogenic belt. Altogether more than 50 various samples were analysed during 2017.

Adam Mickiewicz Univeristy in Poznań, Poland, Internal code No. 7042: **Trace elements of detrital garnets of the Opole Basin and their sources** (*J. Sláma*, *M. Svojtka* & M. Kowal-Linka)

Cooperation in the research project based at the Institute of Geology of the Adam Mickiewicz Univeristy in Poznań. The laser ablation ICP-MS analysis of garnets in 12 garnetiferous rocks from the Bohemian Massif and their comparison with data from 13 detrital garnet samples from the Opole Basin should contribute to the development of the tectonic model of the Bohemian Massif denudation during the Mesozoic.

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

Hydrological year 2016 can be assessed as average with bulk precipitation amount at 796 mm. In areas covered by spruce forest it reached 604 mm. The monitoring time span of atmospheric deposition at Kuní vrch within the Bohemian Switzerland National Park has been continued since 2008. The bulk precipitation pH ranged from 4.17 to 5.75, which was well comparable with the pH values in previous hydrological years. The spruce throughfall pH values were lower, ranging 3.91 to 6.03. High variation

■ **Fig. 12.** Coring of the wet depression with possible environmental record comparable with the settlement history of the site. Photo by P. Lisý.

in pH of both precipitation types results from buffering of the acid precipitation by various organic and inorganic materials such as pollen, dust, tree debris etc. The bulk deposition fluxes of the most important acidificants SO_4^{2-} and NO_3^- further remained virtually similar to the previous hydrological year at 7.9 and 12.9 kg·ha^{-1}·yr^{-1}. Similarly, the spruce throughfall deposition of SO_4^{2-} and NO_3^- amounted at 22.9 and 29.7 kg·ha^{-1}·yr^{-1}.

Sampling protocol at the Bohemian Switzerland National Park was extended by an installation of special samplers for the monitoring of mercury (Hg) deposition (Navrátil *et al*. 2017).

NAVRÁTIL T., *DOBEŠOVÁ I.*, *ROHOVEC J.* & *HUBIČKOVÁ S.* (2017): *Monitoring srážkových vod na území NPČŠ. Zpráva za rok 2016*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for the Administration of the Bohemian Switzerland National Park: 1–20. Praha. [in Czech]

Velkolom Čertovy schody, Inc., Internal code No. 7302: **Velkolom Čertovy schody (Giant Quarry of Devil Steps): documentation of progress of quarry walls – reclamation of the Quarry–West** (*P. Bosák*)

Another hydrothermal cave was documented in downward continuation of caves originally documented on benches at ca 345 and 338 m a.s.l. in 2009/2010. A relatively big cave (some 6 × 8 × 6 m) with coating of cloud-like crystal speleothems was opened by blasting in two subsequent quarry faces on bench at ca 320 m a.s.l. (Bosák 2017; Fig. 13).

Mineralogical and chemical composition of 5 samples from the Giant Quarry of the Devil Steps studied harmfull components in Lower Devonian (Pragian) Koněprusy Limestone in the Quarry – West: (1) Koněprusy organodetrital limestone; (2 and 3) Koněprusy Limestone metasomatized by organic-phosphatic substance in two intensities; (4) dark-colored fine-grained clastics injected to tectonized zones and fissures, and (5) neptunian dykes filled with rocks of the Kačák event (Bosák *et al*. 2017).

■ **Fig. 13.** Hydrothermal cave in the Giant Quary of Devil Steps, bench at ca 320 m a.s.l. Photo by P. Bosák.

BOSÁK P. (2017): *Postup těžebních stěn Velkolomu Čertovy schody–západ. Akce sanace a rekultivace severní stěny. Posudek. Období: leden až prosinec 2016*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Velkolom Čertovy schody, a. s.: 1–20 + 1–79. Praha. [in Czech]

BOSÁK P., *ŠŤASTNÝ M.*, *ROHOVEC J.* & *MATOUŠKOVÁ Š.* (2017): *Mineralogické a chemické složení vzorků z Velkolomu Čertovy schody*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for LHOIST Vápenka Čertovy Schody, a. s.: 1–45. Praha. [in Czech]

GeoTest, a. s. Brno, Internal code No. 7302/2017-2: **The Maleník Block** (*P. Bosák* & J. Otava, Czech Geological Survey, Brno, Czech Republic)

The purpose of the expertise is the extension of a limestone quarry in the town of Hranice na Moravě. The expertise should react to 3 principal questions of the customer: (1) Maleník Block and processes responsible for its origin and development; (2) the relation of platform carbonates (Devonian) to the surrounding formations (Lower Carboniferous, Carpathian flysch, Cenozoic siliciclastics), and (3) the geological structure of the carbonate platform at the site of the resurgence of thermomineral waters in the town of Teplice nad Bečvou. Newly constructed geological cross-section indicates that the groundwater migration from (i) the east is less probable; (ii) the south is more probable, as carbonate platform subsided here to substantial depths allowing water to obtain both mineralization and temperature; (iii) the west, northwest to north is highly probable also due to a decreasing ceiling of the carbonates and intersection with regional fault systems. The resurgence of thermomineral waters in the Hranice area is a result of elevated position of Devonian limestones, which are exposed to the surface here (up to 310 m a.s.l.) but submerged to depths of 4 to 6 km in the surroundings . The second reason is the intersection with NW–SE-striking regional fault systems (Sudetic System, like Marginal Sudetic Fault or Haná Fault Zone) and a NE–SW-striking fault limiting a segment of the Carpathian Foredeep known here as the Moravian Gate (Bosák 2017). The broader area is also characterized by a number of cold springs of mineralized waters and gases, and by an elevated seismic activity (e. g., Špaček *et al*. 2015). The springs at Teplice nad Bečvou are the only ones with elevated temperature (up to 22 °C), high carbon dioxide content (e. g., Kunský 1957) and H_2S traces, and mantle-derived helium (Meyberg & Rinne 1995).

BOSÁK P. (2017): *Kra Maleníku*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Geotest, a. s.: 1–20. Praha. [in Czech]

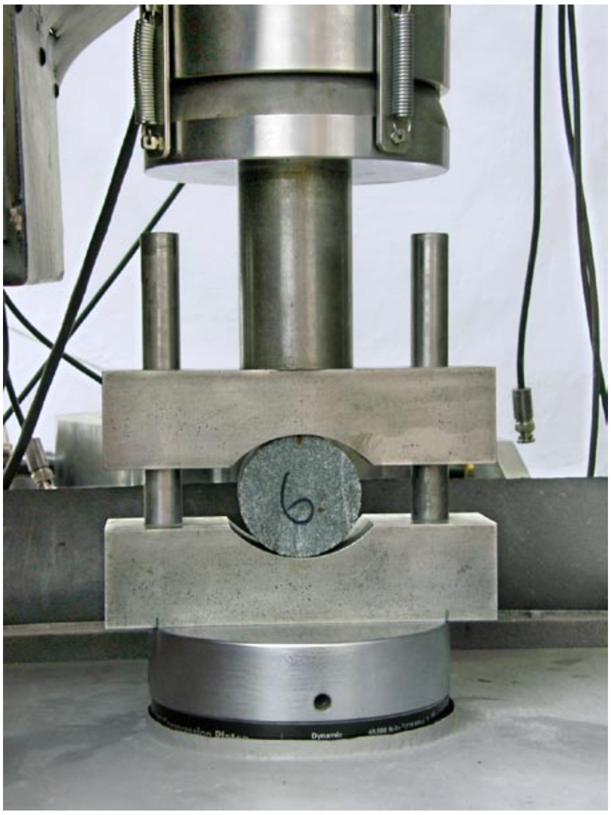
KUNSKÝ J. (1957): Thermomineral karst and caves of Zbrašov, Northern Moravia. – *Sborník Československé společnosti zeměpisné*, 62, 4: 306–351.

MEYBERG M. & RINNE B. (1995): Messung des $^3He/^4He$-Isotopenverhaltnisses im Hranicka Propast (Tschechische Republik). – *Die Höhle*, 46, 1: 5–8. Wien.

ŠPAČEK P., BÁBEK O., ŠTĚPANČÍKOVÁ P., ŠVANCARA J., PAZDÍRKOVÁ J. & SEDLÁČEK J. (2015): The Nysa–Morava Zone: an active tectonic domain with Late Cenozoic sedimentary grabens in the Western Carpathians' foreland (NE Bohemian Massif). – *International Journal of Earth Sciences (Geologische Rundschau)*, 104: 963–990.

Správa úložišť radioaktivních odpadů – SÚRAO, Internal code No. 7045: **Determination of mechanical properties of main rock types from the potential sites of deep nuclear waste repository** (*M. Petružálek*, *L. Svoboda* & *V. Filler*)

The report summarizes the results of laboratory tests measured on rock samples from potential sites of deep nuclear waste repositories. Namely: descriptive properties; uniaxial, triaxial and indirect tension strengths; P- and S-wave ultrasonic velocities; static and dynamic elastic moduli, coefficient of hydraulic conductivity (Figs. 14 and 15).



■ **Fig. 14.** Brazilian disc test, indirect measurement of tensile strength of rocks, loading in vertical direction.

■ **Fig. 15.** Failed specimens after Brazilian test, fracture is parallel to loading direction.

PETRUŽÁLEK M. (2017): *Stanovení mechanických vlastností hlavních petrografických typů na potencionálních lokalitách HÚ. Závěrečná zpráva*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Správa úložišť radioaktivních odpadů: 1–76. Praha. [in Czech]

Energoprůzkum Praha, s. r. o., Internal code No. 7045: **Mechanical properties of rocks in the vicinity of the Dukovany Nuclear Power Plant (NJZ EDU 5, cooling tower, nuclear island)** (*M. Petružálek*, *L. Svoboda* & *V. Filler*)

The report summarizes the results of laboratory tests measured on rock samples from the vicinity of the Dukovany Nuclear Power Plant. Namely: descriptive properties; uniaxial, triaxial and indirect tension strengths; P- and S-wave ultrasonic velocities; static and dynamic elastic moduli.

PETRUŽÁLEK M., *SVOBODA L.* & *FILLER V.* (2017): *Laboratorní zkoušky hornin na vzorcích z lokality NJZ EDU - VH objekty a trasy pro přívod surové vody a odvod odpadních vod: závěrečná zpráva*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Energoprůzkum Praha, spol. s r. o.: 1–29. Praha. [in Czech]

SG Geotechnika, a. s., Internal code No. 7045: **Determination of Hoek-Brown failure envelope for paragneiss from the Temelin site (Final Report)** (*M. Petružálek*, *L. Svoboda* & *V. Filler*)

The report summarizes the results of geomechanical testing of paragneiss from the vicinity of the Temelín Nuclear Power Plant. The Hoek-Brown failure envelope was determined from the measured strengths (uniaxial, triaxial and indirect tension strengths).

PETRUŽÁLEK M. (2017): *Stanovení obálky smykové pevnosti triaxiální zkouškou na vzorcích z lokality Temelín. Závěrečná zpráva*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for SG Geotechnika, a. s.: 1 – 9. Praha. [in Czech]

Senckenberg Museum für Naturkunde Görlitz (Germany), Project 7516: **Palynology of selected samples of the coal seam of Waltersdorf near the Lusatian Fault (Lausitz Overthrust/ Lausitzer Überschiebung, the Zittau Mts.)** (*M. Svobodová* & O. Tietz, Senckenberg Museum für Naturkunde Görlitz)

The report summarizes the results of palynological investigation of dark brownish shale in the vicinity of a phonolite intrusion (Svobodová 2017). Palynomorphs were strongly affected by thermal alteration, the assemblage corresponds to Upper Cretaceous age. The depositional environment indicates variable salinity, i. e. estuarine marshes or shallow marine conditions.

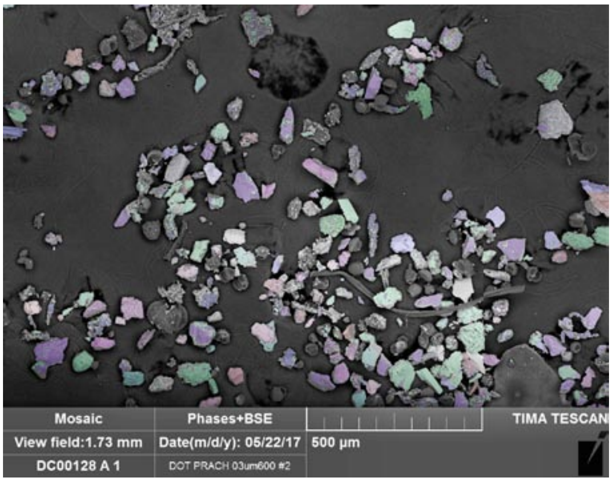
SVOBODOVÁ M. (2017): *Palynology of two selected samples from the coal seam in Waltersdorf (Zittau Mountains, Germany)*. – Unpublished research report. Inst Geol, Czech Acad Sci, Prague for Senckenberg Museum Görlitz, Germany: 1–5. Praha.

4f. Strategy AV21 Programme – Natural Hazards and Programmes of Institutional Research Plan

Strategy AV21 Programme – Natural Hazards

Project No. 9221: **Automated analysis of dust particles by electron microscopy, and creation of a "Dust particle atlas"** (*T. Hrstka*, *J. Hladil* & *L. Chadimová*)

The project is a successful continuation of the research focused on the advanced analytical techniques in the study of atmospheric dust. To face the problematic automated identification of the individual dust constituents from deposited dust samples we focused the research on the use of similarity search and artificial intelligence (AI) for advanced sorting and recognition of unknown spectroscopic data. In collaboration with Charles University, Faculty of Mathematics and Physics (Prague), the basis for a software package usable for expert guided AI was developed. This software could greatly help in fingerprinting the source and origin of the constituents of deposited dust from the SEM EDS data. It is designed to speed up the identification of unknown components of any deposited dust samples through the methods of clustering, involving neural networks self-learning algorithms (Fig. 16). As a part of the research, a free online database of dust particles and micromarkers – a "Dust particle atlas" – was started as a BETA version.



■ **Fig. 16.** Individual dust particles under the scanning electron microscope. Cluster analysis was used to automatically identify the individual components present (displayed in false colors). Photo by T. Hrstka.

Project No. 9222: **Record and classification of rockfall phenomena in the Bohemian Paradise area** (*J. Adamovič*)

This is a continuation of a project documenting rockfall phenomena in sandstone-dominated Protected Landscape Areas in the Czech Republic. The database of rockfall events, both recent and historic, is kept on webpage http://rockfall.gli.cas.cz. In 2017, the sites from the Kokořín area were complemented with sites from the Bohemian Paradise.

The rockfall phenomena are described in detail including their geological and geomorphic settings, sandstone lithology and tectonic deformation, situation in the detachment area and in the accumulation area. Triggering mechanisms of specific rockfalls are suggested, although many of the sites in the Bohemian Paradise are under permanent cliff-stability monitoring by the Institute of Rock Structure and Mechanics. Historic rockfalls were dated with the maximum possible precision.

In the Bohemian Paradise, most of the rockfall cases were registered in sandstones of the Teplice Formation. The incidence of rockfall is geographically highly uneven, probably depending on tectonic deformation and rock consistency. The highest number of rockfall phenomena has been found in strongly jointed sandstones of the Příhrazy–Mužský area, where many of them are also associated with large landslides due to bulging of the plastic footwall sediments. This is true also for the Prachov area. Lesser numbers were registered in the Hrubá Skála, Borek and Kozlov areas. Rockfall is very rare in soft sandstones in the Apolena rock city near Trosky, where sandstone degradation is mainly by granular disintegration. Rockfall phenomena in the sandstones to quartzites of the Peruc-Korycany Formation at Suché skály Cliffs are specific in that they mostly involve only separate detached boulders. On the other hand, gravitational mobilization of rock debris filling open crevasses and chimneys is a common phenomenon.

Project No 9224: **River flood sediments in the Czech Republic from 1996 to 2016** (J. Stemberk, Czech Acad Sci, Inst Rock Struct & Mech, Prague & *R. Mikuláš*)

River floods generate basically two kinds of geological events: (1) sedimentary, and (2) erosional. In the case of floods in recent cultural landscapes, these events also occur. However, from the view of human society, economic, social, and medicinal circumstances of floods are stepping forward in front of the natural processes. Unlike in all previous geological epochs, human populations in advanced countries struggle to minimize changes of landscapes caused by floods in the Recent, i. e. they remove new sedimentary bodies and fill empty space of eroded materials (e. g., soils). This way, flood sediments (derived mostly from floodplain lagoons, crevasse splays, and natural levees) are removed prior to their adequate documentation and geologic study.

It is also obvious that flood sediments of the present decades and centuries are different from those in the past, being influenced by changing climate, effects of compacting the soil by heavy agricultural machines, large areas of impermeable land cover, non-traditional crop plants that do not protect land from erosion etc. Thereby, the present/modern flood sediments (most often well-sorted gravels, sands and silt layers) should be discernible from the previous ones. The difference, however, is difficult to demonstrate due to their limited knowledge. Therefore, one of the goals of the project is to rescue randomly collected and/or still *in situ* collectible samples of flood sediments in the Bohemian Massif from 1996–2013 in the Material Documentation Store of the Czech Geological Survey, Prague.

Programmes of Institutional Research Plan

Project No. 9328: **Advances in co-operation with the Institute of Earth Sciences, Slovak Academy of Sciences (Bratislava, Slovakia) in research of historical environmental contamination with mercury – assessment of geochemical archives from lake sediments** (*T. Navrátil*, *T. Nováková*, *M. Roll* & *J. Rohovec*)

Lake sediments belong to the traditional geochemical archives used for the reconstruction of environmental processes in the past. In cooperation with the Inst Earth Sci, Slovak Acad Sci, this project was focused on studies of Zelené Pleso sediments, which belongs to the alpine lakes in the area of the High Tatra Mountains. A sediment section 14 m long was sampled and analyzed for mercury and loss on ignition in the laboratories of the Inst Geol, Czech Acad Sci. Concentrations of mercury in Zelené Pleso sediments ranged from 11 to 93 $\mu g \cdot kg^{-1}$. However, more detailed information such as sedimentary core dating, which will be provided by the Slovak Institute in 2018, is needed to draw more detailed conclusions.

Project No. 9324: **Highly siderophile element and Re-Os isotopic geochemistry of orogenic lamproites, Bohemian Massif** (*L. Ackerman*, *L. Krmíček* & *J. Ďurišová*)

This project is focused on highly siderophile element geochemistry (HSE) of rare orogenic-type lamproites found at several localities in the Bohemian Massif to reveal possible different mantle sources of these peculiar rocks. The results showed that Variscan lamproites from the Saxothuringian Unit contain low HSE contents with only subtle HSE fractionation but highly variable and radiogenic $^{187}Os/^{188}Os$ compositions (up to 0.66), which seems to be connected with a subduction-related process. In comparison, the Moldanubian Unit lamproites exhibit highly fractionated HSE patterns with pronounced enrichment in Pd paralleled by only slightly radiogenic Os isotopic values.

Project 9325: **In situ spores and pollen of reproductive organs of Early Permian lycophytes and ferns from the Wuda Coalfield, Inner Mongolia, China** (*J. Bek*)

The aim of the project is the discovery of new fertile and sterile specimens of Early Permian plants and their connection with their spores and pollen. The most important specimen is the oldest cycadalean plant (298 Ma) in the World. *In situ* spores were isolated from reproductive organs of lycophytes (*Spencerites*), sphenophytes (*Palaeostachya, Sphenophyllum*), noeggerathialean (*Paratingia*) and ferns (*Chansitheca, Etapteris, Oligocarpia*). The reconstruction of tropical forest buried by volcanic ash ("Permian Pompeii") will be made based on the excavation of an area of 2,500 m^2.

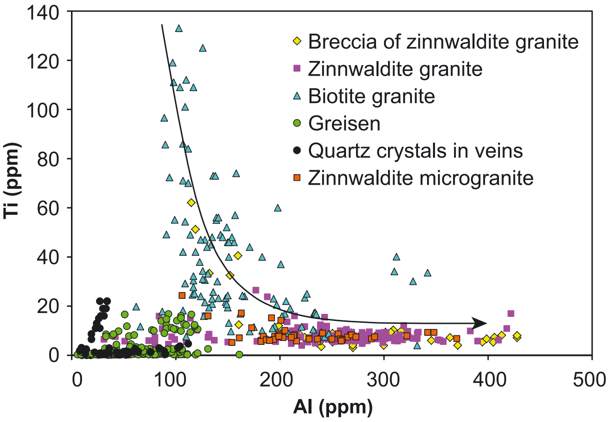
Project No. 9329: **Detailed palaeomagnetic and rock magnetic investigations of sedimentary fills of the Domica Cave in Slovakia** (*P. Pruner*, *P. Bosák*, *P. Schnabl* & *K. Čížková*)

The Domica–Baradla cave system, one of the most significant cave systems of Central Europe, was inscribed into the UNESCO World Heritage List in 1995. The studied sections are located on both sites of the western end of the Suchá chodba Passage (the upper evolution level) near the southern opening of the artificial tunnel connecting the Suchá chodba and Panenská chodba passages. The samples were demagnetized by alternating field (AF) and or/thermal demagnetization (TD; some of consolidated samples). Except for samples with very low intensity, the maximum angular deviation (MAD) values are generally lower than 10°; therefore the palaeomagnetic directions are well determined. Pilot samples were subjected to the analysis of the IRM acquisition and AF demagnetization curves with the aim to establish magnetic hardness of the magnetically active minerals contained in the sediments. As a complementary technique to magnetostratigraphy, the measurements of the anisotropy of low-field magnetic susceptibility (AMS) were performed throughout the section. Magnetic fabric (AMS) of the studied sediments is more or less coaxial with the bedding. The natural remanent magnetization and magnetic susceptibility curves show characteristic patterns quite well correlating with lithological boundaries and color changes. They indicate cyclic composition of the whole section. Paleomagnetic declination and inclination are displayed in two sets of samples with normal (N) and reverse (R) polarities and were subsequently used to define the succession of magnetic polarities in the studied section. The Brunhes/Matuyama boundary (ca 780 ka), Kamikatsura excursion (ca 850 ka), Santa Rosa excursion (ca 922 ka) and Jaramillo magnetozone (ca 990–1,070 ka) were determined inside the newly studied section in the Suchá chodba Passage. Results of the high-resolution magnetostratigraphy combined with radiometric dating allowed to construct the age-depth model for the first time in our 20 years-long experience with cave sediments (Bella *et al.*, in print).

BELLA P., *BOSÁK P.*, BRAUCHER R., *PRUNER P.*, HERCMAN H., MINÁR J., VESELSKÝ J., HOLEC J. & LÉANNI L. (in print): Multi-level Domica–Baradla cave system (Slovakia, Hungary): Middle Pliocene–Pleistocene evolution and implications for the denudation chronology of the Western Carpathians. – *Geomorphology*, 327: 62–79. doi.org/10.1016/j.geomorph.2018.10.002

Project No. 9331: **Trace elements in quartz – information about transition of magmatic to hydrothermal processes** (*K. Breiter* & *J. Ďurišová*)

Altogether 24 samples of quartz from granites, greisens and quartz veins from a 1596 m long vertical section through the Cínovec Li-Sn-W deposit (Czech Republic) was studied using cathodoluminescence (CL) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP MS). The contents of trace elements Al, Ti, Li, Ge and Rb, and variations in the Ge/Ti and Al/Ti values in quartz in magmatic rocks (granites) reflect the degree of fractionation of parental melt from which primary quartz crystallized. During the evolution from biotite granite through zinnwaldite microgranite to the youngest zinnwaldite granite, quartz is characterized by increasing contents of Al (from 136–176 to 240–280 ppm) and decreasing Ti contents (from 16–54 to 6–14 ppm), while the contents of Li and Ge are similar (15–36 and 0.8–1.7 ppm, respectively; Fig. 17). In metasomatically transformed greisens, two types of quartz can be distinguished based on CL and contents of trace elements: the CL-intensity of the newly formed hydrothermal quartz and its Ti content are much lower than in the associated remnants of magmatic quartz. Quartz of the greisen stage and vein stage is generally poor in all measured trace elements (26–59 ppm Al, 0.5–1.6 ppm Ti, 2–13 ppm Li, 0.8–1.6 ppm Ge). The late low-temperature quartz, forming thin coatings in vugs in greisens and veins, differs in its extreme enrichment in Al (>1,000 ppm) and Li (~100 ppm) and very low Ti (<1 ppm) (Breiter *et al*. 2017).



■ **Fig. 17.** Decreasing Ti contents together with increasing Al contents illustrate chemical evolution of quartz in a fractionated magmatic system (highlighted by the arrow). Hydrothermal-stage quartz from greisens and veins is typically poor in all trace elements (original).

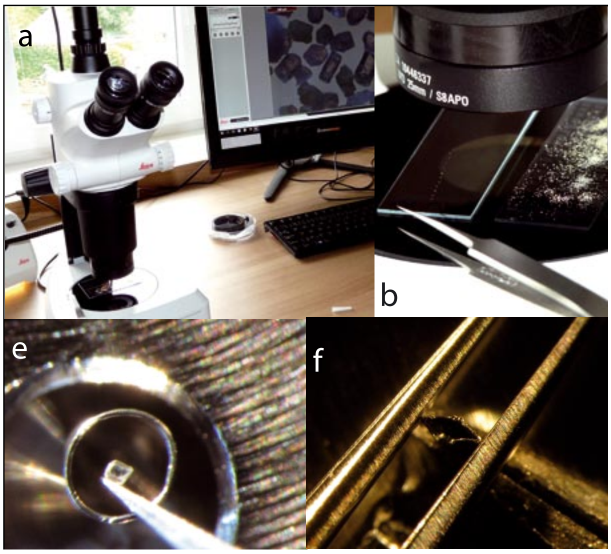
BREITER K., *ĎURIŠOVÁ J.* & DOSBABA M. (2017): Quartz chemistry – A step to understanding magmatic-hydrothermal processes in ore-bearing granites: Cínovec/Zinnwald Sn-W-Li deposit, Central Europe. – *Ore Geology Reviews*, 90: 25–35.

Project No. 9332: **Extensional tectonic event of the Eger Rift evolution reflected by brittle deformation and mineralisation of Miocene volcanics** (*M. Coubal*, *M. Šťastný*, *J. Adamovič* & P. Zelenka, Czech Geological Survey, Prague)

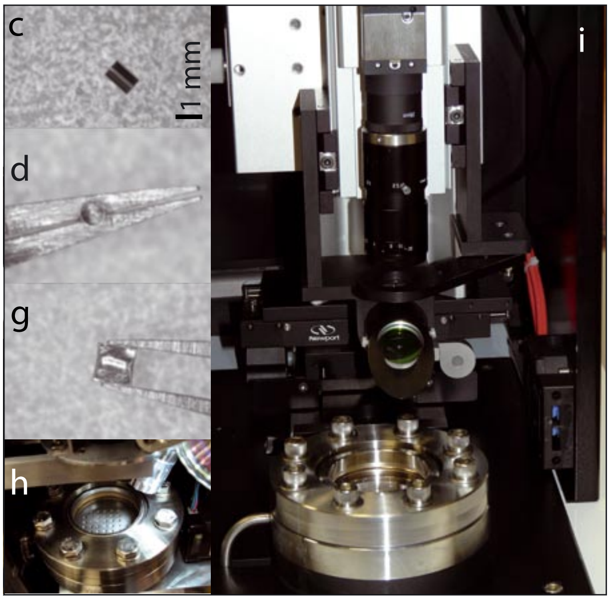
In 2017, our team progressed in the reconstruction of the character of tectonic phases affecting the northern part of the Bohemian Massif during the Tertiary. Aim of the study is given to a more precise determination of their kinematic character and especially their timing, which made easier their parallelism with tectonic events in other regions of the Alpine foreland. Paleostress analysis of fault slip data was the essential method to study kinematic and dynamic characteristics of the brittle structures. With respect to the timing of tectonic phases, the study concentrated on volcanic bodies from the Eger Rift, whose age had been previously determined by geochronological dating. This year, the study was focused on bodies of Miocene age (e. g., Milá Hill, ca 20 Ma). Also, elongate volcanic bodies respecting the strikes of the main faults of the Krušné hory Fault Zone: these were formed in extensional regime (e. g., Raná Hill, Oblík Hill, Brnik Hill). Rocks from Raná Hill are presently dated using Ar-Ar method at Potsdam University. Equally, different morphological types of striae on fault planes were studied. The aim of this study was to estimate temperatures governing the formation of differential striae types (hot/cold regime). Results of paleostress analysis combined with geochronology dating show that the extensional regime in this area started later than 20 Ma. Most of the identified morphological types of striated slickensides are typically brittle structures, which were formed in cold regime, much later than the magma solidification.

Project No. 9338: **Development of low-temperature dating using the (U-Th)/He thermochronology at the Institute of Geology of the Czech Academy of Sciences** (*D. Kořínková*)

This project was aimed at low-temperature dating using (U-Th)/He thermochronology and on establishing collaboration with the Department of Neotectonics and Thermochonology at the Inst Rock Struct & Mech, Czech Acad Sci, where Alphachron MkII is installed for this purpose. To introduce this method into practice, real samples of apatites from granitoids rocks were used, which had been taken in the Lusatian Fault Zone in previous years. These samples were dated using apatite fission track analysis (FTA). The other goal of this project was to complement existing FTA results with additional data from (U-Th)/He dating on the same apatites. This will allow to construct a time-temperature model to even lower temperatures than just using the FTA. A large part of this year's work was laboratory preparation of apatite grains for measurement on Alphachon. Apatite grains suitable for the analysis were pre-selected from each sample (Fig. 18a, b), and at least 5 perfect crystals (without inclusions, cracks, regular shape, min. width of 90 µ) were chosen. These grains were placed each separately into the Pt-capsule of a cylindrical shape. The capsule was first flattened on one edge. The grain was inserted and the second edge of the capsule was closed, so that the grain remains closed like in a pillow (Fig. 18c to g). All of thus prepared grains were placed on a holder (Fig. 18h) and moved under the laser in the Alphachron to measure He isotopes (Fig. 18i). He-isotope ratios were measured for 70 apatite grains (14 samples) in



■ **Fig. 18a, b, e, f.** Progress in preparation apatite grains for (U-TH)/He dating using Alphachron MkII: a, b – hand picking of apatite grains; e, f – inserting individual apatite grains onto the Pt capsule and its closure.



■ **Fig. 18c, d, g h, i.** Progress in preparation apatite grains for (U-TH)/He dating using Alphachron MkII: c, d, g – inserting individual apatite grains onto the Pt capsule and its closure; h – apatite grains in Pt capsules placed in a laser holder; i – measuring of He isotopes in Alphachron.

total. The samples will be now measured using ICP MS at the Inst Geol, Czech Acad Sci, which is the second part of the data.

Project No. 9340: **Geochemical characteristics of stromatolites sensu stricto – search for the criteria of biogenicity** (*R. Mikuláš*)

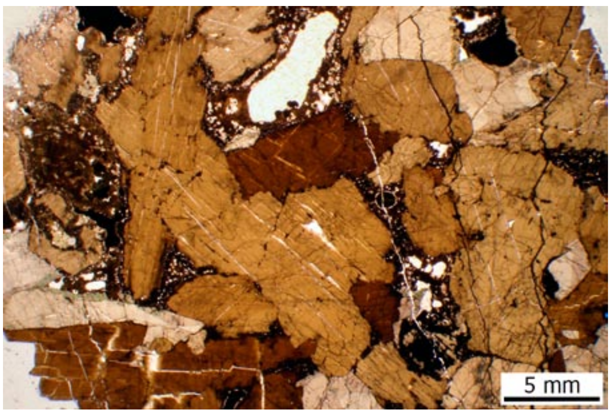
Stromatolites represent an enormously important element of the fossil record, namely, for the old age of many of them. Besides the short Ediacaran time interval at the end of the Proterozoic, they dominated the whole pre-Paleozoic biota; no relevant conclusions can be done on the Proterozoic biota without the deep understanding of stromatolites. Despite these circumstances, no unequivocal, convincing and repeatable criteria of biogenicity of stromatolites have been proposed (Mikuláš 2015). In the initial phase of search for geochemical criteria, one must consider classical occurrences, chemically and morphologically closely comparable to the living stromatolites from the Hammelin Pool, western Australia and from the Bahamas. It is a convenient circumstance that many stromatolites are represented in private collections in the Czech Republic. Among them, samples of the Cotham Marble, and finds from west European sites of Rüsingen, Gannat and few others occur in the quantity and quality that enabled us to document and analyse (SEM, ICP-MS) micro-stratigraphy of the individual stromatolite specimens. The uniquely selected and exactly measured datasets will be, during the next research, compared, and theories on the "biogenicity imprints" will be formulated and tested.

MIKULÁŠ R. (2015): Stromatolity. – *Věda kolem nás*, 35: 1–20. Academia. Praha.

Project No. 9344: **Amphiboles of the magnesio-hastingsite–pargasite–kaersutite series in Cenozoic volcanic rocks: insight into lithospheric mantle beneath the Bohemian Massif** (*J. Ulrych* & *L. Krmíček*)

Amphiboles of phenocrysts (Fig. 19), xenocrysts and cumulates (Fig. 20) from Cenozoic volcanic rocks of the Bohemian Massif belong to the magnesio-hastingsite–pargasite–kaersutite series. Their host rocks are mostly massive basaltic lavas, intrusions, dykes and breccia and scoria pipe fills, less commonly also massive felsic rocks. Felsic rocks with amphibole cumulates represent differentiated magmas which have undergone polybaric fractionation of the mafic minerals. Calculated p–T conditions suggest that almost all amphiboles crystallized in a relatively narrow temperature range (1,020–1,100 °C) at depths corresponding to ~15–35 km (0.45–0.85 GPa) during the magma ascent. These p–T estimates are compatible with the published experimental data on the stability of kaersutite. The lowest concentrations of incompatible elements in the amphiboles are in phenocrysts in alkaline basaltic rocks and mantle xenoliths and megacrysts, followed by phenocrysts in lamprophyric rocks, xenocrysts and cumulates in felsic rocks, and phenocrysts in subvolcanic rocks. Amphibole chemical and Sr-Nd isotopic characteristics resemble those of amphiboles from metasomatic clinopyroxene/amphibole veins in mantle peridotites. The $^{143}Nd/^{144}Nd$ and $^{87}Sr/^{86}Sr$ ratios of amphiboles (0.51266–0.51281 and 0.70328–0.70407, respec-

■ **Fig. 19.** Optical photomicrograph of a homogeneous kaersutite megacryst weathered from altered analcimite from Kostomlaty pod Milešovkou. The inclusion in the lower right part of the megacryst is of diopside composition. Photo by L. Krmíček.



■ **Fig. 20.** Optical photomicrograph of a coarse-grained hornblendite xenolith/cumulate in trachybasalt from Stráž nad Ohří Quarry. Photo by L. Krmíček.

tively) are similar to those of their host rocks (0.51266–0.51288 and 0.70341–0.70462, respectively). Both amphiboles and their host rocks plot to the field of Cenozoic volcanic rocks of the Bohemian Massif and the Central European Volcanic Province. The amphiboles of the magnesio-hastingsite–pargasite–kaersutite series of the Bohemian Massif are characterized by relatively homogeneous ε_{Nd} = +1.4 to +3.8 values, only a single sample from the České Středohoří Mts. revealed a negative ε_{Nd} (–0.6). This testifies to the locally elevated proportion of recycled Variscan crustal material during the melting in association with mantle rich in clinopyroxene/hornblende veins in mantle peridotites. The origin of the veins is associated with metasomatic fluids enriched in HFSE from the EMI-type mantle.

Subproject: **Petrogenesis of the Cenozoic alkaline volcanic rock series of the České Středohoří complex: a case for two lineages** (*J. Ulrych*)

The model of fractionation of the Cenozoic alkaline volcanic rock series of the České Středohoří complex in two lineages was performed. The Cenozoic České Středohoří Volcanic Complex (CSVC) of the Bohemian Massif forms the eastern part of the Central European Volcanic Province and is associated with the Ohře/Eger Graben which belongs to the rift system stretching from Spain and France through Germany to the Czech Republic and Poland. The CSVC is about 90 km long and up to 25 km wide. The main pulse of the magmatic activities took place from Late Eocene to Middle Miocene and peaked from ~32 to ~24 Ma. CSVC is composed of lava flows, volcano-sedimentary deposits and subvolcanic intrusions. The volcanic rocks are sodic (Na_2O>K_2O) alkaline silica-undersaturated types, which form two main associations: (1) basanite–phonolite (Fig. 21), and (2) subordinate trachybasalt–trachyte series, which differ particularly in major element variations and Nd–Sr isotopic compositions. Melilitic rocks concentrate to the northern and southern parts of the Ohře Graben (Fig. 22). Mafic rocks strongly predominate over felsic types (~6 %). Intermediate rocks are rare. Petrological modeling using MELTS software shows that both suites were generated from two distinct parental magmas (basanitic and basalt/trachybasaltic) by fractional crystallization without noticeable crustal contamination. Some phonolites were modified by late- to post-magmatic fluids, particularly with respect to the abundances of several incompatible trace elements such as heavy REE and Zr. Compositional differences among mafic rocks are, in part, related to variably metasomatically enriched lithospheric mantle. The Nd-Sr isotopic and trace element composition of mafic magma indicates that the mantle source was slightly heterogeneous amphibole-and/or phlogopite-bearing garnet peridotite. The presence of garnet, amphibole and/or phlogopite indicates that lithospheric melting took place close to the asthenosphere–lithosphere boundary. The lithospheric mantle source was probably metasomatically enriched by fluids or melts from an upwelling asthenospheric mantle. The enrichment may have taken place during the late stages of the Variscan orogeny. The two mafic parent magmas may be derived from a similar source which showed subtle differences in the source mineralogy mode and Nd-Sr isotopic compositions.

■ **Fig. 21.** Basanite columns forming "Organ" of the Panská skála Cliff near Kamenický Šenov, České středohoří Mts. Photo by L. Krmíček.

■ **Fig. 22.** A relict of an olivine melilite nephelinite dyke of the Devil's Wall near Osečná, northern Bohemia. Photo by L. Krmíček.

Project No. 9346: **Effect of afforestation on soil characteristics in the Český Brod segment of the Blanice Graben** (*A. Žigová & M. Šťastný*)

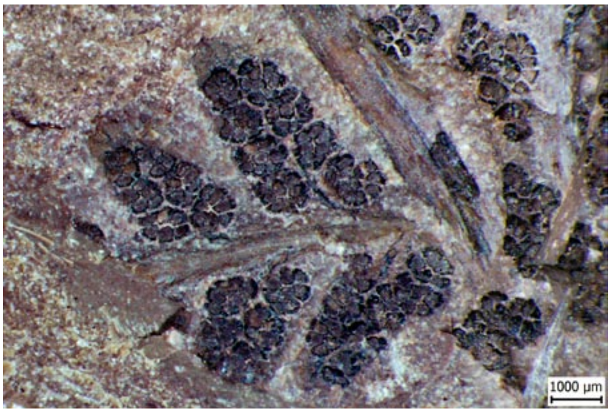
Afforestation of agricultural soil is an important tool for improving the landscape structure and its ecological stability. The aim of the study was to evaluate the effect of changes in landuse on Stagnosol properties.

The soil cover is developed on Permo-Carboniferous rocks in the Český Brod area. The research was performed on arable soil and plots with birch and pine 45 years after afforestation.

The results revealed differences in the properties of the upper part of soils after a change in landuse. Macromorphological analysis showed a preservation of some original pedofeatures even 45 years after the change in landuse. Agriculture soil has a weakly acid reaction in upper parts of the profiles. Upper part of the profiles in birch forests showed an acid reaction and those in pine forests a very acid reaction. Lower values of cation exchange capacity and base saturation were obtained from forest soils compared to those from agricultural soils. Forest soils have more favorable physical properties (e. g., bulk density, porosity) in the A horizons. The duration of afforestation positively affected the humus state of the soils. Carbon concentration in organo-mineral complexes decreased with the increasing depth and clay abundance. Plowing caused an increase in carbon concentration in the upper horizons of Stagnosols. This is due to the application of agricultural technologies and mineral fertilization. After the withdrawal of arable soil from agricultural use, carbon concentration in organo-mineral complexes in secondary forest soils increases both due to the conserved positive impact of former fertilization and due to the incorporation of vegetation residues for quite a long time, as well as due to the absence of fresh organic matter with the harvest. Stagnosols of forest stands established on agricultural lands demonstrated the proximity of colloidal system stability but in peptization state as confirmed by an increase in the zeta potential value and a decrease in the effective diameter value compared to arable Stagnosol.

Project No. 9348: **Anatomy, morphology and reproductive organs with in situ spores of Lower Permian ferns from the Wuda Coal Basin, China** (*J. Frojdová*)

This project was focused on the new species of the genus *Oligocarpia* (Fig. 23) from the Wuda locality. Finds from this site allowed a detailed observation of the reproductive organs (sori, sporangia, sporangial cells as oblique annulus, stomium, ordinary cells, and *in situ* spores) as well as the anatomy of penultimate rachis.



■ **Fig. 23.** A close-up view of ultimate pinnae with pinnules covered with sorus of the new species of *Oligocarpia* sp. nov. from Wuda, Inner Mongolia, China. Photo by J. Frojdová.

Project No. 9351: **Rock magnetic properties of the Žilina-Hradisko drill core** (*T. Elbra*)

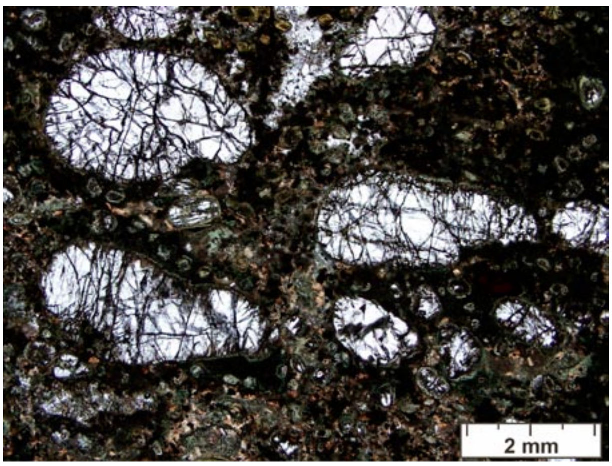
The purpose of the project was to investigate rock magnetic properties (e. g., magnetic susceptibility and its temperature dependence) of Žilina-Hradisko drill core samples in order to gain insight to the magnetic signature of this drill core. Results showed that the magnetic susceptibility and natural remanent magnetization reach their maximum values in the boundary interval. Similar high susceptibility values have been found in close association with the Cretaceous/Paleocene (K/Pg) boundary worldwide. Magnetite was recognized as the main magnetic fraction in all samples. The results will be used to improve the grant project application to the Czech Science Foundation on magnetic signature across the K/Pg boundary in the Western Carpathians in Central Europe.

Project No. 9353: **Chemical composition of Baroque crystal glass** (*Š. Křížová*)

The studied glasses were extracted from waste pits at Prague Castle excavated in 1925 and 1928. Excavated assemblages that have remained unprocessed for a long period of time belong to the find inventory held by the Institute of Archaeology of the Czech Academy of Sciences. A total of 40 pieces of glass from the latter half of the 17th century to the 18th century were selected based on their typology context, shape, color and decorations. Chemical composition of these glasses was analyzed by the EMPA and LA-ICP-MS. The results show that all samples, with the exception of one, correspond to potassium-rich glasses (K_2O-CaO-SiO_2), which can be further divided into three groups: (I) wood ash glass; (II) potash glass, and (III) potassium glass with arsenic. None of the glasses can be considered to represent imported items based on a comparison of their chemical compositions with the published historical foreign glass materials.

Project No. 9354: **Sources and distribution of Li in mantle magmatic rocks from cratonic (anorogenic) regions of India and their comparison with the Li systematics of orogenic lamproitic rocks from the Bohemian Massif** (*L. Krmíček*)

Orogenic mantle-derived melts suggest that subduction may effectively introduce lithium from the crust back into the mantle. The question is which Li signature persists in mantle beneath the thick stable cratonic areas and how Li signature eventually develops over the time. This institutional research project was focused on the determination and interpretation of whole-rock compositions and on isotopic composition of lithium in a representative set of Proterozoic to Cretaceous kimberlites and lamproites from two cratonic areas in India (Fig. 24). Pilot results were compared with existing data for orogenic lamproitic rocks from the Bohemian Massif. Li isotope data revealed that kim-



■ **Fig. 24.** A photomicrograph of Chintalampalle kimberlite (1.1 Ga) with unusually fresh olivine containing up to 2 ppm Li (Wajrakarur kimberlite field, India). Photo by L. Krmíček.

berlites and lamproites from anorogenic areas are dominated by isotopically heavy Li (up to +16 ‰ δ^7Li) resembling the presence of important mantle component compositionally similar to altered oceanic crust, whereas orogenic lamproites differ in isotopically lighter Li in their mantle source. This reflects the presence of evolved Gondwana-derived crustal material subducted beneath the Bohemian Massif.

Project No. 9356: **Emplacement mechanisms of post-caldera intrusions: an example from the Platoro caldera, San Juan volcanic locus, Colorado** (*F. Tomek*)

This project focuses on the evaluation of magnetic anisotropy and geochronology data of the intra-caldera monzonite pluton emplaced after a collapse of the Platoro caldera, San Juan volcanic locus, southern Colorado. Due to strong winter (2016/2017) and abnormally high snow in June 2017, we could not finish sampling in high-altitude areas of the caldera (Project No. 6501 to F. Tomek). Such additional support allowed us another field campaign (travel from New Mexico to Colorado), during which we completed mapping and sampling of the monzonite pluton.

Project No. 9360: **Problematics of selected magnetic fabrics in Paleozoic rocks and development of methodology for separation of different magnetic fabrics** (*J. Černý*)

The project was focused on anisotropy of magnetic susceptibility (AMS) and strongly developed inverse magnetic fabrics found in Paleozoic rocks, Barrandian, Czech Republic. Such case of extreme magnetic fabric was suitable for laboratory and numerical experiments. As a consequence, two new methods for AMS fabric separation were developed and a software was created for a simple separation of distinguished magnetic fabrics as a user-friendly tool.

Project No. 9371: **Advance in the co-operation with Chinese institutions in exploration and research of karst areas in Shaanxi Province, central China** (*M. Filippi*, *Z.* Motyčka, R. Šebela, L. Matuška & J. Sirotek, Czech Speleological Society)

Speleological exploration (Shaanxi Project) in karst areas close to Hanzhong City in central China (Shaanxi Province) is a joint project of the Czech Speleological Society, Institute of Geology of the Czech Academy of Sciences, Institute of Karst Geology of the Chinese Academy of Sciences in Guilin and Shaanxi Geological Institute in Xi'an. During the 2017 expedition, several dolines and caves were discovered and visited, and their survey started. In total, more than 16 caves were visited and 2,940 m of new passages were mapped and partly photo-documented (Motyčka & Filippi 2017; Fig. 25). The achieved results were presented in several journals, TV and broadcast and at the 17th International Congress of Speleology (2017, Sydney; Motyčka *et al*. 2017). A Memorandum of cooperation in technical and business exchanges between Shaanxi Geological Survey, the Inst Geol, Czech Acad Sci and the Czech Sepleological Society was signed during the visit of Chinese colleagues in Prague in June 2017.

■ **Fig. 25.** A cave river in the Diheluoshuidong Cave, Shaanxi Province, China. Photo by M. Filippi.

MOTYČKA Z. & *FILIPPI M.* (2017): Shaanxi 2016: První české stopy v Číně. – *Speleofórum 2017*, 36: 59–69. Česká speleologická společnost. Praha. [in Czech]
MOTYČKA Z., *FILIPPI M.* & ZHANG Y. H. (2017): Cave exploration in Xiaonanhai karst area, Shaanxi Province, China. – *in*: MOORE K. & WHITE S. (Eds.): *Proceedings of the 17th International Congress of Speleology, Sydney, NSW, Australia, July 22–28, 2017*, 2: 330–333. Australian Speleological Federation, Inc. Sydney.

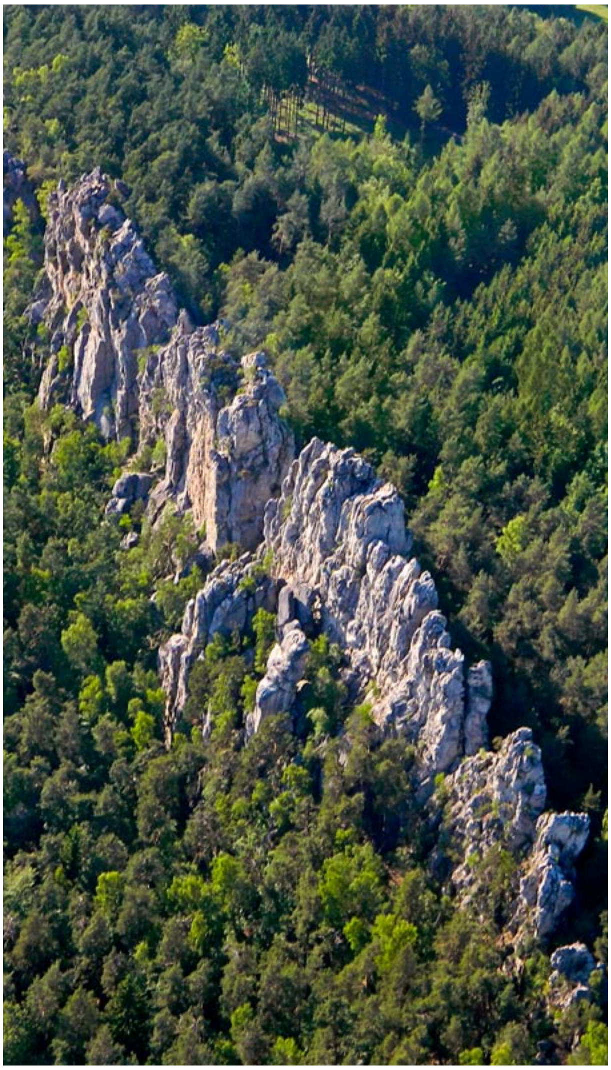
Project No. 9373: **Raman spectroscopy as a tool for quantification of carbonate content in the structure of natural apatites and as a possible tool for identification of monoclinic symmetry of Cl-rich apatites** (*N. Mészárosová*)

The first part of the current project was a continuation of the previous project called "Detection of carbon presence in apatite structure and verification of existence of the tetrahedron CO_3F in apatite structure by Raman spectroscopy" which showed that Raman spectroscopy is an appropriate tool for the identification of carbonate in apatite structure. However, it appeared that it is not possible to quantify carbonate contents without an appropriate calibration. The present project was dealing with a calibration of the S&I MonoVista CRS+ Raman microspectrometer for quantification of carbonate content in natural apatite samples or biomaterials. A set of synthetic hydroxylapatites with varying carbonate contents was required to establish the calibration curve. The apatite structure of synthetic samples was verified by power X-ray diffraction. One sample was found to be pure hydroxylapatite, and carbonate contents of six other samples ranged from 0.5 % to 4 % $(CO_3)^{2-}$. The carbonate contents were determined by thermogravimetry and by the TIC method using the Shimadzu TOC Analyzer. High-resolution Raman spectra of the samples were obtained and resolved by curve fitting. A combination peak of ν_3 vibration mode of phosphate and ν_1 vibration mode of carbonate at ~ 1,070 cm^{-1} were observed with variable intensity depending on the amount of carbonate content. Several possible calibration models are currently tested.

The second part of the project was focused on testing of Raman spectroscopy as an identification tool of monoclinic symmetry of Cl-rich apatites. The idea was based on the observation of some spectra of natural Cl-rich apatite samples, which showed significant differences (peak at ~ 1,000 cm^{-1}) compared to the spectra of other natural apatites. A synthesis of pure chlorapatite with a monoclinic structure was required first. Powder X-ray diffraction (XRD) was used for the confirmation of monoclinic structure of chlorapatite. Unfortunately, the results were ambiguous; it was not possible to confirm or exclude the monoclinic structure. Single-crystal XRD is required to confirm the monoclinic symmetry, which would indicate a successful synthesis and substantiate further investigation. The Raman spectra of this synthetic chlorapatite so far acquired did not show a substantial difference from the spectra of apatites displaying hexagonal structure.

Project No. 9375: **Publication of a book – Lusatian Fault** (*M. Šťastný*, *M. Coubal & J. Adamovič*)

After the release of several scientific papers on the Lusatian Fault, a major tectonic structure of the Bohemian Massif, this project intended to present the obtained results to a general Czech reader interested in geology. Although the publication mentions previous knowledge of the Lusatian Fault, it basically includes a comprehensive summary of data acquired by this team of authors over the last two decades. It reviews the structure, geological history and kinematic development of the Lusatian Fault zone and places them within the context of geological history of Alpine Europe. It includes detailed geological descriptions of 12 typical localities (geological maps, cross-sections, tectonograms), supplemented by photographs (Fig. 26). This part is meant as a guide for geotourists, covering the most exciting and geologically most informative localities along the fault. In addition, the book also brings broader information from the fields of geology, geomorphology, geothermics, seismology, hydrogeology and economic geology. With its generally orientated chapters and rich illustrations, it can be equally used as a textbook of geology. Manuscript of the book titled "Lusatian Fault – a border between two worlds" was submitted in November 2017, and is scheduled to be published by Novela Bohemica Publishers in 2018.



■ **Fig. 26.** A crest of the Suché skály Cliffs, formed by Cenomanian sandstones in the proximity of the Lusatian Fault. An aerial photo by M. Coubal.

Project No. 9378: **Usselo soils in the area of Czech Republic – pedogenetical processes in the Last Glacial** (*L. Lisá*)

Usselo soils are supposed to be the type of soils developed during relatively warm period at the end of the Last Glacial (Allerød ~ 13.8–12.6 ka BP). These soils were preserved due to sand accumulation during the younger Dryas (~ 12.6–11.7 ka BP). The appearance of these soils was not known in the area of Czech Republic until 2016. New finds of Usselo soil in the Vlkov area were the motive for the project proposal. The age of the Vlkov soils was confirmed but the hitherto obtained data from other potential localities in the Třeboňská pánev Basin and in the Polabí Lowland show much younger ages in spite of a similar stratigraphical context.

5. Publication Activity of Staff Members of the Institute of Geology

5a. Papers Published

(Arranged according to descending impact factor values and then in alphabetic order)

12.353* MAGNA T., *ŽÁK K.*, PACK A., MOYNIER F., MOUGEL B., PETERS S., *SKÁLA R.*, *JONÁŠOVÁ Š.*, MIZERA J. & ŘANDA Z. (2017): Zhamanshin astrobleme provides evidence for carbonaceous chondrite and post-impact exchange between ejecta and Earth's atmosphere. – *Nature Communications*, 8, 1, Article number 227: 1–8. DOI: 10.1038/s41467-017-00192-5

5.073* GROSCH E. G. & *SLÁMA J.* (2017): Evidence for 3.3 billion-year-old oceanic crust in the Barberton Greenstone Belt, South Africa. – *Geology*, 45, 8: 695–698. DOI: 10.1130/G39035.1

4.690* *ACKERMAN L.*, MAGNA T., *ŽÁK K.*, *SKÁLA R.*, *JONÁŠOVÁ Š.*, MIZERA J. & ŘANDA Z. (2017): The behavior of osmium and other siderophile elements during impacts: insights from the Ries impact structure and central European tektites. – *Geochimica et Cosmochimica Acta*, 210: 59–70. DOI: 10.1016/j.gca.2017.04.028

4.610* *NAVRÁTIL T.*, ŠIMEČEK M., SHANLEY J. B., *ROHOVEC J.*, *HOJDOVÁ M.* & HOUŠKA J. (2017). The history of mercury pollution near the Spolana chlor-alkali plant (Neratovice, Czech Republic) as recorded by Scots pine tree rings and other bioindicators. – *SCIENCE OF THE TOTAL ENVIRONMENT*, 586: 1182–1192. DOI: 10.1016/j.scitotenv.2017.02.112

4.100* USUKI T., IIZUKA Y., HIRAJIMA T., *SVOJTKA M.*, LEE H.-Y. & JAHN B.-M. (2017): Significance of Zr-in-rutile thermometry for deducing the decompression P–T Path of a garnet–clinopyroxene granulite in the Moldanubian Zone of the Bohemian Massif. – *Journal of Petrology*, 58: 1173–1198. DOI: 10.1093/petrology/egx050

3.993* *BREITER K.*, *ĎURIŠOVÁ J.* & DOSBABA M. (2017): Quartz chemistry – A step to understanding magmatic-hydrothermal processes in ore-bearing granites: Cínovec/Zinnwald Sn-W-Li deposit, Central Europe. – *Ore Geology Reviews*, 90: 25–35. DOI: 10.1016/j.oregeorev.2017.10.013

3.992* NEJMAN L., WOOD R., WRIGHT D., *LISÁ L.*, NERUDOVÁ Z., NERUDA P., PŘICHYSTAL A. & SVOBODA J. (2017): Hominid visitation of the Moravian Karst during the Middle-Upper Paleolithic transition: New results from Pod Hradem Cave (Czech Republic). – *Journal of Human Evolution*, 108: 131–146. DOI: 10.1016/j.jhevol.2017.03.015

3.907* KONOPÁSEK J., HOFFMANN K.-H., *SLÁMA J.* & KOŠLER J. (2017): The onset of flysch sedimentation in the Kaoko Belt (NW Namibia) – implications for the pre-collisional evolution of the Kaoko-Dom Feliciano-Gariep orogen. – *Precambrian Research*, 298: 220–234. DOI: 10.1016/j.precamres.2017.06.017

3.893* DOSTAL J., SHELLNUTT J. G. & *ULRYCH J.* (2016): Petrogenesis of the Cenozoic alkaline volcanic rock series of the České Středohoří complex (Bohemian Massif), Czech Republic: a case for two lineages. – *American Journal of Science*, 317: 677–706. DOI: 10.2475/06.2017.02

3.857* *ACKERMAN L.*, MAGNA T., RAPPRICH V., UPADHYAY D., KOCHERGINA Y., KRÁTKÝ O., ČEJKOVÁ B., ERBAN V. & *HRSTKA T.* (2017): Contrasting petrogenesis of spatially related carbonatites from Samalpatti and Sevattur, Tamil Nadu, India. – *Lithos*, 284/285: 257–275. DOI: 10.1016/j.lithos.2017.03.029

3.857* *BREITER K., ĎURIŠOVÁ J., HRSTKA T., KORBELOVÁ Z.*, HLOŽKOVÁ VAŇKOVÁ M., VAŠINOVÁ GALIOVÁ M., KANICKÝ V., RAMBOUSEK P., KNÉSL I., DOBEŠ P. & DOSBABA M. (2017): Assessment of magmatic *vs*. metasomatic processes in rare-metal granites: A case study of the Cínovec/Zinnwald Sn-W-Li deposit, Central Europe. – *Lithos*, 292/293: 198–217. DOI: 10.1016/j.lithos.2017.08.015

3.857* SOEJONO I., BURIÁNEK D., JANOUŠEK V., *SVOJTKA M.,* ČÁP P., ERBAN V. & GANPUREV N. (2017). A reworked Lake Zone margin: Chronological and geochemical constraints from the Ordovician arc-related basement of the Hovd Zone (western Mongolia). – *Lithos*, 294/295: 112–132. DOI: 10.1016/j.lithos.2017.08.014

3.722* BRUTHANS J., *FILIPPI M.*, ŘIHOSEK J. & SCHWEIGSTILLOVÁ J. (2017): Quantitative study of rapidly weathering sandstone overhang. – *Earth Surface Processes and Landforms*, 42, 5: 711–723. DOI: 10.1002/esp.4016

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5d. Other Lectures and Poster Presentations

ADAMOVIČ J.: Databáze skalního řícení v pískovcích české křídové pánve. – *Seminář Stabilita pískovcových skalních věží v turisticky atraktivních oblastech, September 16, 2017. Broumov*. *Lecture, September 16, 2017.*

BREITER K.: Lithium v Krušných horách, geochemie, ložiska a perspektivy těžby. – *Seminář CEMIR, Česká geologická služba, December 6, 2017. Praha*. *Invited lecture, December 6, 2017.*

CHADIMA M.: Magnetic anisotropy of rocks with a special emphasis on deformed sediments. – *LatinMag2017 – Workshop, September 18, 2017. Queretaro, Mexiko*. *Lecture, September 18, 2017.*

HRSTKA T.: Identification of sources and origin of hazardous contaminants in atmosphere - Dust Particle Atlas. *Lecture. – Outokumpu - Finland 2017. Lecture, September 11, 2017.*

LOKAJÍČEK T., VASIN R. N., KERN H., *SVITEK T.*, LEHMANN E., MANNES D.C., CHAOUCHE M. *&* WENK H.-R. (2017): Elastic anisotropy of gneiss: comparison of experimental measurements, crystal orientation and microstructure-based modelling. *– 4th International workshop on Rock Physics, 29.5.–2.6., Trondheim, Norway. Poster, May 30, 2017.*

SCHUBERT A. & *ADAMOVIČ J.*: Historie zapsaná do skal. Historické cesty v pískovcích mezi Kokořínem a Mšenem. *– Národní památkový ústav. Praha. Lecture, June 8, 2017.*

SLAVÍK L.: Multiproxy přístup a HI-Res stratigrafie: kontrastní příklady stupně přesnosti dosažené v korelaci středněpaleozoických sedimentárních sekvencí. *– Sedimentární a paleontologický seminář, Přírodovědecká fakulta Univerzity Karlovy v Praze, December 13, 2017. Lecture, December 13, 2017.*

STEMBERK J., *COUBAL M.* & MÁLEK J.: Bizardní skalní útvary a k čemu je dobré je zkoumat? *– Stabilita pískovcových skalních věží v turisticky atraktivních oblastech, September 16, 2017. Broumov. Lecture, September 16, 2017.*

SVITEK T., VAVRYČUK V., LOKAJÍČEK T. & PETRUŽÁLEK M. (2017): Effect of pressure on 3D distribution of P-wave velocity and attenuation in antigorite serpentinite. *– 4th International Workshop on Rock Physics, May 29 – June 2, 2017. Trondheim, Norway. Lecture, June 1, 2017.*

ŽIGOVÁ A.: Charakteristika mineralogického složení vybraných půdních typů z referenčních tříd LUVISOLY a KAMBISOLY. *– Česká společnost pro výzkum a využití jílů. Praha. Lecture, June 1, 2017.*

5e. Popular Science

Magazines, Journals, Newspapers, Books

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BOROVIČKA J. (2017): Kdo se bojí, nesmí do lesa. *– Lidové noviny*, *Orientace*, 4. 3. 2017: 21. Praha.

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MIKULÁŠ R. (2017): Samota v Čechách. *– Lidové noviny, Orientace*, III/17–19, 15. 7. 2017. Praha.

MIKULÁŠ R. (2017): Šance na dlouhý věk. *– Lidové noviny, Orientace*, III/21, 11. 11. 2017. Praha.

MIKULÁŠ R. (2017): Sousto pro kreacionisty. *– Lidové noviny, Orientace*, III/21, 6. 5. 2017. Praha.

MIKULÁŠ R. & OLIVOVÁ J. (2017): Strojově přečtené fosilie. *– A / Věda a výzkum*, 1, 2: 7. Praha.

SOUČEK M., *MIKULÁŠ R.*, FATKA O. & *VAVRDOVÁ M.* (2017): Konečně spolehlivý nález. *– Vesmír*, 96, 12: 712–715.

TUČEK J. (Ed.) & *KLETETSCHKA G.* (2017): Stromy svědčí o katastrofě. *– Lidové noviny*, *Orientace, Věda*, 23. 12. 2017: 26/VIII. Praha.

Television and Radio Broadcasting

BOROVIČKA J.: Večerní host Radiožurnálu. – *Český rozhlas 1, Radiožurnál*: 3.9. 2017. Praha.

BOROVIČKA J.: Výzva: Jeden hřib asi vyřadíme ze seznamu jedlých hub, říká mykolog. Houba obsahuje vysoké množství arzénu. – *Seznam TV*: 28. 9. 2017. Praha.

BREITER K.: České lithium. – *Česká televize*, *ČT24*: 6. 10. 2017. Praha.

HARVAN J., LEDERER A. & *CÍLEK V.*: České a moravské podzemí (52 dokumentárních filmů ze série Podzemní Čechy I, Podzemní Čechy II, Tajemný podzemní svět, Mizející místa domova a Tajný život skal včetně dvou repríz). – *Česká televize, ČT 2*: březen–listopad 2017. Praha.

HRSTKOVÁ T. & *CÍLEK V.*: Pozemský cestopis I. – *Český rozhlas Leonardo. Český rozhlas+*: 14. 3. 2017. Praha.

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MORAVEC V., *CÍLEK V.*, KAVINA P. & STARÝ J: Otázky Václava Moravce. Lithium, wolfram, uran. O národním bohatství pod zemí s geology Václavem Cílkem, Jaromírem Starým a Pavlem Kavinou. – *Česká televize, ČT 1*: 19. 3. 2017.

SENKOVÁ Z. & *CÍLEK V.*: Jak to vidí… – *Český rozhlas Dvojka*: 11. 1. 2017. Praha.

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SENKOVÁ Z. & CÍLEK V.: Jak to vidí… – *Český rozhlas Dvojka*: 30. 5. 2017. Praha.

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STÁRKOVÁ B., DUDÍK SCHULLMANNOVÁ B. & *MIKULÁŠ R.*: Kamenná Praha. – *Český rozhlas Vltava*: 1. 5. 2017. Praha.

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BOROVIČKA J.: Houby a arzén. *Lecture, ČSOP Podorlicko, 6. 10. 2017*. Česká Třebová.

BOROVIČKA J.: Houby a arzén. *Lecture, Cyklus přednášek České mykologické společnosti, 14. 3. 2017*. Prague.

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CÍLEK V.: Cesty k indiánům. *Lecture, Husa na provázku, 16. 2. 2017*. Brno.

CÍLEK V.: Antropocén. *Lecture, Přírodovědecká fakulta U.K.. 18. 1. 2017*. Praha.

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CÍLEK V.: Detroit, jak rozpustit civilizaci. *Lecture, Livingstone, Colours of Ostrava, 19. 7. 2017*. Ostrava.

CÍLEK V.: Energy and Water. *Lecture, Knihovna AV, 30. 11. 2017*. Praha.

CÍLEK V.: Mezi indiány. *Lecture, Kosmas, Colours of Ostrava, 19. 7. 2017*. Ostrava.

CÍLEK V.: Osudy měst. *Lecture. Junktown, Bratronice, 23. 6. 2017*. Bratronice.

CÍLEK V.: Staré cesty. *Lecture,* 22. 7. 2017. Smolnice.

CÍLEK V.: Svět a jeho proměny. *Lecture, Golem Klub, 3. 10. 2017*. Praha.

CÍLEK V.: Trendy současného světa. *Lecture, 19. 9. 2017.* Stará Boleslav.

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CÍLEK V.: Zadržování vody v krajině. *Lecture, 8. 12. 2017*. Slavonice.

CÍLEK V.: Změny současného světa. *Lecture, Fujitsu Day, Grandior, 29. 3. 2017*. Praha.

FILIPPI M.: Čeští jeskyňáři v Zemi draka. *Lecture, Café Nobel, 8. 8. 2017*. Teplice.

MIKULÁŠ R.: Paleoichnologie – stopy po činnosti fosilních organismů na území ČR. *Lecture*, *Kavárna Universitas, Univerzita Pardubice & Divadlo 29 & SSČ AVČR, 23. 5. 2017*. Pardubice.

MIKULÁŠ R.: Pohled do země pod Kladnem. *Lecture, Sládečkovo vlastivědné muzeum & SSČ AV ČR Praha, 5. 5. 2017*. Kladno.

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MIKULÁŠ R.: Co zanechalo na moře a jezera v okolí Loun? *Lecture & Excursion, SSČ AV ČR,* Inst Geol, Czech Acad Sci *& Muzeum Zkamenělý les, 17. 6. 2017.* Louny.

MIKULÁŠ R.: Geologický a paleontologický význam Barrandienu. *Lecture & Excursion, Czech Acad Sci, Inst Geol., 11. 10. 2017.* Praha.

MIKULÁŠ R.: Geologie Prahy. *Lecture, Den s osobnostmi, Střední průmyslová škola stavební, Dušní, 19. 4. 2017***.** Praha.

MIKULÁŠ R.: Nekonečná zásobárna drobných zkamenělin - lom Mušlovka. *Lecture & Excursion, SSČ AV ČR & ZŠ Satalice, 8. 6. 2017.* Praha.

MIKULÁŠ R.: Nová krajina. *Lecture, Společnost Gales, 12. 10. 2017.* Praha.

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MIKULÁŠ R.: Z chladného moře k tropickým útesům – prvohorní usazeniny v okolí Berouna. *Lecture & Excursion, SSČ AV ČR & Inst Geol, Czech Acad Sci, 3. 6. 2017.* Koněprusy.

MIKULÁŠ R.: Za jineckými trilobity. *Lecture & Excursion, SSČ AV ČR & Inst Geol, Czech Acad Sci, 6. 6. 2017.* Rejkovice.

MORAVEC V. & CÍLEK V.: Máme se bát islamizace? Veletrh vědy. *Veřejná diskuze. Letňany, 10. 6. 2017*. Praha.

ŠŤASTNÝ M.: Přehled geologie ČR. *Lecture, Summer art school, August 2017*. Trstěnice.

VRÁNKOVÁ K. & *MIKULÁŠ R.*: Kde bylo kdysi moře. *Lecture on a boat during the way on the Vltava River, Den architektury, Magistrát hlavního města Prahy*, *30. 9. 2017.* Praha.

WEINEROVÁ H.: Tajemné mikrofosilie z devonu Čech a Moravy. *Lecture, Mineralogický klub Česká Třebová o.s., 24. 5. 2017*. Česká Třebová.

Geological Olympics

Černý J.

Regional geologist in the regional round of the Geological Olympics competition for elementary and secondary education in the Liberec region. Formation of suitable collections for testing, test evaluation and subsequent expert discussion with participants. Following participation in the national round of the Geological Olympics competition.

5f. Unpublished Reports

ADAMOVIČ J., *ULRYCH J.*, *ROHOVEC J.*, *RAJLICHOVÁ J.* & PEROUTKA J. (2017): *Ověření geologických poměrů podél čedičových žil zadržujících povrchové a podzemní vody na území CHKO Kokořínsko-Máchův kraj. Závěrečná zpráva*. – Inst Geol, Czech Acad Sci, Prague for Nature Conservation Agency of the Czech Republic: 1 – 100. Praha.

BOROVIČKA J. (2017): *Mykologický průzkum PP Hadce u Hrnčíř, zpráva za rok 2017.* – Inst Geol, Czech Acad Sci for Český svaz ochránců přírody Vlašim: 1–9. Praha.

BOSÁK P. (2017): *Kra Maleníku.* – Inst Geol, Czech Acad Sci, Prague for Geotest, a. s.: 1–20. Praha.

BOSÁK P. (2017): *Postup těžebních stěn Velkolomu Čertovy schody-západ. Akce sanace a rekultivace severní stěny. Posudek. Období: leden až prosinec 2016.* – Inst Geol, Czech Acad Sci, Prague for Velkolom Čertovy schody, a. s.: 1–20 + 1–79. Praha.

BOSÁK P., *ŠŤASTNÝ M.*, *ROHOVEC J.* & *MATOUŠKOVÁ Š.* (2017): *Mineralogické a chemické složení vzorků z Velkolomu Čertovy schody*. – Inst Geol, Czech Acad Sci, Prague for LHOIST Vápenka Čertovy Schody, a. s.: 1–45. Praha.

LISÁ L. & ALEXANDROVÁ J. (2017): *Geoarcheologický posudek z lokality „Rezidence Cukerní“.* – Inst Geol, Czech Acad Sci, Prague for Archaia Praha, v. v. i.: 1–15. Praha.

NAVRÁTIL T., *DOBEŠOVÁ I.*, *ROHOVEC J.* & *HUBIČKOVÁ S.* (2017): *Monitoring srážkových vod na území NPČŠ. Zpráva za rok 2016*. – Inst Geol, Czech Acad Sci, Prague for the Administration of the Bohemian Switzerland National Park: 1–20. Praha.

NAVRÁTIL T., *NOVÁKOVÁ T.*, *ŽÁK K.*, *ROHOVEC J.*, *MATOUŠKOVÁ Š.*, *ROLL M.*, *HUBIČKOVÁ S.* & *DOBEŠOVÁ I.* (2017): *Kontaminace lesních a vodních ekosystémů CHKO Brdy rtutí a speciace hliníku v povrchových vodách*. – Inst Geol, Czech Acad Sci, Prague for Nature Conservation Agency of the Czech Republic: 1–81. Praha.

PETRUŽÁLEK M., *SVOBODA L.* & *FILLER V.* (2017): *Laboratorní zkoušky hornin na vzorcích z lokality NJZ EDU – VH objekty a trasy pro přívod surové vody a odvod odpadních vod: závěrečná zpráva*. – Inst Geol, Czech Acad Sci, Prague for Energoprůzkum Praha, spol. s r. o.: 1–29. Praha.

PETRUŽÁLEK M. (2017): *Stanovení mechanických vlastností hlavních petrografických typů na potencionálních lokalitách HÚ. Závěrečná zpráva*. – Inst Geol, Czech Acad Sci, Prague for Správa úložišť radioaktiovních odpadů: 1–76. Praha.

PETRUŽÁLEK M. (2017): *Stanovení obálky smykové pevnosti triaxiální zkouškou na vzorcích z lokality Temelín. Závěrečná zpráva.* – Inst Geol, Czech Acad Sci, Prague for SG Geotechnika, a. s. 1 – 9. Praha.

PRUNER P., *ČÍŽKOVÁ K.* & *KDÝR Š.* (2017): Paleomagnetic research of the fill in the Kalacka Cave, Poland. Final report. Catalogue of primary paleomagnetic data. – Inst Geol, Czech Acad Sci, Prague for University of Silesia: 1–35. Praha.

ROHOVEC J. (2017): *Tracing experiment on elevated highway D8, Prackovice. (Contract owner: Isatech, s. r. o.). Supplementary study of water passage under the Prackovice elevated highway*. – Inst Geol, Czech Acad Sci, Prague for ČSOP Vlašim: 1–10. Praha.

SKÁLA R. & *ADAMOVIČ J.* (2017): *Určení horniny dlažebních obkladů. Závěrečná zpráva*. – Inst Geol, Czech Acad Sci, Prague for ČR Generální ředitelství cel: 1–68. Praha.

SKÁLA R. & *MIKYSEK P.* (2017): *Analýza stavebního prachu. Posudek*. – Czech Acad Sci, Inst Geol., Prague for Zlatnická, s. r. o.: 1–9. Praha.

SVOBODOVÁ M. (2017): *Palynologie vybraných vzorků z lokality Pecínov.* – Inst Geol, Czech Acad Sci, Prague for Czech Acad Sci, Inst Geophys (NS085200 Sedimenty): 1–8. Praha.

SVOBODOVÁ M. (2017): *Palynology of two selected samples from the coal seam in Waltersdorf (Zittau Mountains,*

Germany). – Inst Geol, Czech Acad Sci, Prague for Senckenberg Museum Görlitz, Germany: 1–5. Praha.
ŽÁK K., FATKA O., *LAIBL L.* & *MIKULÁŠ R.* (2017): *Revize stavu paleontologických a geomorfologických lokalit na území CHKO Brdy*. – Inst Geol, Czech Acad Sci, Prague for Nature Conservation Agency of the Czech Republic: 1–36 + 1–134. Praha.

6. Organization of Conferences and Scientific Meetings

International Workshop: **Workshop on atmospheric dust monitoring, Outokumpu – Finland, September 10–12, 2017**. Organized by the Institute of Geology of the Czech Academy of Sciences, Prague & Geological Survey of Finland. Organizing committee: *T. HRSTKA* & A. BUTCHER.

The workshop was focused on the techniques and methodology used in the analysis of atmospherically deposited dust. The aim was to initiate a discussion on the application of innovative microanalytical techniques and to establish future collaboration in the area of dust particle studies. This workshop was attended by 8 persons from 2 countries.

International conference: **4th International Conodont Symposium ICOS4: Progress on Conodont Investigation. Jointly with the International Subcommission on Devonian Stratigraphy (SDS) and the International Subcommission on Silurian Stratigraphy (ISSS) of the ICS/IUGS, Valencia – Spain, June 20–July 5, 2017**. Organized by Univestity of Valencia, Spain, University of Cagliari, Italy, Institute of Geology of the Czech Academy of Sciences, Prague & University of Graz, Austria. Organizing committee: VALENZUELA RÍOS J. I., LIAO J.-C., MARTÍNEZ-PÉREZ C., CORRADINI C., *SLAVÍK L.* & SUTTNER T.

The 4th International Conodont Symposium jointly with the International Subcommission on Devonian Stratigraphy and the International Subcommission on Silurian Stratigraphy (ICS/IUGS) took place in June 2017 in Valencia, Spain. The Institute of Geology was among principal organizers of this important event focused on progress in the investigation of enigmatic conodont organisms that are considered direct ancestors of vertebrates. Conodonts are fundamental for global stratigraphy of the Paleozoic, dating marine sedimentary rocks; thus serving as a basis for subsequent geological studies conducted in marine environment. The Symposium was held jointly with the International Subcommission on Silurian Stratigraphy (ISSS) and the International Subcommission on Devonian Stratigraphy (SDS) of the ICS/IUGS; both meetings were organized by the officers of the commissions, *P. Štorch* (Chairman of the ISSS) and *L. Slavík* (Secretary of the SDS), respectively. Over 100 specialists and stratigraphers – the subcommission members from all over the world took part at the Symposium and adjoined stratigraphic meetings. Participants from five continents took part in the follow-up Post-Symposium Excursion to the Prague Synform and Carnic Alps that was co-organized by L. Slavík. It was focused on Silurian and Devonian sections, both the well-known classic localities including GSSP and many other less famous but interesting sites. An extensive volume of contributions has been issued by the organizers (Liao & Valenzuela-Ríos, Eds., 2017). Also an extensive field excursion guidebook divided into three parts (Spanish Central Pyrenees, Iberian Ranges, Prague Synform and Carnic Alps) was published by the organizers (Suttner *et al*., Eds., 2017).

LIAO J.-C. & VALENZUELA-RÍOS J. I. (Eds., 2017): Fourth International Conodont Symposium ICOS IV: Progress on Conodont Investigation. – *Cuadernos del Museo Geominero*, 22: 1–346. Instituto Geológico y Minero de España. Madrid.
SUTTNER T. J., VALENZUELA-RÍOS J. I., LIAO J.-C., CORRADINI C. & *SLAVÍK L.* (Eds., 2017): International Conodont Symposium 4: Progress on Conodont investigation, Valencia 25-30th June 2017, Field Guide Book. – *Berichte des Institutes für Erdwissenschaften, Karl-Franzens-Universität Graz*, 23: 1–286.

7. Undergraduate and Graduate Education

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

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

ČERNÝ J.: *Geoscience Documentation of Territory* (G4221). Role: Instructor of geological mapping in the field. Undergraduate 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.

CÍLEK V.: *The environment of central European towns*. *5-day excursion.* Graduate/undergraduate course, USAC, Prague.

CÍLEK V.: *The evolution of Czech landscape*. Graduate course, School of Architecture. Academy of Fine Arts, Prague.

CÍLEK V.: *Landscape and History*. Under/graduate course, Summer School, Simon Fraser University, Vancouver (at Faculty of Liberal Arts, Charles University, Prague).

DATEL J. & *MIKULÁŠ R.*: *Geology for archaeologists* (APA500029-PVP). Undergreaduate (compulsory) Course, Faculty of Philosophy, Charles University, Prague.

DRESLEROVÁ D., *LISÁ L.*, KOČÁR 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.

HOJDOVÁ M.: *Fundamentals of geology* (APA35E). Undergraduate Couse, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences, Prague.

KLETETSCHKA G.: *Geotechnology in global changes* (MG451P10). Under/graduate (required) Course, Faculty of Science, Charles University, Prague.
KLETETSCHKA G.: *Physics of the Earth* (MG452P04G). Under/graduate (required) Course, Faculty of Science, Charles University, Prague.
KOHOUT T.: Planetary geophysics (535021). Under/graduate Course, Faculty of Science, University of Helsinki, Finland.
KRMÍČEK L.: *Geology* (BF001). Undergraduate (obligatory) Course, Faculty of Civil Engineering, Brno University of Technology, Brno.
KRMÍČEK L: Isotope geochemistry (G5961). Undergraduate (optional) Course, Faculty of Science, Masaryk University, Brno.
KRMÍČEK L.: *Principles of modern geochemical modeling in igneous petrology* (G9271). Undergraduate (optional) Course, Faculty of Science, Masaryk University, Brno.
KRMÍČEK L.: *Principles of regional geology of the Czech Republic for civil engineers* (BF092). Undergraduate (optional) Course, Faculty of Civil Engineering, Brno University of Technology, Brno.
LISÁ L.: *Geoarchaeology* (KAR_GEOA). Graduate (optional) Course, Faculty of Philosophy, University of West Bohemia, Pilsen.
MATULA S. & *HOJDOVÁ M.*: *Fundamentals of Geology and Hydrogeology* (AIA17E). Undergraduate Couse, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague.
MAZUCH M. & *PŘIKRYL T.*: *Paleontology of fossil vertebrates (MG422P36)*. Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
MIKULÁŠ R. in HOLCOVÁ K. et al.: *Paleoecology* (MG422P51). Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
MIKULÁŠ R. in SAKALA J. et al.: *Principles of paleobiology I* (MG422P02). Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
MIKULÁŠ R.: *Trace fossils and ichnofabric of sedimentary rocks* (MG421P40). Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
NAVRÁTIL T.: *Heavy metals in the environment* (MG431P92). Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
NOVÁKOVÁ T. & ROLL M.: *Dating of environmental changes* (MG410P07). Under/graduate (optional) Course, Faculty of Science, Charles University, Prague.
PŘIKRYL T.: *Comparative anatomy of vertebrates (MB170P47)*. Undergraduate (optional) Course and Practical Study, Faculty of Science, Charles University, Prague.
PŘIKRYL T.: *Paleontological seminars (MG422S42)*. Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
PŘIKRYL T. in HOLCOVÁ K. et al.: *Principles of paleobiology I (MG422P02)*. Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
PŘIKRYL T. in KOŠŤÁK M. et al.: *Paleoecology (MG422P51)*. Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
SKÁLA R.: *Impact cratering and shock metamorphism* (MG431P39). Undergraduate/graduate (optional) course, Faculty of Science, Charles University, Prague.
SKÁLA R.: *Meteorites, their origin and composition* (MG431P40). Undergraduate/graduate (optional) course, Faculty of Science, Charles University, Prague.
SKÁLA R.: *Mineralogy* (MG431P52). Undergraduate (obligatory) course, Faculty of Science, Charles University, Prague.
SKÁLA R. & PLÁŠIL J.: *Minerals: Their origin, occurrence and structure* (MG431P48). Undergraduate/graduate (optional) course, Faculty of Science, Charles University, Prague.
ŠTORCH P.: *Principles and methods of stratigraphy* (G421P25). Undergraduate (optional) Course, Faculty of Science, Charles University, Prague.
TOMEK F.: *Economic geology lecture: Mineral deposits of magmatic systems.* Undergraduate course, New Mexico Highlands University.
TOMEK F.: *Laboratory course in physical geology I* (MG421C21A). Undergraduate (obligatory) course, Faculty of Science, Charles University, Prague.
TOMEK F.: *Structural geology lecture: Geological history and evolution of the Bohemian Massif with emphasis on granite magmatism.* Undergraduate course, New Mexico Highlands University.

7b. Supervision in Undergraduate Studies

Open Science

HLADÍKOVÁ K., Faculty of Science, Charles University, Prague (*supervisor P. Schnabl, 2017*)

Erasmus+

NIKOLOPOULOS G., Department of Geology, Univestity of Patras, Greece (*supervisor P. Schnabl, 2017*)

Bc. Theses

KAMENÍKOVÁ T., Faculty of Science, Charles University, Prague (*supervisor G. Kletetschka, since 2014*)
PÍŠOVÁ B., Faculty of Science, Charles University, Prague (*supervisor R. Skála, since 2017*)
VITOUŠ P., Faculty of Science, Charles University, Prague (*supervisor F. Tomek, since 2017*)

MSc. Theses

ADAMEKOVÁ K., Faculty of Science, Masaryk University, Brno (*supervisor L. Lisá, defended 2017*)
CHMELOVÁ K., Faculty of Science, Charles University, Praha (*supervisor T. Přikryl, since 2013, interrupted in 2016*)
GRACIA DE C., Faculty of Science, Charles University, Praha (*supervisor T. Přikryl, defended 2017*)
HAKALOVÁ P., Faculty of Science, Charles University, Praha (*supervisor T. Přikryl, since 2017*)
HUŠKOVÁ A., Faculty of Science, Charles University, Prague (*supervisor L. Slavík, defended 2017*)

KUBOUŠKOVÁ S., Faculty of Science, Masaryk University, Brno (*supervisor L. Krmíček, since 2016)*
LEBEDOVÁ K., Faculty of Science, Charles University, Prague (*advisor S. Čermák, since 2016*)
PLICHTA A., Faculty of Science, Masaryk University, Brno (*advisor J. Wagner, since 2016*)
POLÁK L., Faculty of Science, Charles University, Prague (*supervisor L. Ackerman, defended 2017*)
ŠMEJKAL R., Faculty of Science, Charles University, Prague (*supervisor S. Čermák, since 2015*)
ŠVŮGROVÁ B., Faculty of Science, Charles University, Prague (*supervisor T. Přikryl, since 2017*)

7c. Supervision in Graduate Studies

Ph.D. Theses

ADAMEKOVÁ K., Faculty of Science, Masaryk University, Brno (*supervisor L. Lisá, from 2017*)
DZIKOVÁ L., Faculty of Science, Masaryk University, Brno (*supervisor R. Skála, since 2007, temporarily suspended due to maternity leave*)
HOŠEK J., Faculty of Science, Charles University, Prague (*supervisor L. Lisá, defended in 2017*)
HRUBÁ J., Faculty of Science, Charles University, Prague (*supercisor G. Kletetschka, since 2013*)
HRUBÝ J., Faculty of Science, Masaryk University, Brno (*supervisor L. Krmíček, since 2017*)
HUŠKOVÁ A., Faculty of Science, Charles University, Prague (*supervisor L. Slavík, since 2017*)
JONÁŠOVÁ Š., Faculty of Science, Charles University, Prague (*supervisor R. Skála, since 2014*)
KALLISTOVÁ A., Faculty of Science, Charles University, Prague (*supervisor R. Skála, since 2010*)
KOŘÍNKOVÁ D., Faculty of Science, Charles University, Prague (*supervisor J. Adamovič, since 2015*)
MARKLEY M., Faculty of Science, Charles University, Prague (*supervisor G. Kletetschka, since 2016*)
MÉSZÁROSOVÁ N., Faculty of Science, Charles University, Prague (*supervisor R. Skála, since 2016*)
POLÁK L., Faculty of Science, Charles University, Prague (*supervisor L. Ackerman, since 2017*)
ŠAMÁNEK J., Faculty of Science, Masaryk University, Brno (*co-supervisor/advisor R. Mikuláš, since 2016*).
ŠIŠKOVÁ P., Faculty of Science, Masaryk University, Brno (*supervisor L. Krmíček, since 2017*)
SOUMAR J., Faculty of Science, Charles University, Prague (*supervisor R. Skála, since 2011*)
ŠUJANSKÁ D., Faculty of Civil Engineering, Brno University of Technology, Brno (*supervisor L. Krmíček, since 2017*)
SUN Z. Y., State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing, and University of Chinese Academy of Sciences, Beijing, P. R. of China (*co-supervisor/advisor P. Štorch, since 2016*)
VAŠINKA M., Faculty of Science, Masaryk University, Brno (*supervisor L. Krmíček, since 2016*)
VAŠKANINOVÁ V., Faculty of Science, Charles University, Prague (*co-supervisor J. Zajíc, 2010-2017*)
VEJROSTOVÁ L., Faculty of Science, Charles University, Prague (*supervisor L. Lisá, 2013–2017*)

7d. Memberships in Scientific and Academic Boards

BOROVIČKA J.

Member, Presidium, Scientific Secretary, Czech Mycological Society, Prague.

BOSÁK P.

Member, Permanent Commission for defense of Doctor of Sciences (DrSc.) degree in geology (010501–010502) and geochemistry (010533) at the Ministry of Education, Science, Research and Sports of the Slovak Republic (since April 1, 2016).
Chairman, Committee for Degree of Doctor of Sciences (DSc.) in Geological Sciences at the Czech Academy of Sciences, Prague.
Chairman of the Executive Board of Institute of Geology of the Czech Academy of Sciences, Prague.
Member, Academic Assembly of the Czech Academy of Sciences, Prague (until May 31, 2017).
Member, Board of Graduate Studies in Geology (4 years), Faculty of Science, Charles University, Prague.
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, Prague.
Member, Committee for Defenses of Dissertations, Ph.D. Study Program of Applied Geology, Faculty of Science, Charles University, Prague.
Member, Committee for Defenses of Dissertations, Ph.D. Study Program of Physical Geography and Geoecology, Faculty of Science, Charles University, Prague.
Member, Committee for State Doctoral Examinations, Ph.D. Study Program of Physical Geography and Geoecology, Faculty of Science, Charles University, Prague.
Member, Committee for State Rigorosum Examinations in Geology (general geology), Faculty of Science, Charles University, Prague.

CÍLEK V.

Vesmír. Member of the Editorial Board, Prague (since 1998).

FILIPPI M.

Vice-Chairman, Executive Board of the Institute of Geology of the Czech Academy of Sciences, Prague.

HLADIL J.

Member, Committee for degree of Doctor of Sciences (DSc.) in geological sciences at the Czech Academy of Sciences, Prague.
Member, Board of Graduate Studies in Geology, Faculty of Science, Charles University, Prague.

Member, Board of Graduate Studies in Geology, Faculty of Science, Masaryk University, Brno.
Member, Executive Board of the Institute of Geology of the Czech Academy of Sciences, Prague.

KLETETSCHKA G.
Member, Advisory Board of Scientific Activities, Ministry of Tranport of the Czech Republic, Prague
Member, Advisory Board of Cosmic Activities, Ministry of Tranport of the Czech Republic, Prague.
Member of Review Board, National Aeronautics and Space Administration, USA.

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

MIKULÁŠ R.
Vice-Chairman, Supervisory Board of the Institute of Geology of the Czech Academy of Sciences, Prague.
Alternating Member of the Doctoral Examination Committee in Geology, Faculty of Science, Charles University, Prague.
Member, Editorial Board of the Czech Academy of Sciences, Prague.
Member, Advisory Board of the Czech Academy of Sciences for Internal Media and Science Communication, Prague.
Member, Czech Committee for UNESCO, Board for Natural Environment, Prague.
Member, Board of Directors, Bohemian Paradise UNESCO Global Geopark, Turnov.

NAVRÁTIL T.
Member of the Committee for Finals of Doctoral Students in Applied Geology, Faculty of Sciences, Charles University, Prague.
Member of the Committee for Doctoral Thesis Defense in Applied Geology, Faculty of Sciences, Charles University, Prague.
External Member, State Magisterium and Rigorosa examinations in Geology, Faculty of Sciences, Charles University, Prague.
Member, Earth Science Panel (geophysics, geochemistry, geology mineralogy and hydrogeology) of Czech Science Foundation, Prague.

PRUNER P.
Member of the Board of the Graduate Studies in Geophysics, Faculty of Science, Charles University, Prague.
Member of the Commitee for degree of Doctor of Sciences (DSc.) in geological sciences at the Czech Academy of Sciences, Prague.
Member of the Permanent Working Group of Geosciences Accreditation Commission, Czech Republic.
Member, Executive Board of the Institute of Geology of the Czech Academy of Sciences, Prague.

ROČEK Z.
Member, Committee for Degree of Doctor of Sciences (DSc.) in Zoology and Physiology of animals at the Czech Academy of Sciences, Prague.

SKÁLA R.
Chairman, Committee for Finals of Undergraduate Students in Geology, specialization Mineralogy and Crystallography, Faculty of Sciences, Charles University, Prague.
Member, Committee for Finals of Undergraduate Students in Geology, specialization Geochemistry, Faculty of Sciences, Charles University, Prague.

SLAVÍK L.
Member, Executive Board of Institute of Geology of the Czech Academy of Sciences, Prague.
Alternating Member, Doctoral Examination Committee in Geology, Faculty of Sciences, Charles University, Prague.
Member, Undergraduate (MSc.) and Doctoral Committee in Geology-specialization Geobiology, Faculty of Sciences, Charles University, Prague.

ŠTORCH P.
Alternating Member, Committee for Degree of Doctor of Sciences in Geological Sciences, Czech Academy of Sciences, Prague.

SVOJTKA M.
Member, Committee for Finals of Undergraduate and Doctoral Students in Geology, Faculty of Sciences, Charles University, Prague.
Member, Committee for Finals of Doctoral Thesis Defense in Geology, Faculty of Sciences, Charles University, Prague.
Member, Executive Board of the Institute of Geology of the Czech Academy of Sciences, Prague.

ULRYCH J.
Member, Committee for Degree of Doctor of Sciences (DSc.) in Geological Sciences at the Czech Academy of Sciences, Prague.
Member, Board of Graduate Studies in Geology, Faculty of Science, Charles University, Prague
Member, Committee for Finals of Undergraduate Students in Geochemistry, Faculty of Science, Charles University, Faculty of Science, Prague.
Member, Committee for Finals of Undergraduate Students in Mineralogy, Faculty of Science, Charles University, Faculty of Science, Prague.
Member, Examination Committee for Degree of Doctor of Natural Sciences (RNDr.) in Geochemistry and Mineralogy, Charles University, Faculty of Science, Prague.

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

ŽIGOVÁ A.
Member, Committee of Soil Science and Soil Conservation of Scientific Council of Research Institute for Soil and Water Conservation, Prague.
Member, Committee of the Czech Society of Soil Science, Prague.
Member, Board of the Committee of Soil Science of the Czech Academy of Agricultural Science, Prague.
Member, Board of the Doctoral Examination Committee in Physical Geography and Geoecology, Faculty of Science, Charles University, Prague.

7e. Membership in Foreign Academies

BOSÁK P.
Foreign Member, Polish Academy of Arts and Sciences (election approved by the Polish President in 2007).
Corresponding Member, Slovenian Academy of Sciences and Arts (elected 2005).

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

7f. Degrees Obtained by the Staff of the Institute of Geology

Habilitation

LISÁ L.
The phenomena and processes in the inanimate nature in context of recent landscape development and archaeological record (in Czech). – Habilitation Thesis, Department of Geological Sciences, Faculty of Science, Masaryk University: 1–252. Brno (defended on April 26, 2017).

The defended habilitation work is generally focused on the study of the phenomena and processes in the inanimate nature during the Quaternary, i. e. the period covering approximately the last 2.5 Ma. However, phenomena and processes important to the understanding of the current landscape on the Earth took place not only during the Quaternary, but in essence continuously proceeded from the beginning of the Earth's development. Therefore, the main factors of the development of the landscape can be generally summarized under the concept of Geodiversity. This is a complex, constantly changing and evolving system influenced by a multitude of both exogenous as well as endogenous factors. At the same time, it can be understood as the driving engine for the formation of ecofactors, therefore, the landscape as a whole, which inevitably to some extent also affects us and our perception of cultural values. In the first part of the work, a general introduction to the study of formation processes is provided. Here, the basic formation processes of the Quaternary sediments corresponding to the type of environment in which they form are summarized and, at the same time, the consequences of these processes are described both in the natural and archaeological context. Discussion of the individual environments is conceived either methodically or in relation to climate change and anthropogenic influence on the evolution of the current landscape. The methodological tools commonly used in the context of these studies are summarized in the second part of the work. These mainly include basic sedimentological descriptions, micromorphological characteristics in natural or anthropogenic contexts, grain size analysis, environmental magnetism, and chemical composition of the studied sediments and soils.

Ph.D.

ČERNÝ J.
Anisotropy of magnetic susceptibility in clastic sediments and sedimentary rocks (in English) – Ph.D. Thesis, Department of Geological Sciences, Faculty of Science, Masaryk University, Brno: 1–71. Prague (defended on October 6, 2017)

The subject of the Dissertation is methodical study of anisotropy of magnetic susceptibility (AMS) and magnetic fabrics in sediments and sedimentary rocks. The study of primary magnetic fabrics in sediments was carried out on samples collected in a lagoonal environment of the Pacific Ocean coast in Mexico. Magnetic fabrics and lateral variability of AMS parameters were studied in sediments. The results from sediments showed the presence of an unusual primary non-coaxial fabric in clay interpreted as lateral imbrication as well as a significant lateral variability of some AMS parameters. The study of magnetic fabrics in sedimentary rocks was performed in Ordovician rocks of the Prague Synform, Barrandian area, Czechia. The presence of normal, intermediate and inverse magnetic fabrics was identified in the Ordovician sequence. The greatest attention was given to inverse magnetic fabrics which were caused by the presence of ankerite in the samples. The use of samples with ankerite allowed to perform a new methodological study focused on the separation of magnetic fabrics. This methodological study allowed to separate inverse and hidden normal magnetic fabric components. The identified intermediate magnetic fabrics were exclusively linked to the two basal formations of the Ordovician sequence. The reason for their occurrence in the Ordovician rocks of the Prague Synform is not fully understood yet. However, a few possible causes of their origin are suggested. Normal magnetic fabrics were found throughout the whole territory of the Prague Synform, and both primary and secondary magnetic fabrics were identified. The secondary deformational fabrics recognized in the synform are certainly connected with several different deformations, so it was quite difficult to separate each type of deformational fabrics from one another. Nevertheless, one type of deformational magnetic fabrics is certainly associated with the Hercynian thrust tectonics that affected the area. This type of magnetic fabrics has the mean direction of magnetic lineations parallel to large fold axes in the Prague Synform trending NE–SW. The second type of deformational magnetic fabrics with N–S orientation of magnetic lineations may be associated with at least two different strain events. The third type of deformational magnetic fabrics is probably related to the Závist Fault.

FROJDOVÁ J.
Sphenopterid type of true ferns from the Carboniferous basins of the Bohemian Massif (in English) – Ph.D. Thesis, Institute of Geology and Palaeontology, Faculty of Sciences, Charles University, Prague: 1–124. Prague (defended on November 14, 2017)

This thesis deals with the sphenopterid types of ferns from the Czech Carboniferous basins. The thesis is presented as a combination of two published papers in peer-reviewed journals, one manuscript in review and one manuscript ready for submission. The actual text of the thesis is a general introduction to the study subject of sphenopterid ferns, methodology, studied type collections, terminology and the result of the study. The introduction of the thesis provides a general overview of the ferns and history of their studies. All four presented papers are focused on modern redescription, redefinition, emendation and revision of genera *Boweria* Kidston, *Dendraena* Němejc and *Sturia* Němejc. Based on the revision of these genera, the following two new genera were established: *Kidstoniopteris* gen. nov. and *Paraszea* gen. nov. A new species of *Boweria nowarudensis* has been described during the course of this study. The "whole plant concept" was applied to all studied specimens, which allows to obtain maximum possible information on fern morphology, anatomy and reproductive organs. This was combined with data on *in situ* spores as well as sedimentological and petrological analyses. The sporangial cells as annulus, stomium and apical cells and *in situ* spores were described for all genera and species for the first time. The new observations allow a better integration of genera/species into the plant system. The analysis of reproductive organs combined with *in situ* spores and anatomy studies enable a more detailed systematic evaluation of the studied genera. This proved useful in palaeoenvironmental and palaeoecological interpretations as well, especially when combined with sedimentological analyses.

Bc.
KAMENÍKOVÁ T.
Nature of magnetic anomalies on Moon, sample analysis. – Bc. Thesis, Faculty of Science, Charles University, Prague: 1–57. Prague (defended on September 7, 2017)

Magnetic properties of rocks on Earth are mostly well known. But what are the magnetic properties of rocks which originated in extraterrestrial conditions, such as on the Moon? We are interested in the intensity of paleofield of some lunar rocks which were sampled by the Apollo 15 mission in early 1970s.

The text is a summary of the basic knowledge of magnetism and the process it originates. It also contains the basics of paleomagnetism and the methods how the rocks can get own magnetisation, their properties and an outline how lunar rocks can acquire their own magnetisation even if the Moon does not have a dynamo.

Information obtained from measurements of two samples of lunar rocks (15404.219 and 15445.277) is summarized. These samples were divided to subsamples and measured in the Paleomagnetic laboratory of the Czech Academy of Sciences.

Each subsample was measured separately on 2G cryogenic magnetometer. We were interested in AF (alternating field) remanent magnetisation spectra from which we got an estimation of the intensity of paleofield from which the samples acquired their own magnetisation.

The final part is devoted to the discussion of possible existence of a lunar dynamo or other possibilities how lunar rocks could have received their magnetisation.

7g. Awards

KRMÍČEK L.
Dean's award for the competition "TOP 10 publications in impacted journals", Faculty of Civil Engineering, Brno University of Technology, Brno (June 21, 2017).

LAIBL L.
Dean's award for the best Ph.D. thesis for 2017, Faculty of Science, Charles University in Prague (December 13, 2017).

LAIBL L.
Radim Kettner award for the best student paper 2017 (Fig. 27), Institute of Geology and Paleontology, Faculty of Science, Charles University in Prague (December 19, 2017).

MOTYČKA Z., *FILIPPI M.*, MATUŠKA L., ŠEBELA R., SIROTEK J., BUČEK J., HUSÁK R., MÁTL Š., MOKRÝ T. & KOTOL M.
Award for the most imporatnt discovery of members of the Czech Speleological Society abroad, for discoveries within the *Shaanxi Project*, awarded by the Board of the Czech Speleological Society, Sloup, Moravian Karst (April 22, 2017).

SCHEINER F.
Joseph A. Cushman Award for Student Research, Cushman Foundation for Foraminiferal Research (April, 2017).

ŽÁK K.
Award of the town of Beroun for scientific work and popularization of scientific results in regional literature, October 31, 2017, awarded by the Beroun Municipality.

ŽÁK K., MAJER M., HŮLA P. & *CÍLEK V.*
The main regional Miroslav Ivanov Award for an outstanding publication in factual literature, for the book "Křivoklátsko – příběh královského hvozdu" (together with M. Majer and P. Hůla), awarded by the Jaroměř-Josefov Municipality, the Club of Factual Literature Authors and the Administration of the Heritage of Egon Ervín Kisch (May 12, 2017).

■ **Fig. 27.** Dean´s award for the best Ph.D. thesis – *L. Laibl*. Photo by L. Laibl.

7h. Institute Staff on Fellowships

SLÁMA J.: **J. E. Purkyně Fellowship for outstanding creative scientists, Institute of Geology of the Czech Academy of Sciences, Praha**. 2016–2020.

Fellowship annotation for 2017: The new ^{175}Lu-^{180}Hf double-spike was prepared and calibrated in 2017 using the ^{175}Lu- and ^{180}Hf-enriched stock solutions. From these, two different solutions were prepared, one with high and one with low Lu/Hf ratio. Using the technique of sample bracketing and prepared normal Lu and Hf solutions of known isotopic compositions and concentrations, the two new mixed spikes were analyzed giving the final values of: (1) Lu^{176}/Hf^{180} ratio of 0.16326 (0.3945 ppm Lu, 1.636 ppm Hf) for the analysis of whole-rock samples or common minerals, and (2) Lu^{176}/Hf^{180} ratio of 3.90941 (0.5705 ppm Lu, 0.0988 ppm Hf) for the analysis of high-Lu minerals like, e. g., garnet of apatite. The deployment of the new Cetac Teledyne excimer laser significantly improved the quality of retriever data as well as the efficiency of U-Pb dating. With the currently set method the instrumentation is capable of providing 140 measurements of individual zircon grains within a 4-hour session as compared to ca 10 hours in the past. The testing run of *in situ* monazite U-Th-Pb dating was also performed in 2017. The four various monazite samples (namely Baikal, India, Madagascar and WY9029) were used for U-Pb cross-calibration, and the results show an accuracy of within ca 2 %. During 2018, the technique should be set up as a routine analysis into the LA-ICP-MS lab of the Institute of Geology. Besides the already set collaborations, new ones were established in 2017 including people and institutions from the Czech Republic as well as outside the Czech Republic.

TOMEK F.: **Internal post-doctoral fellowship for the Czech Acad Sci institutions, Program supporting prospective human resources.** Awarded 2015 (January 1, 2016–June 30, 2018).

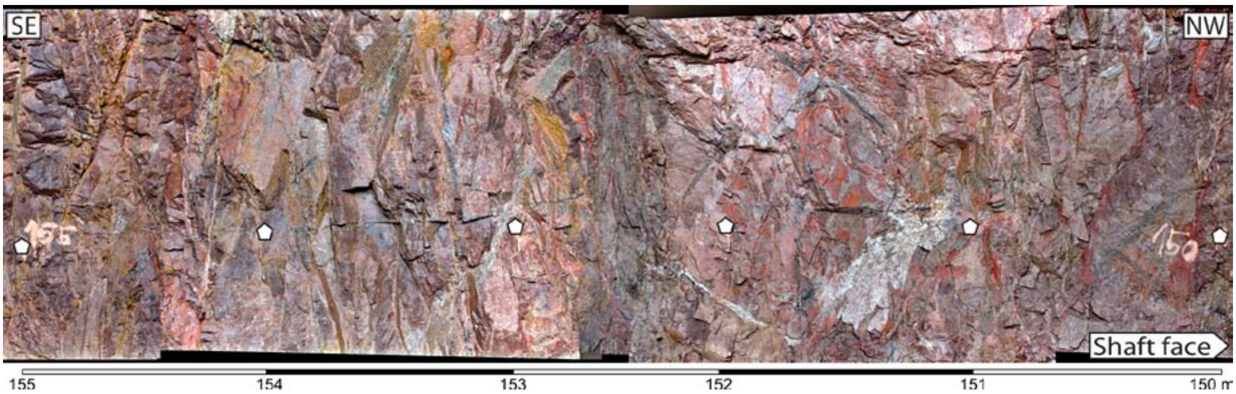
The postdoctoral fellowship was focused on structural inventory of volcanic-plutonic complexes in order to explore the magma ascent, emplacement and eruption processes. The year 2017 was split to two parts due to half-year foreign fellowship of F. Tomek. The main part of the project was focused on underground mapping of brittle structures of the Cínovec/Zinnwald granite. Particular attention was given to the study of spatial distribution of fractures and faults, and their relation to greisen mineralization. In addition, a study of ring dike emplacement processes in the Altenberg-Teplice caldera was finished (Fig. 28).

ROČEK Z.: **Visiting scientist under the Chinese Academy of Sciences President's International Fellowship Initiative (PIFI)** for 2017 (August 21–September 9, 2017).

The earliest articulated frogs from the Lower Cretaceous of China: during 2017 field works at the Moqi locality in Inner Mongolia (Figs. 29 and 30), our Czech-Chinese joint team gathered more than 130 articulated and exceptionally well preserved skeletons of adult frogs of the genus *Genibatrachus*, plus several tens of juveniles in various stages of development. This makes this collection unique among all known Mesozoic anuran taxa worldwide, because specimens arranged in developmental cohorts

■ **Fig. 29.** Zbyněk Roček with Professor Yuan Wang (Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing) during their fieldwork at the Moqi locality, Inner Mongolia, in September 2017. Photo by Liping Dong.

■ **Fig. 30.** A sample from the Moqi locality. Photo by Z. Roček.



■ **Fig. 28.** A composite image of fracture pattern in the Teplice rhyolite 25 m from its contact with the Cínovec/Zinnwald Li-mica granite. Tiefen Bünau Stollen, Germany. Photo by F. Tomek.

allow comparisons with individuals of corresponding individual age of other taxa, and the number of available specimens allows to assess individual variation. Other frogs of approximately the same stratigraphic age are known from the Liaoning Province, and our revision (Dong *et al*. 2013) proved that they belong to a very uniform group. Thus, we now have two rich samples of well preserved frogs from the early Cretaceous (ca 128 Ma) which permits to reconstruct their anatomy as well as developmental processes. This is the basis for our considerations whether their characters are suitable for taxonomic analyses and whether they can be used for the reconstruction of some evolutionary trends.

DONG L., *ROČEK Z.*, WANG Y. & JONES M. E. H. (2013): Anurans from the Lower Cretaceous Jehol group of Western Liaoning, China. – *PLOS ONE*, 8, 7: e69723.

8. Positions in Editorial Boards and International Organizations

8a. Editorial Boards

ADAMOVIČ J.

Příroda, Member of Editorial Board, Nature Conservation Agency of the Czech Republic, 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 2012–2017; Member of the Executive Committee 2005–2012 and since 2017), 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 International Editorial Board, Official international journal of the Union Internationale de Spéléologie, Scholar Commons, University of South Florida, USA (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; Member of the Editorial Board in 1976 to 1998), Regional journal published by the Museum of the Czech Karst in Beroun.

Research Reports of the Institute of Geology, Co-editor, Czech Academy of Sciences (since 2007).

Slovenský kras/Acta Carsologica Slovaca (member of the Editorial Board, published by the Slovak Museum of Nature Protection and Speleology and Slovak Caves Administration, Liptovský Mikuláš, Slovakia, since 2014).

Speleo (Prague), Member of Editorial Board, bulletin of the Czech Speleological Society, Prague (since 1990).

Speleofórum, Co-editor, published by the Czech Speleological Society, Prague (since 2000).

Editorial Board of the Czech Speleological Society, Member (since 1990).

BREITER K.

Journal of Geochemical Exploration (Elsevier), Associate Editor, Amsterdam, Netherlands (since 2015)

Zprávy o geologických výzkumech (Geoscience Research Reports), Member of Editorial Board, Czech Geological Survey, Prague (since 2014).

Bulletin of Geosciences, Co-editor, Czech Geological Survey, Prague (since 2006).

Geologica Carpathica, Member of Editorial Board, Earth Science Institute of the Slovak Academy of Sciences, Bratislava, Slovakia (since 2001).

Geological Quarterly, Consulting Editor, Polish Geological Institute – National Research Institute, Warsaw, Poland (since 2004).

CÍLEK V.

Slovenský kras, Member of Editorial Board, Liptovský Mikuláš, Slovakia (since 2006).

DAŠKOVÁ J.

Fossil Imprint (formerly *Acta Musei Nationalis Pragae, Series B, Historia Naturalis*), Member of Editorial Board, National Museum, Prague (since 2016).

Journal of the National Museum (Prague), Natural History Series, Editor-in-Chief, National Museum, Prague (since 2017).

FILIPPI M.

International Journal of Speleology, Member of International Editorial Board, Scholar Commons, University of South Florida, USA (since 2017).

HLADIL J.

Bulletin of Geosciences, Co-editor, Czech Geological Survey, Prague (since 2006).

Geologica Carpathica, Member of Editorial Board, Earth Science Institute of the Slovak Academy of Sciences, Bratislava, Slovakia (since 2001).

Geological Quarterly, Consulting Editor, Polish Geological Institute – National Research Institute, Warsaw, Poland (since 2004).

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 of the Czech Academy of Sciences, Prague (since 1998).

Fossil Imprint (formerly Acta Musei Nationalis Pragae, Series B, Historia Naturalis), Member of Editorial Board, National Museum, Prague (since 2008).

PRUNER P.

Geolines, Member of Editorial Board, Institute of Geology of the Czech Academy of Sciences, Prague (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.
Geologica Carpathica, Co-Editor, Official journal of the Carpathian-Balkan Geological Association, Earth Science Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic (since 2017).

ROČEK, Z.
Palaeobiodiversity and Palaeoenvironments, Member of Editorial Board, Senckenberg Forschungsinstitut und Naturmuseum Frankfurt am Main, Germany (since 2010)

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

SLAVÍK L.
Bulletin of Geosciences, Member of Editorial Board, Czech Geological Survey, Prague (since 2013).
Fossil Imprint, Associated Editor, National Museum, Prague (since 2016).

ŠŤASTNÝ M.
Acta geodynamica et geomateralia, Member of Editorial Board, Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, Prague (since 1998).
Informátor, Editor, Česká společnost pro výzkum a využití jílů [Czech Society for Study and Utilization of Clays], Prague (since 1995).
Journal of Geosciences, Member of the Editorial Board, Czech Geological Society, Prague (since 2017).

ŠTORCH P.
Bulletin of Geosciences, Co-editor, Czech Geological Survey, Prague (since 2011).
*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, P. R. China Geological Survey, Xian (since 2012).

SVOJTKA M.
Geolines, Research Reports, Editor-in-chief, Czech Acad Sci, Inst Geol, Praha, Czech Republic (since 1996).

WAGNER J.
Bulletin of Geosciences, Member of Editorial Board, Czech Geological Survey, Prague (since 2011).
Fossil Imprint, Associated Editor, National Museum, Prague (since 2016).

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

ŽÁK K.
Český kras, Member of Editorial Board (since 2007), Co-editor (since 2008), regional journal published by the Museum of the Bohemian Karst, Beroun.

8b. Positions in International Organizations

BOSÁK P.
Honorary Member, the UIS Bureau, the International Union of Speleology (UIS, affiliated to the IUGS; elected 2009).
Member, Advisory Committee, the International Union of Speleology (UIS, affiliated to the IUGS; elected in 2009, re-elected 2013, 2017).

DAŠKOVÁ J.
Councillor, the Organization of Czech and Slovak palynologists (affiliated to the IFPS; elected in 2008).

HLADIL J.
Committee Member and Web Site Administrator, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 1994).
Corresponding Member, Subcommission on Devonian Stratigraphy of the ICS and IUGS (renewed, since 2013).

MIKULÁŠ R.
Chairman and Committee Member, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 2003, Chairman since 2013)

SLAVÍK L.
Secretary & Titular Member, Subcommission on Devonian Stratigraphy of the ICS/IUGS (re-appointed in 2016).
Corresponding Member, Subcommission on Silurian Stratigraphy of the ICS/IUGS (since 2011).

ŠTORCH P.
Chairman, Subcommission on Silurian Stratigraphy of the ICS/IUGS (since 2016).

SVOBODOVÁ A.
Committee Member and Secretary, International Geoscience Programme of the UNESCO and IUGS – Czech National Committee for IGCP (since 2014).

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

9. Institute Structure and Staff

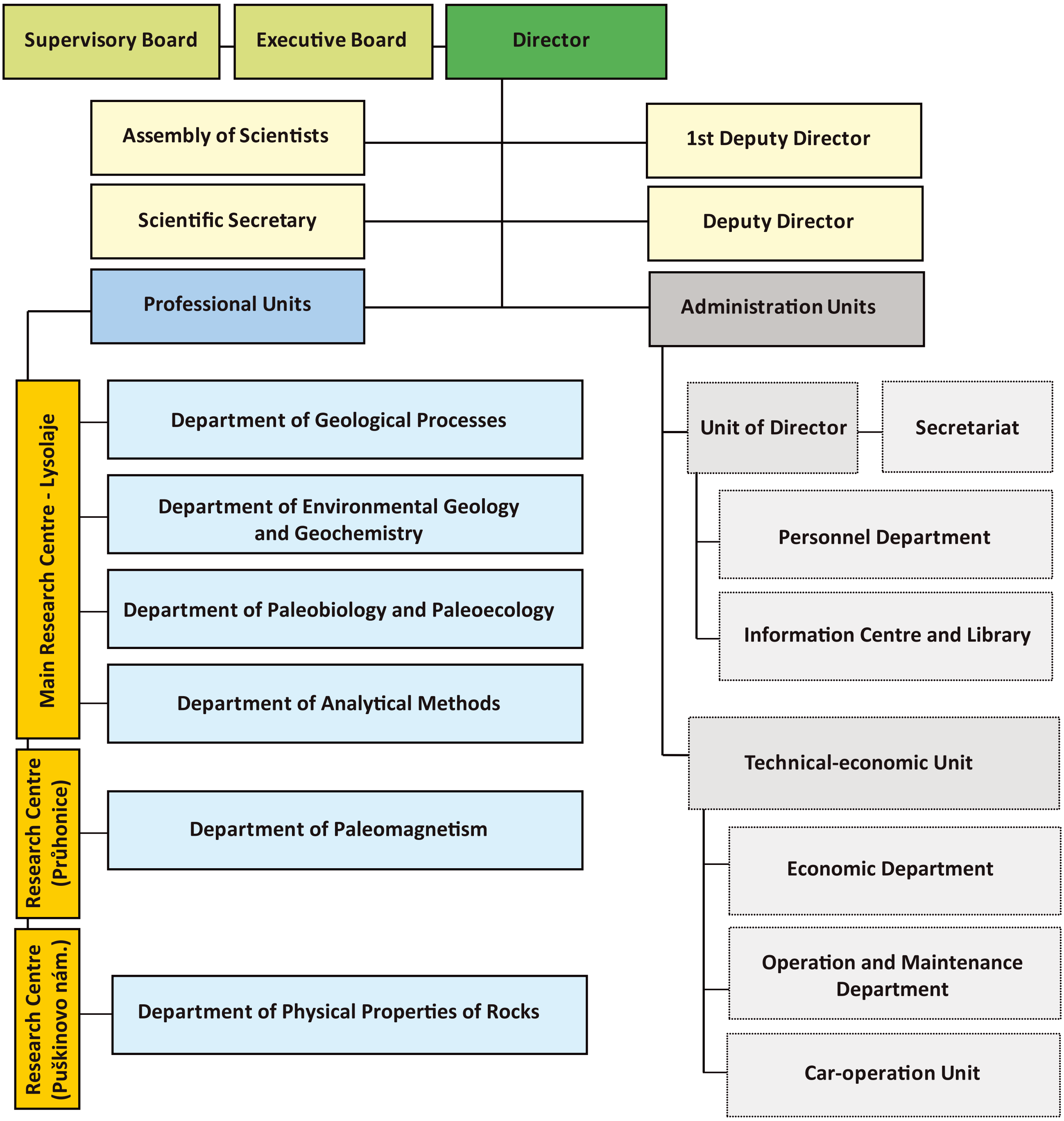
9a. Organization Units

The research potential of the Institute is divided into 6 research 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/Cenozoic 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. **Department 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. **Department of Physical Methods** represents a service analytical unit.

Two **administration units** represents the Unit of Director (Secretariat, Information Centre and Library, and Personnel Department (organisation chart). Car Operation Unit was incorporated into the Technical-Economic Section in 2017 due to tragical personnel changes.

Specialized laboratories of the Institute are not independent units. They are incorporated within the structure of scientific and service departments. For details see Chapter 9d – Laboratories.

9b. Contact Information

Institute . . . . http://www.gli.cas.cz
Institute management . . . . inst@gli.cas.cz
Geolines Editorial Board . . . . geolines@gli.cas.cz
Library . . . . knih@gli.cas.cz

Supervisory Board (since May 1, 2017)

prof. Jiří Chýla, CSc. (Head Office of the Czech Acad Sci) . . . . Chairman
RNDr. Radek Mikuláš, CSc., DSc.. . . . . Vice-Chairman
RNDr. Pavel Hejda, CSc. (Czech Acad Sci, Geophys Inst, Prague) . . . . Member
doc. RNDr. Václav Kachlík, CSc. (Faculty of Science, Charles University in Prague) . . . . Member
doc. RNDr. Stanislav Opluštil, Ph.D. (Faculty of Science, Charles University in Prague) . . . . Member

Supervisory Board (until April 30, 2017)

prof. Jiří Chýla, CSc. (Head Office of the Czech Acad Sci) . . . . Chairman
RNDr. Radek Mikuláš, CSc., DSc.. . . . . Vice-Chairman
prof. Ing. Jiří Čtyroký, DrSc. (Scientific Council of the Czech Acad Sci, Praha) . . . . Member
prof. Jiří Pešek, DrSc. (Faculty of Science, Charles University in Prague) . . . . Member
doc. Ing. Richard Šňupárek, CSc. (Czech Acad Sci, Inst Geonics, Ostrava) . . . . Member

Executive Board (since January 4, 2017)

prof. RNDr. Pavel Bosák, DrSc.. . . . . Chairman
Mgr. Michal Filippi, Ph.D. . . . . Vice-Chairman
RNDr. Tomáš Přikryl, Ph.D. . . . . Member
Ing. Petr Pruner, DrSc. . . . . Member
RNDr. Ladislav Slavík, CSc. . . . . Member
Mgr. Martin Svojtka, Ph.D. . . . . Member
doc. RNDr. Emil Jelínek, CSc. (Charles University in Prague) . . . . Member
prof. RNDr. Martin Mihaljevič, Ph.D. (Charles University in Prague) . . . . Member
Ing. Petr Uldrych (Ministry of the Environment of the Czech Republic, Prague) . . . . Member

Executive Board (until January 3, 2017)

RNDr. Petr Štorch, DrSc. . . . . Chairman
Mgr. Michal Filippi, Ph.D. . . . . Vice-Chairman
prof. RNDr. Pavel Bosák, DrSc. . . . . Member
doc. RNDr. Jindřich Hladil, DrSc. . . . . Member
Ing. Petr Pruner, DrSc. . . . . Member
RNDr. Ladislav Slavík, CSc. . . . . Member
doc. RNDr. Emil Jelínek, CSc. (Charles University in Prague). . . . . Member
doc. RNDr. Stanislav Opluštil, Ph.D. (Charles University in Prague). . . . . Member
RNDr. Jan Pašava, CSc. (Czech Geological Survey). . . . . Member

9c. Staff (as of December 31, 2017)

Management

RNDr. Tomáš Přikryl, Ph.D.. . . . . .Director of the Institute
Mgr. Michal Filippi, Ph.D.. . . . . .1st Deputy Director

Administration units

Unit of Director

Secretariat
Michaela Uldrychová, Andrea Golubovičová (assistants to the Director)

Information Centre and Library
Bc. Lenka Haškovcová – Head (librarian)
Mgr. Václava Škvorová – Deputy Head (librarian)
Bc. Jana Popelková (librarian)

Personnel Department
Stanislava Dušková (human resources)

Technical-Economic Section
Ing. Bohumil Pick – Head

Economic Department
Iveta Höschlová (external accountant)
Alena Kocová (phone operator, mail service)
Renata Müllerová (payroll accountant)
Eva Petráčková (accountant)
Ing. Miroslav Píšek (IT specialist)

Operation and Maintenance Department
Ing. Irina Kosevanova (sanitor)
Roman Pisklák (technical service, garage attendant)
Oksana Seniv (sanitor)

Scientific departments

Department of Geological Processes

Scientific Staff:
Mgr. Martin Svojtka, Ph.D. – Head (geochronology, geochemistry)
doc. Mgr. Lukáš Ackerman, Ph.D. – Deputy Head (geochemistry, mantle petrology)
Mgr. Jiří Adamovič, CSc. (basin analysis, tectonics)
RNDr. Karel Breiter, Ph.D., DSc. (petrology, mineralogy)
Mgr. Jan Černý, Ph.D. (structural geology)
RNDr. Miroslav Coubal, CSc. (structural geology, tectonics)
Ing. Jiří Fiala, CSc. (petrology, structure of lithosphere)*
doc. RNDr. Jindřich Hladil, DrSc. (Devonian environments, experimental sedimentology, dust deposition)*
Mgr. Tomáš Hrstka, Ph.D. (microanalysis using scanning electron microscopy)
RNDr. Leona Koptíková–Chadimová, Ph.D. (sedimentary petrology, metasediments, magnetic susceptibility)
doc. RNDr. Lukáš Krmíček, Ph.D. (geochemistry, igneous petrology)
doc. Mgr. Lenka Lisá, Ph.D. (Quaternary sedimentology)
Mgr. Hedvika Weinerová (sedimentary petrology, metasediments, magnetic susceptibility)
Mgr. Jiří Sláma, Ph.D. (geochronology, isotope geochemistry)
Mgr. Filip Tomek (magmatic petrology, structure geology)
Mgr. Jakub Trubač (magmatic petrology, geochemistry)
doc. RNDr. Jaromír Ulrych, DrSc. (igneous petrology, geochemistry)*

Technical Staff:
Ing. Jana Ďurišová, Ph.D. (ICP-MS mass spectrometry analyst)
Mgr. Eva Haluzová, Ph.D. (clean laboratory analyst)
Mgr. Dagmar Kořínková, Ph.D. (fission track methods)
Mgr. Šárka Matoušková, Ph.D. (ICP-MS mass spectrometry analyst)
Jana Rajlichová (graphics)
RNDr. Jan Rejšek, Ph.D. (TIMS mass spectrometry analyst)
RNDr. Martin Štastný, CSc. (mineral separation)

Department of Paleobiology and Paleoecology

Scientific Staff:
RNDr. Ladislav Slavík, CSc. – Head (Silurian–Devonian stratigraphy, conodont biostratigraphy, sedimentary sequences, paleogeography)
Mgr. Andrea Svobodová, Ph.D. – Deputy Head (Cretaceous micropaleontology)
RNDr. Jiří Bek, CSc., DSc. (Devonian and Carboniferous spores)
RNDr. Stanislav Čermák, Ph.D. (Cenozoic vertebrate paleontology, small mammals)
RNDr. Jiřina Dašková, Ph.D. (Carboniferous and Cenozoic palynology)
Mgr. Jana Frojdová, Ph.D. (Carboniferous and Permian ferns)
Mgr. Lukáš Laibl, Ph.D. (Lower Paleozoic trilobites)
RNDr. Radek Mikuláš, CSc., DSc. (ichnofossils)
RNDr. Tomáš Přikryl, Ph.D. (vertebrate paleontology, fishes)
prof. RNDr. Zbyněk Roček, DrSc. (origin and evolution of the Amphibia, Tertiary Anura and Sauria)*
Mgr. Filip Scheiner (Tertiary foraminifers and paleoecology)
RNDr. Petr Štorch, DrSc. (graptolite stratigraphy, stratigraphy in general, sedimentary sequences, paleogeography)
RNDr. Marcela Svobodová, CSc. (Cretaceous palynology)**
Mgr. Radek Vodrážka, Ph.D. (Cretaceous macrofauna and paleoecology)
Mgr. Jan Wagner, Ph.D. (Cenozoic vertebrate paleontology, large mammals)
Mgr. Tomáš Weiner (Late Devonian conodonts and bioevents)
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:
Pavel Lisý (technician)

Department of Environmental Geology and Geochemistry

Scientific Staff:
RNDr. Jan Rohovec, Ph.D. – Deputy Head (analytical chemistry, ICP analyses)

RNDr. Tereza Nováková, Ph.D. (geochemistry of sedimentary rocks, geomorphology) – Deputy Head
RNDr. Jan Borovička, Ph.D. (biogeochemistry)
RNDr. Václav Cílek, CSc. (Quaternary and environmental geology)
Mgr. Michal Filippi, Ph.D. (mineralogy, environmental geochemistry)
RNDr. Maria Hojdová (environmental geochemistry)
doc. RNDr. Tomáš Navrátil, Ph.D. (aquatic and environmental geochemistry)
RNDr. Karel Žák, CSc. (Quaternary geology, environmental geochemistry)
RNDr. Anna Žigová, CSc. (pedology, paleopedology)

Technical Staff:
Ing. Irena Dobešová (environmental monitoring)
Mgr. Martin Šimeček (environmental monitoring)
Světlana Hubičková (technician)
Bc. Michal Roll (technician, economic geology)
Michaela Uldrychová and Andrea Golubovičová (secretaries)

Department of Paleomagnetism
Scientific Staff:
Mgr. Petr Schnabl, Ph.D. – Head (geophysics, paleomagnetism)
Ing. Petr Pruner, DrSc. – Deputy Head (geophysics)*
prof. RNDr. Pavel Bosák, DrSc. (karstology, geomorphology, sedimentology)
M.Sc. Tiiu Elbra, Ph.D. (paleomagnetism, geophysics)
Mgr. Martin Chadima, Ph.D. (geophysics, paleomagnetism)
RNDr. Günter Kletetschka, Ph.D. (paleomagnetism, geophysics)
doc. Mgr. Tomáš Kohout, Ph.D. (physical properties of meteorites)
prom.-phys. Otakar Man, CSc. (geophysics)**

Technical Staff:
Bc. Šimon Kdýr (technician)
Bc. Kameníková Tereza (technician)
Mgr. Kubišová Lenka, Ph.D. (archeomagnetism)
Mgr. Petr Petráček (programming)
Jiří Petráček (technician)
Mgr. Kristýna Šifnerová–Čížková (geophysics)
RNDr. Richard Štorc, Ph.D. (technician)

Department of Physical Properties of Rocks
Scientific Staff:
Ing. Tomáš Lokajíček, CSc. – Head (rock elastic anisotropy)
Mgr. Matěj Petružálek, Ph.D. – Deputy Head (geophysics, acoustic emission analysis)
Mgr. Tomáš Svitek, Ph.D. (geophysics, elastic anisotropy analysis)

Technical Staff:
Tomáš Feřtek (technician, electroengineering, 3D printing)
Vlastimil Filler (technician, electrician)
Lucie Holomčíková (technician, administration)
Vlastimil Nemejovský (mechanic, technician, rock cutter)
Radek Onysko (petrological analysis)
Ing. Libor Svoboda (technician, machinery design, rock grinding)

Department of Analytical Methods
Scientific Staff:
RNDr. Roman Skála, Ph.D. – Head (X-ray powder diffraction/Raman spectroscopy)

Technical Staff:
RNDr. Zuzana Korbelová – Deputy Head (microprobe and scanning microscope)
Jaroslava Jabůrková (technician, grinding, preparation of thin/polished sections)
Ing. Šárka Jonášová (microprobe and scanning microscope/Raman spectroscopy)
Mgr. Noemi Mészárosová (microprobe and scanning microscope/Raman spectroscopy)
Mgr. Petr Mikysek (X-ray powder diffraction)

Emeritus employees

Fiala Jiří *, Forman Josef **, Hladil Jindřich*, Lang Miloš **, Langrová Anna **, Ložek Vojen *, Man Ota **, Pavková Jaroslava**, Pruner Petr*, Roček Zbyněk*, Rudajev Vladimír *, Siblík Miloš **, Skřivan Petr *, Svobodová Marcela**, Ulrych Jaromír*, Vavrdová Milada **, Žítt Jiří **.
* *emeritus employee – academical*
** *emeritus employee – institutional*

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)
Prof. Ronald Parsley (Department of Geology, Tulane University, New Orleans, USA)
Prof. Dr. Franz Pertlik (Institut für Mineralogie und Kristallografie, Universität Wien, Geozentrum, Austria)
Prof. 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.

9d. Laboratories
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 (the chapter summarizes the list of the most important laboratory equipment):

Laboratory of Analytical Methods (Head: RNDr. Roman Skála, Ph.D.)

TESCAN VEGA3XMU scanning electron microscope (SEM) is a 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 with Bruker X-Flash 5010 detector (129 eV resolution on MnKα line). Also available is a low vacuum secondary electron detector (LVSTD). The source of electrons is a tungsten-heated cathode. The system has been acquired in 2010. In 2012, color cathodoluminescence (CL; detection range 350 nm–850 nm) detector has been added to the system.

CAMECA SX-100 electron probe microanalyzer (EPMA) purchased in 2002 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. Later (in 2015) the EPMA capabilities has been extended by implementation of ED spectrometer Bruker X-Flash 5010.

Bruker D-8 DISCOVER X-ray powder diffractometer (acquired in 2011) is a multipurpose powder X-ray diffraction instrument with a variable measuring radius designed to study powder samples or solid polycrystalline blocks (polished sections, thinsections, rock chips etc.). Diffractometer is of the θ–2θ design and allows studying materials in both reflection and transmission (either foil or capillary) geometry. 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 the *Philips X'Pert compact X-ray powder diffractometer* can be used (consisting of PW 1830 generator, PW 3710 MPD control unit, PW 3020 goniometer, and PW 3719 dispay unit) with a secondary graphite monochromator (PW 1752) (the system purchased in 1997).

Reliable quantitative local chemical analysis and/or acquisition of element distribution maps using EPMA/SEM require planar polished conductive surfaces. Such prerequisites are fulfilled when bulky solid samples are sectioned, polished and coated. For that purpose a *suite of cutting, grinding, lapping and polishing machines* to prepare polished sections or thin sections is available at our laboratory [cutting and grinding machines Buehler PetroThin (2017) and Struers Discoplan TS (2005), grinding machines with diamond platen wheel Montasupal (1977), custom-made grinding machines with wheels for loose abrasive powder (1986, 1989), custom-made saw (1986), polishing machines Struers Planopol-3 (1989), Kent Mark II (2 pcs, 1970), and MTH APX-010 with MTH KOMPAKT-1031 (2005)]. 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 to prevent their charging. The laboratory owns necessary *instruments to carbon-coat or gold-sputter the specimens* including carbon-coater and metal-stutterers VEB Hochvakuum Dresden B 30.2 with R HVG 32 glass recipient (1976), Carl Zeiss Jena HBA 1 (1968), and Quorum Q150T ES (2014); the latter allows controlled deposition of conducting media on samples to be investigated.

S&I MonoVista CRS+ Raman micro-spectrometer (purchased in 2015) is based on Olympus BX-51 WI upright microscope, Princeton Instruments SpectraPro SP2750 spectrometer (750 mm focal length and aperture ratio f/9.7) and a CCD detector ANDOR iDus 416 with 2,000 × 256 pixels (pixel size 15 μm). Excitation lasers have wavelengths of 488 nm, 532 nm and 785 nm. Microscope is designed for sample observation in either reflected or transmitted light; an option of (cross-) polarization is available. Objective lenses with following magnifications are installed on microscope turret: 4×, 10×, 50×, 50× LWD and 100×. Samples are placed on computer controlled motorized stage. Spatial resolution with 100× objective is 1 μm laterally and 2 μm axially. System allows collection of spectra within the range of 60–9,300 cm^{-1} with 488 nm and 532 nm excitation lasers and 60–3,500 cm^{-1} with 785 nm excitation laser. Spectral resolution is better than 1.0 cm^{-1} for 1,800 $gr.mm^{-1}$ grating and 532 nm excitation laser and 0.65 cm^{-1} for 1,200 $gr. mm^{-1}$ grating and 785 nm excitation laser.

Thermo ScientificNicolet iS-50 Fourier-transform infra-red spectrometer (FTIR), purchased in 2017, has been acquired with built-in mid- and far-IR capable diamond attenuated total reflectance (ATR) accessory. The spectrometer is equipped with a ceramic infra-red radiation source (9,600–50 cm^{-1}) and a DLaTGS detector with KBr window. In transmission arrangement, the spectrometer covers the wavenumber range of 7,800–350 cm^{-1}. In ATR mode, the wavenumbers covered are 4,000–100 cm^{-1} depending on used beam-splitter.

Paleomagnetic laboratory (Head: Mgr. Petr Schnabl, Ph.D.)

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) – classical 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).

AGICO MFK1-FA Kappabridge is the most sensitive laboratory instrument for measuring magnetic susceptibility and its anisotropy. In conjunction with a CS4/CSL temperature control unit it is further used for measuring temperature dependence of magnetic susceptibility over a temperature range of –192 °C to 700 °C. MFK1-FA represents a fully automatic inductivity bridge, which allows high precision measurements at three different frequencies (976 Hz, 3904 Hz, 15616 Hz) and in wide field range (2–700 $A.m^{-1}$). MFK1-FA Kappabridge with 3D-Rotator allows rapid measurements with full auto-ranging and enables to determine 640 directional susceptibilities during a single anisotropy measurement. The measurements are controlled by the SAFYR4W (magnetic susceptibility, anisotropy) and SUFYTE5W (temperature dependence) software (2016).

LDA-3 AF Demagnetizer (2002) – The instrument operates in field range 1 to 200 mT. The whole demagnetization process is microprocessor-controlled and automated.

AGICO LDA5 – PAM1 ALTERNATE FIELD DEMAGNETIZER AND ANHYSTERETIC MAGNETIZER (2016). The advanced demagnetizer allows to use AF demagnetization fields from 1 to 200 mT, four rates of AF field decrease and three different courses of alternating field decrease for special demagnetization process. The *PAM1* attachment allows to perform anhysteretic magnetization in the AC field 1–200 mT and DC field up to 500 µT, The apparatus is also used for partial anhysteretic magnetization and pulse magnetization in the field range 0–20 mT.

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 $A.m^{-1}$ to 300 $A.m^{-1}$.

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 1×10^{-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 hoods and levigation sinks.

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

WILFLEY 13 B (1990) laboratory table; *VT 750* (1992) vibration processor; *CD 160*90* (1991) crusher; *RETSCH* (1970) laboratory mill; *ŽELBA D 160/3* (1999) crusher; *SIEBTECHNIK* (1995) mill; *LAC LMH 11/12* (2011) muffle oven; *4H HYDROTRONK MONTOLIT* (2011) hydraulic slab cutter; *FRANTZ* (2016) electromagnetic separator, and *GÜDE* (2016) compressor.

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).

The *OLYMPUS BX51* polarization microscope with the *OLYMPUS DP70* digital camera and *U-RFL-T fluorescence light source* equipped with X-ray fluorescence with wavelength filters; *QuickPHOTO MICRO 2.2* software (2006) and *Deep Focus* module; The *OLYMPUS SZX16* Binocular microscope with digital camera *CANON EOS 1200*; *Deep Focus 3.0* (2007): software, and *OLYMPUS SZ51* (2007): binocular microscope.

Sedimentary laboratory (Head: RNDr. Anna Žigová, CSc.).

The laboratory is equipped with apparatus for samples preparation and pH measurements: *SETRA EL–2000S* analytical balance (1999); *WST 5010* laboratory dryer (1991); *FRITSCH* planetary mill (1986); pH 330 / SET pHmeter (2000), and *TESLA* ultrasonic cleaner (1985).

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

Laboratory of liquid and solid samples (Head: RNDr. Jan Rohovec, Ph.D.)
Ultrasonic horn Bandelin Sono plus (2016); *Gas chromatography system for methylmercury separation DANI* (2015); *ICP-EOS spectrometer Agilent 5100* (2014); *HPLC system (KNAUER 2010)*: anion analysis in aqueous samples using ion-exchanging column and *conductivity detector* (2013); *Anton Paar High Pressure Asher* (2012); *Mettler-Toledo* (2011): analytical balances; *TOC-VCPH Shimadzu* (2011): total Carbon Analyser; *MARS* (2009): microwave digestion unit – with 8 fully equipped PTFE digestion vessels; *MILESTONE mls 1200 meg*a (2009): microwave digestion unit – with 6 fully equipped PTFE digestion vessels; *CINTRA 303* (2009): UV-VIS Spectrometer; *BALANCE 2000G* (1999): analytical balances; *B-2A Epi/FL* (1996): filtration blocks, and *SARTORIUS Basic analytical* (1992): analytical balances.

Mercury analysis laboratory (Head: doc. RNDr. Tomáš Navrátil, Ph.D.)
AMA 254 mercury analyser (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; *Shimadzu DOC/TOC analyser* (2010): Dissolved organic carbon content, total organic carbon content, inorganic carbon in aqueous samples, and *RA-915M mercury analyser* (2016): real time direct detection of mercury vapor analysis in air and gases.

Laser ablation ICP-MS Laboratory (Supervised by Ing. Jana Ďurišová, Ph.D. & RNDr. Šárka Matoušková, PhD.; Head Mgr. Martin Svojtka, Ph.D.)
The laboratory is equipped with the *ELEMENT 2* (ThermoFisher Scientific) high-resolution magnetic sector field ICP-MS (inductively coupled plasma – mass spectrometer), purchased in 2009. The instrument is equipped with a high mass resolution to access spectrally interfered isotopes and is used for: (1) multi-element trace analysis across the periodic table covering a $mg \cdot l^{-1}$ to sub $pg \cdot l^{-1}$ concentration range, and (2) measuring of isotope ratios. The Element 2 ICP-MS is coupled with an *ANALYTE EXCITE EXCIMER* 193 nm laser ablation system (Teledyne; 2016) for analysing solid samples and with an Aridus II desolvating nebulizer (Teledyne; 2009).

Clean Chemistry Laboratory (Head: Mgr. Eva Haluzová, Ph.D., supervised by doc. 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 × 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 × originally designed laminar flow hoods (class-100 filtered air), 1 × open laminar flow work space (class-100 filtered air), 2 × analytical weight (0.0000X g), 1 × device for the preparation of clean water (Millipore Elix 3 + Millipore Milli-Q Element), 1 × teflon destillation aparatus (Savillex) for the preparation of ultraclean acids and 1 × centrifuge (2009).

Laboratory of ICP EOS (Head: RNDr. Jan Rohovec, PhD.)
The laboratory is equipped with the Agilent 5100 ICP EOS (inductively coupled plasma -emission optical spectrometer), together with conventional and ultrasonic nebulisers, system for hydride generation, speciation ovens etc. The instrument is used for routine analyses of macroelements (Al, Ca, Fe, K, Mg, Mn, Na, P, S, Si) in liquid samples as for as custom made analyses of practically all ICP accessible elements. The sensitivity of measurement reaches routinely 0.0x ppm. The instrument is also applied for study of speciation of mercury and arsenic.

TIMS Laboratory (Head: RNDr. Jan Rejšek, Ph.D., supervised by doc. Mgr. Lukáš Ackerman, Ph.D.)
The laboratory is equipped with TRITON (ThermoFisher Scientific; 2017), a thermal ionization mass spectrometer (TIMS) that is capable of making very precise measurements of isotope ratios of elements that can be ionized thermally. TIMS mass spec is equipped with 1,013 Ω amplifier technology with gain calibration and tau correction and central dual-channel detector (SEM/Faraday cups).

Laboratory of liquid and solid samples (Head: RNDr. Jan Rohovec, Ph.D.)
DSC/TG analyser SDT 650, TA Instruments (2017): simultaneous differential scanning calorimetry and thermogravimetric analysis, sample weight max. 200 mg, temperature room – max 1,500 °C, air or argon atmosphere.
The instrument analyser SDT 650, manufactured by TA Instruments (2017) is used for differential scanning calorimetry and thermogravimetric analyses, performed simultaneously. The sample is heated linear with the step of 0.1–100 $°C \cdot m^{-1}$ in with the dynamic temperature precision of 0.5 %. The weighting accuracy is 0.5 % with the sample amount of max 200 mg. The temperature maximum is 1,500 °C and the calorimetric accuracy is about 2 %. The sample can be analysed in the air- or inert atmosphere of argon. Typical samples for the analysis are samples of soil, clay, bentonite and other geological samples.

Laboratory of rock behaviour under high pressure and **Laboratory of rock elastic anisotropy** (Head: Ing. Tomáš Lokajíček, CSc.)

The new methods are developed for the assessment of stability of mechanically loaded rocks, for multichannel monitoring of seismoacoustic signals occurring during various loading regimes. 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 the 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 (2004): PC controlled servo-hydraulic rock-testing system with high stiffness for compressive loading up to 4,500 kN; *High pressure chamber* for elastic anisotropy measurement under hydrostatic pressure up to 700 MPa (2000); *PG-HY-700-1270* (700 MPa; 2007): electronically controlled high pressure generator; *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* (2003): multichannel acoustic emission system; *Hottinger* (Centipede-100, UPM-40, UPM-60; 2003): digital strain meters; *Permeability apparatus* for measurement of permeable and low permeable materials under constant hydraulic pressure (2006), and *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 Czech Acad Sci	40 917
2.	From the Grant Agency CR (accepted research projects)	12 482
3.	From theTechnological Agency CR (accepted research projects)	0
4.	From the internal research projects of the Czech Acad Sci	2 484
4.	From other public sources	119
5.	Applied research	4 809
6.	Investment (instruments)	14 315
7.	Investment (constructions)	0
TOTAL INCOMES		**75 126**

B. EXPENSES		
1.	Scientific staff (wages, insurances)	38 858
2.	Research and scientific activities	11 827
3.	Administration and technical staff (wages, insurances)	5 510
4.	General expenses (service, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc.)	2 043
5.	Library	1940
6.	Editorial activities	276
7.	Investment (instruments)	14 470
8.	Investment (constructions)	202
TOTAL EXPENSES		**75 126**

Notes

Notes

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