RESEARCH REPORTS

2018

Institute of Geology of the Czech Academy of Sciences

Published by the Institute of Geology of the Czech Academy of Sciences

Praha, November 2019

Cover photo: Speleological exploration in the newly discovered Heiwodong Cave, Shaanxi Province, China. Photo by Michal Filippi

2018

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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of the Czech Academy of Sciences

Contents

Introduction by the Director

As I look back, the year 2018 passed relatively smoothly at the Institute with a variety of activities scheduled. It was marked by several noteworthy events. In late June, the Institute of Geology was visited by the President of the Czech Academy of Sciences Prof. RNDr. Eva Zažímalová, CSc., together with members of the Academy Council. Besides the main workplace at Rozvojová Street, they also visited the laboratories at Puškinovo Square. The visit was a pleasure for us, but also an opportunity to present the activities, results, and limitations of our work.

Publication activity in 2018 increased relative to previous years, and Institute employees authored and co-authored high-quality outputs, as you can see on the following pages. Nevertheless, our work does not leave aside "practical" life as is obvious from the Programmes of Strategy AV21 of the Czech Academy of Sciences. The Institute also succeeded in the Academic tender for high-cost equipment, and an electron probe microanalyzer being purchased and will be installed in the Department of Analytical Methods in the second half of 2019. I am sure that this equipment, now considered a standard one, will produce precise data for researches from all departments as well as for external scientists.

Research projects launched in previous years continued and the traditional topics of the Institute stay in our working scope with the incorporation of modern and actual attitudes. Although seven projects of the Czech Science Foundation ended in 2018, the Institute was successful in the new tender: nine new grant projects for the 2019–2021 period were obtained and project funding was increased.

It is also necessary to mention the election of new representatives of the Institute of Geology to the Academy Assembly. I would like to acknowledge the previous representative, RNDr. Karel Žák, CSc., who ended his term, and I wish good luck to RNDr. Jiřina Dašková, Ph.D. and Assoc. Prof. Mgr. Lukáš Ackerman, Ph.D., who were elected for the term 2018–2022.

Tomáš Přikryl
Director

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 Institute of Geology of the Czech Academy of Sciences is a broad-scope scientific institute performing geological, paleontological, petrological, mineralogical and other disciplines, lately accentuating environmental geology and geochemistry. Major research areas covered by the Institute include: 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.

As concerns the history of the Institute, its predecessor, 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 of Pedology and Laboratory of Geochemistry; Collegium for Geology and Geography of the ČSAV represented the cover organization. On July 1, 1960, also the Institute of Geochemistry and Raw Materials of the ČSAV was established. This Institute covered technical and organization affairs of adjoined geological workplaces until their unification 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 within 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 within the Geological Institute.

On March 1, 1979, the Geological Institute merged 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 Academy. The Institute belongs to the 1st 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 Institutional Financing are evaluated by a 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.

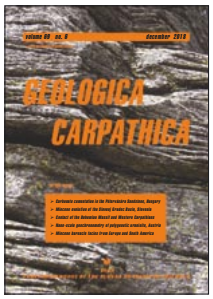
3. Publishing Activity of the Institute of Geology

a) Research Reports

Research Reports is an annual report issued by the Institute of Geology that summarizes research results of the Institute of Geology in both printed and electronic forms (https://www.gli.cas.cz/en/annual-reports). *BOSÁK P.*, ed. *Research Reports 2016.* Praha: Czech Academy of Sciences, Institute of Geology, 2018: 92 pp.

b) Journals Co-published by the Institute of Geology

Geologica Carpathica



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 Board (at present P. Bosák 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 publishes six issues per 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 2018, six issues (1 to 6) of Volume 69 were published with 34 scientific papers and short communications. Impact factor for 2018 has been set at 1.699. 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.

4. Organization Units

4a. Management, Executive Board, Supervisory Board

Management

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

Executive Board

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

Supervisory Board

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). . . . . Member
prof. RNDr. Stanislav Opluštil, Ph.D.
(Faculty of Science, Charles University). . . . . Member

4b. Scientific Departments

The **Department of Geological Processes** has utilized a combined approach using a range of methods in petrography, mineralogy, geochemistry and geochronology.

From the beginning of the year 2018, the Department managed to launch several methodical procedures linked with the newly acquired Thermal Ionization Mass Spectrometer (TIMS). Besides the measurement of the isotopic systems of Sr, Nd and Os, these included also high-precision measurement of the isotopic composition of Mo, Cd, Sm and Pb. Within a short time, these methodical approaches were routinely installed, which opened collaboration with other scientific institutions. New collaboration in the measurement of isotopic composition of geological and archaeological materials was started with the Archaeological Institute of the Czech Academy of Sciences, National Museum and scientific institutions in Turkey, India and Germany. Jan Černý, who works for the Department, was granted annual Mexican post-doctoral fellowship with Universidad Nacional Autónoma de México (Mexico City). His research relates to the area focused on seismic activity and tsunami as permanent geohazards for this area. Within the continued "*J. E. Purkyně Fellowship for outstanding prospective scientific workers*", Jiří Sláma continued his studies of rock materials using the Lu-Hf isotopic system and of U-Pb zircon dating. Staff members of the Department were involved in two continued grant projects supported by the Czech Science Foundation: the study of black shales (principal investigator Lukáš Ackerman) and geoarchaeology (principal investigator Lenka Lisá). In the course of year 2018, staff of the Department of Geological Processes published the results of their research in over 25 prestigious geological journals and it should be noted that majority of data published in these papers had been produced by the laboratories of the Department of Geological Processes.

Scientific activity of the **Department of Environmental Geology and Geochemistry** in 2018 was targeted towards biogeochemistry of toxic elements, to studies of rock weathering and water retention in landscape with relation to climate change. The obtained results were published in IF journals as well as in the form of public lectures and contributions in popular press. A series of scientific and popularization outputs dealing with mercury geochemistry, presenting the last results of our research activities, was published.

We have started development of new progressive research techniques based on isotopic geochemistry of toxic elements. Mercury isotopic ratios measurements were successfully elaborated on multi-collector ICP-MS in cooperation with Faculty of Science, Charles University. Isotopic geochemistry of cadmium was developed on the TIMS. Both innovative research directions were supported by the Czech Science Foundation grants starting in 2019. Besides this, a Czech Science Foundation project continued to support the research of thallium dynamics in soils.

An important deed in the field of environmental geology and speleology was the publication of a comprehensive review on cryogenic minerals in ice caves, incorporated into a book titled "*Ice Caves*", published by Elsevier. With respect to climate change issues, cryogenic minerals provide detailed information for paleoclimatic development, permafrost formation and thawing.

Geological research of sandstones and related issues in 2018 led to the recognition of a new specific weathering form, referred to as "*arcades, arcade pits*" and "*arcade cavities*". The arcades were identified to be a product of stress redistribution along planar discontinuities in the rock. Honeycombed sandstone was studied to explain this type of weathering. Measurement of suction, and especially the visualization of capillary water, vapour zones, and evaporation front strongly supported the hydraulic hypothesis of the formation.

The long-term project focused on monitoring of fluxes and deposition within the Bohemian Switzerland National Park as well as the long-term monitoring project based on the experimental Lesní potok catchment in the Voděradské bučiny National Nature Reserve within the GEOMON network continued in 2018.

The publication of book „*Granitic Landscapes of Central Bohemia*" written by the staff of the Department was an essential activity in the sense of science presentation to the wide public. Furthermore, the book „*Landscape and Water*" was awarded the Prize of E. E. Kisch for non-fiction literature in 2018.

The staff of the **Department of Analytical Methods** primarily provides an analytical service to cover the needs of other institutional departments. Nevertheless, research focused largely on the application of instrumental methods to earth and planetary sciences is carried out as well.

Researchers of the Department continued in the study of tektites and tektite-like natural glasses as well as archaeological glasses. Special attention was given to Australasian tektites from central Laos and to the so-called irghizites from the Zhamashin crater in Kazakhstan. Study of archaeological glasses from cesspits from the Prague Castle led to a publication of the paper in Microchemical Journal magazine. Formerly developed protocol to decipher carbon speciation in natural and synthetic apatites using Raman spectroscopy was applied to characterize apatites from Slovak volcanics. The ongoing process of design and improvement of analytical protocols in the analytical laboratories was focused, besides other topics, on analyses of synthetic selenides and tellurides of platinum-group elements using electron microprobe and glass characterization using Raman spectroscopy.

The **Department of Physical Properties of Rocks** deals with the study of mechanical properties of rocks under uniaxial or triaxial load.

The Department studies acoustic emission monitored during brittle fracturing of rocks. In this, the shear-tensile mechanism is used as a fracturing model. This model represents the simplest model, which combines shear and tensile components. The Department also deals with the study of elastic anisotropy of rocks under high hydrostatic stress. The study is carried out by ultrasonic sounding of longitudinal and transversal waves through spherical samples. The aim of the study is the determination of full stiffness tensor and its changes according to the different values of hydrostatic stress. Staff members of the Department were involved in two grant projects supported by the Czech Science Foundation: the study of solid body fracturing mode by shear-tensile source model (finished) – principal investigator Tomáš Lokajíček – and the study of petrographic parameters and rock mechanical properties influencing technological-mechanical performance of selected rocks used for crushed stone (continued) – co-investigator T. Lokajíček. In addition, they were

involved in international project, by the study of elastic anisotropy and properties of lithosphere materials using neutron diffraction and ultrasonic sounding and elastic anisotropy of layered rocks. Results of the research conducted by the staff of the Department were published in prestigious geophysical and geological journals in 2018. Most of the published data in these journals were produced by the laboratory of the Department.

The **Department of Paleomagnetism** has its laboratory in the Průhonice Research Centre. The laboratory deals with paleomagnetism, magnetostratigraphy, mineral magnetism, geological interpretation of obtained data, and development of new laboratory techniques. Research in 2018 was focused on high-resolution magnetostratigraphy on six sections at the Jurassic/Cretaceous transition, and five drill cores into Miocene lake sediments. Karst sediments were investigated in number of caves of the Krkonoše Mountains (Krkonoše National Park) and in the Malé Karpaty Mts. (Slovakia). Data interpretations encompass geotectonic, stratigraphic and paleogeographic synthesis including paleoenvironmental reconstructions. In addition, the Department solves problems of space weathered material with unusual magnetic components of superparamagnetic state as well as application of magnetic fields on tephra. The Department is also involved in the study of magnetic parameters of carbon nanomaterials and in continued archaeomagnetic research. The conference of the Berriasian Working Group was organized, and cooperation with the Chinese Academy of Sciences was extended.

The **Department of Paleobiology and Paleoecology** stands as an open unit strategically positioned at the intersections of many scientific disciplines and research topics. The Department concentrates on four main research areas – Paleozoic stratigraphy and paleoenvironment, Carboniferous plants, vertebrate paleontology and Cretaceous research. These can be further subdivided into various sub-topics.

In 2018, the Department of Paleobiology and Paleoecology produced several important results that were published in prestigious geological journals. These include the discovery of the oldest vascular land plant, published in the Nature Plants journal, and the first unambiguous record of cave bears in China, published in the Quaternary Science Reviews journal. An important part of the production was also popular science, especially in public media, and several awards. Radek Mikuláš obtained an award in a scientific photograph competition „Věda fotogenická“, and Filip Scheiner obtained a student travel award for the best poster from the Cushman Foundation for Foraminiferal Research. Lukáš Laibl prolonged his prestigious fellowship at University of Lausanne (Switzerland) for the entire year 2018. Petr Štorch obtained James Visiting Chair professorship and spent four months at St. Francis Xavier University, Antigonish, Canada. From the begining of 2018, Martina Kočová Veselská joined the Department staff and accomplished her PhD in the same year. Aneta Hušková acomplished her three months' stay at University of Toulouse. Several members of the Department formed the organizing committee (coordinator Andrea Svobodová) of the 19th Czech-Slovak-Polish Palaeontological Conference & 11th Micropalaeontological Workshop MIKRO 2018 held in Prague. Ladislav Slavík co-organized the Meeting of the International Subcommission on Devonian Stratigraphy (SDS of the ICS/IUGS) that was held jointly with the International Palaeontological Congress in Paris. In the same year he became a member of the Board of Doctoral (Ph.D.) Programme Geology at the Faculty of Science, Charles University, Prague. A. Svobodová co-organized the Berriasian Working Group Meeting held in Kroměříž. Jiřina Dašková was elected an Institute representative in the Academy Assembly of the Czech Academy of Sciences. In 2018, a new three-year project of the Czech Science Foundation started, focused on the reconstruction of Carboniferous tropical forests.

4c. Laboratories and Library

Clean Chemistry Laboratory (Head: E. Haluzová, supervised by L. Ackerman)
Laboratories for processing of samples (Fig. 1) for (ultra)trace and isotopic analyses. Both labs are supplied with HEPA filtered air. One lab (class-100000 filtered air) is used for sample decomposition and labware cleaning. It contains 1× fume-hood designed for the work with strong acids hosting two digitally controlled hotplates, 1× device for the preparation of clean

■ **Fig. 1.** Clean laboratory for isotopic analyses. Photo by M. Svojtka.

water (Millipore Essentials), 1× analytical balances (Kern, 0.0000X g) and 2× teflon distillation apparatus (Savillex) for the preparation of ultraclean acids The other lab (class-10000 filtered air) is used for clean chemistry (e.g., ion exchange chromatography separation, special chemical procedures for separation of certain elements) and final preparation of samples for mass spectrometry (HR-ICP-MS, MC-ICP-MS, TIMS).

■ **Fig. 2.** Wilfey table for mineral separation. Photo by M. Svojtka.

It contains 2× originally designed laminar flow hoods (class-100 filtered air), 1× open laminar flow work space (class-100 filtered air), 1× analytical balances (Sartorius Cubis, 0.0000X g), 2× device for the preparation of (ultra)clean water (Millipore Essentials + Millipore Milli-Q Element) and 1× centrifuge.

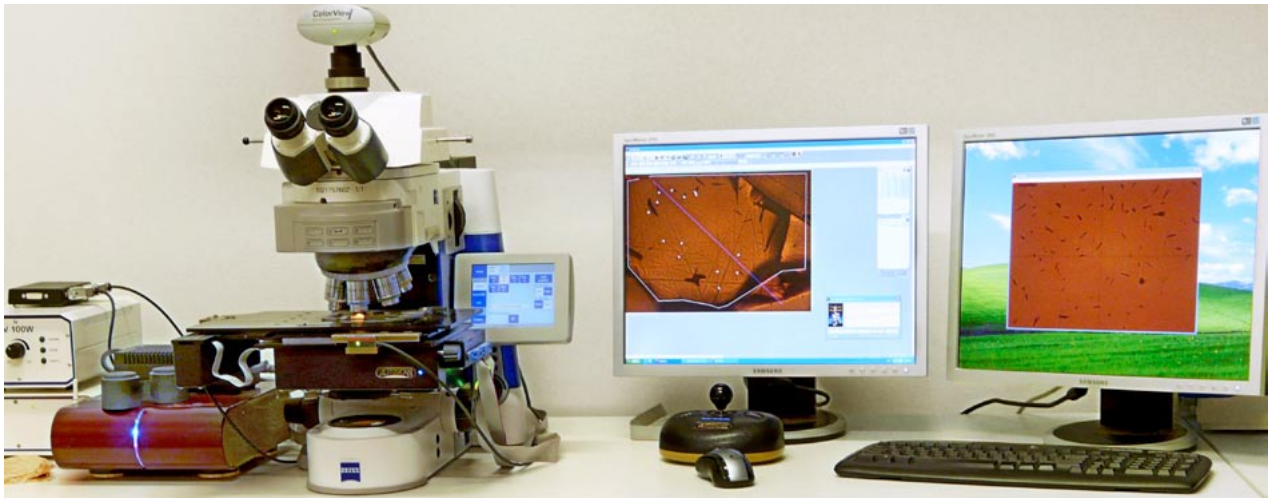
Laboratory of rock processing and mineral separation (Head: M. Šťastný)

Equipment of the lab for mineral and rock separation: WILFLEY 13B laboratory table (Fig. 2); VT 750 vibration processor; CD 160*90 crusher; RETSCH laboratory mill; ŽELBA D 160/3 crusher; SIEBTECHNIK mill; LAC LMH 11/12 muffle oven; 4H HYDROTRONK MONTOLIT hydraulic slab cutter; FRANTZ electromagnetic separator, and GÜDE air compressor.

Fission-track laboratory (Head: D. Kořínková)

The laboratory provides fission-track dating analyses for determination of the age and time-low temperature evolution (t/T modeling) of minerals and rocks (Figs 3, 4). The analytical system for fisson track analyses includes the following items: AXIOPLAN ZEISS microscope and Trackscan AUTOSCAN system; ZEISS IMAGER M1m microscope and AUTOSCAN computer-controlled microscope stage, and MTH APX 010 polishing and grinding machine.

■ **Fig. 3.** Sample preparation lab for fission-track analyses. Photo by M. Svojtka.



■ **Fig. 4.** Fission-track system for rock dating. Photo by. M. Filippi.

■ **Fig. 5.** Magnetic sector field ICP-MS coupled with an excimer laser ablation system. Photo by M. Svojtka.

■ **Fig. 6.** Thermal ionization mass spectrometer (TIMS). Photo by M. Svojtka.

Laser ablation ICP-MS Laboratory (Heads: J. Ďurišová, Š. Matoušková, supervised by M. Svojtka)
The laboratory (Fig. 5) is equipped with the ELEMENT2 (ThermoFisher Scientific) high-resolution magnetic sector field ICP-MS (inductively coupled plasma – mass spectrometer), purchased in 2009. The instrument is equipped with high mass resolution to access spectrally interfering 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) isotope ratios measurements. The Element2 ICP-MS is coupled with an ANALYTE EXCITE excimer 193 nm laser ablation system (Cetac/Teledyne) for analyses of solid samples and with an Aridus II desolvating nebulizer (Teledyne).

TIMS Laboratory (Head: J. Rejšek, supervised by L. Ackerman)
The laboratory is equipped with TRITON Plus (ThermoFisher Scientific), a thermal ionization mass spectrometer (TIMS; Fig. 6) whose applications serve three purposes: (a) elemental abundance determinations with the isotope dilution method; (b) precise isotopic ratio analyses, and (c) isotopic fractionation measurements. TIMS is supplied with five 10^{13} Ω technology amplifiers along with a 3.3 pA current calibration board, a central dual-channel detector (SEM/Faraday cup), an oxygen bleeding valve and a RPQ device. The filament bakeout device (ThermoFisher Scientific) is placed in the TIMS laboratory for the filament degassing and PCR box Airstream (ESCO) for sample loading.

Geoarchaeology Laboratory (Head: L. Lisá)
The laboratory is a basic sedimentological laboratory equipped with a set of sieves and a pH-meter. The laboratory is also equipped with the Cillas 2000 laser granulometer (purchased in 2011) with the range of 0.004–2500 micrometres. The centrifuge and the air hood are used for grain size distribution analyses too. The granulometer operates in water as well as in air suspension. The dryer and vacuum chamber serve for sample impregnation, i.e., preparation for thin sectioning.

Sedimentary laboratory (Head: A. Žigová)
The laboratory is equipped with an apparatus for sample preparation and pH measurements: Analytical balance SETRA EL–2000S (1999), WST 5010 (1991): laboratory dryer, FRITSCH (1986): planetary mill, pH-meter pH 330 / SET (2000), TESLA (1985): ultrasonic cleaner.

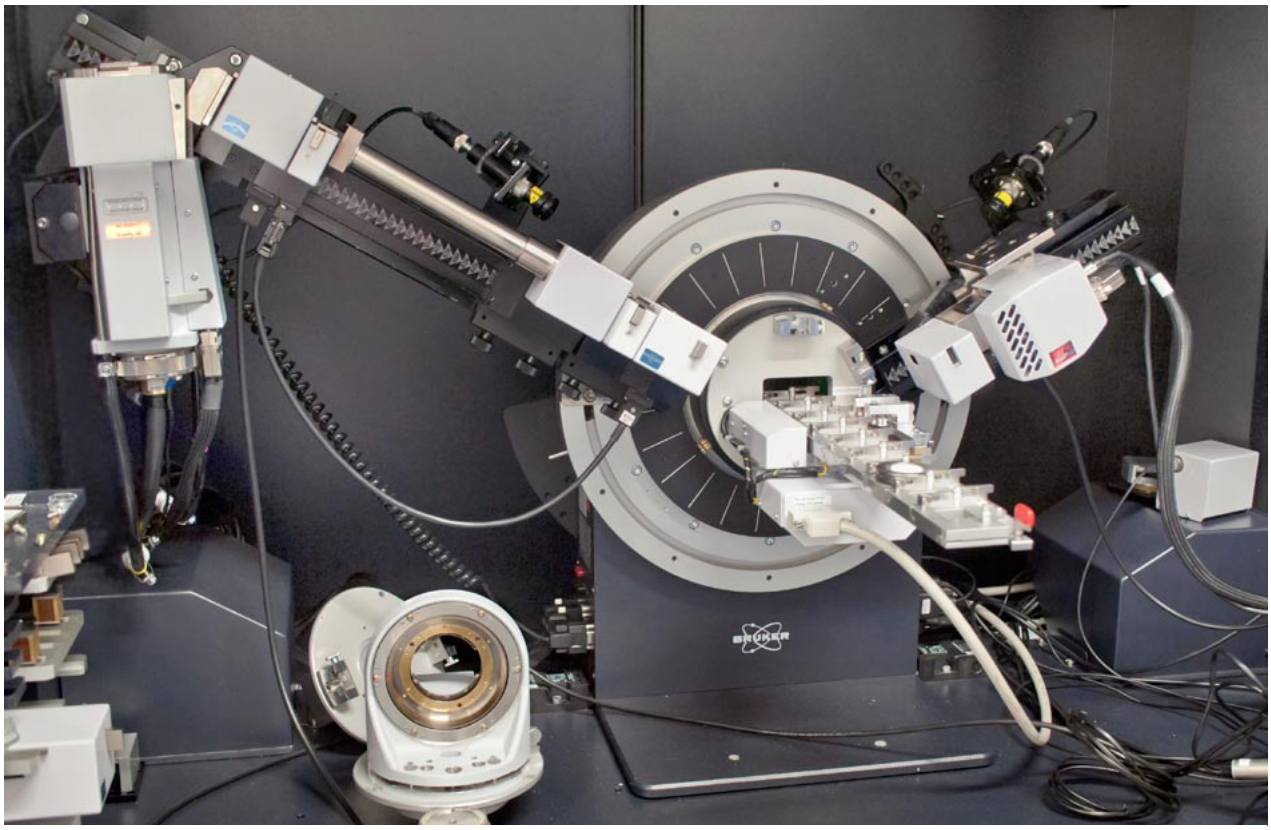
Laboratory of liquid and solid samples (Head: J. Rohovec)
The laboratory is equipped with ultrasonic horn Bandelin Sono plus (2016), gas chromatography system for methylmercury separation DANI (2015), ICP-EOS spectrometer Agilent 5100 (2014), HPLC system (KNAUER 2010): anion analysis in aqueous samples using an 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 mega (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: T. Navrátil)
The laboratory is equipped with a two zone cylinder furnace Classic (2018), total mercury and methylmercury analyser MERX (2017), 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,
RA-915M mercury analyser (2016): real-time direct detection of mercury vapor analysis in air and gases.

Laboratory of Electron Microanalysis (Supervised by R. Skála)
The Tescan VEGA3XMU (Fig. 7) scanning electron microscope (SEM) 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, the Bruker QUANTAX 200 energy-dispersive (ED) spectrometer, a low vacuum sec-

■ **Fig. 7.** Electron column of the TESCAN VEGA3XMU scanning electron microscope with SE, BSE, LVSTD, CL and ED detectors. Photo by R. Skála.

■ **Fig. 8.** CAMECA SX-100 electron probe microanalyzer with four wave-dispersive crystal spectrometers. Photo by R. Skála.



■ **Fig. 9.** Bruker D-8 DISCOVER multi-purpose X-ray powder diffractometer with installed Flipstick automatic sample changer. Photo by R. Skála.

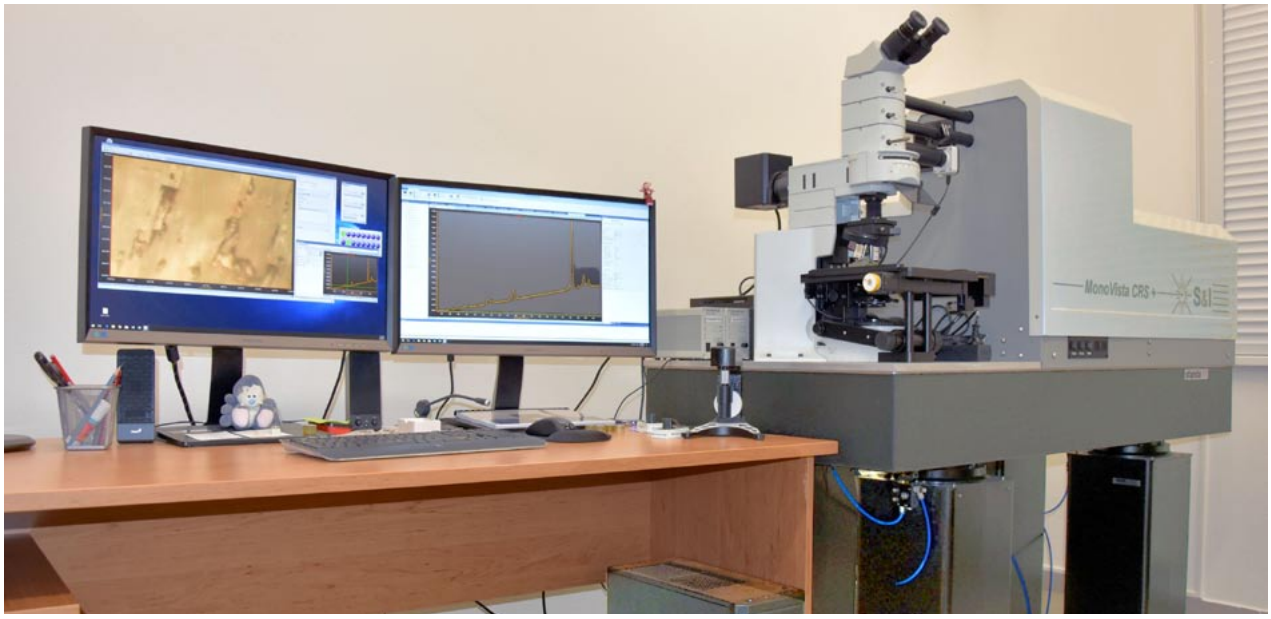
ondary electron detector (LVSTD), and a colour cathodoluminescence detector (CL).

The CAMECA SX-100 (Fig. 8) electron probe microanalyzer (EPMA) is used mainly for non-destructive quantitative analyses of solid-state materials on the micrometre scale. The instrument is equipped with four wave-dispersive crystal spectrometers. Two of them carry 4 individual standard crystals each, two other house two so-called large crystals each (i.e., crystals with lower detection limits). The instrument allows analyses for elements from B to U. To image the studied samples, BSE and SE detectors are used. For fast compositional screening, the EPMA is equipped with ED spectrometer Bruker.
The laboratory also possesses necessary instruments to carbon-coat or gold-sputter the specimens including VEB Hochvakuum Dresden B 30.2, Carl Zeiss Jena HBA 1, and Quorum Q150T ES.

Laboratory of X-ray Powder Diffraction (Supervised by R. Skála)
The Bruker D-8 DISCOVER (Fig. 9) X-ray powder diffractometer is a multipurpose powder X-ray diffraction instrument with a variable measuring radius designed to study powder samples or solid polycrystalline blocks (polished/thin sections, rock chips etc.). The 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 iscollected 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), the beam is limited with a collimator, and the sample is placed on a special motorized xyz-stage.

Grinding and Polishing Shop (Supervised by R. Skála)
Reliable quantitative local chemical analysis and/or acquisition of element distribution maps using EPMA/SEM require planar polished conductive surfaces. Such prerequisites are met when bulk solid samples are sectioned and polished. For that purpose, a suite of cutting, grinding, lapping and polishing machines is available to prepare polished sections or thin sections (cutting and grinding machines Buehler PetroThin and Struers Discoplan TS, grinding machines with diamond platen wheel Montasupal, custom-made grinding machines with wheels for loose abrasive powder (Fig. 10), custom-made saw, polishing

■ **Fig. 10.** Grinding machines with diamond plated wheel Montasupal and custom-made grinding machines with wheels for loose abrasive powder. Photo by R. Skála.



■ **Fig. 11.** S&I MonoVista CRS+ Raman dispersive micro-spectrometer. Photo by R. Skála.

machines Struers Planopol-3, Kent Mark II (2 pcs), and MTH APX-010 with MTH KOMPAKT-1031).

Laboratory of Raman and Infrared Spectroscopy (Supervised by R. Skála)
The S&I MonoVista CRS+ Raman dispersive micro-spectrometer (Fig. 11) is based on Olympus BX-51 WI upright microscope, Princeton Instruments SpectraPro SP2750 spectrometer and a CCD detector ANDOR iDus 416. Excitation lasers have wavelengths of 488, 532 and 785 nm. The microscope is designed for sample observation in either reflected or transmitted light. Objective lenses with the following magnifications are installed: 4×, 10×, 50×, 50× LWD and 100×. Samples are placed on a computer-controlled motorized stage. Spatial resolution with 100× objective is 1 µm laterally and 2 µm axially. The system allows collection of spectra within the range of 60–9,300 cm^{-1} with the 488 nm and 532 nm excitation lasers and 60–3,500 cm^{-1} with the 785 nm excitation laser.
The Thermo Scientific Nicolet iS-50 Fourier-transform infra-red spectrometer (FTIR) with built-in mid- and far-IR capable diamond attenuated total reflectance (ATR) accessory is equipped with a ceramic infra-red radiation source and a DLaTGS detector with a 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 the used beam-splitter.

Laboratory of Paleomagnetism (Head: P. Schnabl)
The laboratory is equipped with 2G 755 4K Superconducting Rock Magnetometer: an automatic precise magnetometer equipped with an AF demagnetizer (Fig. 12). The magnetometer

■ **Fig. 12.** An 2G 755 4K Superconducting Rock Magnetometer: an automatic precise magnetometer equipped with AF demagnetizer. Photo by P. Schnabl.

is cooled by a two-stage pulse tube cryocooler that is capable of reaching temperatures as low as 2.5 Kelvin, AGICO JR5a and JR-6A Spinner Magnetometer: standard highly sensitive automatic magnetometers, AGICO KLF-4 magnetic susceptibility measuring apparatus: rapid and precise measurement of magnetic susceptibility in variable magnetic fields of Rayleigh Law range, Weiss Coil Magnetizer: a standard instrument that creates magnetic fields up to 1.5 Tesla (T), MAVACS: Magnetic Vacuum Control System – a unique system designed and built in the Czech Republic to create and maintain virtual magnetic vacuum; MAGNETIC MEASUREMENTS MMTD80 Thermal Demagnetizer: standard instrument for fast and precise thermal demagnetization. The instrument can be used for demagnetization of up to 80 standard paleomagnetic samples; MAGNETIC MEASUREMENTS MMPM10 Pulse Magnetizer: this sophisticated high-field instrument for creating isothermal remnant magnetizations can accurately generate pulsed fields of up to 9 T; AGICO MFK1-FA Kappabridge: the instrument is capable of accurate measurement of anisotropy of magnetic susceptibility and bulk magnetic susceptibility in weak variable magnetic fields and frequencies; AGICO KLY4 Kappabridge: a standard instrument for accurate measurement of anisotropy of magnetic susceptibility and bulk magnetic susceptibility in weak variable magnetic fields; AGICO LDA-3A AF Demagnetizer: the instrument is used for alternating magnetic demagnetization in tumbling or static mode; AGICO LDA-5 and PAM-1 Specimen Unit: this multifunctional apparatus is adjusted for anhysteretic magnetization and alternate-field demagnetization in the field range 1 to 200 mT, it can be used also as a pulse magnetizer in weak fields (1 to 20 mT), the instrument is also able to communicate with JR6 spinner magnetometer which is used for the study of viscous isothermal remanent magnetization.

Sample Preparation Room (Head: J. Petráček)
The laboratory is equipped with (1) a portable saw: the saw contains two parallel diamond sintered cutting blades used for precise formatting of the drilled samples into actual sample cylinders of specific height; (2) a static saw: a heavy duty saw used for basic shaping of hand samples, and (3) a static drill: a heavy duty drill for sample formatting.

Micropaleontological Laboratory (Heads: L. Slavík, P. Lisý)
The laboratory of micropaleontology disposes of a room for sample preparation with standard equipment and chemicals, and a laboratory of sample processing with hoods and levigation sinks.

5. Awards and reserach fellowships

Cílek V., ***Rohovec J.***, ***Zajíc J.***, ***Mikuláš R.***, ***Nováková T.***
Egon Erwin Kisch Award for the book "Water and Landscape" (in Czech: "Voda a krajina", published by Dokořán, 2017), together with T. Just, Z. Sůvová, P. Mudra, I. Dostál, P. Havel, D. Storch, and P. Moravec, Club Authors Of Non-Fiction, The town of Letohrad and the Legacy Trust of Egon Erwin Kisch, Letohrad (September 19, 2018).

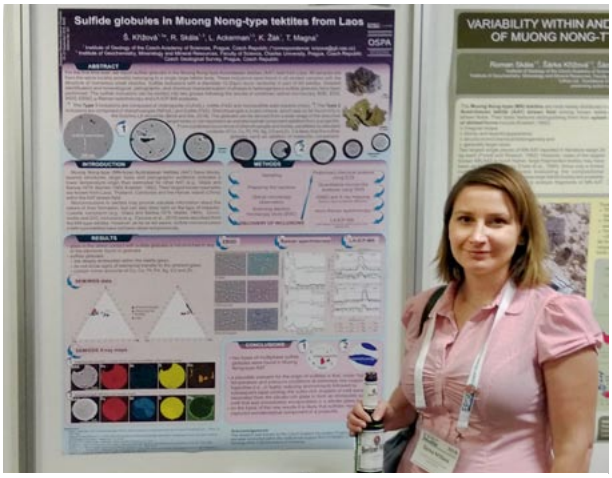
Černý J.
The postdoctoral fellowship focused on Active tectonics of the Mexican subduction zone at the Institute of Geography, National Autonomous University of Mexico, Mexico (March 1, 2018–February 28, 2020; Fig. 13).

■ **Fig. 13.** Pie de la Cuesta is one of the famous tourist destinations located in the Guerrero seismic gap. This zone might be potentially vulnerable due to long seismic silence. Palaeoseismological investigations are essential for the evaluation of seismic hazards and consequent tsunami hazards. Photo by J. Černý.

Sláma J.
J. E. Purkyně Fellowship for outstanding creative scientists, The Czech Academy of Sciences, Praha (awarded for 2016–2020).

Tomek F.
Internal post-doctoral fellowship for the Czech Academy of Sciences institutions, Program of supporting prospective human sources (awarded for 2016–2018).

Křížová Š.
Outstanding Student Poster Award, European Planetary Science Congress (EPSC 2018), Berlin, Germany (September 16–21, 2018; Fig. 14)



■ **Fig. 14.** Šárka Křížová standing at her poster during the poster session at the European Planetary Science Congress held in Berlin in September 2018. Šárka Křížová has received the Outstanding Student Poster Award for her presentation. Photo by R. Skála.

Mikuláš R.

3rd place in the category: Selfie Science, Expert Panel Award, The Photogenic Science, Czech Academy of Sciences, Praha (October 25, 2018).

Scheiner F.

2018 Joseph A. Cushman Award for Student Travel, The Cushman Foundation for Foraminiferal Research, U.S.A. (June 18, 2018).

Štorch P.

Appointee to the Dr. W. F. James Visiting Chair: Visiting James Chair Professor of Pure and Applied Sciences at Department of Earth Science, St. Francis Xavier University, Antigonish, Canada (June 6 – September 24, 2018).

6. Projects

6a. 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 in Salzkammergut, in particular on maps 95 St. Wolfgang and 97 Bad Mitterndorf** (H. Lobitzer, Geologische Bundesanstalt, Wien, Austria; L. Švábenická, Czech Geological Survey, Praha; ***M. Svobodová***; 2018)

The Gosau Group sediments of Wörschach-Liezen, situated in the Northern Calcareous Alps, contain foraminifers, calcareous nannofossils and palynomorphs of Middle Coniacian age (nannoplankton zone UC10 according the presence of *Micula staurophora*). The palaeoenvironment can be interpreted as shallow marine near mainland (the presence of non-marine green algae, i.e., *Chomotriletes minor*) with fluctuating salinity and/or a gradual marine transgression.

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

Late Pleistocene lacustrine sediments and their relation to red soils in the northeastern margin of the Dinaric Karst are studied. A large karst doline at section Hrastje–Lešnica in the Dolenjska region (SE Slovenia) was uncovered during the construction of Slovenian highway No. A2 (Fig. 15). From bottom to top, its fill consists of: brownish-yellow clay to silt with plant remains and ferrugineous coatings, and thick lacustrine (palustrine) laminated grey clayey sediments which were partly rubified.

Brownish-yellow clay to silt with few plant remains, ferrugineous coatings after root casts and gastropods (paleosol horizon) at the bottom of the doline contains quartz, chlorite, muscovite and feldspars transported as external clastic material from evolved karst and non-carbonate landscapes from the surroundings to the site. The sediments represent well-weathered material with brown paleosols at some levels. The strongly impoverished malacocoenosis indicates a Quaternary warm

■ **Fig. 15.** A panoramic view of the Hrastje profile during the construction of highway A2 Ljubljana – Novo mesto (Slovenia) at profiles Nos. 104 and 105. The morphologically complicated large karst doline is filled by paleosol at the bottom and grey lacustrine/palustrine deposits. Both units are partly rubified and laterally pass into red soils (of the *terra rossa* type). Upper red-coloured part is formed by artificially redeposited red soils from doline surroundings. Photo by J. Hajna.

phase characterized by light semi-open forest with patches of open ground habitats. One paleomagnetic sample in the bottom of the sediment succession shows reverse polarity of magnetic field and represents a geomagnetic excursion, i.e., the Blake excursion at ca 120–112 ka (MIS 5e), rather than the Brunhes/Matuyama boundary at 0.78 Ma (MIS 19).

Thick laminated grey clayey sediments are dominated by quartz, muscovite, chlorite and feldspar with randomly interstratified structures of chlorite-muscovite type. The sediment was almost unweathered (contents of feldspars, muscovite and chlorite); it was just slightly rubified on its surface, in middle part of the section and at the contact with the underlying karstified limestone slope of the depression. The grey sediment has a different mineral composition than the underlying soils (e.g., lack of quartz, chlorite) and non-carbonate residue of host limestones. Therefore, grey sediments could not serve as a parent (source) material for terra rossa formation in the broader area (i.e., polygenetic red soils developed in paleoclimate related to the present Mediterranean climatic conditions). The laminated sediment was deposited in a rather cold climate. Relatively poor palynospectra can indicate transport of pollen grains out of depocentre with flowing water and a the high depositional rate. The latter is supported also by not sufficiently centered paleosecular variations. Plant assemblages indicate that the surrounding landscape was covered dominantly by riparian forest of temperate climatic zone with some quite humid environment as wetlands and ponds on periodically flooded plain. A regional correlation, based especially on the abundance of *Fagus*, indicates the deposition at the beginning of the last glacial cycle (Weichselian) in its warmer oscillation marine isotope stage – MIS 5c (ca. 105–95 ka). All paleomagnetic samples from this part of sediment section show a normal magnetic polarity and a negligible clockwise rotation by 1.8° ± 4.7°.

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, Nanjing, China; X. Wan, School of Earth Sciences and Resources, China University of Geosciences, Beijing, China; ***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 joint project helped to establish cooperation between the Inst Geol, Czech Acad Sci, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences and School of Earth Sciences and Resources, China University of Geosciences (Beijng). The research was conducted in collaboration with the Berriasian Working Group of the ICS Subcommission on Cretaceous Stratigraphy and thus contributed to the definition of the boundary between the Jurassic and Cretaceous formations, which is the last such boundary without a Global Boundary Stratotype Section and Point (GSSP).

The principal aim of the project was to acquire and evaluate new data for the global definition of the boundary between the Jurassic and Cretaceous by means of multidisciplinary approach of magnetostratigraphy, biostratigraphy and sedimentology; this interconnection allowed an accurate correlation of high-resolution stratigraphy with marine and continental sediments previously studied in other regions. The study was aimed to compare the Jurassic-Cretaceous (J-K) stratigraphic boundary between two areas over 7,000 km apart, namely western Liaoning and Moravia. West Liaoning is known for its Lower Cretaceous continental units (and its fossils) including the Tuchengzi Formation. Rapid sedimentation in the Liaoning area caused that the individual studied sites contain only one magnetozone per site, so it was necessary to connect the individual profiles by means of biostratigraphy and photodocumentation obtained from the drone. The acquired fossils of clam shrimps (Branchiopoda) and ostracodes in combination with magnetostratigraphy allow direct connection of Liaoning sites with the Swanage site in South England.

Ongoing projects

Australian Research Council, No. LP160101353: **Tectonic Geography of the World's Oldest Petroleum Play, the McArthur Basin** (Alan Collins, University of Adelaide, Australia; The University of South Australia; The University of Wollongong; Northern Territory Geological Survey; Santos Ltd.; Origin Energy; ***L. Ackerman***, ***E. Haluzová***, ***J. Rejšek***, ***J. Ďurišová***; 2017–2019)

This extensive project, where the Inst Geol, Czech Acad Sci represents the partner investigator, deals with the McArthur Basin covering large areas of northern Australia and containing shale source and reservoir rocks >1 Ga in age. Within this project, we determined Re-Os ages for the three black shale successions coming from deep borehole sampling in the Roper Group.

Bilateral co-operation between Institute of Geology of the Czech Academy of Sciences, v. v. i., 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**; internal code 7448; supported by RVO67985831; since 1997) in co-operation with *MOBILITY PAS/CAS No. PAS-17-22* (P. Sierpień, H. Hercman, Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland) and *MOBILITY SAZU/CAS No. SAZU-16-03* (N. Zupan Hajna, A. Mihevc, Karst Research Institute, ZRC SAZU, Postojna, Slovenia; ***P. Pruner***, ***P. Bosák***)

Paleoclimate reconstruction of Pliocene–Pleistocene transition: oxygen and carbon stable isotopes from flowstones in the Račiška pečina Cave (SW Slovenia). The Račiška pečina Cave is 304 m long, with the maximum height of passages of 10 m. A unique sediment succession was deposited in the main cave passage. Various types of flowstones alternate with fine-grained siliciclastics (redeposited weathering products of Eocene flysch sediments and red soils) in a large dome-like structure. The deposits were exposed, most probably during military use of the

■ **Fig. 16.** Central part of the flowstone section in the Račiška pečina Cave (SW Slovenia) with a segment containing mostly N-polarized Olduvai subchron (1.99 to 1.77 Ma, black line). The height of the whole section is about 3 m. Photo by P. Bosák.

cave, in a ca. 13 m long section with a composite thickness of nearly 6.5 m. Based on paleomagnetic and magnetostratigraphic analyses, mammalian zoopaleontology and numerical datings, the flowstones started to deposit at more than 3.4 Ma with the termination at ca. 1 ka. The section contains Pliocene/Pleistocene (at ca. 1.8 Ma) and Pleistocene/Holocene transition periods as well as a well-developed segment belonging to the Olduvai normal magnetic subzone (ca 1.95 to 1.77 Ma) within the reverse Matuyama Chron (Fig. 16; Zupan Hajna *et al*. 2008).

The section consists of three main segments. The lowest one (180 cm), represents the stages of large stalagmites growth and consists of brown and red-brown, massive, porous speleothems with interbeds of red clay sediments (1–2 cm thick). The lowest part terminates with a distinct unconformity. The middle part (368 cm) is built of laminated, porous flowstones, densely interbedded with red clays (1 mm to 10 cm thick) in the central part of the section. Huge blocks of rock detached from the ceiling of the cave and fauna can be seen at the base of this segment. The upper segment (96 cm) is represented by bright, massive, laminated speleothems with two inserts of grey-brown/yellow clays with cave bear bones.

Stable isotope analyses of flowstones were performed at the Institute of Geological Sciences of the Polish Academy of Sciences in Warsaw. The value of $\delta^{18}O$ varies within the range of ca. 3 ‰ (from −4.27 ‰ to −7.17 ‰). Variation in the carbon isotopic composition is wider and reaches 6 ‰ (the $\delta^{13}C$ from −3.36 ‰ to −11.02 ‰). The obtained isotopic records were correlated with global and regional paleoclimatic data. The analysis resulted in new information on climatic conditions around the Pliocene/Pleistocene transition in the studied area.

Bilateral co-operation between Institute of Geology of the Czech Academy of Sciences, v. v. i., 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. Bosák***, ***P. Mikysek***; internal code 7448; supported by RVO67985831; since 1997)

The Plavecká jaskyňa Cave near Plavecké Podhradie village on the western marginal fault of the Malé Karpaty Mountains (Western Slovakia) is a result of multi-phased and hypogene speleogenesis in fractured Triassic limestones. Waters ascended along the horst-graben fault boundary of the Malé Karpaty Mountains with the Záhorská nížina Lowland (northeastern part of the Vienna Basin). Morphologically, the cave is featured by (1) phreatic chimneys, cupolas, ceiling pockets, spongework cavities, upward wall channels and upward oriented large scallops, (2) epiphreatic flat corrosion bedrock floors, feeding fissures and wall water-table notches, as well as (3) vadose vents, upward half tubes and shallow cupolas formed by condensation corrosion on the cooler overlying walls and ceilings. Flat corrosion bedrock floors breached by fissure discharge feeders, on the edges with wall water-table notches, indicate a rapid lateral corrosion by the sulphuric low thermal waters. Three subhorizontal passages developed at former levels of the piezometric surface during water table stagnations corresponding with phases of decelerated or interrupted tectonic subsidence of the Vienna Basin graben structure. The passage of the lower level at about same elevation as the present spring of slightly warmer groundwater in front of the cave (11.6 to 13.6 °C; about to 3 °C warmer than the regional mean annual temperature).

In addition to morphological indicators (flat corrosion floors, fissure discharge feeders, convention niches, upward half tubes and shallow cupolas), the sulphuric low-temperature acid speleogenetic phases of the Plavecká jaskyňa Cave are indicated by the presence of gypsum in association with hydrated kaolinite, illite, clinochlore and montmorillonite (XRD) in rare deposits. Calcite popcorn rims were also deposited due to evaporation processes at the edges of feeding fissures that were still active as thermal vents when the water table dropped. Hydrogen sulphide involved in the sulphuric acid speleogenesis was most probably released from hydrocarbon reservoirs of the adjacent Vienna Basin during tectonic movements. Features similar to

those detected in the Plavecká jaskyňa Cave were identified also in some other caves of the Plavecký Karst. Sulphuric acid speleogenesis has been identified for the first time in Slovakia here.

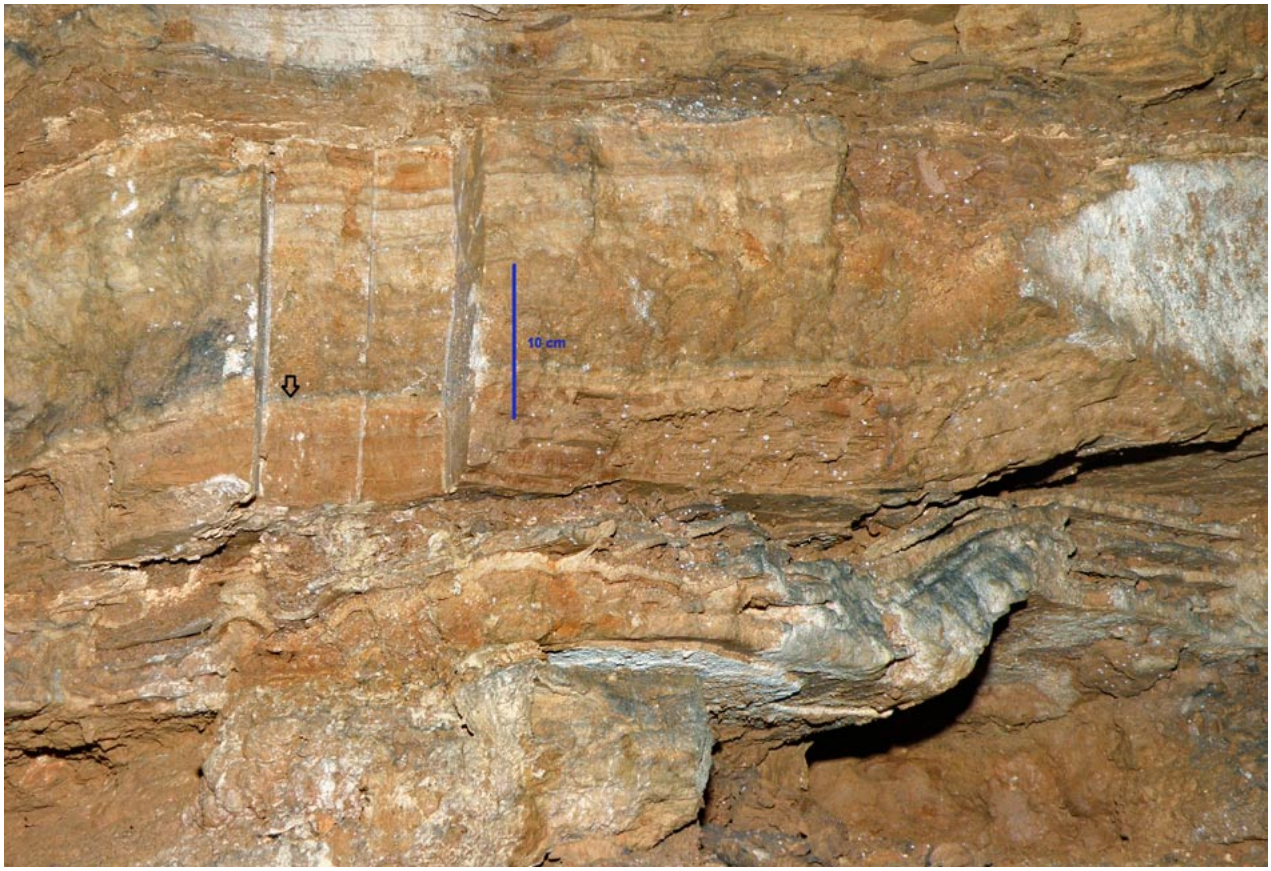
International Geoscience Programme (IGCP) of UNESCO & IUGS, Project Code IGCP No. 653: **The onset of the Great Ordovician Biodiversification Event** (International Leader: T. Servais, French National Centre for Scientific Research, France; Czech representative: O. Fatka, Faculty of Science, Charles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

Post-mortem feeding activities along the internal sides of early buried shells or expanded inside them can remain traces in the filling sediment, hence preserved and visible on internal moulds of shelly fossils. Almost no such activities were recorded in three lowermost Ordovician formations (Třenice, Mílina and Klabava; Tremadocian to Dapingian) of the Prague Basin in the Barrandian area (Czech Republic). In contrast, a distinct overturn occurs in the Šárka Fm. (early and middle Darriwilian). The feeding traces are very common, related to shells preserved in the siliceous nodules.

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, P. Sierpień, Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland; ***P. Bosák***, ***P. Pruner***, ***Š. Kdýr***, ***Š. Matoušková***, ***J. Rohovec***; supported by RVO67985831; 2017–2019)

Climate change at Matuyama-Brunhes boundary: multi-proxy record from flowstones from the cave Račiška pečina Cave (SW Slovenia). The relict cave of Račiška pečina is located in the Matarsko Podolje (Classical Karst, SW Slovenia). Technical adaptations of cave interior provided a large exposure in cave sediments. A unique series of sediments composed of interbedded flowstones and red fine-grained clastic sediments deposited in the main cave passage at the intersection with a narrow fissure-like invasion vadose passage. The studied section is about 13 m long with a real thickness of around 3 m and the cumulative thickness of all sampled segments of nearly 6.5 m. Detailed paleomagnetic and magnetostratigraphic studies, combined with mammalian microzoopaleontology and numerical dating (U-series) stated the start of flowstone deposition at over 3.4 Ma and the termination at ca. 1 ka, i.e., from early Pliocene to Holocene with hiatuses, some of them long-lasting. Charcoal layers (residues of fireplaces) in the upper part of the flowstone profile proved repeated human inhabitation of the cave (radiocarbon dates of ca. 3 to 12 ka).

Reddish light brown flowstone was collected from the upper part of the section below yellow clastic interbeds with cave bear bones in the thickness of ca 23.5 cm. The boundary of Brunhes and Matuyama Chrons (B/M) was found at the depth of ca 17.5 cm (Fig. 17). The flowstone is built of three macroscopic



■ **Fig. 17.** The Brunhes-Matuyama boundary in sample RP66 (black arrow) from the Račiška pečina Cave (SW Slovenia). Photo by P. Bosák.

types of calcite with different porosities and colours. Based on microscopic observations, most of the flowstone is built of calcite facies similar to dendritic fabric with characteristic high porosity, significant contents of detrital material and V-shaped appearance of branching polycrystals. The most significant changes were related to the B/M boundary zone, where dendritic open fabric changed to a columnar microcrystalline one (with the highest calcite crystals purity throughout the analysed flowstone) over a relatively short distance. Other transitions are less noticeable.

Oxygen isotopic composition ($\delta^{18}O$) of the analysed flowstone varies within the range of 3‰ (from −4.5 to −7.5‰). A characteristic rapid decrease in the $\delta^{18}O$ values was observed at the B/M transition. Carbon isotopic composition ($\delta^{13}C$) changes within a similar range of −8.3‰ to −11‰. The $\delta^{13}C$ values drop by ~1‰ at the B/M transition, i.e., there is a similarity with the oxygen isotopic record. The isotopic record was correlated with other proxies from the studied flowstone section, i.e., trace elements relative content or magnetic susceptibility. All proxies indicated a clear change in paleoenvironmental conditions at the B/M boundary.

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. Ivankina, I. Zel, R. Vasin, Joint Institute for Nuclear Research, Frank Laboratory of Neutron Physics, Dubna, Russia; ***T. Lokajíček***, ***M. Petružálek***, ***T. Svitek***; 2015–2020)

Subproject 1: Comprehensive analysis of the lithosphere elastic anisotropy and properties of lithosphere materials using neutron diffraction and ultrasonic sounding: In order to assess the relationships between anisotropic geomechanical properties of weathered granitic rocks, physical and mechanical analyses were performed on Rapakivi granite extracted from the Viborg region near St. Petersburg, Russia. This sample is a coarse-grained rocks with typical K-feldspar ovoids (crystals 1 to 5 cm in diameter) that are entirely mantled by oligoclase. Neutron texture measurements were carried out using the time-of-flight texture diffractometer SKAT at the beamline of 7A. Lattice (crystallographic) preferred orientation (LPO) of the major minerals (K-feldspar, oligoclase and quartz) are well-pronounced but weak. Spatial distributions of elastic velocities of P-waves for RAP1 under hydrostatic pressure up to 400 MPa were obtained using equipment at the Inst Geol, Czech Acad Sci. P-wave velocity anisotropy of spherical granite samples was measured at increasing confining pressures. Starting from A = 14 % at 0.1 MPa, anisotropy coefficient decreased significantly to A = 8 % at 400 MPa. Texture-based calculation of the elastic P-wave distribution approaching Voigt averaging shows a weak effect of texture on the bulk elastic properties. The results suggest that dry and saturated unit weight, porosity, ultrasonic velocity, texture measurements and petrographic studies, effectively revealed the main reason for the disintegration of the Rapakivi – the degree of weathering followed by two systems of open microcracks.

Subproject 2: Elastic anisotropy of layered rocks: ultrasonic measurements and texture-based theoretical predictions: Experimental and theoretical investigations were performed on a highly anisotropic sample of plagioclase-biotite gneiss with structure of compositional layering PL367 and biotite gneiss sample of weak anisotropy OKU2. Two acoustic methods are used for measuring seismic anisotropy: measurements of P-wave ray velocities on a sphere and comprehensive measurements of P- and S-wave phase velocities on a cube under different confining pressures. Both samples exhibit orthorhombic symmetry of elastic anisotropy, although layered PL367 tends to the higher transversely-isotropic symmetry in Vp distribution. The textures of biotite gneisses were obtained using neutron diffraction. Crystallographic preferred orientations (CPOs) of major rock-forming minerals (biotite, muscovite, plagioclase and quartz) were measured at the SKAT neutron texture diffractometer. At atmospheric pressure, the anisotropy is controlled completely by orientated microcracks which – in case of sample PL367 – are well developed inside mica grains and between its layers. Microcracks SPO (shape-preferred orientation) are always correlated with mica CPO. The bulk elastic anisotropy was found to be caused by the preferred orientations of mica grains and microcracks.

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, Nanjing, China; 2017–2019)

The main focus of the project is a detailed morphological and morphometric analysis 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). The primary issues addressed in the project are as follows: (1) which of the stratigraphically important graptolite species recorded in the Rhuddanian/Aeronian boundary strata at 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) how much intraspecific diversity occurs in these taxa, and (3) which of the closely similar twin-taxa may figure under a single name in the high-resolution quantitative correlation of the European and Chinese sections? The present study concentrated on stratigraphically distinct populations of early rastritids and petalolithids. Taxonomic revision of the lower and middle Aeronian rastritids revealed a distinct palaeogeographical distribution of the species and subspecies recognized in a stratigraphic interval ranging from *triangulatus* to *leptotheca* biozones. None of these forms exhibit a cosmopolitan distribution. *Rastrites longispinus longispinus* Perner, *R. approximatus* Perner, *R. peregrinus* Barrande, *R. rossicus* (Obut & Sobolevskaya), *R.* aff. *rossicus* and *R. norilskensis* Obut & Sobolevskaya were revised using material from China and Czech Republic, supplemented by specimens from Canada, Spain, and published data. *Rastrites longispinus brevispinus*

subsp. nov. was described as a new biogeographical subspecies confined to China and northern North America. In turn, "*Stavrites*" *laticellatus* Obut & Sobolevskaya, *R. guizhouensis* Mu *et al*., *R. confertus* Chen & Lin, *R. geinitzii* Tornquist, *R. orbitus* Churkin & Carter and *R. hemigyratus* Chen & Lin are considered to be junior synonym names. Cluster analysis of palaeogeographical distribution of the *Rastrites* species involved in this revision indicates that two provinces existed in the early–early-middle Aeronian: low-latitude Northern Hemisphere Province of South China, Siberia and northern North America, and largely mid-latitude Southern Hemisphere Province comprising Avalonian British Isles, Baltic area, central Europe, western and southern Europe, and North Africa. A similar study follows on petalolithids including *P. ovatoelongatus* (Kurck), *P. praecursor* Bouček & Přibyl, *P. primulus* Bouček & Přibyl, *P. ankyratus* Mu *et al*., *P. palmeus* (Barrande) *sensu* Chen and Lin (1978), and *P. elacatus* Ni in order to test the palaeobiogeographic model outlined by means of rastritid distribution. Populations of the respective species were taken from specific samples available from sections sampled in 2014–2018.

6b. Czech Science Foundation

Finished projects

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, Praha; 2016–2018)

We developed advanced methods for acoustic emission (AE) data processing and for the improvement of quality of the picked amplitudes of the P-wave to determine a reliable source mechanism for a large quantity of AEs. These methods were applied for the moment tensor (MT) and shear-tensile crack (STC) inversions as well as for the estimates of their reliability expressed in terms of the confidence regions for any particular solution. The performance of the STC was tested in numerous experiments, mimicking both seismological and laboratory setups. The STC, as a special type of the constrained MT, by definition provides a solution with smaller confidence region than the full MT. We demonstrated that the improvement of the confidence often allows to resolve between volumetric and shear mechanisms (i.e., between fracture modes I and II/III), which is frequently a difficult task for the MT inversion. We applied the STC source model to the AEs and compared to the standard MT approach. The confidence regions in the STC approach shrink markedly especially concerning the decomposition of the mechanism, enhancing the resolution of the shear *vs.* volumetric nature of the events significantly. In addition, the reliability of the MT decreases with increasing contents of the non-DC component. The experimental part, uniaxial tests with AE monitoring, covers mainly the influence of grain size and already preexisting microcracks (preheated specimens, from the same 5 granites, heated up, in turn, to 100, 200, 400 and 600 °C) on stress-induced microcracking. Data processing of experiments on preheating of the specimens appeared to be unexpectedly more complicated, namely due to the very high attenuation of the specimens tested.

No. *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, Praha; P. Skupien, Institute of Geological Engineering, Faculty of Mining and Geology, VŠB-TU Ostrava; M. Bubík, L. Švábenická, Czech Geological Survey, Praha; 2016–2018)

New integrated stratigraphy (e.g., magneto-, chemo-, calpionellid, nannofossil, non-calcareous dinoflagellate, ammonite and belemnite stratigraphy) was determined for several Tethyan sections in France, Czech Republic and Great Britain.

The main focus of the team of the Paleomagnetic Department, Inst Geol, Czech Acad Sci, was on rock-magnetic and paleomagnetic measurements and evaluation of data from Czech, French and Ukrainian localities. Microfacies and high-resolution studies of calpionellids, calcareous and non-calcareous dinoflagellate cysts, palynomorphs and calcareous nannofossils compared with magnetostratigraphy provided stratigraphic results and paleoenvironmental interpretations across the J-K boundary in the Kurovice quarry, Outer Western Carpathians. Magnetozones from M21n to M17r were identified and supported by calpionellid, dinoflaggellate and nannofossil distribution which indicated early Tithonian (*Semiradiata* Zone), late Tithonian (*Tenuis-Fortis* Zone, *Crassicollaria* Zone) to early Berriasian (*Alpina*, *Ferasini* and *Elliptica* Subzones of the *Calpionella* Zone) age. The Kurovice section represents an interval of nannofossil zones from NJT15b to NK-1, and data indicate a paleolatitude of 24°N. Furthermore, the Kotouč Quarry near Štramberk was considered one of the potential J-K transition sections. Magnetozones M18r and M18n were found. The overall paleolatitude suggests 33°N position.

The team from the Faculty of Science, Charles University confirmed that stable isotopes $\delta^{18}O$ and $\delta^{13}C$ from bulk rock and belemnites across the J-K transition show the same trends in many Tethyan sections. A comparable $\delta^{13}C_{carb}$ signature was received from peri-reefal and deeper-water facies in the Carpathians in the Czech Republic. The Czech Geological Survey team prepared a detailed log of the Kurovice section and provided sedimentology, nannofossil stratigraphy and evaluation of foraminifera. The team of the VŠB-Technical University provided evaluation of ammonite fauna from the Štramberk Limestone in the Kotouč Quarry and contributed to the taxonomy of the family Haploceratidae.

The 19th Czech-Slovak-Polish Palaeontological Conference & 11th Micropalaeontological Workshop MIKRO 2018 as well as Berriasian Working Group meeting were held under the auspices of the Inst Geol, Czech Acad Sci. The results of this work will be used as a basis for the global stratotype proposal of the International Subcommittee for Cretaceous Stratigraphy.

No. *16-14762S*: **Mercury and methylmercury in surface waters and soils at two sites with contrasting deposition histories** (***T. Navrátil***; 2016–2018)

Primary target of this project was to elucidate the current deposition rate of Hg at two contrasting sites. The deposition

■ **Fig. 18.** Litterfall sampler at the Cervik catchment. Photo by M. Šimeček.

at the two contrasting sites was dominated by litterfall and wet deposition accounted for <5% of the total (Fig. 18). But the observed differences between Hg deposition at both sites were negligible. The most important achievement of the project was the evaluation of historical Hg deposition through litterfall. Using larch tree rings as archives of Hg atmospheric levels we estimated that Hg deposition to the forested ecosystems in the Czech Republic decreased after the peak in 1960s and 1970s. Furthermore, the analysis of the archived litterfall samples at Plešné and Čertovo lakes indicates a decline of litterfall Hg deposition to the Czech forest ecosystems. The decrease of Hg in spruce bark and other litterfall components reached up to 50 % in the period of 2003–2017. Forest dying due to the bark beetle infestation caused a 5-fold increase in litterfall Hg deposition for a period of 5 years.

Second of all, the conclusions in terms of differences between the peak in methylation rates occurred right after the forest death, and currently Hg methylation in dead stands decreased to lower levels. Mercury concentrations and pools at both sites were comparable and, according to the study of archived soil samples from Bohemian Forest sites since the year 2000, it can be concluded that Hg concentrations in forest soils in the Czech Republic are decreasing.

Furthermore, we succeeded in the assessment of Hg and methylated Hg input by tributaries to the Plešné Lake during the three years of the project on a 3-weeks' steps basis. Mean concentrations of Hg and MeHg at both sites were determined by DOC. At the same time, lake water and lake output at the Plešné Lake allowed to calculate for lake watershed mass balance which indicated a Hg accumulation level of >85%.

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

Zinc accumulation and its cellular form were investigated in numerous species of the genus *Russula*; the final dataset resulted from the analysis of 360 sporocarp collections of 114 *Russula* species from unpolluted sites. In most analysed *Russula* species, Zn concentrations were in the common macrofungal range of 50 to 150 $mg \cdot kg^{-1}$ (dry mass). Phylogenetic analysis unveiled the existence of two low Zn clades (subgenera *Brevipes* and *Compactae*) and a single high Zn clade involving – besides the already known Zn-accumulator *R. bresadolae* – also five newly recognized Zn-overaccumulating *Russula* species. Detailed metal speciation, genetic, and proteomic analyses were performed in *R. pumila, R. ochroleuca*, and *R. viscida* from the high Zn clade. In this extensive genus-wide study on metal accumulation in macrofungi, we documented a dominant role of

zinc-binding peptides (ZBP) in handling of Zn in overaccumulators (thus revealing that Zn binding with ZBPs is not restricted to *R. bresadolae*). Noteworthy, the homology cloning strategy used to obtain sequence information about RaZBP homologues in the genus *Russula* did not detect ZBP-coding sequences in average- or poorly-accumulating species.

Are there any metal accumulators among the *Phaeocollybia* species? This research question stemmed from the fact that the accumulation of elements has been never studied in *Phaeocollybia*. Collections of *Phaeocollybia* spp. were analysed for trace elements, Pb isotopic composition, C/N isotopic composition, and compared with macrofungi growing at the same site. Soil analyses were performed on organic, organomineral, and mineral horizons. We particularly focused on the most common species *P. lugubris*. In all observations, the deeply rooting stipe of *P. lugubris* reached the mineral Bw horizon. Concentrations of Na in common mushrooms associated with *P. lugubris* did not exceed 400 $mg \cdot kg^{-1}$. In contrast to this, Na concentrations in *P. lugubris* were found to exceed 10,000 $mg \cdot kg^{-1}$. This significant Na accumulation (followed by the accumulation of Rb and Cs) was confirmed from all sampling areas. Furthermore, elevated Cd concentrations were observed (circa 20 $mg \cdot kg^{-1}$). Surprisingly, the Pb isotopic fingerprints in *P. lugubris* sporocarps do not indicate Pb accumulation from the Bw horizon, as we expected, but from the organic horizons. When compared with other fungi, only *Russula cyanoxantha* showed Pb isotopic fingerprints indicating Pb accumulation from the Bw horizon. According to C/N isotopic analyses, both C and N isotopic fingerprints of *Phaeocollybia* well overlap with those of ectomycorrhizal fungi. 23 individual collections of 4 *Phaeocollybia* species clustered together in the δC–δN isotope plot and showed a considerably low variation in their C/N isotopic composition.

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

The project concentrated on chemostratigraphic, magnetostratigraphic and cyclostratigraphic analysis of Miocene lake sediments in the Most Basin. The Most Basin is the largest basin within the Ohře Rift in the Czech Republic. The Early Miocene Most Formation (topmost part of the Most Basin) is divided into 5 members, ranging from the Duchcov Member up to the Osek Member and comprises lacustrine, alluvial and fluviodeltaic sediments with interjected coal seams. Geochemical analyses were performed on 11 drill cores in the project. Validity of the chemostratigraphic scheme was verified across the whole basin from the Bílina and Tušimice mine areas to the northwest (Ústí nad Labem, Teplice, Duchcov cities). The entire thickness of the basin fill is now available in at least 2 correlated cores (Fig. 19).

Cyclostratigraphy analyses were performed in 6 cores. The study was performed using both classical and novel approach in the conventional methods guaranteed by Mathieu Martinez, a relatively novel tool 'test Precession' by Cristian Zeeden and absolutely new approach was undertaken by Otakar Man. Previous assignment of magnetozones to chrons was specified and confirmed by producing a consistent scheme for the entire basin and entire thickness of the studied sediments.

Magnetic polarity was analysed in 9 cores covering a time interval of 1.8 My. The composite section was correlated with the reconstructed extent of the East Antarctic Ice Sheet and with ocean (global) $\delta^{13}C$ and $\delta^{18}O$ records. The target interval

■ **Fig. 19.** The Tušimice Quarry. Photo by Š. Kdýr.

recorded in the Most Basin was shown to mark several distinct environmental (climatic) periods or thresholds. Data show that the timing of the Astronomically Tuned Neogene Timescale (ATNTS2012) should be adjusted.

The study established and dated the most detailed (with a precision around ten thousand years), continuous, paleoenvironmental record of the onset of the Miocene Climatic Optimum in the continental realm and correlated it with global marine records. The work is important for paleontologists and paleobotanists working in the Most Basin, and even for the mining industry.

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

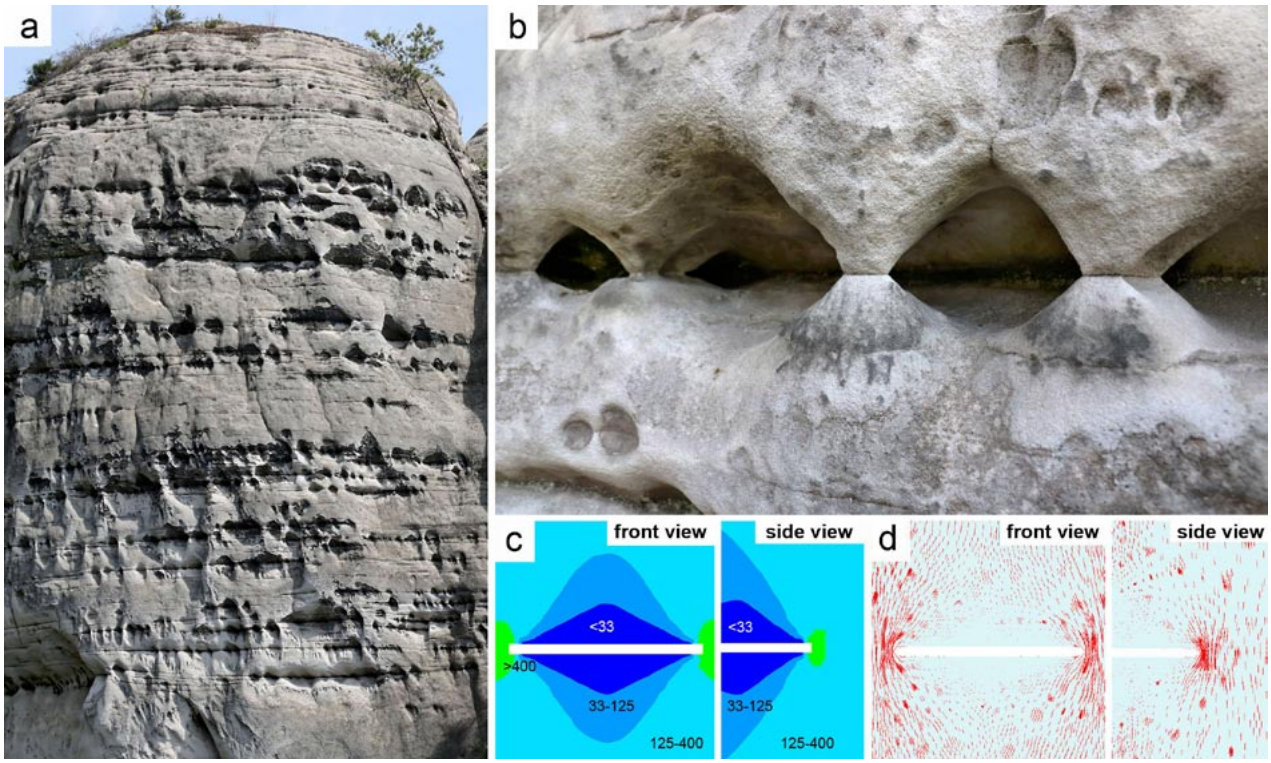
This project was focused on weathering and erosion of sandstone, which is known to form very interesting landscapes with numerous towers, arches, table mountains and other forms protected in numerous national parks across the world (e.g., USA, Australia, Czech Republic, China, etc.). These landscapes are visited by millions of people each year. Sandstone has been also a very important building material for millennia, and some of the nicest architecture is built from sandstone blocks or directly carved in sandstone cliffs (e.g., Petra – World heritage site, Jordan).

The objective of the project was to characterize the effect of gravity loading stress on the evolution and degradation of various natural/artificial sandstone forms using various approaches, especially using laboratory experiments, 3D physical modelling and numerical modelling. This objective was followed by 4 partial aims, which are as follows.

First aim: erosional progress (shape evolution) of rock pillars, arcades, arches and masonry wall was modelled physically and numerically (Fig. 20). It was clearly demonstrated that arcades, well-developed arches and tops of pillars result from stress-controlled erosion and that the stress affects erosion of masonry walls.

Second aim: a relationship between stress magnitude and decay rate was characterized for lithologically different sandstones. In general, the decay rate decreases exponentially with increasing stress for both salt and frost weathering. Even low tension drastically increases the decay rate. This aim provided a functional relationship necessary for modelling of stress-controlled erosion. The study was finalized by the identification of salts on rock outcrops and by the determination of factors affecting the transport of moisture with dissolved salts including the application of newly developed techniques.

Third aim: erosion of blocks was documented in fracture zones in the Střeleč Quarry. As expected, small blocks (not loaded by surrounding material) were eroded rapidly, which resulted in opening of conduits that enabled a rapid groundwater flow. On the other hand, in fine-grained limy sandstones



■ **Fig. 20.** Arcades – a newly recognized weathering form together with the results of numerical modelling of their evolution using PLAXIS software: a) natural cliff in weak sandstone with numerous arcades; b) a close-up view of well-developed, more or less symmetrical arcades – both examples from the Apolena Rock City, Czech Republic; c) stress distribution around the initial discontinuity points to the presence of a stress shadow (dark blue), which indicates further evolution into a lenticular shape; d) principal rock stress directions around the initial discontinuity (red lines). Photos by M. Filippi.

to sandy limestones of the Jizera Fm. of the Bohemian Cretaceous Basin, the effect of stress is negligible based on the experiments.

Fourth aim: a material model was developed to simulate erosion of locked sand and other materials where erosion is stress-controlled. The model is based on the condition of maximum principal stress as erosion-controlling quantity. This model was implemented into 2D and 3D finite element software Tochnog Professional using a user-defined material model interface. Numerical modelling of the origin of various sandstone forms was first performed in 2D. Finally, we also performed complex 3D simulations.

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 aim of the project was to analyse, describe and evaluate changes in fish assemblages at selected sites of Moravia during the Oligocene to Lower Miocene time interval, with a focus on a detailed interpretation of the observed changes.

The assemblages were studied and their taxonomic components were identified within separate localities (namely Kelč-Strážné, Loučka, Vážany nad Litavou, Krumvíř) and compared with similar localities within the Czech Republic and other parts of Europe. The fishes of the class Chondrichthyes are represented by a very limited number of specimens (isolated teeth and gill rays), while remains of the Teleostei are dominant.

Some taxa were described to be new for science (toadfish *Louckaichthys novosadi*, goby *Gobius jarosi* or ophidiiform *Kalabisia krumvirensis*), some of them representing the earliest skeletal fossil record of these groups. New taxa were described also at comparative localities (e.g., bristlemouth *Gonostoma dracula*). It can be generally stated that the diversity at the studied Oligocene (Kiscellian) and Oligo-Miocene (Egerian) localities is higher than previously expected.

The Oligocene (Kiscellian) assemblages from the localities of Loučka and Kelč were collected mainly from the Dynów Member of the Menilitic Formation (while data from other parts of the formation are much more incomplete). They are dominated by protacanthopterygian "*Glossanodon*" *musceli* (tentatively classified to be argentiniform or osmeriform) and highly disarticulated and incomplete clupeids. Other taxa represent relatively wide range of different groups with less numerous individuals (in some cases represented by a single specimen), including numerous remarkable groups, such as bristlemouths (Gonostomatidae), toadfishes (Batrachoidiformes with a new species *Louckaichthys novosadi*), morid cods (Moridae), cusk-eels (Ophidiiformes) and many others.

The Egerian assemblage of the locality of Krumvíř shows developmental relation to the Oligocene assemblages, but as a whole it is clearly a separate entity. The most contrasting feature is the total absence of protacanthopterygian "*Glossanodon*" *musceli*. Although the assemblage of this level has been long known, a new taxon was recognized also at this level (ophidiiform *Kalabisia krumvirensis*).

The Vážany nad Litavou site, previously considered to be Egerian in age, is reclassified to Burdigalian age. The assemblage is represented by significantly different taxa, especially neritic ones. The most interesting is the oldest record of the genus *Gobius*, classified as a new species named *Gobius jarosi.*

Ongoing projects

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, Praha; M. Mihaljevič, Faculty of Science, Charles University, Praha; ***J. Rohovec***; 2017–2019)

Research activities dealing with thallium thermal desorption study from soils developed on mineralized carbonate rocks continuted. Thermal desorption (TD) experiments were performed in dynamic air atmosphere, inert and strongly reducing atmosphere. Generally, strong influence of organic matrices was observed for all soil samples, especially for upper soil horizons. Formation of tarry by-products complicated release of thallium from samples and thus influenced the TD curves. In these cases, the shape of TD curve was not specific for certain Tl species present in the soil, its interpretation was rather troublesome. In order to suport interpretation of TD data, DTA and DSC study of the soil samples was performed.

The aim of atmosphere modification was exploration of the influence of the atmosphere used on the TD behaviour of thallium during its release from samples of soils and coal. As an inert atmosphere, argon was used, while the reduction atmosphere was realised by stream of carbon monoxide. The thermodynamic calculations proved the ability of CO to reduce both Tl^{I} and Tl^{III} to the comparative volatile Tl^{0}. Different behaviour with respect to the TD in air atmosphere was found for pyrite and brown coal samples. In the case of pyrite and coal, the first signal, occuring at 350 °C, was absent. At the same time, the expected shift of Tl release towards lower temperatures was observed. This observation can be used for a more detailed distinguishing of thallium species released at similar temperatures, but differing in redox sensitivity. Results obtained in the inert atmosphere were quite similar to those recorded in CO but the amount of total thallium released from samples is lower. The effect of atmosphere used in the TD measurement can influence the TD behaviour (curve shape) and the amount of total thallium released in the case of brown coal and pyrite, while in the case of soil samples no significant changes were observed. Reproducibility of TD experiments for certain sample was tested and found to be comparable with other thermoanalytical techniques. Position of thallium TD signals remains preserved in all measurements, the intensity varies approximately +/– 10 %. Reproducibility of Tl species identification: Various pyrite samples gave TD curves closely similar in shape, the signal intensity fluctuated despite corrections on variable amount of Tl present in the samples.

Regarding TD data interpretation, it was found to be beneficial to consider TD experiments in air and in CO atmosphere, together with DTA/DSC result at the same time. Applying this approach, various chemical processes proceeding during the TD experiment (sample decomposition, redox processes, burning) determining thallium desorption from the sample can be identified and taken into account in thallium-bearing species identification.

No. *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, Praha; 2017–2019)

Multiproxy studies of several sections in the Přídolí provided important data. Detailed sampling through lower and middle part of the Pridoli Series at Hvížďalka section in the Radotín Valley allowed for the recognition of *Monograptus pridoliensis*, *M. lochkovensis*, *M. bouceki* and *M. perneri* graptolite biozones in the 11 m thick succession of the Požáry Fm. formed by black laminated calcareous shales interchanging with beds and lenses of laminated lime mudstones. Graptolites were collected from each of the 42 shale intervals, then prepared, determined, photographed and line-drawn. Along with 12 species of planktic graptolites, less common dendroids, scyphocrinid columnals, ceratiocarids, rare nautiloids, brachiopods and bivalves were recorded.

The evaluation of the obtained conodont material from previous sampling in the Koněprusy VČS section was finished. Although most of the samples from the Přídolí contained conodont elements, only few samples were biostratigraphically important. The critical spathognathodontids – the most promising clade for prospective subdivision of the Přídolí Series – included several index taxa: *Z. ivochlupaci*, that is close to the expected entry of the graptolite *M. bouceki*, *Oz. typica* s.l. and *W eosteinhornensis* s.s. The material includes also the most important prioniodontids: *D. elegans* and *D. detorta*. The late Přídolí fauna contains even the last tentative index for the latest Pridoli – *Z. klonkensis,* a taxon originally described by Jeppsson, 1989 as *Oz. s. remscheidensis* from beds 11 and 12 from the Klonk section. The entry lies approximately 2 m below the Silurian-Devonian boundary at the GSSP section. The conodont fauna obtained was photographed (SEM) and data were extrapolated into the section. The conodont succession from the Koněprusy VČS section confirms precisely the conodont zonation suggested at the Požáry section. The final evaluation of the conodont faunas from the Požáry section – the Přídolí GSSP – was completed. The most promising conodont succession enables the first basic subdivision of the Přídolí Series by means of conodonts. The basic subdivision that includes: *Z. zellmeri, Z. ivochlupaci, D. detorta, W eosteinhornensis s.s.* and *Z. klonkensis* were matched to the already published graptolite data and integrated to detailed petrological and geophysical data.

Integration of the multiproxy studies resulted in the refinement of biostratigraphy and sea-level history reconstruction of the Pridoli for this part of the Prague Synform. The situation in matching conodont and graptolite index taxa for a prospective subdivision of the Pridoli, however, seems to be still complicated.

No. *17-10233S*: **The oldest vascular land plants and palynomorphs from the Silurian-Lower Devonian of the Barrandian area, Czech Republic** (***J. Bek***, M. Libertín; J. Kvaček, National Museum, Praha; J. Pšenička, West-Bohemian Museum, Plzeň; 2017–2019).

The most important result of the project is the find of *Cooksonia barrandei* (Fig. 21), the oldest vascular land plant in the global scope (432 Ma). Also dispersed spores macerated from these rocks represent the oldest sculptured spores in the world.

■ **Fig. 21.** *Cooksonia barandei* (coll. National Museum, Praha, D552a), the oldest vascular land plant. Photo by M. Libertín.

The robust size of this plant places it among the largest known early land plants generally. This provides evidence that the first land plants were green and photosynthetically autonomous.

No. *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; J. Žák, J. Hajná, J. Trubač, Faculty of Science, Charles University, Praha; 2017–2019)

During the second year of this project, we continued our research in the composition of black shale formations, cherts and volcanic rocks from the Teplá-Barrandian Unit especially in new data gathering, additional fieldwork and presentation of the obtained results.

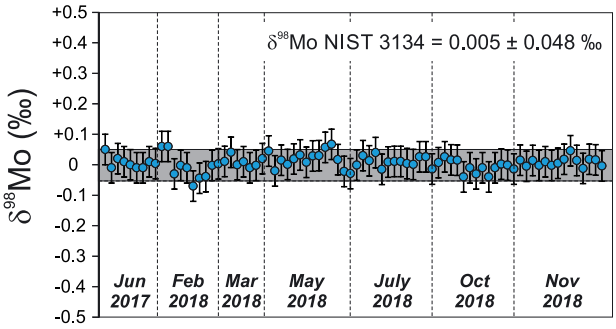
The sampling strategy in 2018 was focused on (meta)sedimentary rocks from the SW part of the Teplá-Barrandian Unit in order to fill the gap in missing geochronology. The datings showed predominance of 540–550 Ma, 580 Ma and 610–625 Ma among the detrital ages. Furthermore, several sampling campaigns were focused on volcanic rocks from the Davle volcanic complex (basalt, andesite, rhyolite, dacite, plagiogranite) with intimate relationship to the overlying black shales.

An extensive dataset of Cu-Zn-Cr-Os isotopic ratios for excellently preserved suites of normal (NBS) and metal-rich (HMBS) black shales was collected. As indicated by rock compositions, the input of Cu and Zn was controlled by variable proportions of high-metal authigenic and low-metal terrigenous sources. Chromium isotopic composition revealed a complex history of Cr uptake and fractionation through the dominant Cr input from different terrigenous sources with variable δ^{53}Cr followed by Cr fractionation. In comparison, the Re–Os contents of the NBS are controlled by hydrogenous component while the HMBS Re–Os composition was largely influenced by hydrothermal fluids.

A selected sample set of well-characterized (black)shales from three different geotectonic settings (ca. 50 samples) were analysed for its Mo-Cr-S isotopic compositions. The δ^{98}Mo data

acquired so far showed a wide scatter of values from –1.6 to +0.43 ‰, reflecting vast differences in the redox state during sediment deposition. This is also clearly recognized from the hitherto obtained variable $\delta^{53}Cr$ and $\delta^{34}S$ data.

The Mo analytical protocol was successfully developed in the joint laboratory of the Institute of Geology of the Czech Academy of Sciences (chemistry) and Czech Geological Survey (mass spectrometry). This method includes sample decomposition in the presence of ^{97}Mo–^{100}Mo double spike, Mo separation using ion exchange chromatography and isotopic measurements by MC-ICP-MS resulting in excellent external reproducibility achieved (±0.05‰) on NIST 3134 Mo standard over a long time period (Fig. 22).



■ **Fig. 22.** External reproducibility of $\delta^{98}Mo$ values (grey box) for Mo standard solution NIST 3134 of a newly established Mo isotopic protocol at the Inst Geol, Czech Acad Sci. Original by L. Ackerman.

■ **Fig. 23.** A close-up view of Au-rich black shale from the Žloukovice outcrop. Photo by Martin Svojtka.

The Ediacaran black shales (Fig. 23) hosting Au mineralization at the Žloukovice section exposed in the lithologically monotonous Belt I were newly discovered. The maximum depositional age of the greywackes–shales was determined at 571 ± 3 Ma. The analyses of major and trace elements revealed the presence of two types of shales – normal black shales and Au-rich black shales. Geochemical characteristics indicate that these facies contain chemically immature crustal material originated in an active continental margin/continental island arc. Conversely, Au-enriched facies are strongly silicified.

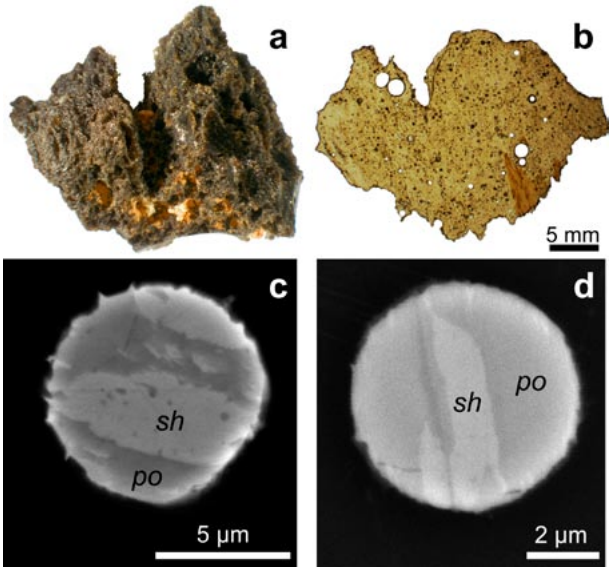
No. *17-23836S*: **Transformation of the Burgher House in the 13th Century (Brno–Prague–Wroclaw)** (M. Peška, Archaia Brno, z.ú., Brno; ***L. Lisá***; T. Cymbalak, NPU, Prague; 2017–2019)
The project investigates the changes in urban constructions in the course of the 13th century, particularly the transition from non-masonry to masonry houses. The geoarchaeological part is concerned mainly with the use of the space and formation processes of the occupational surface. During the second year of the project, samples from Kučerov, five localitites in Brno, two localities in Prague, one locality in Opava and one locality in Jihlava were prepared in the form of thin sections and made ready to be included into the archaeological context. The other part of geoarchaeological research included geo-ethno-archaeology. The principal aim of this sub-project was to collect missing reference information about the composition and the formation history of earth floors (samples were collected at Dolní Němčí).

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 research activities addressed several problems. Triple oxygen isotope analyses of tektites are extremely useful in the study of two aspects of tektite formation, (1) oxygen isotope exchange of overheated tektite glass with the atmospheric oxygen, and (2) determination of possible minor admixture of meteorite matter in the tektite glass. Triple oxygen isotope measurements were performed on eleven individual specimens of AAT in cooperation with Prof. A. Pack (University of Göttingen, Germany). The sample set was dominated by Muong Nong-type tektites (MNAAT), including separated layers of glass of different appearance and chemistry from four samples. This first larger set of oxygen isotope data of MNAAT revealed an only slightly wider $\delta^{18}O$ range than the previously reported range for splash-form AAT. The $\Delta'^{17}O$ values of MNAAT and splash form AAT are all in the range of data typical for terrestrial crustal rocks, with no mass-independent oxygen isotope fractionation (from the impactor or from exchange with atmospheric O_2) being observed.

The HSE analyses of the same set of the samples of ATT as above were finalized (15 samples). Collectively, very low HSE contents detected and variable $^{187}Os/^{188}Os$ ratios indicate a maximum of ~0.005% addition of a chondritic impactor, which is in contrast to previous studies of Ni-rich Australasian splash-form tektites and microtektites.

Petrological and mineralogical characteristics of sedimentary rocks collected as potential source materials of AAT were finished and supplemented already existing bulk major, minor and trace element compositional data. The Sr-Nd-Pb isotopic dataset for selected 15 sedimentary rocks (sandstone, siltstone) and 15 pcs. of AAT (identical to those analysed for oxygen isotopes and HSE) was finalized. While the data for sediments vary substantially, those for tektites cluster tightly. Such data make straightforward identification of potential parent material of tektites among the studied sediments impossible, obviously any matching of isotope ratios will require additional mixing and possibly also an addition of a yet unknown component or specific formation conditions to be found.



■ **Fig. 24.** A pumice-like Muong Nong-type tektite from Laos contains rare spherules consisting of shenzhuangite (*sh*) and pyrrhotite (*po*). Photos by R. Skála (a), Š. Křížová (b–d).

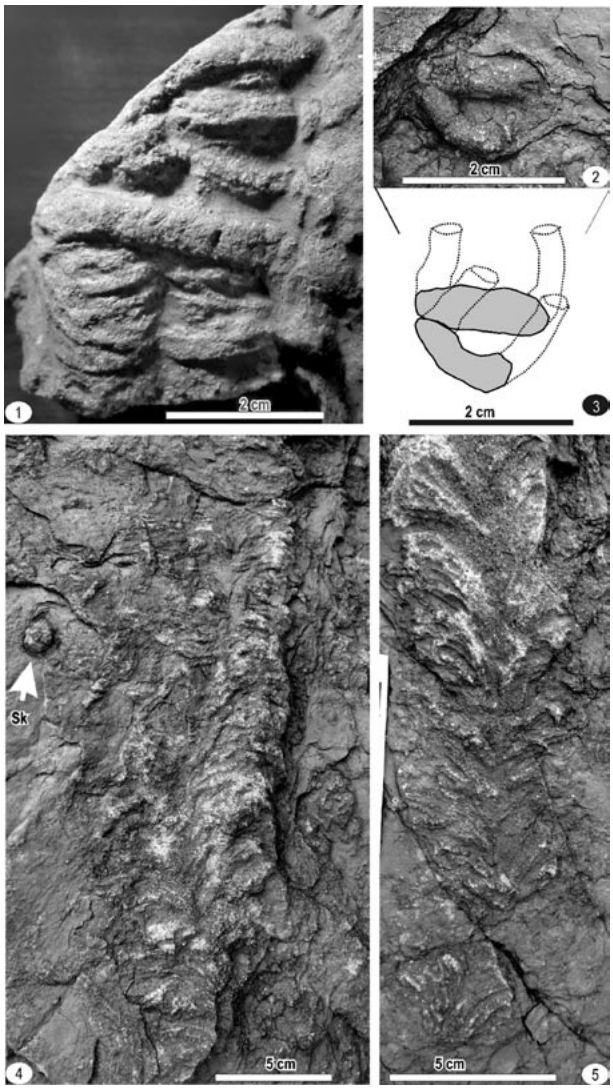
Continued study of inclusions allowed the identification of Australasian Muong Nong-type tektites from the locality centered at 16.46150° N, 106.48917° E in Laos that contains several spherical heterogeneous sulphide inclusions less than 10 µm in diameter; these were found to represent a mixture of rare mineral shenzhuangite (tetragonal $NiFeS_2$) and a pyrrhotite polytype (possibly troilite) using the electron probe microanalyser and electron backscatter diffraction (Fig. 24). In addition to shnezhuangite, other AAT samples from the same locality provided inclusions comprising chalcopyrite and pyrrhotite/troilite.

No. *18-02606S*: **Non-destructive determination of heated artifacts in Upper Palaeolithic assemblages** (M. Moník, Z. Nerudová, Palacký University Olomouc, Faculty of Science, ***P. Schnabl***; 2018–2020)

The principal goal of the project is to distinguish heated chipped stone artifacts from unheated ones by means of petrophysical methods.

Erratic flints from their natural outcrops at Závada u Opavy were studied to be compared with Paleolithic artifacts. Selected 60 samples were studied by XRF to obtain information about their elemental composition. Spectrophotometric (colour), magnetic susceptibility (MS) and paleomagnetic (IRM) measurements were also carried out so that natural flints could be compared with artefacts as well. Potentially heat-treated artefacts were primarily selected from the Magdalenian layers of the Balcarka Cave. Unfortunately, the detailed 2D position of the artefacts and fireplaces/hearths in Balcarka Cave remains unknown, i.e., the resulting GIS plan is not as informative as we planned before the project. This was caused by imprecise drawings/recording during the old excavations. It also became clear that the colour and the MS are not able to distinguish heat-treated flints from unheated ones by themselves. IRM, however, was able to identify artifacts which were most likely not heat-treated in prehistory. We were thus able to reject heat treatment in most of the analysed artifacts from the Balcarka Cave. We have concluded that erratic flints were probably not heat treated in the Balcarka Cave but other raw materials like cherts could have been. For that reason, we also sampled Olomučany cherts from their outcrops and initiated their investigation with spectrophotometry, MS and IRM. In this endeavour, we focus on three Magdalenian sites where Olomučany chert was used as raw material.

No. *18-05935S*: **From past to present: fossil vs. recent marine shelled organisms as a substrate for colonization and bioerosion** (K. Holcová, Faculty of Science, Charles University, Praha; Z. Heřmanová, National Museum, Praha; M. Vohník, Czech Acad Sci, Inst Bot; ***R. Mikuláš***, ***L. Slavík***; M. Mergl, University of West Bohemia, Plzeň; 2018–2020)



■ **Fig. 25.** Trilobite trace fossils from the Lower Quartzite Mb. (LQM), Khud-Drabil section, Nigali Dhar Syncline, Lesser Himalayas. All photographed *in situ*, (1): *Cruziana salomonis* and *Planolites* cf. *beverleyensis*, scale bar 5 cm; (2-3): *Arenicolites* isp. and its reconstruction showing the two tightly arranged bases, scale bar 2 cm; (4-5): *Cruziana fasciculata* and associated *Skolithos* isp., scale bar 5 cm. Photo and illustration by B. P. Singh.

Integrated ichnology, sedimentology and sequence stratigraphy of the Lower Quartzite Mb. to the Arkosic Sandstone Mb. of the Koti Dhaman Fm. (Cambrian Series 2, Stage 4), Tal Group, Nigali Dhar Syncline, Lesser Himalayan lithotectonic zone, are presented. Trilobite traces of Gondwanan affinity, i.e., *Cruziana salomonis*, *Cruziana fasciculata*, *Rusophycus dispar* and *Rusophycus burjensis* are recorded along with *Arenicolites* isp. and *Skolithos* isp. which represent partly "hidden" deep tier of the assemblage (e.g., couple of neighbouring *Arenicolites* can erroneously be determined as *Rusophycus*). A rich and diverse ichnoassemblage attributed to the Cruziana ichnofacies is described for the first time from the Arkosic Sandstone Mb. of the same formation. Seven ichnofossil assemblages, i.e., *Cruziana-Rusophycus*, *Planolites beverylensis*, *Planolites-Palaeophycus*, *Cruziana problematica*, *Diplichnites*, *Cochlichnus anguineus*, *Bergaueria perata*, and *Psammichnites gigas* were recognized in the Lower Quartzite to Arkosic Sandstone members of the Koti Dhaman Fm. (Fig. 25).

No. *18-08826S*: **Resistance to brittle damage: use of petrographic/ rock mechanical data for the technological-mechanical behaviour and serviceability of crushed stone** (R. Přikryl, Faculty of Science, Charles University, Praha; ***T. Lokajíček***, ***M. Petružálek***, ***T. Svitek***; *Z. Weishauptova, M. Vorokhta*, Czech Acad Sci, Inst Rock Struct & Mech, Praha; 2018–2020)

Sampling of experimental material was conducted in active quarries located in the Czech Republic. The first set of rock experimental material encompassed basalts and related basic rocks, trachytes, rhyolites, and metavolcanics (spilites) from 15 localities. At each locality, 2–4 compact homogeneous blocks of approx. size 30×30×25 cm were sampled. For spilites, a set of 10 varieties at a single locality (active quarry) was sampled. Along with blocks suitable for preparation of specimens for laboratory rock mechanical tests, end-products – crushed stone of specific size fractions were sampled as well to facilitate mechanical technological tests. In the case of sampled blocks, the preparation of test specimens (cylindrical shape) for rock mechanical test was started. Prior to destructive rock-mechanical tests, during which stress-strain behaviour was recorded for certain portion of specimens, the index petrophysical properties (density, open porosity, water uptake) were recorded as well.

In the case of sampling sites – active quarries, where end-products were available, the respective fractions of crushed stone required for specific technological-mechanical tests (e.g. Los Angeles attrition test, micro-Deval test, aggregate crushing value, aggregate impact value, Nordic abrasion test) were prepared by sieving. This encompasses thin section preparation and detailed microscopic examination (including both optical microscopy and scanning electron microscopy with microanalysis). In the case of more porous rock types (as evaluated by mercury porosimetry study), additional set of thin sections with pore space impregnated with epoxy resin / fluorescent dye mixture is being prepared as well. This set of thin sections allows for pore space identification under fluorescent incident light microscopy. Microscopic analyses focus both on the identification of present mineral phases and their quantification (by employment Petrographic Image Analysis – PIA), and on the study of rock microfabric. The petrographic study of sampled rocks is supplemented with powder X-ray diffraction and wet-silicate analyses.

6c. Grant Agency of Charles University

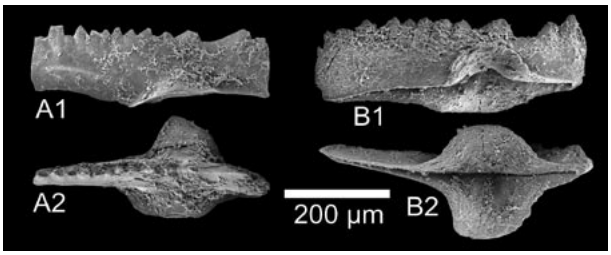
Finished projects

GAUK No. 250252: **Family Spathognathodontidae (Conodonta) from the Silurian/Devonian boundary and its biostratigraphic correlation (Na Požárech and Praha-Radotín sections; Prague Synform)** (***A. Hušková***, ***L. Slavík***; 2016–2018)

Conodonts from two representative sections (Na Požárech and Praha-Radotín) in the Prague Synform were studied in search of alternative biostratigraphic markers of the Silurian/Devonian boundary. The sections were chosen to represent different depositional environments. The Devonian part of the Na Požárech section has the character of light grey, coarse-grained carbonates, and limestones in the Praha-Radotín section are typically dark grey, micritic, with shale intercalcalations. However, both sections contain the "*Scyphocrinites* Horizon" just above the base of the Devonian. The contrasting depositional environments at the two sites were expected to result in differences in the composition of conodont faunas. Conodont data from the Praha-Radotín section were gained for the first time and showed that *Icriodus* cf. *w. woschmidti* co-occurs with the graptolite index taxon in the same bedding couplet just below the entry of *Icriodus hesperius* (= the current conodont biostratigraphic marker of the S/D boundary). This co-occurrence of conodont markers and graptolite taxon is relatively rare and brings the proof that the conodont marker in limestone can be as reliable as the FAD of the *Monograptus uniformis* in the shales.

The abundance of conodonts in both sections is relatively high: several thousands of elements were found from the families Icriodontidae and Spathognathodontidae. Altogether 18 taxa were identified. A striking similarity in the faunal composition between the two sections is obvious in spite of contrasting depositional environments; this can also be explained by fluctuations in water depth. The test of bathymetric sensitivity of particular conodont clades is, however, biased by the dominance of calciturbidite deposition in the Praha-Radotín section, where conodont elements including shallower-water icriodontids were probably transported together with other faunas to deeper parts of the slope.

Representatives of the spathognathodontid clade seems to be more tolerant to water depth than icriodontids in the late Silurian – Early Devonian times. A newly described spathognathodontid taxon, *Zieglerodina petrea* sp. nov., seems to have a great potential for identifying the base of the Devonian in sections where critical graptolite and icriodontid taxa are missing (Fig. 26).



■ **Fig. 26.** The newly descibed taxon of *Zieglerodina petrea* sp. nov., A: sample RAD1, cat. No. RAD-1-001, A1 – lateral view, A2 – upper view. B: sample RAD1, cat. No. RAD-1-002, B1 – lateral view, B2 – lower view. Photo by A. Hušková and Z. Korbelová.

6d. Grants of the State Departments

Ongoing projects

Administration of the Krkonoše National Park/Ministry of the Environment of the Czech Republic, No. CZ.05.4.27/0.0/0.0/15_009/0004533: **Inventarization of the Krkonoše karst areas; subproject: Scientific evaluation of cave sediments** (R. Tásler, Speleoalbeřice ZO 5-O1 ČSS, Svoboda nad Úpou; ***P. Bosák***, ***M. Šťastný***; internal code 7325; 2018–2020)

The inventory of caves situated in the territory of the Krkonoše National Park (northern Bohemia) includes the preparation of detailed cave cadastre, closure of open cave entrances and also scientific research of cave fills = petrology, mineralogy, paleontology, paleomagnetism and magnetostratigraphy, isotopic studies and numerical dating of speleothems (ICP-MS U-series method). Detailed samplings of cave fills were performed in the Albeřická, Medvědí, Trucovna and Ponikelská caves. Preliminary results of the ICP-MS U-series dating of small stalagmite from the Medvědí (Bear) Cave in the village of Svoboda nad Úpou were obtained: the top was dated to 28.5 ± 0.7 ka and the base to 73 ± 2 ka, i.e., to the course of the Last Glacial (Weichselian; end of MIS 2 to MIS 4). Fauna below flowstone in the excavated part of the Medvědí Cave was dated to early Holocene (Boreal). Dating and stable isotope analyses are performed in co-operation with bilateral project MOBILITY PAS/CAS No. PAS-17-22.

6e. Industrial Grants and Projects

Biological Centre of the Czech Academy of Sciences and Charles University, Czech Republic, Project No. 7004: **Platinum-group element concentrations in paleolakes in Šumava Mts.** (***L. Ackerman***, ***J. Ďurišová***)

A joint project dealing with platinum-group element concentrations in paleolake sediments.

Clausthal Technical University, Germany, Project No. 7004: **Molybdenum isotopic compositions of Mn-rich ores from Brazil** (***L. Ackerman***, ***E. Haluzová***)

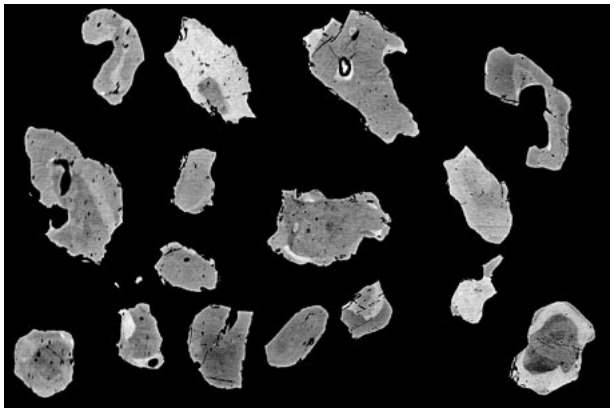
A joint project dealing with molybdenum isotopic compositions of Paleoproterozoic Mn-rich ores and black shales from Brazil.

Institute of Archaeology of the Czech Academy of Sciences and National Museum, Czech Republic, Project No. 7004: **Strontium and lead isotopic compositions of selected burial grounds** (***L. Ackerman***, ***J. Rejšek***)

A joint project dealing with Sr and Pb isotopic compositions of enamels and bones from selected burial grounds in the Czech Republic.

Institute of Geological Sciences, Polish Academy of Sciences, Krakow, Warszaw, Project No. 7042: **In-situ U-Th-Pb LA-ICPMS analysis and its application to various geological problems** (***J. Sláma***; M. Paszkowski, B. Budzyn, S. Mazur, M. Jastrzębski, A. Żelazniewicz, Institute of Geological Sciences, Polish Academy of Sciences, Poland).

A joint project with the Institute of Geological Sciences, Polish Academy of Sciences, aimed at various topics with the employment of the U-Th-Pb LA-ICPMS dating of accessory minerals (Fig. 27). The investigated topics include the detrital zircon age provenance and Hf isotopic study of a complete Mesoproterozoic to Cambrian sequence of East European Craton platform sediments recording the amalgamation of Rodinia and later docking of exotic peri-Gondwanan terranes or the tectonic and metamorphic evolution of NE part of Bohemian Massif. Within the project, brand new monazite reference material from Madagascar labelled as "TS-mon" was extensively analysed for U-Th-Pb isotoic ages.



■ **Fig. 27.** Variable BSE patterns of monazite from the Zagórze Śląskie granulite of the Sudetes (NE part of Bohemian Massif). The size of ca. 370 Ma grains is about 200–500 μm. Photo by J. Sláma.

Jan Evangelista Purkyně University in Ústí nad Labem, Philosophical Faculty, Project No. 7464: **Petrographic study for NAKI II Project – Hortus Montium Mediorum. Documentation, research and presentation of cultural heritage of selected sites of northeastern České středohoří Mts., No. DG 18P02OVV066** (***J. Adamovič***)

According to the project schedule, this year's studies concentrated on the church at Zahořany (Fig. 28), the chateau at Zahořany and the complex of historical buildings (church, chateau and brewery) at Konojedy. The aim of the petrographic study is the provenance determination of sandstone used in the different construction phases of the objects studied. This provenance study was combined with

■ **Fig. 28.** The chateau at Zahořany, now in the need of reconstruction, results from three construction phases ranging from Renaissance period (southern wing, on the right) to modern times. Sandstone was used mainly for portals and for window sills. Photo by J. Adamovič.

an archival study and a construction-historical study performed by the other parts of the team. Petrographic study included optical microscopy of thin sections, scanning electron microscopy, pore size analysis, helium pycnometry and mercury intrusion porosimetry. Samples were taken from historical building stones and from quarries and outcrops suspected as possible source areas.

Construction of the church and the chateau at Zahořany did not employ local building stone with the exception of sandy marlstone which is probably of local origin. Different sandstones from the lower Elbe River basin were used, probably including the Mšené sandstone. The main portal of the Zahořany church has its origin in Carboniferous arkoses of the Kladno-Rakovník Basin, quarried, e.g., in the Kralupy area. Building stone for the Konojedy buildings was rather of local origin, with the most distant material taken from the quarries at Úštěk. Tephrite building stone, used mostly for masonry, comes from the quarries at Dubí hora at Konojedy.

Karadeniz Technical University and Gümüshane University, Turkey, Project No. 7004: **Re-Os and highly siderophile element analyses of basaltic rocks from Turkey** (***L. Ackerman***, ***E. Haluzová***, ***J. Ďurišová***, ***J. Rejšek***)

A joint project with Karadeniz Technical University (Dr. Arslan) focused on the determination of highly siderophile elements and $^{187}Os/^{188}Os$ compositions of selected basaltic rocks from Turkey.

New Mexico Highland University, USA, Project No.7004: **Sr-Nd-Pb isotopic compositions of volcanic dykes from New Mexico** (***L. Ackerman***, ***J. Rejšek***)

A joint project dealing with Sr-Nd-Pb of mafic dykes from the New Mexico Highlands, USA.

MPO, Project No. 7801: **Higher order generation non-active tracers** (P. Bílý, L. Kelnar, J. Michálková, P. Novák, H. Semíková, M. Vaněček, Watrad s. r. o., Praha; J. Baier, Progeo s. r. o., Roztoky; ***J. Rohovec***)

Various aspects of higher order generation non-active tracers were solved in detail in a set of thermodynamic and kinetic studies. The sorption rates of fluorescent tracers on selected solid supports, like granite and dacite, were measured at room temperature. Beside this, thermodynamics of the sorption proces was studied, leading to a set of binding constants describing the stability of tracer-solid support complex. Thermodynamic parameters were implemented into mathematical models developed for the description of binding of strongly sorbent tracers on rocks. The kinetic study proved that the binding of sorbent tracer occurs comparatively fast, in the order of seconds. The thermodynamic studies testified that all the selected groups of fluorescent sorbent tracers (Auramine, Fuchsine, Rhodamine B, Nile blue) adsorb on the support sufficiently strongly for practical application in field experiments.

The *in situ* field test was set up in the Josef Gallery (CEG Josef, Technical University in Praha) as a third generation fissure experiment. The fissures of the first generation were identified between drills PV2 and PV3 already present in the face of gallery JP2. The fissures were labelled by the first generation fluorescent tracer. Subsequently, the hydraulic high-pressure cleavage was performed, opening the second generation fissures. These were labeled by the second generation tracer. Similarly, the third generation fissures were generated and worked up. Currently, the stage of identification of the labelled fissures and regions by observation drills and micro-camera inspections is reached.

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

Elevated precipitation amount of 961 mm in year 2017 was the primary cause for an increase in elemental fluxes at the monitored sites within the Bohemian Switzerland National Park with respect to previous hydrological year. The analysis of long-term trends of pH since year 2002, it can be concluded that bulk precipitation pH increased. Since the year 2003, bulk precipitation solutions with pH <4.1 were rather scarce and pH of bulk precipitation increased from 4.5 to 5.0 during the 15 years.

The instrumentation of sampling sites was upgraded with a new sampling vessel capable of collecting double the volume of the formerly used. Furthermore, bulk deposition of environmentally important risk element mercury (Hg) was assessed. The concentrations of Hg in bulk precipitation ranged from 0.9 to 3.0 $ng \cdot l^{-1}$ and the annual bulk deposition flux of Hg amounted at 2.0 $\mu g/m^2/yr$. This deposition can be considered relatively lower with respect to values from the central part of the Czech Republic with deposition rates up to 6.3 $\mu g/m^2/yr$.

Nature Conservation Agency of the Czech Republic (AOPK), Project No. 7454: **Evaluation of requests for speleological research in the Bohemian Karst Protected Landscape Area** (***K. Žák***, ***S. Čermák***, ***P. Bosák***)

Requests for speleological prospection in caves of the Bohemian Karst, submitted by individual caving clubs, are evaluated within this small project. The evaluation considers the value of the cave from scientific point of view (Fig. 29). The importance of the cave for general nature protection is also considered. An expert opinion whether the planned works are possible and under which regulations can they be performed is issued for each

■ **Fig. 29.** A layer of cave sediment rich in vertebrate microfauna from the late part of the Last Glacial was found during the evaluation of the Kubrychtova Cave at Tetín. Photo width 5 cm. Photo by K. Žák.

request. Two requests were evaluated in 2018, one submitted by Speleological Club Prague for prospection in the caves in Chlum Hill near Srbsko, the second submitted by Speleological Club Tetín for activities in caves around this village.

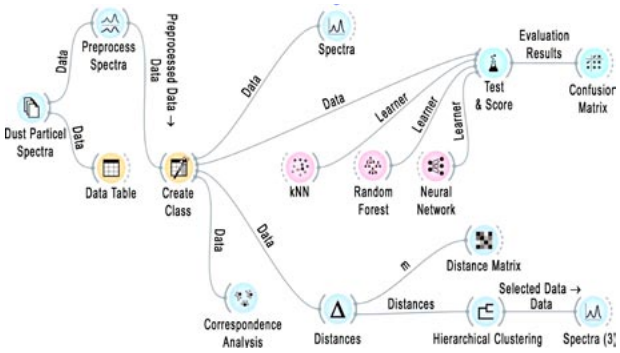
Czech Geological Survey, Praha, Project No. 7516: **Palynology of selected samples from the Veselí u Přelouče borehole (4310-03W)** (***M. Svobodová***)

A rich and diversified palynomorph assemblage was ascertained in 7 studied samples from the Veselí u Přelouče (4310-03 W) borehole. The palynofacies consists of prevailing phytoclasts with abundant spores, angiosperm and gymnosperm pollen, green algae of non-marine origin, rare marine admixture of foraminifers, acritarchs and a single specimen of dinoflagellates. The composition of angiosperm pollen corresponds to the Cenomanian age (the Peruc Mb.). The specimens were deposited at a fluctuating salinity (non-marine and shallow marine environments).

6f. Programmes of Strategy AV21 of the Czech Academy of Sciences

Project No. 9221 within the Natural Hazards Programme: **Dust particle database extension and presentation - development of similarity analysis methodology for dust particle studies. (*T. Hrstka*, *J. Hladil*, *L. Chadimová*, *Z. Korbelová*, *N. Mészárosová*)**

The project is a continuation of the research focused on better understanding of individual constituents of the deposited dust and their potential effects related to human health and the environment. According to the World Health Organization (WHO), 90 % of people live in areas where air quality is inadequate and the pollution in respect of certain contaminants/constituents exceeds the recommended values. Therefore, this subject is one of the key current research topics. Based on our previous results, manual interpretation, identification and cataloguing of dust particle data obtained through automated electron scanning microscopy proved to be very challenging. Therefore our main goal was to develop techniques and methods which would help with further automation of analyses of the deposited dust samples. As a part of this project we have implemented the support of necessary data formats in the latest version of Orange software package for visual programming and machine learning. This can now be applied to the analysis of deposited dust samples on a "particle by particle" level (Fig. 30). The developed methodology and software modules are of interest to the CHMI.



■ **Fig. 30.** Graphical abstract of an automatic workflow for machine learning on dust particle samples. Original drawing by T. Hrstka.

Project No. 9222 within the Natural Hazards Programme: **Internet database of rockfall phenomena in sandstones – Lusatian Mountains PLA (*J. Adamovič*)**

A database of rockfall events open to the general public was constituted on webpage http://rockfall.gli.cas.cz in 2016 and has been considerably extended since then. It is focused on this type of geodynamic events in sandstone-dominated Protected Landscape Areas in the Czech Republic. In 2018, new sites were documented from the Lusatian Mountains Protected Landscape Area.

Most rockfall events occur in the Březno Fm sandstones. Some of the largest historical or recent rockfalls were encountered in the rock city of Sloup and Svojkov near Nový Bor, in the Lemberk area near Jablonné, in the Kamenice River valley between Česká Kamenice and Kytlice and in the Mařenice area (Fig. 31). For each site, the documented features included geological and geomorphic settings, sandstone lithology and tectonic deformation, situation in the detachment area and in the accumulation area. Faulting associated with jointing seems to be the main prerequisite for hazardous geodynamic phenomena, although no major rockfall was found along the Lusatian Fault, probably due to the very intensive cementation of sandstones. At most sites, tectonic deformation in the detachment area was combined with erosional undercutting of cliff faces due to the presence of less resistant strata.

In villages and where houses are constructed close to clifflines, rockfall poses a serious problem of public safety. It is recommended that such locations are screened in the first stage of data collection, and subsequently monitored by tensiometers or other special devices. In this respect, collaboration with the Inst Rock Struct & Mech, Czech Acad Sci is suggested for the coming years.

■ **Fig. 31.** This 150 m^3 rockfall at Juliovka from 2009 heavily damaged the previous house "U Galejníka", which had to be demolished. The event was caused, among other factors, by artificial undercutting of the cliff face. Photo by J. Adamovič.

Project No. 9223 within the Diversity of Life and Health of Ecosystems: **Mobility of ecotoxic elements in the Litavka River ecosystem (*T. Navrátil*, *T. Nováková*, *M. Roll*, *K. Žák*)**

The project evaluated transfer of selected risk elements (Hg, Pb, Cd, Zn) from polluted sediments of the Litavka River fluvial system to the local vegetation (Fig. 32). A part of the Litavka floodplain sediments near Trhové Dušníky were identified as severely polluted with risk elements originating from Pb ore mining and processing in the Příbram Ore District. The Litavka River, due to the mountainous character of its upper reach, transported high amounts of sediments during frequent floods in the past. The transported material was historically deposited near Trhové Dušníky due to favourable parameters of the river channel and floodplain for sedimentation. More recently, this area has become a source of polluted sediment material for transport downstream – the source of secondary pollution. The local floodplain material contains high concentrations of risk elements, i.e., 1,200 $mg \cdot kg^{-1}$ of Pb, 3 000 $mg \cdot kg^{-1}$ of Zn, 20 $mg \cdot kg^{-1}$ of Cd and 0.5 $mg \cdot kg^{-1}$ of Hg. Significant proportions of these elements are available for biological uptake as can be implied from relatively high-risk element contents in the local vegetation, i.e., the local grass contained mean concentrations 6.5 $mg \cdot kg^{-1}$ of Pb, 186 $mg \cdot kg^{-1}$ of Zn, 1.8 $mg \cdot kg^{-1}$ of Cd and 0.2 $mg \cdot kg^{-1}$ of Hg. The use of this area for grazing purposes thus might mediate the entry of the selected risk elements to the human food chain. The purpose of this project was to raise public knowledge on this issue.

Project No. 9225 within the Natural Hazards Programme: **Assessment of environmental legacy deposited within the Litavka River sediments (*Nováková T.*, *Navrátil T.*, *Roll M.*,** Kotková K., Matys Grygar T.)

The aim of the project was to determine the spatial distribution of the toxic elements (Pb, Zn, Cu, Cd and Hg) originated from past mining and ore smelting activities within the floodplain sediments of the Litavka River followed by the subsequent assessment of risks associated with bank erosion during floods, mechanisms of migration of these elements, and their further transport into the river catchment.

These goals were achieved by documenting the distribution of contamination at the selected study sites and by the analysis of active lateral movements of the Litavka River based on available aerial images from the last 60 years using GIS (Geographic Information Systems).

The expected outcome included estimation of the amount of toxic elements released annually back into the aquatic environment and also proposals of preventive measures to modify the current approach to landscape management in the Litavka River basin to reduce the amount of eroded contaminated sediment.

Project No. 9226 within the Natural Hazards Programme: **Potential sources of mercury contamination in ecosystems of the Czech Republic (*M. Roll*, *J. Borovička*, *T. Nováková*)**

The aim of the project was to further investigate former mercury minning sites and their impact on the environment. Three sites were selected for this project: Jedová hora near Neřežín,

■ **Fig. 32.** Erosion of the highly polluted Litavka River floodplain sediments near Trhové Dušníky. Photo by T. Navrátil.

Svatá near Beroun (both SW of Central Bohemia) and also Horní Luby (western part of the Czech Republic). Dump materials, soil profiles, organic forest horizons, larch tree cores, mushrooms and berries were collected at every site. All materials were analysed for mercury and obtained data were used for scientific papers (in progress) and for education purposes (Science Fair).

Project No. 9227 within the Natural Hazards Programme: **The threat of magnetic polarity reversal, record in lake sediments in the Bohemian Forest** (***G. Kletetschka***)

Preliminary measurements show that the magnetic field can be reversed at this time. A detailed magnetic record of long cores was measured in Paris by Dr. France Lagroix. The subject of the research was the removal of the sediment from the paleolake of Stará Jímka and several lakes in Alaska.

Sediment was measured from both Alaska and Bohemian Forest lakes and revealed that magnetic remanence can be used for paleointenisty prediction. Magnetic reversals, however, were not confirmed for this time period.

Project No. 9228 within the Diversity of Life and Health of Ecosystems: **The story of rivers and streams in the central Czech Republic region** (***V. Cílek***, ***T. Nováková***, ***K. Žák***, ***T. Navrátil***)

The word "imbalance" appears more and more frequently in the whole range of research fields. It may stand for a state after disturbance of various kinds such as natural disasters. On the other hand, word resilience describes an effective response to the disturbance and rapid return not to the original state but to a functional state. A part of this project was the evaluation of recent climatic and environmental changes in the area of the Czech Republic but in the necessary global context. One part of these changes is the return of the central Czech Republic ecosystems into the new steady state after the acidification in 1970s and 1980s. The recovery of soils has been inducing changes in chemistry of affected streams and rivers, which are slowly recovering from acidified state. In the recent years, we observed the cumulative effect of climate changes, long-term soil acidification and environmental nitrification that may lead in some areas to a substantial "weakness" of the local forests. Water conservation strategies represent a complex problem but one of the most important factors is the state of the agricultural and forests soils.

6g. Programmes of Institutional Research Plan

Project No 9325: In situ spores and pollen of reproductive organs of Early Permian lycophytes and ferns from the Wuda Coalfield, Inner Mongolia, China (***J. Bek***)

Project No. 9331: Chemical composition of quartz from the ore-bearing granite system at Orlovka, Transbaikalia (***K. Breiter***, ***J. Ďurišová***)

Project No. 9344: Geochemical characteristics of Miocene volcanics of the andesite association in the Uherský Brod area compared with the volcanics of the Bohemian Massif and Carpathian orogen (***J. Ulrych***, ***L Krmíček***, ***L. Ackerman***; P. Uher, Comenius University in Bratislava, Slovakia; P. Šišková, Masaryk University, Brno)

Project No. 9346: Soil development on rocks of the central part of the Bohemian Cretaceous Basin (***A. Žigová***, ***M. Šťastný***; Figs 33, 34, 35)

Project No. 9348: A detailed study of Lower Permian ferns of the Wuda coal basin (China) using a holistic approach: anatomy, morphology, sporangial and cuticular analysis as well as *in situ* spores (***J. Frojdová***)

Project No. 9351: Rock magnetic and geochemical analyses of Berrias and St. Bertrand ridge sections in France (***T. Elbra***)

Project No. 9354: Radiogenic isotope characteristic of magmatic rocks of the Slavkov Terrane and Central Basic Belt of the Bru-

- **Fig. 33.** Soil profile from the Klíčov site. Photo by A. Žigová.
- **Fig. 34.** Soil profile from the Brodce site. Photo by A. Žigová.
- **Fig. 35.** Soil profile from the Opukový lom site. Photo by A. Žigová.

■ **Fig. 36.** An underground camp near the largest chamber of the Thianxingyan Cave, Xiaonanhai area, China. Photo by J. Sirotek.

novistulian microcontinent (***L. Krmíček***, ***L. Ackerman***, ***J. Sláma***, ***S. Krmíčková***)
Project No. 9365: Roveacrinid crinoids of the Bohemian Cretaceous Basin (taxonomy, distribution, taphonomy, palaeoecology) (***J. Žítt***)
Project No. 9371: Speleological-geological documentation of Xiaonanhai karst area, Shaanxi Province, central China (***M. Filippi;*** *Z.* Motyčka, R. Šebela, L. Matuška & J. Sirotek, Czech Speleological Society; Fig. 36)
Project No. 9373: Distribution of chemical composition of sulphides and phosphides across different kinds of meteorites (***N. Mészárosová***)
Project No. 9378: Reconnaissance geoarchaeological research of the Dzeravá skála Cave (***L. Lisá***)
Project No. 9380: Geochemical and magnetic analyses of J-K boundary samples from the Snežnica quarry (Slovakia) (***Š. Kdýr***, ***K. Šifnerová***)
Project No. 9381: Cooperation with the Slovak Earth Institute of the Slovak Academy of Sciences on lake sediment research as geochemical archives of the history of mercury pollution (***T. Nováková***, ***T. Navrátil***, ***M. Roll***, ***J. Rohovec***)
Project No. 9383: Ice accumulation in ice caves as natural archive of mercury deposition: methodology of testing (***M. Roll***, ***K. Žák***, ***J. Rohovec***, ***T. Nováková***, ***T. Navrátil***)
Project No. 9384: Improvement of the method of mercury isotope analysis in environmental samples (***M. Vaňková***, ***J. Rohovec***, ***Š. Matoušková***, ***T. Nováková***, ***T. Navrátil***)

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

7a. Papers Published

13.297* Libertín, M., Kvaček, J., ***Bek, J.***, Žárský, V., ***Štorch, P.*** Sporophytes of early polysporangiate land plants from the early Silurian may have been photosynthetically autonomous. *Nature Plants.* 2018, 4, 269–271.

9.530* ***Filippi, M.***, Bruthans, J., Řihošek, J., Slavík, M., ***Adamovič, J.***, Mašín, D. Arcades: Products of stress-controlled and discontinuity-related weathering. *Earth-Science Reviews.* 2018, 180, 159–184.

7.149* Wu, S., Vosátka, M., Vogel-Mikus, K., Kavčič, A., Kelemen, M., Šepec, L., Pelicon, P., ***Skála, R.***, Powter, A. R. V., Teodoro, M., Michálková, Z., Komárek, M. Nano zerovalent iron mediated metal(loid) uptake and translocation by arbuscular mycorrhizal symbioses. *Environmental Science and Technology.* 2018, 52(14), 7640–7651.

7.149* ***Navrátil, T.***, ***Nováková, T.***, Shanley, J. B., ***Rohovec, J.***, ***Matoušková, Š.***, Norton, S. A., ***Vaňková, M.*** Larch

Tree Rings as a Tool for Reconstructing 20th Century Central European Atmospheric Mercury Trends. *Environmental Science and Technology*. 2018, 52(19), 11060–11068.

5.580* Escobar-Cerezo, J., Penttilä, A., ***Kohout, T.***, Muñoz, O., Moreno, F., Muinonen, K. Simulations of Effects of Nanophase Iron Space Weather Products on Lunar Regolith Reflectance Spectra. *Astrophysical Journal.* 2018, 853 (1:71), 6 pp.

5.399* Braeuer, S., Goessler, W., Kameník, J., Konvalinková, T., ***Žigová, A.***, ***Borovička, J.*** Arsenic hyperaccumulation and speciation in the edible ink stain bolete (*Cyanoboletus pulverulentus*). *Food Chemistry.* 2018, 242, 225–231.

5.108* ***Navrátil, T.***, Burns, D. A., ***Nováková, T.***, Kaňa, J., ***Rohovec, J.***, ***Roll, M.***, Ettler, V. Stability of mercury concentration measurements in archived soil and peat samples. *Chemosphere*. 2018, 208, 707–711.

4.916* Braeuer, S., ***Borovička, J.***, Glasnov, T., Guedes de la Cruz, G., Jensen, K. B., Goessler, W. Homoarsenocholine – A novel arsenic compound detected for the first time in nature. *Talanta***.** 2018, 188, 107–110.

4.641* ***Lisá, L.***, Neruda, P., Nerudová, Z., Nejman, L. Podhradem Interstadial; A critical review of the middle and late MIS 3 (Denekamp, Hengelo) in Moravia, Czech Republic*. Quaternary Science Reviews.* 2018, 182, 191–201.

4.641* Jiangzuo, Q., ***Wagner, J.***, Chen, J., Dong, C., Wei, J., Ning, J., Liu, J. Presence of the Middle Pleistocene cave bears in China confirmed – Evidence from Zhoukoudian area. *Quaternary Science Reviews*. 2018, 199, 1–17.

4.637* Farkaš, J., Frýda, J., Paulukat, C., Hathorne, E. C., ***Matoušková, Š.***, ***Rohovec, J.***, Frýdová, B., Francová, M., Frei, R. Chromium isotope fractionation between modern seawater and biogenic carbonates from the Great Barrier Reef, Australia: Implications for the paleoseawater δ^{53}Cr reconstruction. *Earth and Planetary Science Letters.* 2018, 498, 140–151.

4.637* ***Kletetschka, G.*** Magnetization of Extraterrestrial Allende material may relate to terrestrial descend. *Earth and Planetary Science Letters.* 2018, 487, 1–8.

4.333* Zamora, J. C., Svensson, M., Kirschner, R., Olariaga, I., Ryman, S., Parra, L. A., Geml, J., Rosling, A.… ***Borovička, J.***… Ekman, S. Considerations and consequences of allowing DNA sequence data as types of fungal taxa. *IMA Fungus*. 2018, 9, 167–175.

4.259* Paymaneh, Z., Gryndler, M., Konvalinková, T., Benada, O., ***Borovička, J.***, Bukovská, P., Püschel, D., Řezáčová, V., Sarcheshmehpour, M., Jansa, J. Soil matrix determines the outcome of interaction between mycorrhizal symbiosis and biochar for *Andropogon gerardii* growth and nutrition. *Frontiers in Microbiology.* 2018, 9, 2862.

4.100* Bábek, O., Faměra, M., Šimíček, D., Weinerová, H., ***Hladil, J.***, Kalvoda, J. Sea-level changes vs. organic productivity as controls on Early and Middle Devonian bioevents: Facies- and gamma-ray based sequence-stratigraphic correlation of the Prague Basin, Czech Republic. *Global and Planetary Change.* 2018, 160, 75–95.

4.011* ***Kallistová, A.***, ***Skála, R.***, Šlouf, M., Čejchan, P., Matulková, I., Horáček, I. Enamel apatite crystallinity significantly contributes to mammalian dental adaptations. *Scientific Reports.* 2018, 8, 5544.

4.011* Naemura, K., Hirajima, T., ***Svojtka, M.***, Schimizu, I., Iizuka, T. Fossilized Melts in Mantle Wedge Peridotites. *Scientific Reports*. 2018, 8(10116), 1–12.

3.913* Budzyń, B., ***Sláma, J.***, Kozub-Budzyń, G.A., Konečný, P., Holický, I., Rzepa, G., Jastrzębski, M. Constraints on the timing of multiple thermal events and re-equilibration recorded by high-U zircon and xenotime: Case study of pegmatite from Piława Górna (Góry Sowie Block, SW Poland). *Lithos*. 2018, 310-311, 65–85.

3.913* ***Breiter, K.***, ***Ďurišová, J.***, ***Hrstka, T.***, ***Korbelová, Z.***, Vašinová Galiová, M., Müller, A., Simons, B., Shail, R.K., Williamson, B. J., Davies, J. A. The transition from granite to banded aplite-pegmatite sheet complexes: an example from Megiliggar Rocks, Tregonning topaz granite, Cornwall. *Lithos*. 2018, 302–303, 370–388.

3.913* ***Ulrych, J.***, ***Krmíček, L.***, Teschner, C., ***Skála, R.***, ***Adamovič, J.***, ***Ďurišová, J.***, ***Křížová, Š.***, Kuboušková, S., Radoň, M. Chemistry and Sr-Nd isotope signature of amphiboles of the magnesio-hastingsite–pargasite–kaersutite series in Cenozoic volcanic rocks: Insight into lithospheric mantle beneath the Bohemian Massif. *Lithos*. 2018, 312, 308–321.

3.884* Jardine, P. E., Harrington, G. J., Sessa, J. A., ***Dašková, J.*** Drivers and constraints on floral latitudinal diversification gradients. *Journal of Biogeography.* 2018, 45(6), 1408–1419.

3.834* Hajná, J., Žák, J., Dörr, W., Kachlík, V., ***Sláma, J.*** New constraints from detrital zircon ages on prolonged, multiphase transition from the Cadomian accretionary orogen to a passive margin of Gondwana. *Precambrian Research.* 2018, 317, 159–178.

3.780* Chalupa, F., Vilhelm, J., ***Petružálek, M.***, Bukovská, Z. Application of T-matrix model for static moduli approximation from dynamic moduli determined by sonic well logging. *International Journal of Rock Mechanics and Mining Sciences*. 2018, 112, 281–289.

3.681* Bruthans, J., ***Filippi, M.***, Slavík, M., Svobodová, E. Origin of honeycombs: Testing the hydraulic and case hardening hypotheses. *Geomorphology.* 2018, 303, 68–83.

3.585* ***Petružálek, M.***, Jechumtálová, Z., Kolář, P., Adamová, P., ***Svitek, T.***, Šílený, J., ***Lokajíček, T.*** Acoustic emission in a laboratory: mechanism of microearthquakes using alternative source models. *Journal of Geophysical Research: Solid Earth.* 2018, 123(6), 4965–4982.

3.531* Pokorný, R., Koutecký, V., Björck, S., ***Krmíček, L.***, Árting, U. E., Štofik, M. Driftwood in the Eemian interglacial lacustrine unit from the Faroe Islands and its possible source areas: palaeobotanical and ichnological analysis. *Boreas*. 2018, 47(4), 1230–1243.

3.531* Šolcová, A., Petr, L., Hájková, P., Petřík, J., Tóth, P., ***Rohovec, J.***, Batora, J., Horsák, M. Early and middle Holocene ecosystem changes at the Western Carpathian/Pannonian border driven by climate and Neolithic impact. *Boreas*. 2018, 47(3), 897–909.

3.397* Veselovský, F., ***Ackerman, L.***, Pašava, J., ***Žák, K.***, ***Haluzová, E.***, Creaser, R. A., Dobeš, P., Erban, V., Tásler R. Multiphase formation of the Obří důl polymetallic skarn deposit, West Sudetes, Bohemian Massif: Geochemistry and Re–Os dating of sulfide mineralization. *Mineralium Deposita*. 2018, 53, 665–682.

3.300* Klausen, T. G., Müller, R., ***Sláma, J.***, Olaussen, S., Rismyhr, B., Helland-Hansen, W. Depositional history of a condensed shallow marine reservoir succession: stratigraphy and detrital zircon geochronology of the Jurassic Sto Formation, Barents Sea. *Journal of the Geological Society.* 2018, 175(1), 130–145.

3.286* Braeuer, S., ***Borovička, J.***, Goessler, W. A unique arsenic speciation profile in *Elaphomyces* spp. („deer truffles“)-trimethylarsine oxide and methylarsonous acid as significant arsenic compounds. *Analytical and Bioanalytical Chemistry*. 2018, 410, 2283–2290.

3.285* ***Trubač, J.***, ***Ackerman, L.***, Gauert, C., ***Ďurišová, J.***, ***Hrstka T.*** Platinum-group elements and gold in base metal sulfides, platinum-group minerals and Re-Os isotopiccompositions of the Uitkomst Complex, South Africa. *Economic Geology*. 2018, 113, 439–461.

3.261* Hrubá, J., ***Kletetschka, G.*** Environmental record of layers of bubbles in natural pond ice. *Journal of Glaciology.* 2018, 64(248), 866–876.

3.252* Drahota, P., Raus, K., Rychlíková, E., ***Rohovec, J.*** Bioaccessibility of As, Cu, Pb, and Zn in mine waste, urban soil, and road dust in the historical mining village of Kaňk, Czech Republic. *Environmental Geochemistry and Health.* 2018, 40(4), 1495–1512.

3.244* Bábek, O., Faměra, M., ***Hladil, J.***, Kapusta, J., ***Weinerová, H.***, Šimíček, D., ***Slavík, L.***, ***Ďurišová, J.*** Origin of red pelagic carbonates as an interplay of global climate and local basin factors: Insight from the Lower Devonian of the Prague Basin, Czech Republic. *Sedimentary Geology.* 2018, 364, 71–88.

3.244* Žák, J., ***Svojtka, M.***, Opluštil, S. Topographic inversion and changes in the sediment routing systems in the Variscan orogenic belt as revealed by detrital zircon and monazite U–Pb geochronology in post-collisional continental basins. *Sedimentary Geology.* 2018, 377(1), 63–81.

3.230* Topuz, G., Hegner, E., Homa, S. M., ***Ackerman, L.***, Pfänder, J. A., Karimi, H. Geochemical and geochronological evidence for a Middle Permian oceanic plateau fragment in the Paleo-Tethyan suture zone of NE Iran. *Contributions to Mineralogy and Petrology*. 2018, 173, 81.

3.206* ***Křížová, Š.***, Blažková, G., ***Skála, R.*** Chemical composition of archaeological glasses from Prague Castle (Czech Republic) from the period 1650–1800 determined by electron probe microanalysis and laser ablation inductively coupled plasma mass spectrometry. *Microchemical Journal.* 2018, 142, 236–250.

3.000* Žák, J., ***Sláma, J.*** How far did the Cadomian "terranes" travel from Gondwana during early Palaeozoic? A critical reappraisal based on detrital zircon geochronology. *International Geology Review.* 2018, 60(3), 319–338.

2.894* Drahota, P., Kulakowski, O., Culka, A., Knappová, M., ***Rohovec, J.***, Veselovský, F., Racek, M. Arsenic mineralogy of near-neutral soils and mining waste at the Smolotely-Lisnice historical gold district, Czech Republic. *Applied Geochemistry*. 2018, 89, 243–254.

2.777* Hrouda, F., ***Chadima, M.***, Ježek, J. Anisotropy of susceptibility in rocks which are magnetically nonlinear even in low fields. *Geophysical Journal International.* 2018, 213(3), 1792–1803.

2.777* Machek, M., Kalvoda, L., ***Hladil, J.***, Roxerová, Z., Vratislav, S., Drahokoupil, J., Ryukhtin, V. Petrophysical record of evolution of weakly deformed low-porosity limestone revealed by small-angle neutron scattering, neutron diffraction and AMS study. *Geophysical Journal International.* 2018, 215(2), 895–908.

2.777* Pšenčík, I., Růžek, B., ***Lokajíček, T.***, ***Svitek, T.*** Determination of rock-sample anisotropy from P- and S-wave traveltime inversion. Geophysical Journal International. 2018, 214(2), 1088–1104.

2.764* Dudzisz, K., Szaniawski, R., Michalski, K., ***Chadima, M.*** Rock magnetism and magnetic fabric of the Triassic rocks from the West Spitsbergen Fold-and-Thrust Belt and its foreland. *Tectonophysics.* 2018, 728-729, 104–118.

2.687* Vytykáčová, S., Mrázek, J., Puchý, V., Džunda, R., ***Skála, R.***, Peterka, P., Kašík, I. Sol-gel route to highly transparent $(Ho_{0.05}Y_{0.95})_2Ti_2O_7$ thin films for active optical components operating at 2 mm. *Optical Materials.* 2018, 78, 415–420.

2.631* Yasumoto, A., Yoshida, K., Kuwatani, T., Nakamura, D., ***Svojtka, M.***, Hirajima, T. A rapid and precise quantitative electron probe chemical mapping technique and its application to an ultrahigh-pressure eclogite from the Moldanubian Zone of the Bohemian Massif (Nové Dvory, Czech Republic). *American Mineralogist.* 2018, 103(10), 1690–1698.

2.616* Nejman, L., ***Lisá, L.***, Doláková, N., Horáček, I., Bajer, A., Novák, J., Wright, D., Sullivan, M., Wood, R., Gargett, R. H., Pacher, M., Sázelová, S., Nývltová Fišáková, M., Rohovec, J., Králík, M. Cave deposits as a sedimentary trap for the Marine Isotope Stage 3 environmental record: The case study of Pod Hradem, Czech Republic. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 2018, 497, 201–217.

2.616* ***Scheiner, F.***, Holcová, K., Milovský, R., Kuhnert, H. Temperature and isotopic composition of seawater in the epicontinental sea (Central Paratethys) during the Middle Miocene Climate Transition based on Mg/Ca, $\delta^{18}O$ and $\delta^{13}C$ from foraminiferal tests. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 2018, 495, 60–71.

2.615* Moreau, J.-G., ***Kohout, T.***, Wünnemann, K. Melting efficiency of troilite-iron assemblages in shock-darkening: Insight from numerical modeling. *Physics of the Earth and Planetary Interiors.* 2018, 282, 25–38.

2.615* Ullemeyer, K., ***Lokajíček, T.***, Vasin, R. N., Keppler, R., Behrmann, J. H. Extrapolation of bulk rock elastic moduli of different rock types to high pressure conditions and comparison with texture-derived elastic moduli. *Physics of the Earth and Planetary Interiors*. 2018, 275, 32–43.

2.315* Reichenbacher, B., Gregorová, R., Holcová, K., Šanda, R., Vukić, J., ***Přikryl, T.*** Discovery of the oldest *Gobius*

(Teleostei, Gobiiformes) from a marine ecosystem of Early Miocene age. *Journal of Systematic Palaeontology.* 2018, 16(6), 493–513.

2.295* Kołtonik, K., Pisarzowska, A., Paszkowski, M., ***Sláma, J.***, Becker, R. T., Szczerba, M., Krawczyński, W., Hartenfels, S., Marynowski, L. Baltic provenance of top-Famennian siliciclastic material of the northern Rhenish Massif, Rhenohercynian zone of the Variscan orogen. *International Journal of Earth Sciences.* 2018, 107(108), 2645–2669.

2.295* Konopásek, J., Janoušek, V., Oyhantçabal, P., ***Sláma, J.***, Ulrich, S. Did the circum-Rodinia subduction trigger the Neoproterozoic rifting along the Congo–Kalahari Craton margin? *International Journal of Earth Sciences*. 2018, 107(5), 1859–1894.

2.120* ***Elbra, T.***, Bubík, M., Reháková, D., ***Schnabl, P.***, ***Čížková, K.***, ***Pruner, P.***, ***Kdýr, Š.***, ***Svobodová, A.***, Švábenická, L. Magneto- and biostratigraphy across the Jurassic-Cretaceous boundary in the Kurovice section, Western Carpathians, Czech Republic. *Cretaceous Research.* 2018, 89, 211–223.

2.050* ***Kletetschka, G.***, Vondrák, D., Hrubá, J., Procházka, V., Nábělek, L., Svitavská-Svobodová, H., Bobek, P., Hořická, Z., Kadlec, J., Takáč, M., Stuchlík, E. Cosmic-impact event in lake sediments from Central Europe postdates the Laacher See eruption and marks onset of the Younger Dryas. *Journal of Geology.* 2018, 126(6), 561–575.

2.050* Wolbach, W. S., Ballard, J. P., Mayewski, P. A., Adedeji, V., Bunch, T. E., Firestone, R. B., French, T. A., Howard, G. A., Israde-Alcántara, I., Johnson, J. R., Kimbel, D. R., Kinzie, C. R., Kurbatov, A., ***Kletetschka, G.***, LeCompte, M. A., Mahaney, W. C., Mellot, A. L., Maiorana-Boutilier, A., Mitra, S., Moore, C. R., Napier, W. M., Parlier, J., Tankersley, K. B., Thomas, B. C., Wittke, J. H., West, A., Kennett, J. P. Extraordinary Biomass-Burning Episode and Impact Winter Triggered by the Younger Dryas Cosmic Impact approximate to 12,800 Years Ago. 1. Ice Cores and Glaciers. *Journal of Geology.* 2018, 126(2), 165–184.

2.050* Wolbach, W. S., Ballard, J. P., Mayewski, P. A., Parnell, A. C., Cahill, N., Adedeji, V., Bunch, T. E., Dominguez-Vazquez, G., Erlandson, J. M., Firestone, R. B., French, T. A., Howard, G., Israde-Alcántara, I., Johnson, J. R., Kimbel, D., Kinzie, C. R., Kurbatov, A., ***Kletetschka, G.***, LeCompte, M. A., Mahaney, W. C., Mellot, A. L., Mitra, S., Maiorana-Boutilier, A., Moore, C. R., Napier, W. M., Parlier, J., Tankersley, K. B., Thomas, B. C., Wittke, J. H., West, A., Kennett, J. P. Extraordinary Biomass-Burning Episode and Impact Winter Triggered by the Younger Dryas Cosmic Impact approximate to 12,800 Years Ago. 2. Lake, Marine, and Terrestrial Sediments. *Journal of Geology.* 2018, 126(2), 185–205.

1.952* Jiangzuo, Q., Liu, J., ***Wagner, J.***, Dong, W., Chen, J. Taxonomical revision of fossil *Canis* in Middle Pleistocene sites of Zhoukoudian, Beijing, China and a review of fossil records of *Canis mosbachensis variabilis* in China. *Quaternary International*. 2018, 428, 93–108.

1.871* Majerová, L., Bábek, O., ***Navrátil, T.***, ***Nováková, T.***, Štojdl, J., Elznicová, J., Hron, K., Matys Grygar, T. Dam reservoirs as an efficient trap for historical pollution: the passage of Hg and Pb through the Ohře River, Czech Republic. *Environmental Earth Sciences*. 2018, 77, 574.

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

1.746* ***Kohout, T.***, Näsilä, A., Tikka, T., Granvik, M., Kestilä, A., Penttilä, A., Kuhno, J., Muinonen, K., Viherkanto, K., Kallio, E. Feasibility of asteroid exploration using CubeSats-ASPECT case study. *Advances in Space Research.* 2018, 62(8), 2239–2244.

1.746* Michel, P., Kueppers, M., Sierks, H., Carnelli, I., Cheng, A. F., Mellab, K., Granvik, M., Kestilä, A., ***Kohout, T.***, Muinonen, K., Näsilä, A., Penttilä, A., Tikka, T., Tortora, P., Ciarletti, V., Herique, A., Murdoch, N., Asphaug, E., Rivkin, A. S., Barnouin, O., Campo Bagatin, A., Pravec, P., Richardson, D. C., Schwartz, S. R., Tsiganis, K., Ulamec, S., Karatekin, O. European component of the AIDA mission to a binary asteroid: Characterization and interpretation of the impactof the DART mission. *Advances in Space Research.* 2018, 62(8), 2261–2272.

1.736* ***Štorch, P.***, Manda, Š., Tasáryová, Z., Frýda, J., ***Chadimová, L.***, Melchin, M. J. A proposed new global stratotype for Aeronian Stage of the Silurian System: Hlásná Třebaň section, Czech Republic. *Lethaia.* 2018, 51(3), 357–388.

1.719* Vacek, F., ***Slavík, L.***, Sobień, K., Čáp, P. Refining the late Silurian sea level history of the Prague Syncline – a case study based on the Přídolí GSSP (Czech Republic). *Facies*. 2018, 64(4), 30.

1.719* ***Weiner, T.***, ***Weinerová, H.***, Kalvoda, J. Microproblematica, calcareous algae, and microbialites at the Frasnian-Famennian boundary interval in the Šumbera section (Moravian Karst, Czech Republic) and their significance in the context of the Kellwasser Crisis. *Facies*. 2018, 64(4), 26.

1.699* ***Mészárosová, N.***, ***Skála, R.***, ***Matoušková, Š.***, ***Mikysek, P.***, Plášil, J., Císařová, I. Hydrothermal-to--metasomatic overprint of the neovolcanic rocks evidenced by composite apatite crystals: a case study from the Maglovec Hill, Slanské vrchy Mountains, Slovakia. *Geologica Carpathica.* 2018, 69(5), 439−452.

1.674* Halamski, A., Kvaček, J., ***Svobodová, M.*** Fossil mega- and microflora from the Březno beds *s.s.* (Bohemian Cretaceous Basin, Coniacian). *Review of Paleobotany and Palynology*. 2018, 253, 123–138.

1.650* Coufalík, P., ***Krmíček, L.***, Zvěřina, O., Meszarosová, N., Hladil, J., Komárek, J. Model of mercury flux associated with volcanic activity. *Bulletin of Environmental Contamination and Toxicology*. 2018, 101(5), 549–553.

1.584* Angelone, C., ***Čermák, S.***, Moncunill-Solé, B., Quintana, J., Tuveri, C., Arca, M., Kotsakis, T. Systematics and paleobiogeography of *Sardolagus obscurus* n. gen. n. sp. (Leporidae, Lagomorpha) from the early Pleistocene of Sardinia. *Journal of Paleontology.* 2018, 92(3), 506–522.

1.584* ***Laibl, L.***, Cederström, P., Ahlberg, P. Early post-embryonic development in *Ellipsostrenua* (Trilobita, Cambrian, Sweden) and the developmental patterns in Ellipsocephaloidea. *Journal of Paleontology*. 2018, 92(6), 1018–1027.

1.500* ***Přikryl, T.***, Carnevale, G. Ophidiiform fishes from the Oligocene-early Miocene of Moravia, Czech Republic. *Bulletin of Geosciences.* 2018, 93(4), 477–489.

1.500* ***Štorch, P.***, Melchin, M. J. Lower Aeronian triangulate monograptids of the genus *Demirastrites* Eisel, 1912: biostratigraphy, palaeobiogeography, anagenetic changes and speciation. *Bulletin of Geosciences*. 2018, 93(4), 513–537.

1.364* ***Bek, J.*** Palaeozoic in situ spores and pollen: Lycopsida. *Palaeontographica B*. 2018, 296, 1–111.

1.293* ***Elbra, T.***, ***Schnabl, P.***, ***Čížková, K.***, ***Pruner, P.***, ***Kdýr, Š.***, Grabowski, J., Reháková, D., ***Svobodová, A.***, Frau, C., Wimbledon, W. A. P. Palaeo- and rock-magnetic investigations across Jurassic-Cretaceous boundary at St Bertrand's Spring, Dôrme, France: applications to magnetostratigraphy. *Studia geophysica et geodaetica.* 2018, 62(2), 323–338.

1.293* Hrouda, F., ***Chadima, M.***, Ježek, J., Kadlec, J. Anisotropies of in-phase, out-of-phase, and frequency-dependent susceptibilities in three loess/palaeosol profiles in the Czech Republic; methodological implications. *Studia geophysica et geodaetica.* 2018, 62(2), 272–290.

1.275* ***Hrstka, T.***, Gottlieb, P., ***Skála, R.***, ***Breiter, K.***, Motl, D. Automated mineralogy and petrology - applications of TESCAN Integrated Mineral Analyzer (TIMA). *Journal of Geosciences.* 2018, 63(1), 47–63.

1.275* Nováková, L., ***Schnabl, P.***, Büchner, J. The characterization of sunburn basalts and their magnetic and petrographic properties. *Journal of Geosciences.* 2018, 63(4), 333–344.

1.142* Jiangzuo, Q., Liu, J., ***Wagner, J.***, Chen, J. Taxonomical revision of "*Arctonyx*" fossil remains from the Liucheng *Gigantopithecus* Cave (South China) by means of morphotype and morphometrics, and a review of Late Pliocene and Early Pleistocene *Meles* fossil records in China. *Palaeoworld*. 2018, 27(2), 282–300.

1.070* ***Roček, Z.***, Wang, Augé, M. L., Gardner, J. D. In memoriam of Jean-Claude Rage. *Palaeobiodiversity and Palaeoenvironments.* 2018, 98(3), 523–525.

1.070* Wang, Y., ***Roček, Z.***, Dong, L. A new pelobatoid frog from the lower Eocene of southern China. *Palaeobiodiversity and Palaeoenvironments.* 2018, 98(2), 225–242.

1.062* Artemyeva, Z. S., ***Žigová, A.***, Kirillova, N., ***Šťastný, M.*** Dynamics of organic matter in soils following a change in landuse on Permo-Carboniferous rocks in the Český Brod Area (Czech Republic). *Acta Geodynamica et Geomaterialia*. 2018, 15(4), 339–348.

0.865* Blaszczyk, M., Hercman, H., Pawlak, J., Gasiorowski, M., ***Matoušková, Š.***, Aninowska, M., Kicinska, D., Tyc, A. Low to Middle Pleistocene Paleoclimatic Record from the Kraków-Częstochowa Upland (Poland) Based on Isotopic and Calcite Fabrics Aanalyses. *Geochronometria.* 2018, 45(1), 185–197.

0.838* Chaubey, R. S., Singh, B. P., Mikuláš, R., Bhargava, O. N., Subhay, N. K., Prasad, S. K. Integrated ichnological and Sedimentological Analysis of the Cambrian Kunzam La (Parahio) Formation, Shian Section, Pin Valley, Spiti, Northwest Himalaya. *Stratigraphy and Geological Correlation.* 2018, 26(7), 709–721.

0.778* Dykan, N., Kovalchuk, O., Dykan, K., Gurov, E., ***Dašková, J.***, ***Přikryl, T.*** New data on Paleocene-Eocene fauna (gastropods, ostracods, fishes) and palynoflora of the Boltysh impact structure (Ukraine) with reference to palaeobiogeography and palaeoecology. *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen.* 2018, 287(2), 213–239.

0.778* Hyžný, M., Kočí, T., ***Kočová Veselská, M.***, Kroh, A. Isolated decapod crustacean fingers from the Miocene (Langhian) of the Vienna and Carpathian foreland basins (Czech Republic). *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen.* 2018, 289(3), 331–338.

0.778* ***Kočová Veselská, M.***, van Bakel, B. W. M., Kočí, T., Jagt, J. W. M. The first record of *Ferroranina* (Decapoda, Raninoidia, Palaeocorystidae) from Europe. *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen.* 2018, 288(2), 161–171.

0.778* ***Přikryl, T.***, Grădianu, I., Georgescu, V., Carnevale, G. A toadfish (Batrachoidiformes) from the Oligocene of the Eastern Carpathians (Piatra Neamt, Romania). *Neues Jahrbuch für Geologie und Paläontologie-Abhandlungen.* 2018, 287(2), 241–248.

0.759* ***Žák, K.***, Lipták, V., ***Filippi, M.***, Orvošová, M., Hercman, H., ***Matoušková, Š.*** Cryogenic carbonates and cryogenic speleothem damage in the Za Hájovnou Cave (Javoříčko Karst, Czech Republic). *Geological Quarterly.* 2018, 62(4), 829–839.

0.756* ***Bosák, P.***, Zupan Hajna, N. Palygorskite in caves and karst: a review. *Acta carsologica.* 2018, 47(2-3), 97–108.

Adamovič, J., Peroutka, J. Kruhové struktury v pískovcích jizerského souvrství u Doks. *Bezděz*. 2018, 27, 215–246.

Álvares-Vázques, C., ***Bek, J.***, Knight, J. A., Wagner, R. H. Revision and significance of the Westphalian (Middle Pennsylvanian) arborescent lycopsid *Bergeria dilatata* (Lindley & Hutton) Álvarez-Vázquez & Wagner. *Spanish Journal of Palaeontology*. 2018, 33(1), 5–40.

Bella, P., ***Bosák, P.*** Zarovnané skalné podlahy v jaskyniach. *Aragonit*. 2018, 23(1-2), 25–29.

Křížová, Š., Blažková, G., ***Skála, R.*** Chemical Analyses of Glasses Found in Cesspits during Archaeological Excavations in the Salm Palace, Prague, Czech Republic. *Journal of Glass Studies.* 2018, 60(1), 183–205.

Libertín, M., Kvaček, J., ***Bek, J.***, ***Štorch, P.*** Plant diversity of the mid Silurian (lower Wenlock, Sheinwoodian) terrestrial vegetation preserved in marine sediments from the Barrandian area, the Czech Republic. *Fossil Imprint*, 2018, 74(3-4), 327–333.

Mikuláš, R. Inteligence v geologickém záznamu Země? Vesmír. 2018, 97(10), 592–595.

Mikuláš, R., Kadlecová, E., Bruthansová, J. Interakce mezi ichnofosiliemi, schránkami tělesně zachovalých fosilií a litologií v šáreckém souvrství ordoviku Barrandienu studované výpočetní tomografií. *Zprávy o geologických výzkumech.* 2018, 51(2), 189–193.

Navrátil, T., ***Rohovec, J.***, Krištůfek, V., ***Filippi, M.***, Bruthans, J., ***Žák, K.***, ***Bosák, P.*** Srážení schwertmannitu z důlních vod

vyvěrajících ze štoly dolu Arnošt v Českém Krumlově a problematika hydrogeologie krystalických vápenců. *Český kras*. 2018, XLIV, 11–26. (in Czech, Engl. abs.)

Nejman, L., Kučera, L., Škrdla, P., ***Lisá, L.***, Hladilová, Š., Králík, M., Wood, R., Nývltová-Fišáková, M., Wright, D., Sullivan, M., Hughes, P. 2016 excavation of basal layers at Pod Hradem Cave and the finding of shell and amber. *Přehled výzkumů*. 2018, 59(1), 9–15.

Nováková T., ***Navrátil T.***, ***Rohovec J.*** (2018). Rtuť v prostředí lesních ekosystémů CHKO Brdy. *Ochrana přírody* (1): 27–31.

Pauliš, P., Hrůzek, L., Sejkora, J., ***Adamovič, J.***, Radoň, M., Vrtiška, L., Malíková, R., Fediuk, F., Pour, O. Zeolitová mineralizace z Klučku u Heřmaniček u České Lípy (Česká republika). *Bulletin Mineralogie Petrologie*. 2018, 26(1), 43–56.

Pokorný, R., ***Žák, K.***, Juřičková, L., Horáček, I. Nový nález koně (*Equus ferus germanicus* Nehring, 1804) ze svrchněpleistocenních spraší ze Stradonic u Nižboru. *Zprávy o geologických výzkumech.* 2018, 51(1), 25–30.

Pošmourný, K., ***Coubal, M.***, Valenta, J. Utilization of deep geothermal energy in the Czech Republic: possibilities, present state and prospects. *Geotechnica.* 2018, 1, 10–18.

Prošek, J., ***Žák, K.*** Zemřel Antonín Jančařík, jeskyňář, krasový badatel a cestovatel. *Český kras.* 2018, XLIV, 73–76.

Rak, Š., ***Žák, K.*** Odhalení nového pomníku Joachima Barranda v Berouně. *Český kras.* 2018, XLIV, 67–69.

Roll M., Manaenko A., Hloušek J. Základní charakterizace důlních vod ložisek Čelina a Mokrsko. *Zprávy o geologických výzkumech.* 2018, 51(1), 13–16.

Roll M., ***Žák K.***, ***Nováková T.***, ***Navrátil T.*** Srovnání koncentrací Hg ve vybraných horninách CHKO Brdy v tepelsko-barrandienské oblasti. *Zprávy o geologických výzkumech.* 2018, 51(1), 47–51.

Svobodová, M. Významné životní jubileum Blanky Pacltové. *Journal of the National Museum (Prague), Natural History Series*. 2018, 187, 183–184. (in Czech)

Šamánek, J., ***Mikuláš, R.***, Doláková, N., Hladilová, Š. Vrtby ichnorodu *Gastrochaenolites* jakožto životní prostor mlžů z lokality Borač-Podolí (karpatská předhlubeň, Česká republika). *Geologické výzkumy na Moravě a ve Slezsku.* 2018, 25(1-2), 49–57.

Šťastný, M., Dudek, J., Goš, V. Pocula loscicensia aperta, tajemství výroby loštických pohárů odhaleno. *Pravěk NŘ.* 2018, 26, 83–106. (in Czech)

Šťastný, M., Hájek, P. Jílové sedimenty tektonického horninového prostředí v zemětřesné oblasti Nový Kostel. *Informátor – časopis ČSVVJ*. 2018, 62, 14–20. (in Czech)

Tietz, O., Lange, W., Volkmann, N., Gerschel, H., Wenger, E., Wilmsen, M., ***Svobodová, M.***, Büchner, J. Steinkohle in der Oberkreide-Sandsteinen von Waltersdorf in Zittauer Gebirge, Sachsen. *Berichte der Naturforschenden Gesellschaft der Oberlausitz*. 2018, 26(1), 77–105.

Venclová, N., ***Křížová, Š.***, Dillingerová, V., Vaculovič, T. Hellenistic cast monochrome glass vessels from Staré Hradisko, 2nd-1st cent. BCE. *Journal of Archaeological Science: Reports.* 2018, 22, 540–549.

Wang, H.-h., Ma, X.-p., ***Slavík, L.***, Wei, F., Zhang, M.-f., Lü, D. Yúnnán xībù ā lěng chū pōumiàn xià ní pén tǒng yá xíng lèi shēngwù dìcéng. *Dicengxue Zazhi* (*Journal of stratigraphy*). 2018, 42(3), 288–300. (in Chinese)

Weiner, T., ***Weinerová, H.***, Viktorýn, T. Nový nález pygidia scutelluidního trilobita ze svrchního frasnu ze Šumbery u Brna-Líšně (Moravský kras). *Zprávy o geologických výzkumech.* 2018, 51(2), 121–125. (in Czech, Eng. abstr.)

Žák, K. Geomorfologie Středních Brd. *Bohemia centralis.* 2018, 1, 7–29, 450–452.

Žák, K., Rous, I., Dobeš, P., Klomínský, J., Hercman, H., ***Matoušková, Š.*** Stáří a vznik hrubě krystalických speleotém z jeskyně Dvoustovka v Ještědském hřbetu. *Zprávy o geologických výzkumech.* 2018, 51(2), 97–102. (in Czech, Eng. abstr.)

Žák, K., Sýkorová, I., Havelcová, M., Šulc, A. Co je vlastně švartna a jaké má vlastnosti. *Věstník Musejního spolku královského města Rakovníka a okresu rakovnického.* 2018, LVI, 34–45. (in Czech)

Žák, K., Sýkorová, I., Šulc, A., Kočár, P., Matoušková, Š., Majer, M. Datování dvou vzorků uhlíkatých látek z jeskyně Martina v Českém krasu. *Český kras.* 2018, XLIV, 53–59. (in Czech, Eng. abstr.)

7b. Books and Chapters in Books

Adamovič, J. Geologické poměry České Lípy. In: ***Adamovič, J.***, Blažková, J., Ďurčanský, M., Honců, M., Kolka, M., Kratochvíl, J., Krejcar, R., Lhotová, M., Panáček, J., Panáček, M., Peša, V., Rous, I., Smejkal, L., Šindlauer, Z.: *Česká Lípa. Město na Ploučnici.* Česká Lípa: Město Česká Lípa, 2018, pp. 6–39, 520–529, 572–577. (In Czech)

Bosák, P., Geršl, M., Novotná, J. eds. *Speleofórum 2018*. Praha: Czech Speleological Society, 2018, 37, 108 pp. (In Czech, Engl. sum.)

Bosák, P., Rak, Š., ***Žák, K.*** eds. *Český kras*. Beroun: Museum of the Czech Karst, 2018, XLIV, 76 pp. (In Czech, Engl. abs.)

Coubal, M., ***Adamovič, J.***, ***Šťastný***, eds. *Lužický zlom – hranice mezi dvěma světy*. Praha: Novela Bohemica, 2018, 272 pp. (In Czech, Engl. sum.)

Čech, S., Prouza, V., ***Mikuláš, R.***, Souček, M., Stárková, M., Rapprich, V., Gürtlerová, P. *Napříč Broumovským výběžkem*. Praha: Česká geologická společnost, 2018, Exkurze České geologické společnosti, 44 pp.

Černá, E., Vepřeková, J., ***Křížová, Š.*** Středověké sklo z Pražského hradu, ze studny na Jiřském náměstí. In: Kapustka, K., ed. *Profil archeologie středověku. Studie věnované Janu Frolíkovi.* Praha: Archeologický ústav AV ČR, Praha, v. v. i., 2018, pp. 49–73.

Frojdová J. Palaeoecology of Selected Species of Ferns. In: Nowicki L., Kowalska A., eds. *Ferns Ecology, Importance to Humans and Threats.* New York, Nova Science Publishers, 2018, pp. 97–119.

Hora, Z. D., Stein, H., ***Žák, K.***, Dobeš, P. Eaglet property, southeastern British Columbia: Re-Os geochronology, sulphur isotopes, and thermobarometry. In: *Geological Fieldwork 2017, British Columbia Ministry of Energy, Mines and Petroleum Resources.* British Columbia: British Columbia Geological Survey, 2018, pp. 157–166.

Mikuláš, R. *Povodňové usazeniny: z čeho jsou složeny a co s nimi*. Praha: Středisko společných činností AV ČR, v. v. i., 2018, Strategie AV21, Přírodní hrozby, 54 pp.

Rohovec, J. Jak zvětrává žula a co to znamená pro stromy. In ***Cílek V.***, ed. *Žulové krajiny středních Čech*. Praha: Dokořán, 2018, pp. 45–56.

Žák, K., Onac, B. P., Kadebskaya, O. I., ***Filippi, M.***, Dublyansky, Y., Luetscher, M. Cryogenic Mineral Formation in Caves. In: Perşoiu, A., Lauritzen, S. E., eds. *Ice caves.* Amsterdam: Elsevier, 2018, pp. 123–162.

7c. Unpublished Reports

Borovička J. *Mykologický průzkum hadcových lokalit na Podblanicku, závěrečná zpráva.* Institute of Geology of the Czech Academy of the Sciences for ČSOP Vlašim, 2018. 1–10. (In Czech)

Bosák, P. & ***Filippi, M.*** *Jeskyně na etáži č. 300 Velkolomu Čertovy schody – západ. Posudek*. Institute of Geology of the Czech Academy of the Sciences for Velkolom Čertovy schody, a. s., 2018. 1–8. (In Czech)

Bosák, P. *Postup těžebních stěn Velkolomu Čertovy schody–západ. Akce sanace a rekultivace severní stěny. Zhodnocení. Období: leden až prosinec 2017*. Institute of Geology of the Czech Academy of the Sciences for Velkolom Čertovy schody, a. s., 2018. 1–15, 1–25. (In Czech)

Lisá L. *Micromorphological report on Bibracte (Mont-Beuvray. La Chaume), závěrečná zpráva.* Institute of Geology of the Czech Academy of the Sciences for BIBRACTE EPCC, 2018. 1–22.

Navrátil, T., ***Dobešová, T.*** *Monitoring chemismu srážkových vod na území NPČŠ – Záverečná zpráva za rok 2017.* Institute of Geology of the Czech Academy of the Sciences for ČR – Správa Národního parku České Švýcarsko, 2018. 1–17. (In Czech)

Petružálek M. *Detailní ultrazvukové prozařování podélnými vlnami vzorků jádra z vrtu Litoměřice, závěrečná zpráva*. Institute of Geology of the Czech Academy of the Sciences for Czech Geological Survey, 2018. 1–11. (In Czech)

Petružálek M. *Laboratorní zkoušky hornin na vzorcích z lokality El Hierro, závěrečná zpráva*. Institute of Geology of the Czech Academy of the Sciences for Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, 2018. 1–13. (In Czech)

Petružálek M. *Laboratorní zkoušky pro stanovení pevností, elastických konstant a Hoek Brownovy obálky pro pískovec, prachovec a uhlí, závěrečná zpráva*. Institute of Geology of the Czech Academy of the Sciences for Institute of Geonics of the CAS, 2018. 1–43. (In Czech)

Petružálek M. *Stanovení koeficientu hydraulické vodivosti vzorků jádra z vrtu Litoměřice, závěrečná zpráva*. Institute of Geology of the Czech Academy of the Sciences for Czech Geological Survey, 2018. 1–7. (In Czech)

Svobodová M. *Palynologie vybraných vzorků z vrtu Veselí u Přelouče (4310-03 W).* Institute of Geology of the Czech Academy of the Sciences for Czech Geological Survey, 2018, 1–11. (In Czech)

Šťastný, M., ***Bosák, P.*** & Zupan Hajna, N. *Mineralogic analyses of samples from karst sediments in Slovenia, 6. Final Report*. Institute of Geology of the Czech Academy of the Sciences and *Karst Research Institute*, Research Centre of the Slovenian *Academy of Sciences* and *Arts*, 2018. 1–85.

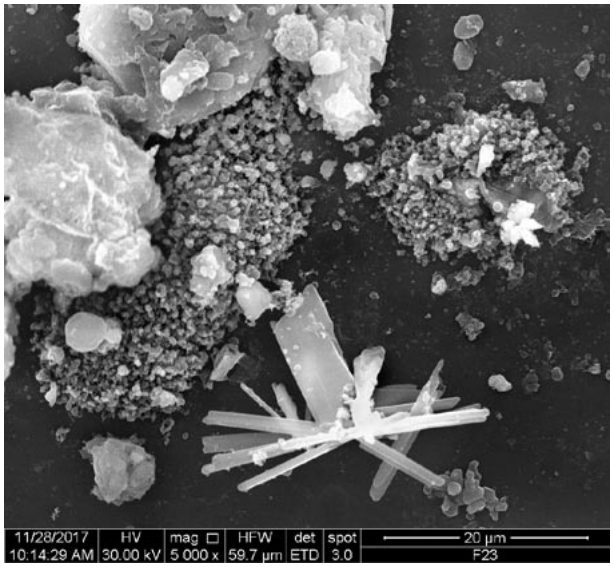
8. Organization of Conferences and Scientific Meetings

International summer course for undergraduate and graduate students: ***Geology of Lithium, Mikulov v Krušných horách, August 27 – September 1, 2018***. Organized by the Inst Geol, Czech Acad Sci. Organizing committee: ***K. Breiter***

Lithium is one of several commodities whose consumption actually has risen sharply and whose availability in the near future will be limiting for the development of modern technology. The Cínovec deposit in the Krušné hory Mts., Czech Republic, is the largest potential source of this raw material within the EU. Thus we decided, within the Czech Acad Sci programme for international cooperation, to organize a course for students with the following aims: (1) to inform young scientists about geological and other aspects of Li acquisition, and (2) to establish contact with potential future workers in this field abroad.

The course comprises lectures about modern geological materials analysis by LA-ICP-MS (M. Vašinová Galiová, Mendel University Brno), about Li minerals and potential Li sources in pegmatites (J. Cempírek, Masaryk University Brno), about processes of Li concentration in granitic rocks and mineral deposits of Li in the Krušné hory Mts. (P. Breiter, Czech Acad Sci, Inst Geol, Praha), and about methods of automated mineralogy in geological research and mining and processing of raw materials (T. Hrstka, Czech Acad Sci, Inst Geol, Praha). Finally, students visited two accessible old ore mines (Krupka, Zinnwald) to see examples of rocks with high Li contents, potentially extractable as a source of Li. The course was attended by 14 students from 9 countries from Europe, Asia and South America (Fig. 37).

■ **Fig. 37.** Participants of the course in front of the Starý Martin adit at the Krupka tin deposit. Photo by K. Breiter.



■ **Fig. 38.** Dust particles consisting of a mixture of mineral grains and combustion engine soot from Prague. Photo by T. Hrstka.

Scientific meeting: ***Dust Particles Workshop – Prague 2018: Academy of Sciences Library, Prague, October 22, 2018***. Organized by the Inst Geol, Czech Acad Sci and the Inst Rock Struct & Mech, Czech Acad Sci, Praha. Organizing committee: M. Havelcová, ***T. Hrstka***

The primary focus of the Dust Particles Workshop was to discuss the recent developments in the research of individual dust constituents and risks related to the poor quality of air. The meeting was attended by 20 participants. Six oral presentations summarized, in particular, the recent progress achieved in dust particle research. The meeting facilitated expert and detailed discussion on various aspects of deposited dust and aerosol research. The new developments of the "*Dust Particle Atlas*" web application were also presented (Fig. 38).

International conference session: ***Paleomagnetic, Structural, and Geophysical Data Applied to Intrusive and Extrusive Igneous Systems, Tectonic Applications, and Paleoclimate Studies.*** T14 session at the ***Geological Society of America (GSA) Joint Meeting of Rocky Mountains and Cordilleran sections, Flagstaff, Arizona, 15-17 May 2018***.

Convenors: Michael S. Petronis, ***F. Tomek*** and Jennifer Lindline

This session was focused on recent advances in the application of geophysical and structural techniques to igneous systems, tectonic processes, and paleoclimate studies. We brought together a diverse mix of geoscientists to discuss physical emplacement and deformational models of igneous rocks, regional strain accommodation in the upper crust, and secular variation studies to constrain paleoclimate history (Fig. 39). Our aim was to bring about a greater appreciation of the utilization of geophysical and structural methods applied to a diverse array of geologic studies.

■ **Fig. 39.** Lecture by Filip Tomek at the GSA Joint Meeting of the Rocky Mountains and Cordilleran sections in Flagstaff (USA). Photo by Z. Shivji.

International conference: ***Berriasian Working Group Meeting, Kroměříž, May 14–18, 2018.*** Organized by the Institute of Geology of the Czech Academy of the Sciences, Praha. Faculty of Science of Charles University, Praha, Czech Geological Survey, Brno, VSB Technical University of Ostrava, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences

Organizing committee: ***P. Schnabl***, W. A. P. Wimbledon, P. Skupien, M. Košťák, M. Bubík, G. Li, ***Š. Kdýr***, ***K. Čížková***, ***K. Hladíková***, ***A. Svobodová***

An international meeting of scientists interested in dating of rocks in the Jurassic/Cretaceous boundary interval (Berriasian Working Group Meeting) was held at Kroměříž in the proximity of best outcrops of the J/K boundry sections in the Czech Republic. The meeting was attended by 6 scientists of our institute, colleagues from Charles University, Czech Geological Survey, Technical University in Ostrava and scientists from Slovakia, Poland, United Kingdom, France, Bulgaria, Hungary and China (Fig. 40). This time interval is highly topical because the Jurassic/Cretaceous boundary is the last boundary between two stratigraphic systems which has not been conclusively defined by a stratotype of the International Commission on Stratigraphy yet. The latest results of integrated research were presented and fieldtrips were made to important sites in the Czech Republic (Kurovice Quarry and Štramberk).

International conference: ***19th Czech-Slovak-Polish Palaeontological Conference & 11th Micropalaeontological Workshop MIKRO 2018, Prague, October 18–20, 2018***. Organized by the Department of Paleobiology and Paleoecology, Institute of Geology, Czech Academy of Sciences, Praha and West Bohemian Museum in Plzeň.

Organizing committee: ***A. Svobodová***, ***J. Frojdová***, ***J. Dašková***, ***H. Weinerová***, ***T. Weiner***, ***F. Scheiner***, J. Pšenička J., M. A. Kaminsky

The conference focused on a wide variety of paleontological topics with the intention to bring researchers from Central Europe together, and to present a plethora of their research interests. One hundred and two researchers from the Czech Republic, Slovak Republic, Poland, Ukraine and Slovenia attended the conference (Fig. 41). There were representatives of wide spectra of in-

■ **Fig. 40.** Participants of the BWG meeting. Photo by K. Fekete.

■ **Fig. 41.** Participants of the 19th Czech-Slovak-Polish Palaeontological Conference & 11th Micropalaeontological Workshop MIKRO 2018 held in Prague.

terests including paleobotany, paleozoology, micropaleontology and also anthropology. Forty-four lectures and forty-seven posters were presented during this conference. The last day was dedicated to a guided field excursion dealing with the stratigraphy and tectonics of the Prague Basin, which was led by František Vacek of the National Museum.

9. Degrees Obtained by the Staff of the Institute of Geology

Ph.D.
Kočová Veselská M.
Crustacea (Decapoda, Cirripedia) from the Bohemian Cretaceous Basin. (Institute of Geology and Palaeontology, Charles University, Praha; supervised by M. Košťák)

10. Financial Report

In thousands of Czech Crowns (CZK)		2018
A. INCOMES		
1.	From the annual budget of the CAS	42 984
2.	From the Czech Science Foundation (accepted research projects)	12 782
3.	From the Technological Agency CR (accepted research projects)	0
4.	From the internal research projects of the CAS	2 267
5.	From other public sources	147
6.	Applied research	6 145
7.	Investment (instruments)	12 589
8.	Investment (constructions)	1215
TOTAL INCOMES		**78 129**
B. EXPENSES		
1.	Scientific staff (wages, insurances)	41 283
2.	Research and scientific activities	10 280
3.	Administration and technical staff (wages, insurances)	5 759
4.	General expenses (service, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc.)	5 034
5.	Library	1 660
6.	Editorial activities	309
7.	Investment (instruments)	12 589
8.	Investment (constructions)	1 215
TOTAL EXPENSES		**78 129**

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