INSTITUTE OF GEOLOGY

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

Second edition - version 2024

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Purpose and Structure of the Text

Who we are…

Where we work…

What we offer…

What we do…

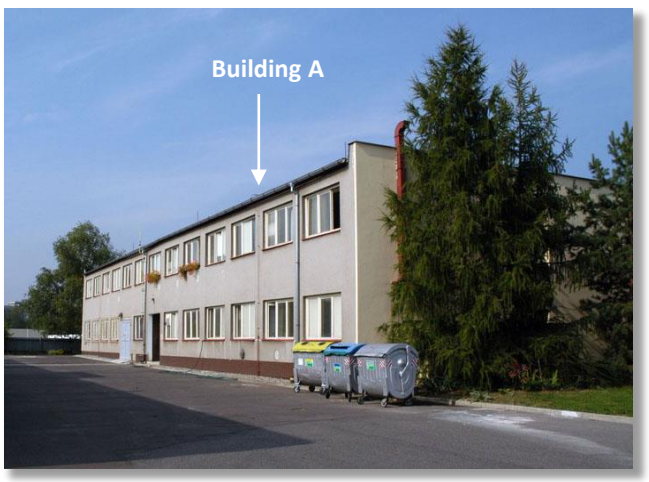
The Geological Institute of the Czechoslovak Academy of Sciences (ČSAV) was founded on July 1, 1960. Nevertheless its structure had developed in the period of 1957 to 1961. During this period, several independent laboratories were constituted: Laboratory of Paleontology, Laboratory of Engineering Geology,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

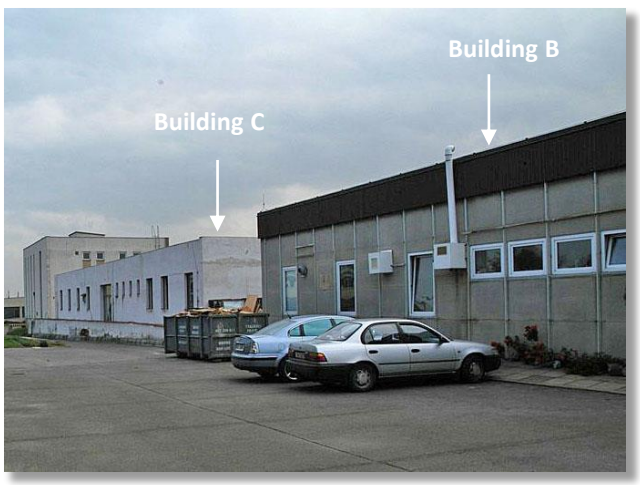
On August 1, 1964 the Institute of Geochemistry and Raw Materials of the ČSAV was integrated into the Geological Institute. On July 1, 1969 the Institute of Experimental Mineralogy and Geochemistry of the ČSAV was founded; a successor of the Institute of Geochemistry and Raw Materials was newly established.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

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

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

The economic and scientific concept of the Institute of Geology of the Czech Academy of Sciences, and the evaluation of its results lie within the responsibility of the Executive Board and Supervisory Board which include both the internal and external members. Plans of the Institutional Financing are evaluated by the special Committee at the Czech Academy of Sciences. Besides research, staff members of the Institute are involved in lecturing at universities and in the graduate/postgraduate education system. Special attention is also given to the spread of the most important scientific results in the public media.





Photos of the three old buildings of the Institute of Geology. Building A was used in period 1969 – 2009; building B in period 1976 – to this day (reconstructed in 2009 – 2010); building C in period 1983 – 2007.

The Institute of Geology (GLI) of the Czech Academy of Science (Czech. Acad. Sci.) is a public research institute of modest size: it employs 90 to 100 staff members (i.e. 67 to 69 recalculated full-time job workers) including 43 to 49 scientists (in 2015). The Institute is a permanently stabilized, relatively homogeneous and internally integrated modern scientific institution, which covers a significant portion of the set of geological sciences. After 55 years of provisional arrangement, it is housed in a new, well technically equipped building (since 2009).

The GLI is an institution with a multi-disciplinary focus, with historically delineated, i.e. "traditional", research themes, and with the ability of scientists to respond to topical needs and problems. The Institute collaborates with other geoscientific institutions in the Czech Republic and abroad (research institutes, universities/technical universities) in disciplines which are not personally covered at the Institute. In addition, the international co-operation gives the opportunity to use scientific equipment not operated at the GLI. Despite the overall fragmentation and specialization of all sciences, the Institute represents a relatively homogeneous scientific body, tied together by a number of running projects, irrespective of its organizational chart (see more in section Scientific ability). Although the number of grant projects slightly decreases in last years (which is however a general trend after the dissolution of one of the grant agencies in the Czech Republic – Grant Agency of the Academy of Sciences CR), the incoming financial support has not changed much. Many of the Institute employees lecture at universities, spread scientific knowledge among the public and participate in scientific activities such as peer reviews, work in university boards and editorial boards of journals.

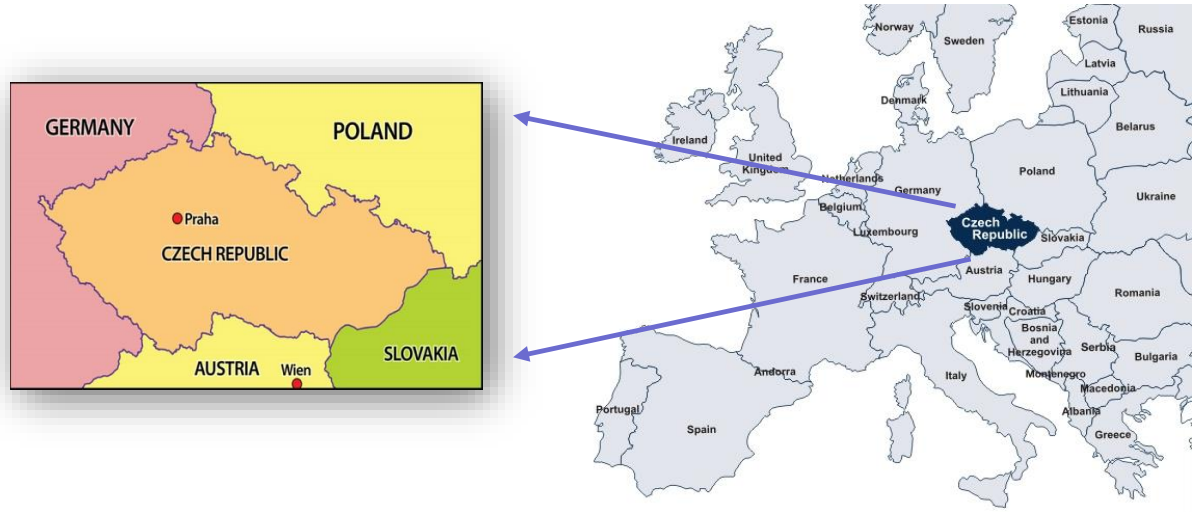
The principal research areas pursued by the Institute are often unique in national or even international scale but – which is the most important – they are firmly settled in the Institute research portfolio. We perceive it as an advantage and our prime asset that the Institute combines top research in selected directions in geology with the tradition of a wide-scope geoscientific institution with rich international co-operation. At the same time, we reflect modern trends in research in the given areas. Although the sites in the Bohemian Massif and neighbouring European areas continue to lie in the main focus of our activities, a positive trend in recent times is the orientation (with project support) to the study of significant localities worldwide connected with interpretations in global scale. Such approach allows to present the results in prestigious international journals.

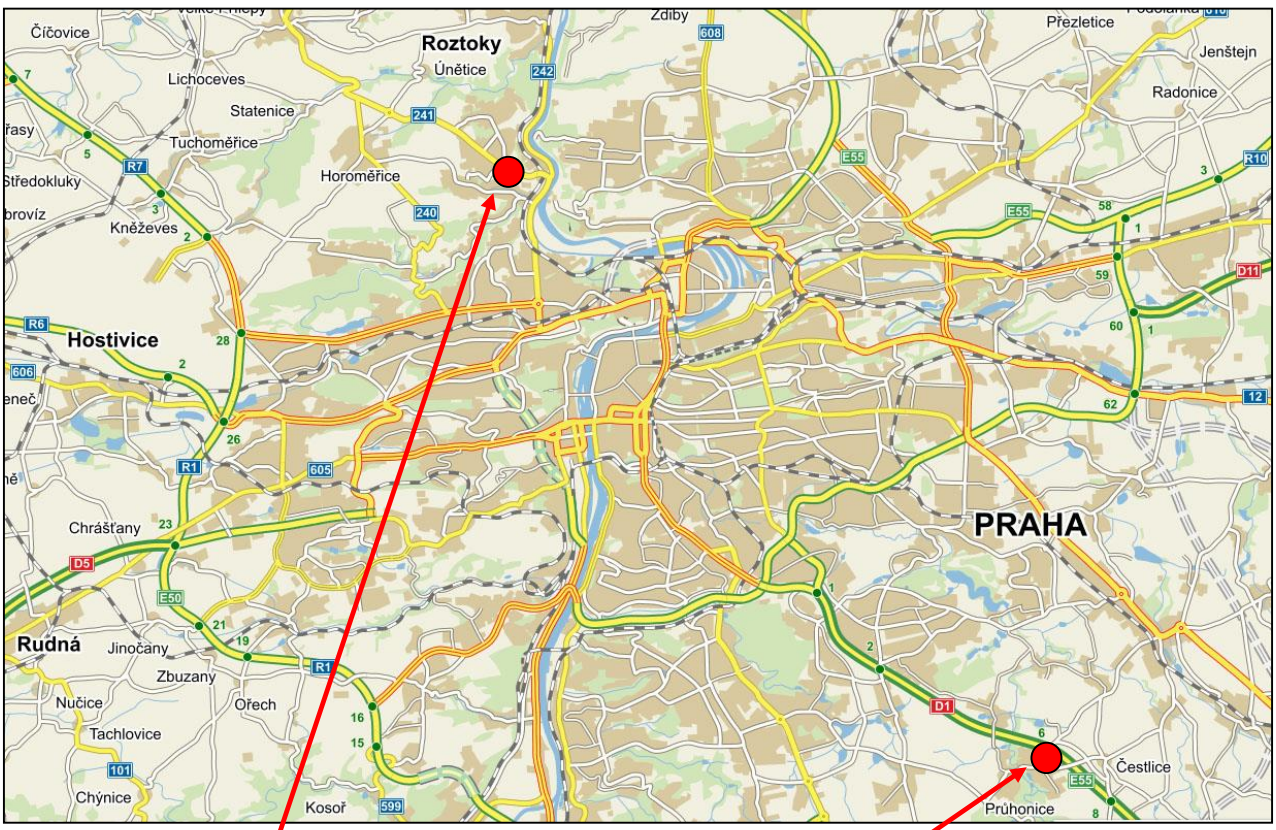
The Institute offers data acquisition and interpretation, together with a share in applied outputs. This provides the greatest financial profit to the Institute.

Demolition of old buildings.

Construction of a new building.

Positions of Research Centres of the Institute of Geology





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Czech Republic

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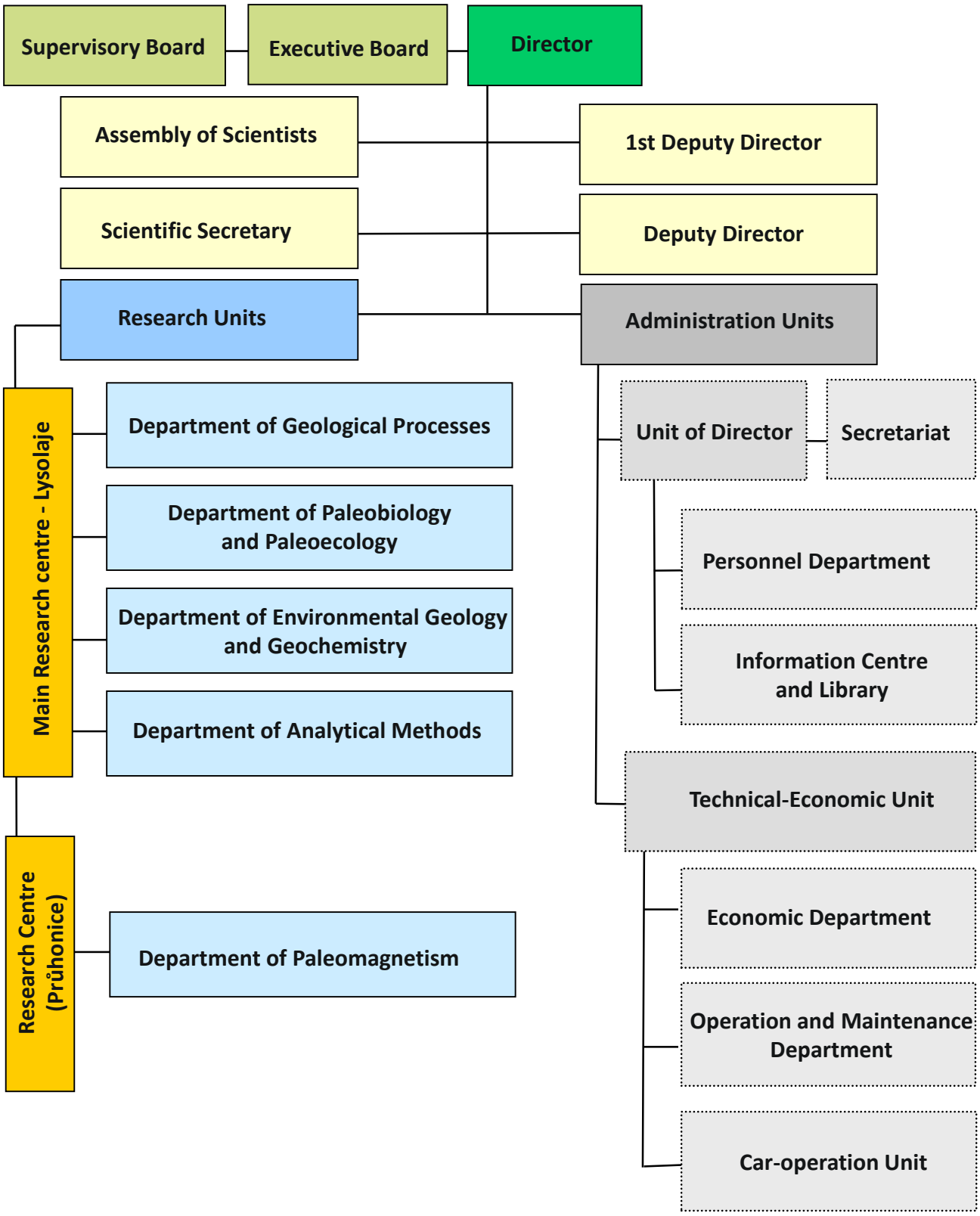
Supervisory Board
Executive Board
Director
Assembly of Scientists
1st Deputy Director
Scientific Secretary
Deputy Director
Research Units
Administration Units
Main Research centre - Lysolaje
Department of Geological Processes
Department of Paleobiology and Paleoecology
Department of Environmental Geology and Geochemistry
Department of Analytical Methods
Unit of Director
Secretariat
Personnel Department
Information Centre and Library
Technical-Economic Unit
Economic Department
Operation and Maintenance Department
Car-operation Unit
Research Centre (Průhonice)
Department of Paleomagnetism

Library of the Institute of Geology of the Czech. Acad. Sci., is a public library with a specialized library fund.
Its main purpose is to collect, process, store and provide scientific information contained in the library fund. It provides its readers with literature focused on Earth sciences, especially from the fields of geology, paleontology, petrology or mineralogy.
The library fund counts some 9,000 books and over 450 journal titles, besides various qualification theses, research reports reprints or maps.

The library serves not only to the Institute employees but also to the wide public. It mediates the following services to its customers:

- **Mediation of documents from its own library fund (within-building and out-of-building loans).**
- Rendering interlibrary loans or reprographic services, among others using the Virtual Polytechnical Library (VPK).
- Making access to specialized bibliographic and full-text information sources (both freely available and licensed).
- Providing information of bibliographic and factographic character.
- Reprographic services.

Another significant task of the Library is keeping files related to publication activities of the Institute of Geology staff using the ASEP (automated system of evidence of publications). The ASEP is designed to collect, proces, store and spread information on publications and other information outputs of basic research in the Czech Academy of Sciences.

Useful links

Official website: https://www.gli.cas.cz/cs/skupina/knihovna

Online catalogue: https://aleph22.lib.cas.cz/F/PI2YIMXI1VAN1NP1ITT15MYMC9MUN7LF386QSXALEH5HVJUC9I-03676?func=file&file_name=find-b&local_base=GLU

ASEP database: http://www.library.sk/i2/i2.entry.cls?ictx=cav&language=2&op=esearch

Contacts

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	(library is located in ground floor)
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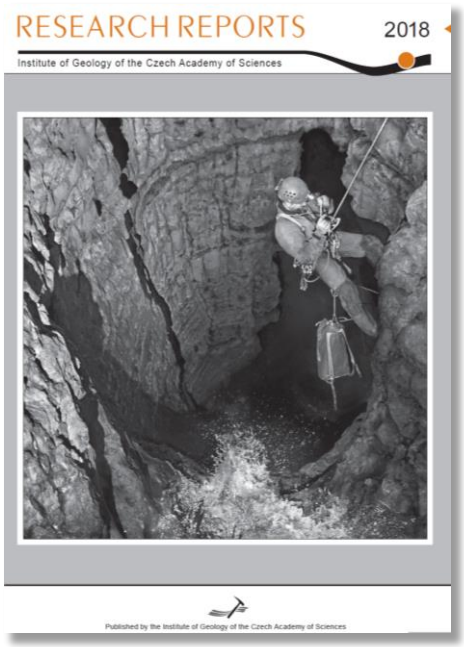
	+420 226 800 273

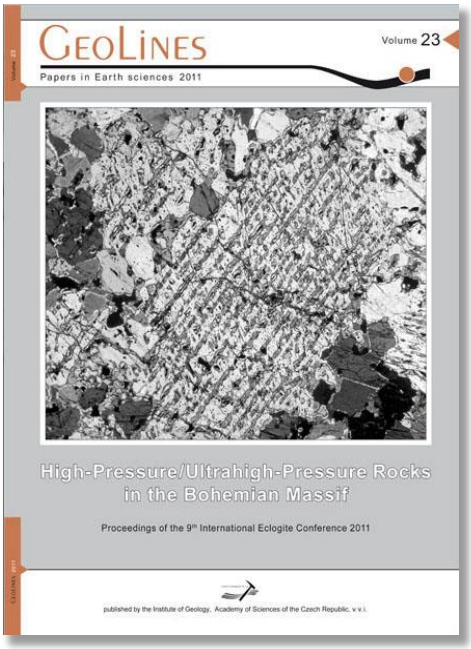
Opening hours:

Monday	08:00 – 12:00
Tuesday	08:00 – 15:00
Wednesday	closed
Thursday	08:00 – 15:00
Friday	08:00 – 12:00

Access beyond the opening hours is subject to advance notification.



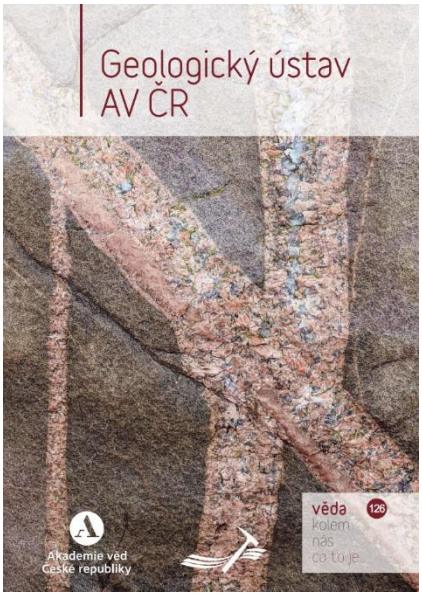
The **Research Reports** journal summarizes in detail all news and the whole production of the institute for each year. It is published in English. *GLI is the publisher.*



The Geolines Journal was a series of occasional papers and monothematic volumes of conference abstracts (issued 1994–2011). GeoLines publishes articles in English on primary research in many field of geology (geochemistry, geochronology, geophysics, petrology, stratigraphy, palaeontology, environmental geochemistry, etc.). *GLI was the publisher.*

GEOLOGICA CARPATHICA

Geologica Carpathica is the official journal of the Carpathian-Balkan Geological Association. The journal publishes contributions to petrology, mineralogy, geochemistry, applied geophysics, stratigraphy, paleontology, sedimentology, tectonics, etc.
Impact factor 2022: 1.3
***GLI was a co-publisher**, together with the Czech Geological Survey in Prague, the Museum of West Bohemia in Pilsen and the Palacký University Olomouc, **until 2016**.*



The publication titled **Institute of Geology** of the Czech Academy of Sciences is a science-promotion booklet bringing together information about the Institute. It was published in 2023 by the Centre of Administration and Operations (Czech Academy of Sciences) in the "Science around us" edition under the heading: What it is... (What they are...).
The booklet, prepared by several scientists working for the Institute, summarizes the development of the Institute of Geology and its activities in the context of the history of geosciences in the Czech Republic.
The pdf version of the booklet can be downloaded here:
http://www.vedakolemnas.cz/co-to-je/20230531-VKN126

Current analytical equipment is in good condition, expired equipment has been refurbished. The new instruments enable the introduction of new methods. Laboratories of the GLI are frequently used by partners from other institutes of the Czech. Acad. Sci., universities, museums and from the private sector. Department of Physical Properties of Rocks provides the best technical equipment in the CR for all basic tests in rock mechanics, including the world-unique apparatus for the determination of high-pressure rock elastic anisotropy using P- and S-waves in spherical samples.

The most important acquisitions for Department of Geological Processes are represented by a brand new 193nm *excimer laser system (Cetac/Teledyne)* to the existing laser ablation ICP-MS lab (2016) and a novel generation of *thermal ionization mass spectrometer (TIMS) Triton Plus (Thermo)* in 2017.

The important instrumental investments were also directed to laboratories of Department of Analytical Methods. *Raman micro-spectrometer S&I MonoVista CRS+* (purchased in 2015) allows a collection of Raman and photoluminescence spectra from a sample with spatial resolution of 1 µm laterally and 2 µm axially. In 2017, a Fourier-transform infra-red spectrometer (FTIR) *Thermo ScientificNicolet iS-50* was acquired with a built-in mid- and far-IR capable diamond attenuated total reflectance (ATR) accessory. Cutting and grinding machine *Buehler PetroThin* was acquired in 2017 to expand the possibilities of manufacture of polished thin sections. In addition, a brand new *electron probe microanalyzer (JEOL JXA 8230)* was installed in November 2019. It provides quantitative chemical composition data for major and minor elements in polished solid state samples including a wide variety of materials covering minerals, rocks, archeological artefacts, glass fibres, catalysts and other synthetic products. For quantitative applications, it is equipped with five wave-dispersive spectrometers housing together 14 analytical crystals. A proprietary JEOL energy-dispersive spectrometer is installed in the instrument to collect overview spectra to determine major constituting elements. Imaging is possible *via* secondary or back-scattered electron detectors. Panchromatic cathodoluminescence detector allows to image fine details in microfabrics otherwise unseen with standard imagery.

This is not a complete list of instrumental investments which support all departments and the Institute as a single unit but shows the most significant acquisitions (often with a significant financial support from the Czech Acad Sci). It is also necessary to mention an effort to expand or improve the spaces for detached workplaces of the Institute.

Price list for services of the Institute.

On the next pages you can find a list of the most important instruments, laboratory equipment and other facilities with brief explanations and comments. For other relevant information see the price list of the Institute.

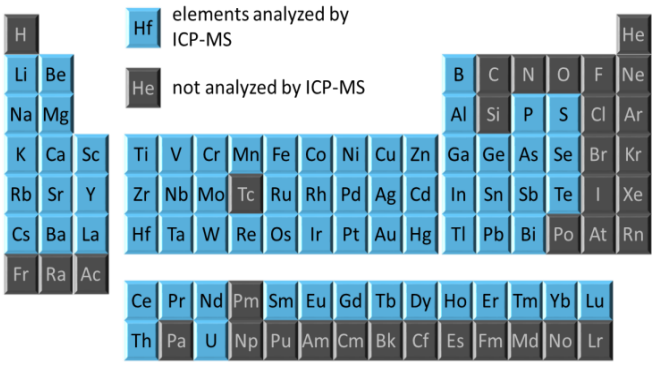
The Department of Geological Processes conducts a complex research in the field of processes, past and present, acting within the lithosphere – the Earth crust and the upper part of the Earth's mantle. The analysis of geochemical, geochronological and structure record preserved in the available rocks permits us to describe the dynamics of large lithospheric blocks in the past, to reconstruct time–temperature and pressure histories of large magmatic and volcanic complexes including the evolution of sedimentary basins from the Early Paleozoic to the present. Good knowledge of these processes in the geological history together with extensive research activities at a global scale enable us to present results of general validity and universal use in the realm of Earth sciences.

Element 2 (Thermo Fisher) inductively coupled plasma mass spectrometer (ICP-MS) is used for trace and ultra-trace element analysis (down to a sub-ppm level) and for the determination of isotope ratios (with a precision of up to 0.1% relative standard deviation). Both solution and solid-state analyses are available. The instrument is equipped with a double focusing magnetic sector field mass analyzer based on a reverse Nier-Johnson geometry, which allows high-speed multielement analysis. A high mass resolution mode of operation enables the elimination of polyatomic interferences. Typical applications include multi-element analysis of digested inorganic and organic materials, ultra-trace analysis of natural waters, determination of $^{206}Pb/^{207}Pb$ and $^{208}Pb/^{206}Pb$ isotope ratios in environmetal samples. Preparation of samples is carried out in a specialized clean laboratory (see next page).

The ICP-MS is equipped with optional sample introduction systems:

- **Aridus II** desolvating nebulizer for the elimination of oxide interferences in solution analyses. It can be also used for simultaneous aspiration of a tracer solution during laser ablation analyses.
- **Hydride generator** provides sub-ppb detection limits for hydride-forming elements such as As, Se, Sb.

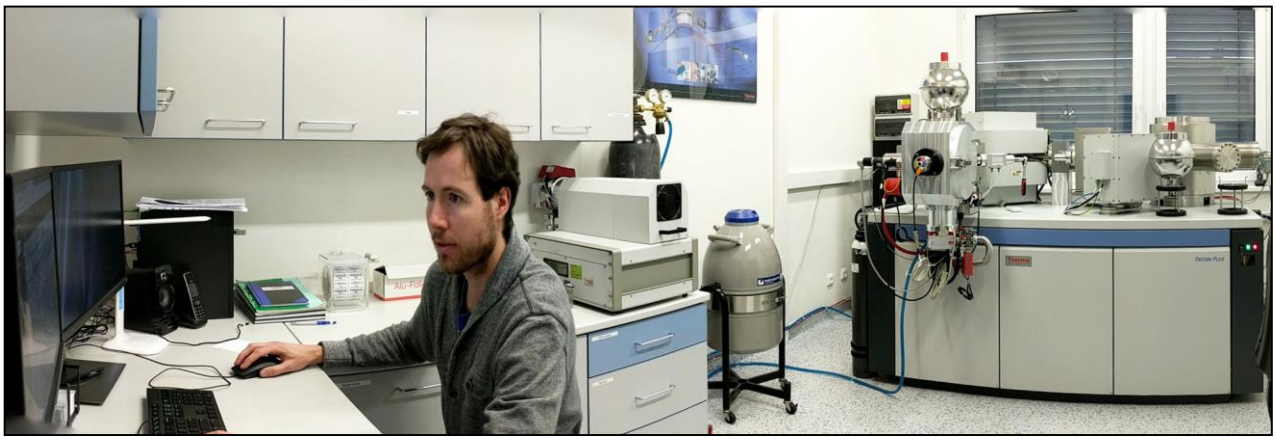
193 nm ArF excimer laser ablation system (Analyte - Excite by Cetac/Teledyne) in connection with the ICP-MS is used for analyses of solid-state materials. The main applications are isotopic analyses, such as U–Pb geochronology of zircons and monazites, space-resolved quantitative analyses of trace elements in mineral grains of silicates (pyroxenes, quartz, etc.) or sulphides (molybdenite, chalcopyrite etc), elemental profiling and mapping. The spatial resolution of the laser beam is in the range of tens of micrometers. Planar polished surface and compact structure of resin-blocks or thin sections are necessary for any analysis using LA-ICP-MS.



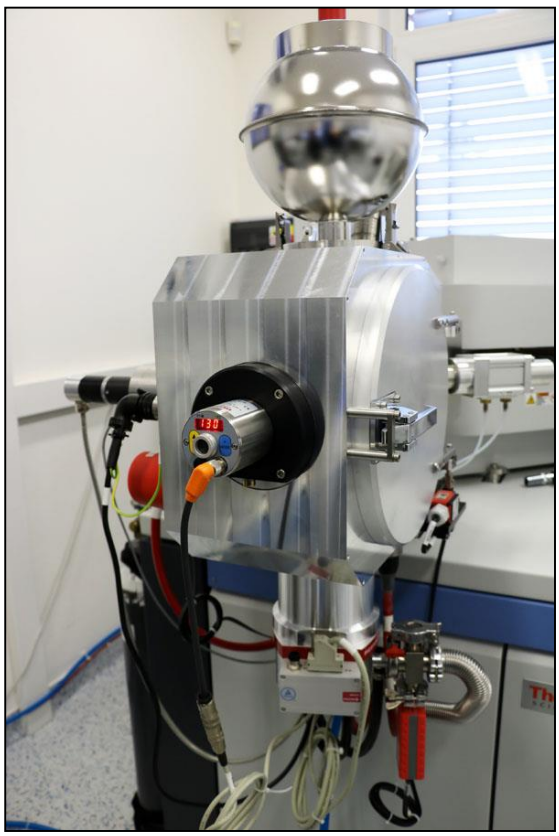
Lab digital analytical balance scale is used for precise sample weighing.

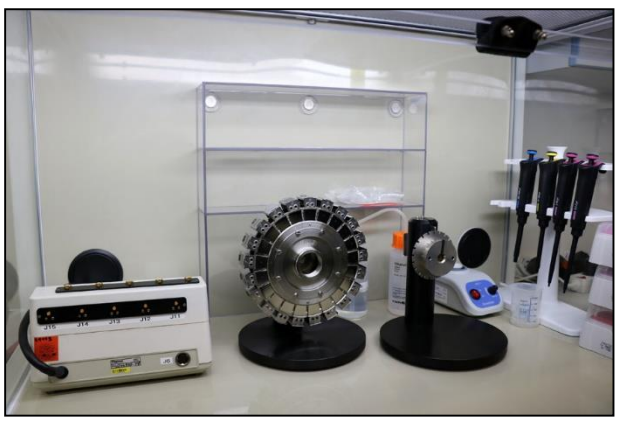
Ultraclean laboratory of the Institute consists of two independent labs with different degree of air quality. The **first lab** (picture upper left) with a HEPA-filtered air of class D is using for sample decomposition in acid-resistant fume hood and acid purification (HNO_3, HCl, HF using two Savillex Distillation Units). The **second lab** (upper right and bottom pictures) with HEPA-filtered air of class C is devoted to low-blank chemistry, which includes sample decomposition and separation of the elements (e.g., Os, Sr, Nd, Mo, Cd, Pb, Lu, Hf) from the matrix for subsequent isotopic analyses. This room is equipped with 2 custom-designed laminar flow hoods with HEPA-filtered air of class A, system for preparation of ultraclean Milli-Q water Millipore IQ 7000 + QPOD Element and high precision weighting device Sartorius Cubis.

Currently, the clean lab is mainly used for research projects dealing with radiogenic (Sr-Nd-Pb-Hf) and stable (Mo, Cd) isotopic analyses and Re-Os, Lu-Hf and Sm-Nd geochronology.

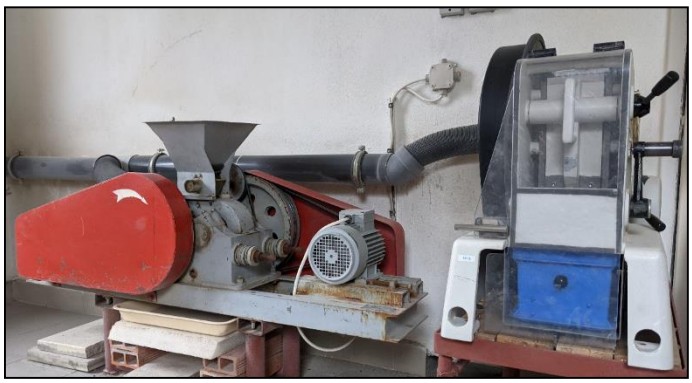


The **Thermo Triton Plus Thermal Ionization Mass Spectrometer (TIMS)** is used for ultra-high precision determinations of isotopic ratios of selected elements (e.g., Sr, Nd, Os, U, Pb) providing an outstanding opportunity to several research topics in the field of rock and environmental geochemistry, paleontology and paleoecology, but also archaeometry and anthropology. The thermal ionization source is characterized by a very small kinetic energy spread of the ions (~0.5 eV), and a single focusing geometry that focuses for angular divergence only is therefore fully sufficient. The ions are detected with either nine Faraday cups or a discrete dynode electron multiplier. The Faraday detectors are laser machined from solid carbon to guarantee uniform response, high linearity and low noise. The discrete dynode electron multiplier is equipped with retarding potential quadrupole lenses that act as high-selectivity filers for ions with disturbed energy or angle. The machine is then equipped with five 10^{11} Ω and five highly sensitive 10^{13} Ω amplifiers coupled to the virtual amplifier concept which eliminates calibration biases. The TIMS lab also includes a vacuum degassing unit, a laminar flow hood with ultralow penetration air (ULPA) filtration and the UPS system.





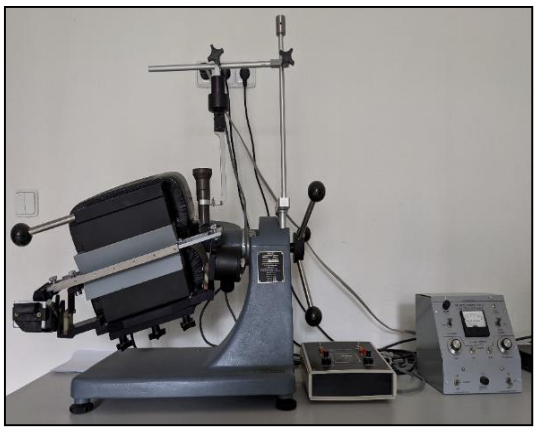
Certain kinds of mineral concentrates are needed for the study of minerals and their properties. This is obtained by separation of minerals from the rocks. First, the rock is crushed in a big **jaw crusher** into smaller fragments, then in **crusher roller mills** to obtain small grains. A **dust-tight jaw crusher** is used for low-volume samples. Sieving of samples to various fractions is the subsequent procedure needed for other processes. Using a **shaking table** and a **magnetic separator**, the grains are separated into light/heavy fractions and into magnetic and non-magnetic minerals. Finally, the mineral grains are separated in heavy liquids based on their density.



Jaw rock crushers

Dust-tight jaw crusher

Vibratory disc mill



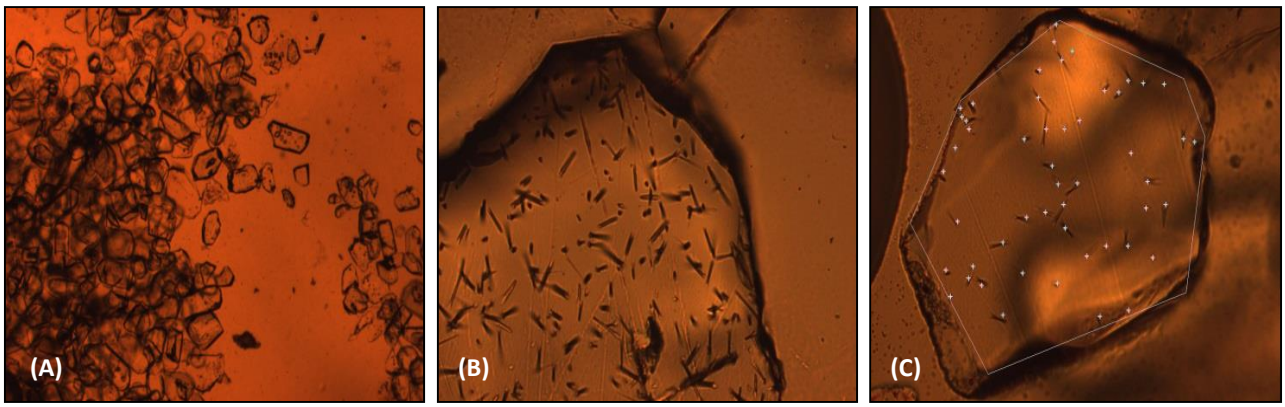
Frantz magnetic separator

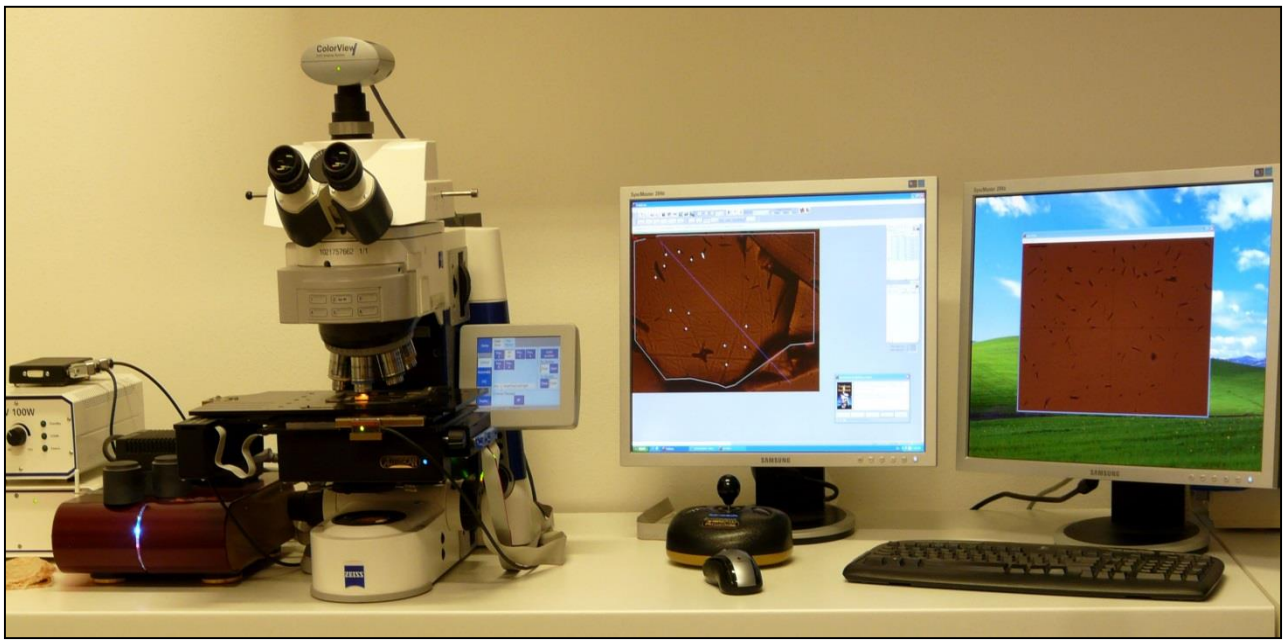
Wilfley shaking table

Laboratory of heavy liquid separation

Fission track analysis is a radiometric dating method based on the analysis of radiation damage trails ("fission tracks") within U-bearing minerals (such as apatite, zircon, titanite, …). This method allows to determine simultaneously time and temperature evolution of rocks by counting fission tracks in individual grains and length-measuring of the confined tracks. This results in time-temperature curves for each sample and in the reconstruction of the uplift/burial history in areas of tectonically active fault zones, sedimentary basins and their source areas.

A simplified procedure for FTA using the ZEISS Imager M1m microscope: apatite grains in a sample at a magnification of 5x (A); a part of the selected grain with fission tracks at a magnification of 50x (B); apatite grain with the defined area and counted fission tracks for age determination (C); confined track for thermal-condition determination.





ZEISS Imager. M1m Microscope connected to two monitors of a computer for a fission track analysis (FTA).
The Microscope is equipped with an AUTOSCAN table moving in directions x, y, z. controlled by a computer and manual joystick; two light sources using reflected and transmitted light. Another part of the microscope is a digitizing equipment for measuring lengths of specific tracks parallel to the surface of the mineral grain (i.e., confined tracks).

RS-230 instrument is a portable radiation detector (Georadis Ltd., Brno, Czech Republic) with Bismuth Germanate detector (103 cm^3) with a high sensitivity (approximately 3 x higher in comparison to the same size NaI detector). Counts per seconds (cps) in selected energy windows are directly converted to the concentrations of potassium, K (%), uranium, U (ppm), thorium, Th (ppm) and total dose (nGy/h). The instrument offers an assay mode (provides sample concentrations of K, U and Th in selectable time intervals), scan mode (numeric display on front panel scanned to memory and audio response) and survey mode (cps at 1/sec rate display on front panel). It has bluetooth and USB data connections.

Gamma-ray spectrometry (GRS) can be used for direct detection of the concentrations of K, U and Th in geological mapping by detecting and delineating the lateral distribution of these elements in surface rocks and soils. Field GRS is very effective method – low-cost, fast, non-destructive and large data sets can be acquired. GRS in sediments is used as a principal tool for correlations in palaeoenvironmental studies and high-resolution stratigraphy. It can reveal information on the quality of impurities trapped in the sediments where Th and K concentrations usually reflect the presence of some minerals.

GR-320 Envispec Portable Gamma-ray Spectrometer (Exploranium, Canada and Geroadis, Czech Republic) is another portable gamma-ray spectrometer which can be used in the field. It has external detector, and the system utilizes 256/512 channel and a high-sensitivity 76x76 mm (3" x 3") Sodium-Iodide detector. Counts per seconds (cps) in selected energy windows are directly converted to the concentrations of potassium, K (%), uranium, U (ppm), thorium, Th (ppm) and total exposure or dose rate (nGy/h). It can be used for the same purposes as the RS-230 device.

Vacuum chamber con-nected with an air-pump is used for preparation of non-solid samples for thin sectioning in the geoarcheological laboratory. When the samples are cured enough, they are processed in a thin sectioning lab (samples 3×4 cm in size).

The **CILAS 1190 LD laser granulometer** is used to provide measurements of grain size distribution in a range from 0.04 to 2,500 µm. The measurement is based on a small amount of material and might be easily repeated. The use of different types of dispersion allows to obtain information on the primary or secondary given grain size distribution. Data can be reported in different fractions set by the user.

The department is focused on:

- paleontological and paleoenvironmental interpretations and reconstructions of biological evolution in selected fossil groups
- reflection of major changes and turnovers in biota – the study of causes of important (often catastrophic) events in the Earth history
- climatic oscillations and paleoenvironmental changes
- high-resolution stratigraphy; precise dating and correlation of sedimentary strata
- paleogeographic reconstructions based on migration of paleobiota
- intersections with sedimentology, geochronology, ecology, archaeology, and other scientific disciplines

The research concentrates to the four principal directions: 1. Paleozoic stratigraphy and paleoenvironments – based on invertebrate fossil groups (especially conodonts, graptolites, trilobites, cephalopods and paleoichnology in a broad stratigraphic range), 2. evolution of vertebrate groups (fishes, amphibians and mammals), 3. Paleozoic–Cenozoic plants and palynology, and 4. Cretaceous research.

The department has **rooms for maceration and processing of micropaleontological samples** equipped with levigation facility and fume hoods.

OLYMPUS SZX 16 Optical binocular microscope with the **CANON digital photocamera** and specialized **QuickPHOTO Micro software** and a **Deep Focus module** is used for the documentation of samples, various sample separations and imaging of objects.

Olympus BX53 light microscope with the **Olympus UC 90 digital camera** equipped with an immersion objective of ×100 magnifications for micropaleontological observations.

is a multi-disciplinary research team, disposing with respectable knowledge from various fields of Earth sciences such as: mineralogy, geochemistry, sedimentology, geomycology, pedology, hydrology, climatology, geomorphology and ecology. Therefore, the department is able to perform a wide range of studies. From "traditional" regional geology, genesis of sandstone rock cities or karst and cave research, to the latest research topics, namely: anthropogenic contaminations of flood plains and forest ecosystems with mercury and lead, the use of fungi as biomarkers in areas affected by industrial activity and studies of environmental archives, like tree rings, peat bogs and lake sediments. The department is also focused on long-term studies of climatic oscillations in small experimental areas as well as in national parks of the Czech Republic.

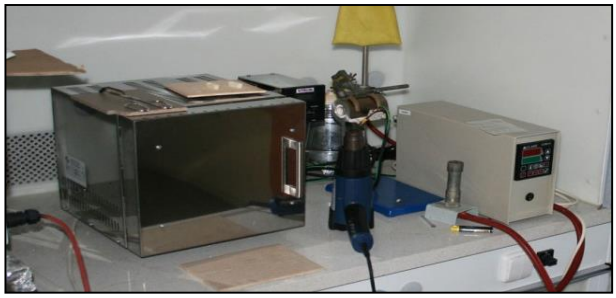
Collection of an environmental sample: **Passive collector** for collection of rain water.

A set of **iceboxes** is used for storage of environmental samples.

We operate with several preparatory laboratories that serve for prime preparation of samples for subsequent analyses.

Before analysis, majority of solid samples are prepared by decomposition in acids. In the **HPA-S Anton Paar high pressure asher**, samples are dissolved at temperatures up to 300 °C and pressures up to 100 atm.

Microwave oven is not only useful in a house kitchen, but with a special teflon PTFE pressure vessels it is equally useful for sample decomposition. Of course, the microwave power inserted on sample is far more higher than in the kitchen models.



Another approach to the decomposition of minerals is based on melting in a resistance oven upon regulated temperature up to 1,300 °C in platinum, silver or quartz crucibles.

SPECIAL EQUIPMENT AND TECHNIQUES FOR WORKUP, PREPARATION AND STUDY OF SAMPLES

Some samples collected in geochemical study sites are air sensitive, prone to decomposition, lost of target analytes or sensitive to contamination. For these samples, special workup procedures are required.

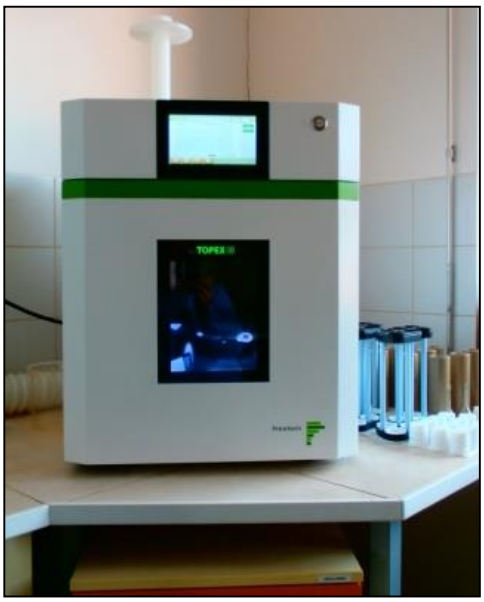
The freeze-drying apparatus is frequently used in biochemical and biological applications for careful drying of sensitive samples. Samples are frozen before drying *in vacuo*, water is removed from the sample by sublimation.

Diluted liquid samples can be preconcentrated before analysis on the **vacuum rotatory evaporator**. Samples are delivered in the plastic bottles, transferred into an evaporation flask and evaporated *in vacuo*. Concentrated sample resulting is present in a small flask connected to the apparatus.

Glove-box where inside the closed space, argon atmosphere is maintained to protect the sample from air influence and contamination from atmospheric dust. Samples are inserted by the port to the right site and handled by gloves connected to long plastic sleeves.

Quantification of inorganic carbon (carbonate) and organic carbon in natural liquid or solid samples is performed on **TOC analyser equipped with autosampler** for liquid samples introduction.

The presence and amount of nitrates, chlorides, sulfates and other anionic component is analysed on the **HPLC liquid analyser** by chromatography on anion exchanging chromatography with conductivity detection.

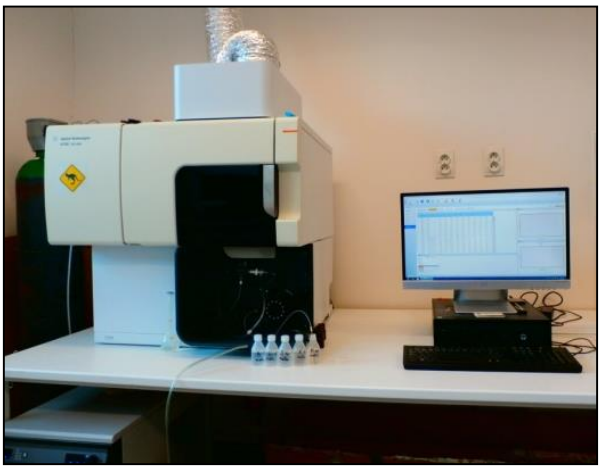


The **Preekem microwave oven** is a high-tech MW digestion unit, **loan of HPST company** for long-term tests at GLI. It uses two different types of rotors, bearing teflon digestion vessels. The maximum operating pressure limit (up to 90 bar) and the highest allowable temperature (approx. 220 °C) are sufficient for dissolution of even the most difficult/stable samples. The movement and state of vessels in the MW chamber can be followed using a built-in camera.

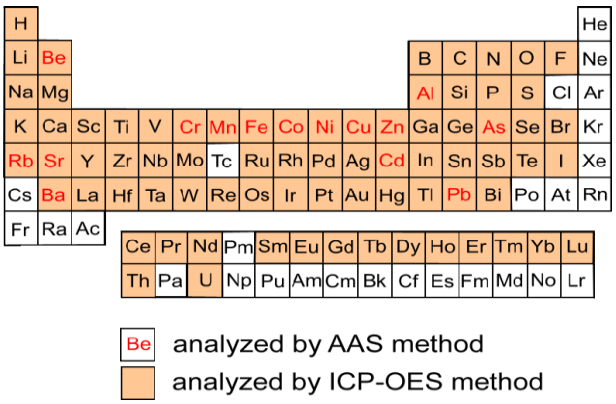
Elemental automatic analyser (vario Macro cube) – Geochemistry of toxic element (e.g. mercury) is tightly interlocked with absolute amount and type of organic materials present. We use the Elemental automatic CHNS analyser for the determination of C, H, N, S in solid samples (biomass, soil horizons etc). Samples, weighted in tin capsules, are burnt at high temperature in O_2 atmosphere into water, carbon dioxide, nitrogen and sulfur dioxide, which are then quantified and recalculated into weight percentages of elements.

Majority of chemical elements can be analysed in the Geochemical labs by ICP techniques.

Samples of various origin are studied. Besides minerals and rocks which are the main materials of interest in geology and geochemistry, the soils, rain, precipitation, water and fog are study subjects in geochemistry. Biogeochemistry concerns various biomaterials (wood, leaves, pines, organic soil horizons etc.).



Chemical composition of samples is studied on universal multielement spectrometers in an argon plasma discharge (**ICP EOS instrument Agilent 5100**). At temperatures about 10,000 K, chemical elements present in the sample emit visible or UV radiation, which is collected and processed. As a result, certain element is identified together with its content in the sample.



Geochemical laboratories are also equipped with other standard instruments: **AAS analysers**, **microwave** and **UV digestion instruments**, **UV spectrometer** equipped with **CV-AFS** and **CV-AAS analysers**, **UV digestion** and of course **ICP-MS ELEMENT 2** with a laser ablation system shared with the Department of Geological Processes.

SPECIALIZED TECHNIQUE PERFORMED AT OUR DEPARTMENT IS UTLTRA-TRACE MERCURY ANALYSIS

Mercury is a highly toxic element, dangerous for the environment and humans even in minimum amounts. The analysis of mercury in ultra-trace amounts, especially in environmentally related samples, is demanding task and extraordinary sensitive machines are required. In the mercury lab at GLI we are working on two such instruments. Detection limits up to 0.1 ng/l of mercury can be reached.

The **AMA 254 advanced mercury analyser** is our basic instrument used for analyses of mercury contents in solid samples without need of prior sample preparation. At present, we are running two of these units. First one is used for Hg analyses in soil horizons, various biomass and general samples, while the second is used solely for readout of Hg content in wood of tree rings in projects dealing with tree ring geochemical archives.

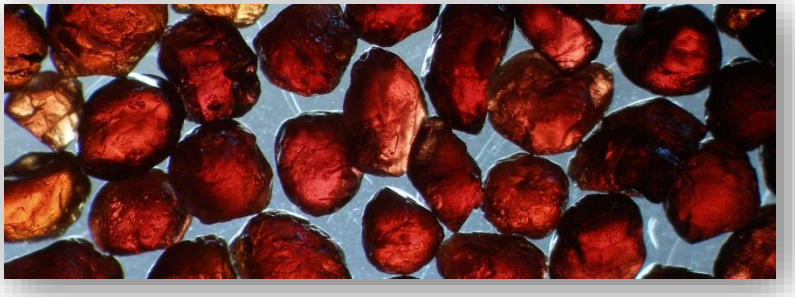
The **PS-Analyser** instrument is designed for mercury analyses in liquid samples and for speciation studies with HPLC separation.

In spite of its small size and modest appearance, this **Brooks Rand Merx system** is the most advanced instrument for mercury quantification on pg (picogram, 10^{-12} g) level. It is used also in mercury speciation analysis for determination of methylmercury, a highly poisonous mercury species formed in nature by methylation of mercury by microorganisms. Its amazing sensitivity imposes extraordinary requirements on cleanness of laboratory work in order to preserve the samples against contamination.

Lumex RA 915M is a portable spectrometer (weight about 6 kg) for field work targeted to gaseous Hg content in the atmosphere. We carry this unit through towns, industrial places, forests, meadows or even caves. It actively sucks ambient air into the instrument, where spectroscopic quantification of Hg proceeds in certain time steps. The registered values are stored in unit memory and finally transferred to PC for data workup and evaluation. In order to expand measuring abilities, the unit can be connected to a benchtop **PyroModule** (not shown on the photo) for Hg analyses in solid and liquid samples indoor.

OLYMPUS SZX 16 Optical binocular microscope with the **CANON digital photocamera** and specialized **QuickPHOTO Micro software** and a **Deep Focus module** is used for the documentation of samples, separation of sub-samples for other methods and, of course, for imaging of samples and details for publications.

OLYMPUS BX50 Optical polarizing microscope with the **DP 70 digital camera** and specialized **QuickPHOTO software** and a **Deep Focus module** is used for a detailed study of thin (for transmitted light) and polished (for reflected light) sections. Software enables documentation, image preparation and image analysis. The microscope is equipped also with a fluorescent source of different wavelengths.

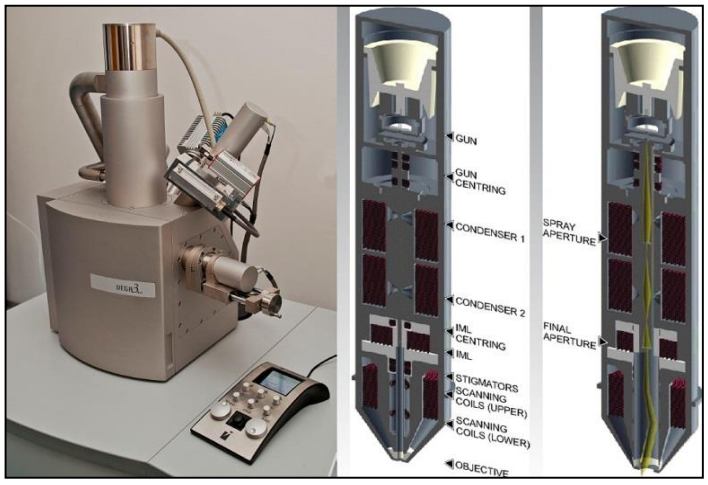


Examples of photos from the above characterized microscopes.

Most facilities of the Department of Analytical Methods are situated in the main research centre. The staff here provides a service for the needs of the other professional units, however, they also pursue their own high-quality research focused especially on the application of instrumental methods to geological sciences.



Reliable quantitative local chemical analysis and/or acquisition of element distribution maps using electron microprobe analyses and scanning electron microscopy (EPMA/SEM) require planar polished conductive surfaces. Such prerequisites are fulfilled when bulky solid samples are sectioned, polished and coated. For that purpose a suite of **cutting**, **grinding**, **lapping** and **polishing machines** to prepare polished sections or thin sections is available at this department. To make the specimens conductive for EPMA/SEM chemical analyses, a coating by carbon is used. For imaging of rough surfaces using secondary electrons in high vacuum, samples are sputtered with gold to prevent their charging. The department owns also all necessary instruments to **carbon-coat** or **gold-sputter** the specimens.



TESCAN VEGA3XMU scanning electron microscope (SEM) is an SEM of a variable pressure construction and allows observation and analysis of not only carbon-coated or gold-sputtered materials but also of uncoated specimens including biological materials. It is equipped with detectors of secondary and back-scatted electrons as well as energy-dispersive spectrometer (EDS) **Bruker QUANTAX 200**, which collects the entire spectrum allowing data acquisition typically within a minute. The spot which the analytical data are collected from may be on the order of 1 um in diameter. Element contents reliably measured with the device are as low as 0.X-X wt.%. Also available are low vacuum secondary electron (LVSTD) and color **cathodoluminescence** (CL) (detection range 350-850 nm) detectors. The source of electrons is a tungsten heated cathode. Under the optimum conditions the magnification of the SEM may reach up to 150,000× which translates to a resolution of 10 nm. The minimum magnification is 1.5× that means that objects as large as 127 mm across can be observed at once. 3D surface metrology is also possible.

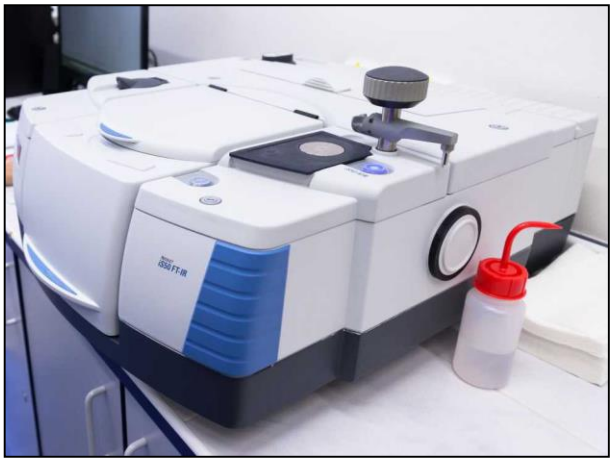
Typical application of the SEM instruments are: observation and imaging of surface characteristics of both coated and uncoated 3D specimens (various objects in paleontology, mineralogy, material science, etc.); observation and imaging of samples (polished (thin)sections) by BSE detector to reveal compositional differences; mapping of element distribution; local standard-less or standard-based chemical analyses.

JEOL JXA 8230 electron probe microanalyzer with a tungsten filament, 5 spectrometers (14 crystals), an ED spectrometer and a panchromatic CL detector is used mainly for non-destructive quantitative analysis of solid-state materials on the micrometer scale from selected spots down to a few microns across. It allows analyses of specimens for elements from B to U. Element contents can be reliably measured from planar polished surfaces down to tens of ppm. All the measurements and imaging are carried out in high vacuum. Though the probe is usually used for point chemical analyses, it occasionally serves also for imaging or collection of element distribution maps.

Bruker D-8 DISCOVER X-ray powder diffractometer is a multi-purpose powder X-ray diffraction instrument designed to study powder samples or solid polycrystalline blocks, e.g., polished (thin) sections or rock chips. It allows studying materials in either reflection or transmission (foil or capillary) geometry. The X-ray beam is generated by a metal-ceramic sealed copper tube. The optional focusing primary asymmetric monochromator of Johansson type produces spectrally pure Kα1 radiation. Diffracted radiation is collected with a 1D position-sensitive detector. In the microdiffraction setup used for bulk samples, the beam is directed on the specimen by polycapillary optics and limited with a collimator, and a sample is placed on a motorized xyz-stage.

Typical applications of the diffractometer include: crystalline phase identification, (semi-)quantitative phase analysis of mixtures, and crystal structure and microstructure analyses.

Two complementary **vibrational spectroscopy techniques** are used for phase identification and molecular structure studies. **Raman spectra** are collected with the **S&I Monovista CRS+** microspectrometer. The system is equipped with excitation lasers of 488 nm, 532 nm and 785 nm wavelengths and may attain spatial resolution down to 1 µm laterally and 2 µm axially with 100× magnifying objective. It allows collection of overview spectra within the range of 60–9300 cm^{-1} with 488 nm or 532 nm excitation and 60–3500 cm^{-1} with 785 nm excitation. Spectral resolution better than 1.0 cm^{-1} may ultimately be attained in narrower spectral windows.

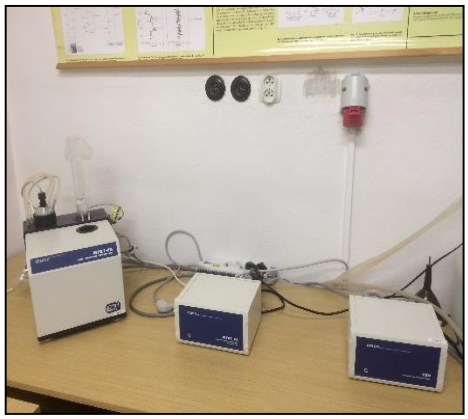


Mid-infrared spectra are acquired with the **Nicolet iS50** Fourier-transform spectrometer**.** It is equipped with a ceramic infra-red radiation source (9600 – 50 cm^{-1}) and a DLaTGS detector with KBr window. In transmission arrangement, the spectrometer covers the wavenumber range of 7800–350 cm^{-1}. Once an **attenuated total reflectance (ATR)** accessory is used, the wavenumbers covered are 4000–100 cm^{-1} depending on the used beam-splitter.

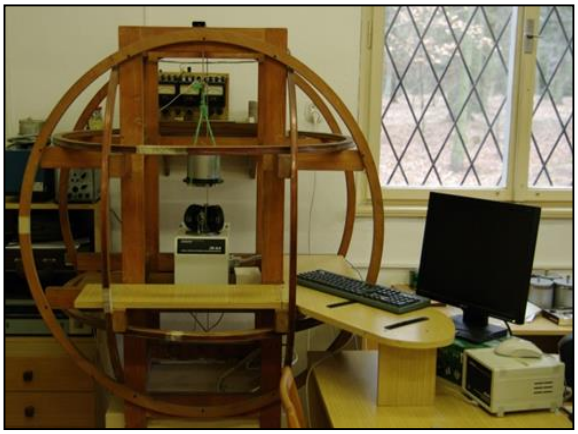
The department is situated in the magnetically quiet environment of the Průhonice Park. It was built using non-magnetic materials to guarantee strict requirements of paleomagnetic research. The team consists of highly experienced scientists and technicians with interests in paleomagnetism, magnetostratigraphy, rock and mineral magnetism, geology and planetology. The team is supported by mathematicians and programmers in order to develop new laboratory techniques. The scientific team members are involved in numerous national and international co-operations. The department is equipped with modern instruments for paleomagnetic and rock magnetic studies, the most important are listed below.

Magnetic Vacuum Control System MAVACS with triaxial **Helmholz Induction Coil System HELICOS**, **Rotating Coil Magnetometer ROCOMA** and **Induction Coil Control Unit ICCON** is a self-contained automatic system creating a limited non-magnetic space (magnetic vacuum < ± 2nT; typical offset of the magnetic field sensor < ± 0.1nT) for paleomagnetic investigations, i.e. for thermal demagnetization of the remanent magnetization is conducted in the oven situated in the center of the MAVACS system. The operation of MAVACS is based on the feedback loop principle where the Earth's magnetic field is compensated by HELICOS and continually monitored by ROCOMA. The output of the ROCOMA controls the ICCON, which supplies the HELICOS generating the compensating magnetic field.

2G 755 4K Superconducting Rock Magnetometer (SRM) with a **2G800 Automatic Sample Handler System** and **Applied Physics Systems 581 DC SQUID System** is a very sensitive (magnetic moment <10 E^{-12} Am^2), liquid helium-free measurement system for determining the intensity and direction of natural remanent magnetization and for conducting alternating field demagnetization of the remanent magnetization. The SRM measures current induced in 3 sets of superconducting pickup coils placed at the center of the rock measurement region. The system permits remanent magnetization measurement in three axes and is designed to process discrete samples with a volume of up to 10 cm^3. Data are collected and displayed using the **2G Acquisition** software.



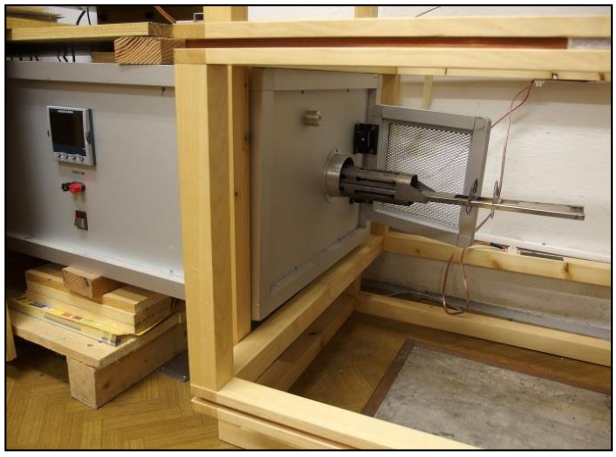
AGICO MFK1-FA Kappabridge is the most sensitive (<2 × 10^{-8} SI) laboratory instrument for measuring magnetic susceptibility and its anisotropy. In conjunction with a CS4/CSL temperature control unit it is further used for measuring temperature dependence of magnetic susceptibility over a temperature range of -192 °C to 700 °C. MFK1-FA represents a fully automatic inductivity bridge which allows high precision measurements at three different frequencies (976 Hz, 3904 Hz, 15616 Hz) and in a wide field range (2-700 A/m). The measurements are controlled by the SAFYR4W (magnetic susceptibility, anisotropy) and SUFYTE5W (temperature dependence) softwares.



AGICO JR-6A Spinner Magnetometer is a sensitive (2.4 μA/m) laboratory instrument used for measurements of remanent magnetization. JR-6A is equipped with automatic specimen holders which enable automatic measuring of all components of the remanence vector. The magnetometer offers two rotation speeds, the higher (87.7 r,p,s) enabling the maximum sensitivity and the lower (16.7 r,p,s) to measure fragile specimens, soft specimens placed in perspex container and specimens with considerable deviations in size and shape. The JR-6A is fully controlled by an external computer and data are processed with REMA6W software.

Magnetic Measurements Pulse Magnetiser MMPM10 is a high field instrument for creating isothermal remanent magnetizations. The MMPM10 is equipped with 2 coils to generate accurate, short-duration (7 ms) high magnetic field pulse: the largest coil (max. field 3T) accommodates standard paleomagnetic samples in any orientation for IRM anisotropy studies. The smaller coil is 1.25 cm in diameter and generates pulsed field up to 9T. The magnetic field pulse is generated by discharging a bank of capacitors through the coil.

Magnetic Measurement Thermal Demagnetizer MMTD80A with **Eurotherm 3204 temperature controller** is a programmable thermal demagnetizer for up to 80 paleomagnetic samples up to 750 °C. The 4-layer closed Mu-metal shield guarantees a constant field of <10 nT during heating and cooling.



AGICO LDA-5 / PAM-1 Specimen Unit is a multifunctional device for laboratory demagnetization up to 200 mT, and for a deliberate acquisition of anhysteretic magnetization or low-field isothermal magnetization of rock samples. The sample is fixed in a special 2-axis tumbler for (de)magnetization in the desired direction. Automatic positioning (18 specimen orientations) allows the determination of anisotropy of magnetic remanence. Triple mu-metal shielding eliminates local magnetic fields.

As we believe, geology will maintain its – to a certain degree – attractive position as one of the essential scientific disciplines in the coming decades. This can be expected especially due to the need of settling the growing environmental, climatic and mineral-resource problems on the Earth. Even in space science, the study of geological samples and geological processes is the first-hand experience. We are convinced that, within a period not longer than a decade, basic research in geology will have to adapt to new themes of increasing significance: carbon dioxide sequestration, understanding of the geological structure of the upper mantle with the aim of large-scale geothermal energy utilization, or a search for rock environments suitable for long-term repositories of nuclear waste. Research directed at a detailed study of climatic oscillations in the young geological past will be probably also growing as it will be necessary to understand the present climate changes on the Earth and to take appropriate measures. These are the reasons why such predictable trends will be reflected and further developed in the wide range of themes now pursued at the Institute of Geology – perhaps the most universal geoscientific institution of the Academy of Sciences of the Czech Republic.

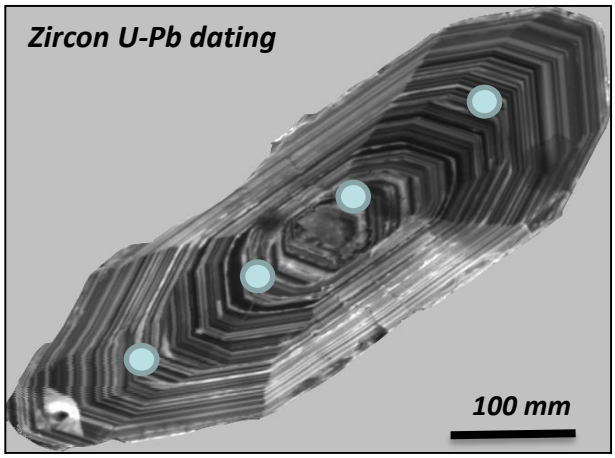
The Institute conducts research in many scientific areas provided by particular departments. This entails intensive collaboration on a variety of research topics with scientific institutions from the Czech Republic and abroad. Below we list and shortly comment/justify major scientific research areas grouped into broader thematically related and/or complementary fields on which we focus our effort. We believe they are of a high scientific importance and topicality.

- **Basic Geological Research** (Evolution of sandstone landscapes; Late Cretaceous and Cenozoic volcanism in the Bohemian Massif; Paleomagnetic and rock magnetic investigation, magnetostratigraphy; New mineral descriptions, and other research areas) guarantee the continuation in traditionally solved topics in the Institute. The results contribute to the general knowledge in geosciences and more universal and versatile research at the Institute.
- **Determination of the Chemical Composition and Evolution of the Earth's Mantle and Earth's Crust** will help to refine our knowledge of the Earth history and also to understand the composition, age and development of extraterrestrial materials/bodies.
- **Studies of Sedimentary Environments, Geomorphology and Quaternary Processes** aim at the understanding of past sedimentary events, evaluation and prediction of formation and destruction of landscapes, which has a direct connection to various natural threats including landslides, rockfalls etc.
- **Paleontological and Paleoenvironmental (Paleoclimatic) Studies** provide knowledge for paleoecological interpretations. A profound understanding of the evolution and extinctions of plant and animal communities and knowledge of paleoclimate history are critical in the context of studies focused on present climatic changes and related responses of present live organisms. Important data on climatic events are also recorded and extracted from cave sediments of various origin and location. Furthermore, paleontological evidence is the only actual proof of evolutionary processes that allow to verify hypotheses produced by various modern (often indirect or theoretical) methods.
- **Cycling and Behaviour of Hazardous Elements in Particular Spheres of the Environment** is an update topic including the whole set of geological and chemical methods. Release and migration of hazardous elements may endanger soil, sources of drinking water and consequently also sources of human food.
- **Atmospheric Transport of Solid Materials** is a relatively new scientific direction pursued at the Institute. It has, however, high impact to several areas of public sphere. Prediction of the amount, direction of transport and related consequences of atmospheric dust during natural disasters are key knowledge for the air transport safety.
- Participation of our Institute in the evaluation of the **Repository of Radioactive Waste Materials** and nuclear safety is a new direction of our applied research. This is a highly topical field of increasing importance since a large number of nuclear power plants in Europe will need a large background for the deposition of nuclear waste in a relatively near future.
- **Analytical service for research and for commercial projects** is an important source of financial income. Moreover, it provides an opportunity to extend scientific collaboration.

Our scientific ability is demonstrated via „Selected Research Topics" presented on the following pages.

Petrochronology *Information: M. Svojtka, J. Sláma*

A combination of petrology and *in situ* laser ablation U-Pb geochronology of zircons and monazites as well as *in situ* Hf analysis of zircons provides in-depth interpretations of geological processes in the past.



Facts of interest: U–Pb dating of detrital zircons and monazites to characterize provenance and paleogeography in post-collisional continental basins.

Selected outputs: 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: 319-338.

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: 63-81.

Re-Os geochronology of molybdenites

Information: L. Ackerman, L. Polák

Determination of molybdenite ages from various tectonic setting using a high-precision Re-Os method.

Facts of interest: The geochronological results provide age constraints on the ore mineralization processes as well as granite-related magmatic and hydrothermal events.

Selected outputs: **Ackerman L, Žák K, Haluzová E,** Creaser RA**, Svojtka M,** Pašava J, Veselovský F. Chronology of the Kašperské Hory orogenic gold deposit, Bohemian Massif, Czech Republic. **Mineralium Deposita.** 2019, 54: 473-484.

Veselovský F, **Ackerman L**, Pašava J, **Žák K**, **Haluzová E**, Creaser RA, 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.

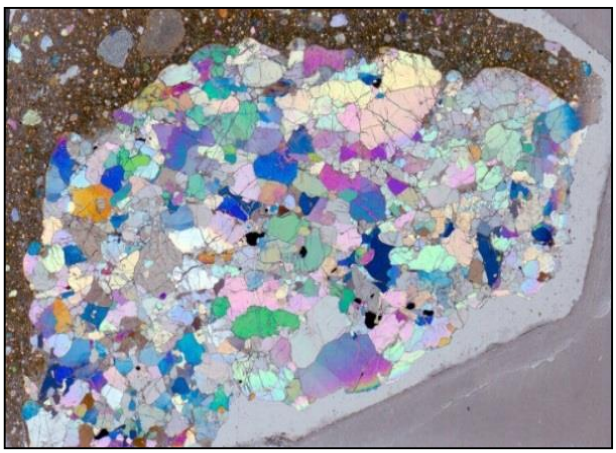
Formation and evolution of Earth´s mantle and crust *Information: L. Ackerman, K. Breiter, L. Polák*

Complex study of petrology, geochemistry and mineralogy of mantle-derived rocks including platinum-group element geochemistry and radiogenic (Sr-Nd-Pb-Hf-Os) as well as stable (Mo-C-O) isotope geochemistry.

Facts of interest: Deciphering the nature of carbonatitic melts with implications to critical metals accumulation.

Selected outputs: **Ackerman L**, **Polák L**, Magna T, Rapprich V, **Ďurišová J**, Upadhyay D. Highly siderophile element geochemistry and Re–Os isotopic systematics of carbonatites: insights from Tamil Nadu, India. **Earth and Science Planetary Letters.** 2019, 520: 175-187.

Breiter K, **Ďurišová J**, **Hrstka T**, **Korbelová Z**, Vašinová Galiová M, Müller A, Simons B, Shail RK, Williamson BJ, Davies JA. 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.



Interactions between volcanism and tectonic deformation in collapsing orogens

Information: F. Tomek, J. Černý

A multidisciplinary research focuses on the mechanical processes driving the emplacement of volcanic and plutonic rocks in active continental margin orogens and during orogenic collapse. Main focus is on the application of various rock-magnetic methods, U-Pb zircon geochronology and conventional petrography of felsic volcanic, hypabyssal and plutonic rocks. The research resulted also in methodological applications of anisotropy of magnetic susceptibility (AMS) and involvement of analogue modelling.

Facts of interest: Columnar cooling joints in a subsurface circular pipe vent of an extensive rhyolite dyke swarm that fed a major caldera-forming eruption of the Altenberg-Teplice Caldera at ca. 314 Ma.

Selected outputs: **Tomek F**, Opluštil S, **Svojtka M**, Špillar V, Rapprich V, Míková J. Altenberg–Teplice Caldera sourced Westphalian fall tuffs in the central and western Bohemian Carboniferous basins (eastern Variscan belt). **International Geology Review.** In press, 2021.

Černý J, Melichar R, Všianský D, Drahokoupil J. Magnetic anisotropy of rocks: a new classification of inverse magnetic fabrics to help geological Interpretations. **Journal of Geophysical Research: Solid Earth**. 2020, 125: Article No. e2020JB020426**.**

Research related to magma transfer and tectonics

Information: J. Ulrych, J. Adamovič, L. Ackerman, F. Tomek, L. Krmíček, J. Sláma

Long-term research of rift-related magmatism presenting and discussing new ideas concerning igneous rocks, their petrogenesis and the acting paleostress.

Facts of interest: Interactions between volcanism and tectonic deformation in continental-margin arcs and Late Cretaceous and Cenozoic dynamics of the Bohemian Massif were studied in detail.

Selected outputs: **Tomek F**, Žák J, Verner K, Holub FV, **Sláma J**, Paterson SR, Memeti V. Mineral fabrics in high-level intrusions recording crustal strain and volcano-tectonic interactions: The Shellenbarger pluton, Sierra Nevada, California. **Journal of the Geological Society 2017**, 174: 193-208.

Krmíček L, Romer RL, **Ulrych J**, Glodny J, Prelevic D. Petrogenesis of orogenic lamproites of the Bohemian Massif: Sr-Nd-Pb-Li isotope constraints for Variscan enrichment of ultra-depleted mantle domains. **Gondwana Research 2016**, 35: 198-216.

Granites as a potential source of critical raw materials

Information: K. Breiter

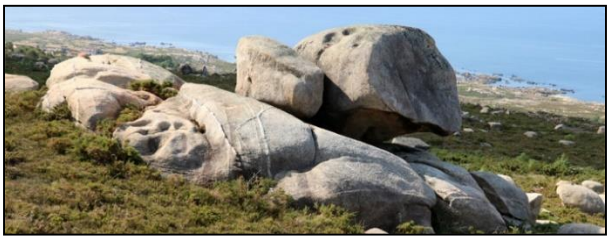
Granites potentially represent the most promising source of lithium and some other high-tech elements (Ta, W, Rb and Sc) within the European Community. In order to assess the metallogenic perspective of particular granite plutons, systematic investigation of petrological/geochemical aspects of the evolution of granites across the European Variscan belt is going on in close cooperation with experts from several countries. Special emphasis is placed on study of quartz and mica as indicators of potential fertility of granitic magmas.


zinnwaldite, Cínovec/Zinnwald

Facts of interest: Based on the globally unique 1.6 km deep section through the Cínovec Li-Sn-W deposit, a new model of vertical evolution of rare-metal granite plutons was developed.

Selected outputs: **Breiter K**, **Ďurišová J**, **Hrstka T**, Korbelová Z, Vaňková-Hložková M, Galiová-Vašinová M, Kanický V, Rambousek P, Knésl I, Dobeš P, Dosbaba M. Assessment of magmatic vs. metasomatic processes in rare-metal granites: A case study of the Cínovec/Zinnwald Sn–W–Li deposit, Central Europe. **Lithos,** 2017, 292-293, 198-217.

Breiter K, Hložková M, ***Korbelová Z***, Vašinová Galiová M. Diversity of lithium mica compositions in mineralized granite-greisen system: Cínovec Li-Sn-W deposit, Erzgebirge. **Ore Geology Reviews.** 2019, 106: 12–27.



Oxygenation of Earth's atmosphere and oceans in the past

Information: L. Ackerman, M. Svojtka

The study extends our understanding of the amounts of free O_2 in the Earth's atmosphere and oceans from the Archean to present, as well as ocean metals cycling.

Facts of interest: Application of non-traditional stable isotope redox proxies (Mo, Fe, Cu, Zn) to sedimentary archives.

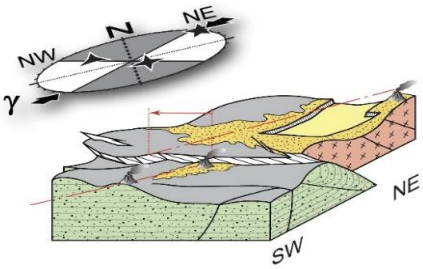
Selected outputs: Cabral AR, Zeh A, Vianna NC, **Ackerman L,** Pašava J, Lehmann B, Chrastný V. Molybdenum-isotope signals and cerium anomalies in Palaeoproterozoic manganese ore survive high-grade metamorphism. **Scientific Reports.** 2019, 9: 4570.

Ackerman L, Pašava J, Šípková A, Martínková E, **Haluzová E**, Rodovská Z, Chrastný V. Copper, zinc, chromium and Os isotopic compositions of the Teplá-Barrandian unit black shales and implications for the composition and oxygenation of the Neoproterozoic-Cambrian ocean. **Chemical Geology.** 2019, 521: 59-75.

Late Cretaceous and Cenozoic dynamics of the Alpine foreland in Europe

Information: M. Coubal, J. Adamovič, M. Šťastný

Detailed 3D mapping of significant tectonic structures of post-Variscan Europe combined with paleostress analysis and radiometric dating are used to refine the paleostress history of Europe in the latest Cretaceous and Cenozoic.



Facts of interest: A robust dataset from one of the most prominent tectonic structures of Alpine Europe allowed an exceptionally detailed identification of paleostress patterns effective in the Alpine–Carpathian foreland. Their parameters were characterized and their kinematic effects were explained within the as yet most precise time frame.

Selected outputs: **Coubal M**, **Adamovič J**, **Šťastný M**, eds. Lužický zlom – hranice mezi dvěma světy. – Novela Bohemica, 2018, 272 p. Praha.

Coubal M, Málek J, **Adamovič J**, Štěpančíková P. Late Cretaceous and Cenozoic dynamics of the Bohemian Massif inferred from the paleostress history of the Lusatian Fault Belt. **Journal of Geodynamics.** 2015, 87: 26-49.

Refining the Lower Paleozoic stratigraphy: cyclicity and paleoclimates

Information: J. Hladil, L. Chadimová, H. Weinerová

The topic involves modern approaches (magnetic susceptibility, gamma-ray logging in combination with dynamic time warping) to the Silurian and Devonian stratigraphic record worldwide to understand the timing of geological units, sequence stratigraphy, diagenetic processes, paleoenvironmental and paleoecological changes in different settings. The results contributed to IGCP projects 596 and 652.

Facts of interest: Paleonvironmental changes were characterized for major events: the Lau Event in Silurian carbonate successions of the Barrandian area and the Hangenberg Event in the Devonian/Carboniferous boundary beds in Central Asian Orogenic Belt. The research revealed Milankovitch and sub-Milankovitch cyclicity in the Lower and Middle Devonian in the Barrandian area and provided a much finer stratigraphic subdivision.

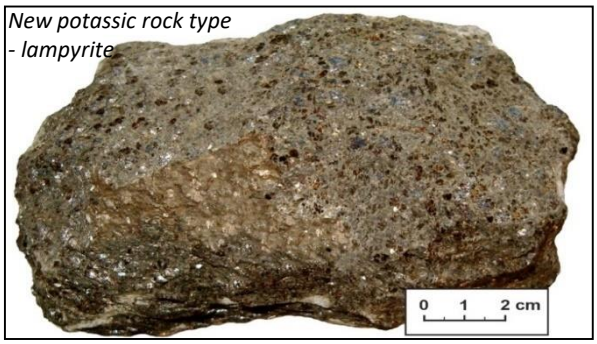
Selected outputs: da Silva AC, **Hladil J**, **Chadimová L**, Slavík L, Hilgen FJ, Bábek O, Dekkers MJ. Refining the Early Devonian time scale using Milankovitch cyclicity in Lochkovian–Pragian sediments (Prague Synform, Czech Republic). **Earth and Planetary Science Letters**. 2016, 455: 125-139.

Weinerová H, Hron K, Bábek O, Šimíček D, **Hladil J.** Quantitative allochem compositional analysis of Lochkovian-Pragian boundary sections in the Prague Basin (Czech Republic). **Sedimentary Geology**. 2017, 354: 43-59.

Deciphering connection between potassic volcanic rocks and plate tectonics

Information: L. Krmíček, J. Ulrych, S. Krmíčková

Long-term research of (ultra)potassic volcanic rocks, presenting and discussing new ideas concerning their petrogenesis and ralation to the plate tectonics.



Facts of interest: Interactions between potassic magmatism and tectonic developement in the Variscan orogenic belt and Late Cretaceous and Cenozoic dynamics of the Bohemian Massif were studied in detail.

Selected outputs: **Krmíček L**, Romer RL, Timmerman MJ, **Ulrych J**, Glodny J, Přichystal, A, Sudo M. Long-lasting (65 Ma) regionally contrasting late-to post-orogenic Variscan mantle-derived potassic magmatism in the Bohemian Massif. **Journal of Petrology.** 2020, 61: egaa072.

Krmíčková S, Krmíček L, Romer RL, **Ulrych J.** Lead isotope evolution of the Central European upper mantle: Constraints from the Bohemian Massif. **Geoscience Frontiers.** 2020, 11: 925-942.

Geochemical record in rocks from polar and sub-polar regions

Information: L. Krmíček

Polar regions represent a unique environment for the study of geochemical cycling and processes related to mechanical weathering. The studied Hg contents in volcanic rocks from Antarctica, Greenland and Iceland show that the input of Hg of geological origin into the polar ecosystem is significantly lower than expected.

Facts of interest: Research in Antarctica was conducted close to the Czech Polar Mendel base.

Selected output: Vašinka M, **Krmíček L**, Všianský D, Hrbáček F, Nývlt D. Chemical weathering in Antarctica: an example of igneous rock particles in Big Lachman Lake sediments, James Ross Island. **Environmental Earth Sciences.** 2020, 79: 186.

Development of new analytical techniques for the mining industry and environment

Information: T. Hrstka

This research is focused on a better understanding of individual constituents of the deposited dust and their potential effects related to human health and the environment. The development of new analytical techniques provides unique tools for understanding the source and characteristics of air contaminants and also related soil pollution.

Facts of interest: Similarity analysis methodology and the "DUST" software package using neural networks for supervised and unsupervised clustering of spectral data are being developed for primary research and applied science.

Selected output: Tuhý M, **Hrstka T**, Ettler V. Automated mineralogy for quantification and partitioning of metal(loid)s in particulates from mining/smelting-polluted soils **Environmental Pollution**. 2020, 266: 115118.

Geoarchaeology

Information: L. Lisá, V. Cílek

The complex evaluation of sedimentary and pedological record using methods of geoarchaeology (including micromorphology in archaeological context) may provide key information on human environment, past climates, but also for example on maintenance practices used in history and prehistory.

Facts of interest: Reconstruction of Upper Pleistocene paleoenvironment in Central Europe was presented.

Selected output: Hošek J, Hambach U, **Lisá L**, Grygar TM, Horáček I, Meszner S, Knésl I. An integrated rock-magnetic and geochemical approach to loess/paleosol sequences from Bohemia and Moravia (Czech Republic): Implications for the Upper Pleistocene paleoenvironment in central Europe. **Palaeogeography, Palaeoclimatology, Palaeoecology.** 2015, 418: 344-358.

Impact glasses *Information: R. Skála, K. Žák*

Tektites from Australasian and Central European fields and proximal impact glasses of the Ries and Zhamanshin Impact Structures are studied in detail. The research includes the study of origin of tektite bodies by in-flight agglomeration of small melt particles. and possible projectile type estimation.

Facts of interest: Chemical composition of tektite-like glasses found around and in the crater of Zhamanshin in Kazakhstan allowed the identification of projectile as carbonaceous chondrite.

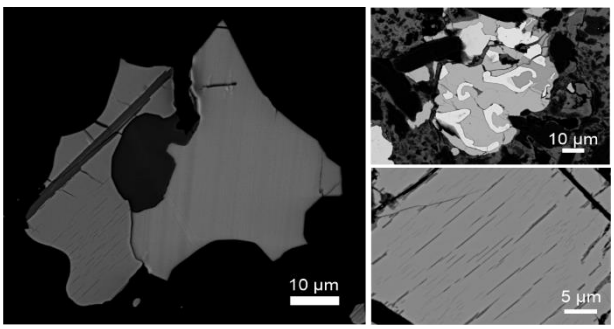
Selected outputs: **Jonášová Š**, **Ackerman L**, **Žák K**, **Skála R**, **Ďurišová J**, Deutsch A, Magna T. Geochemistry of impact glasses and target rocks from the Zhamanshin impact structure, Kazakhstan: Implications for mixing of target and impactor matter. **Geochimica et Cosmochimica Acta.** 2016, 190: 239-264.

Magna T, **Žák K**, Pack A, Moynier F, Mougel B, Peters S, **Skála R, Jonášová Š**, Mizera J, Řanda Z. Zhamanshin astrobleme provides evidence for carbonaceous chondrite and post-impact exchange between ejecta and Earth's atmosphere. **Nature Communications.** 2017, 8: 227.

Mineralogy of enstatite-rich meteorites

Information: N. Mészárosová, R. Skála

Meteorites present one of the oldest materials in the Solar system. Enstatite-rich meteorites were formed under highly reducing conditions, which is reflected in their mineralogy. Investigation of their unusual mineralogy is mainly focused on Cr-Ti-bearing troilites which might record processes of formation and alteration of the solar nebula and their parent bodies.

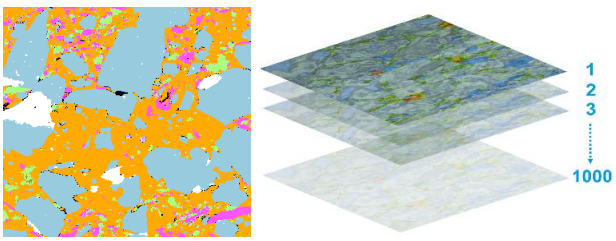


Facts of interest: During the study of Cr-Ti-bearing troilites, an enigmatic Zn-rich FeS phase was found and further investigated in more detail.

Selected outputs: **Mészárosová N, Skála R.** Zinc-bearing iron-dominant member of (Fe,Zn,Mn)S solid solution from Eagle enstatite chondrite. **Meteoritics & Planetary Science.** 2019, 54(s2). ISSN 1086-9379.

Uranium mineralization in the Czech Cretaceous Basin *Information: P. Mikysek*

Uranium ores of sandstone-hosted type situated within the Stráž Block ore district are characterized by remarkable elemental as well as mineral associations. Colloidal to meta-colloidal uranium minerals and mineral components of the ore-bearing assemblage are studied to understand the mineralization processes.

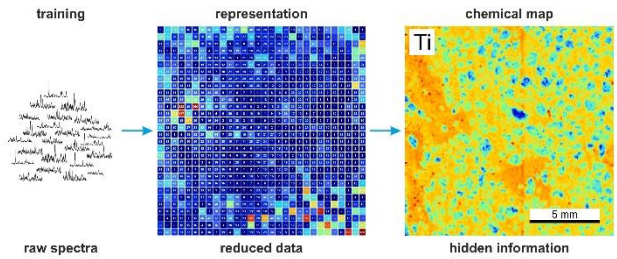


Facts of interest: U-Zr-P-Ti mineralization hosted by Cretaceous sediments of northern Bohemia is marked by several specific and unique features with no direct equivalent hitherto reported from any other country elsewhere in the World.

Selected outputs: **Mikysek P**, Trojek T, **Mészárosová N**, **Adamovič J**, Slobodník M. X-ray fluorescence mapping as a first-hand tool in disseminated ore assessment: sandstone-hosted U–Zr mineralization. **Minerals Engineering**. 2019, 141: 105840.

Multivariate and multidimensional processing of spectral data *Information: P. Mikysek*

High-resolution analysis of heterogeneous material, where valuable information is hidden in a limited fraction of sample mass, requires special treatment. A series of mathematical operations is used for dimensionality reduction or selection of important spectral features. This approach reveals new possibilities in the visualization of chemical information.



Facts of interest: Approaches widely applicable to elemental and mineral characteristics of low-grade mineralizations.

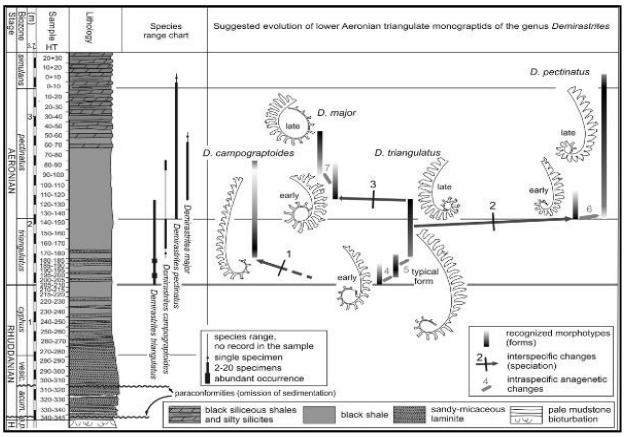
Selected outputs: Klus J, **Mikysek** P, Procházka D, Pořízka P, Procházková P, Novotný J, Trojek T, Novotný K, Slobodník M, Kaiser J. Multivariate approach to the chemical mapping of uranium in sandstone-hosted uranium ores analyzed using double pulse Laser-Induced Breakdown Spectroscopy. **Spectrochimica Acta Part B: Atomic Spectroscopy**. 2016, 123, 143-149.

Klus J, Pořízka P, Procházka D, **Mikysek** P, Novotný J, Novotný K, Slobodník M, Kaiser J. Application of self-organizing maps to the study of U-Zr-Ti-Nb distribution in sandstone-hosted uranium ores. **Spectrochimica Acta Part B: Atomic Spectroscopy**. 2017, 131: 66-73.

Paleozoic biostratigraphy and paleoenvironment

Information: L. Slavík, P. Štorch

The topic includes: i) faunal dynamics, evolution and paleobiogeography of Silurian and Upper Ordovician graptolites; ii) study of potential replacement stratotypes of selected Silurian and Devonian stages; iii) refinement of conodont biozonations in the Silurian and Devonian, global correlation, iv) studies on Devonian paleoenvironment in key peri-Gondwanan areas.



Facts of interest: A proposal of a new global stratotype for Aeronian Stage of the Silurian System was submitted. High-resolution biostratigraphic and petrophysical correlation applied to mid-Paleozoic rocks helped in the assessment of eustatic and climatic changes in the Early Devonian.

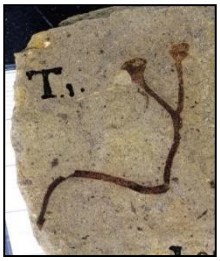
Selected outputs: **Štorch P**, Manda Š, Tasáryová Z, Frýda J, **Chadimová L**, Melchin MJ. A proposed new global stratotype for Aeronian Stage of the Silurian System: Hlásná Třebaň section, Czech Republic. **Lethaia.** 2018, 51: 357-388.

Slavík L, Valenzuela-Ríos JI, **Hladil J, Chadimová L**, Liao J-Ch, **Hušková A,** Calvo H, **Hrstka T.** Warming or cooling in the Pragian? Sedimentary record and petrophysical logs across the Lochkovian-Pragian boundary in the Spanish Central Pyrenees. Palaeogeography, Palaeoclimatology, Palaeoecology. 2016, 449: 300-321.

Paleosoic-Cenozoic plans and palynology

Information: J. Bek, J. Frojdová, J. Dašková

The topic includes the earliest land plants, plant diversity, and the first reconstruction of Carboniferous tropical forests based on palaeobotanical and palynological research; it also includes research on reproductive structures of Cretaceous plants and migration and diversification of flora of Early Paleogene "greenhouse" interval.



Facts of interest: The oldest vascular land plants in the global scope. First direct evidence about colonization of land by vascular plants (432 Ma).

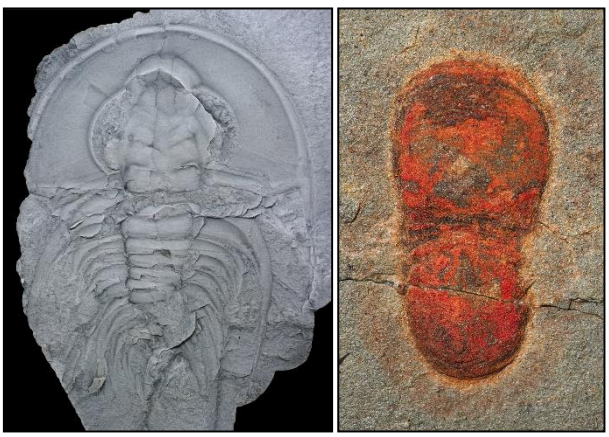
Selected outputs: **Libertín M**, Kvaček J, **Bek J,** Žárský V, **Štorch P.** Sporophytes of polysporangiate land plants from the early Silurian period may have been photosynthetically autonomous. **Nature Plants**. 2018, 180: 269-271.

Frojdová J, Pšenička J, **Bek J**, Cleal J-C. Revision of the Pennsylvanian fern Boweria Kidston and the establishment of the new genus Kidstoniopteris, **Review of Palaeobotany and Palynology,** 2017, 236: 33-58.

Morphology, evolution and development of Paleozoic arthropods

Information: L. Laibl

The topic includes research on various aspects of Cambrian to Carboniferous arthropods, with special emphasis on morphology, development, ecology, evolution and paleobiogeography of trilobites.



Facts of interest: Revealing the ancestral morphology of early developmental trilobite stages and its subsequent modifications. Description of a new arthropod, named *Taricooia tazagurtensis*, from the Ordovician strata of Morocco.

Selected outputs: **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: 1018-1027.

The study of trace fossils *Information: R. Mikuláš*

Useful research helping to asses whether the Holocene floods affected healthy or dead forests, also investigating the occurrence of dinosaurs in the Middle Triassic of the Bohemian Massif, or studying Cambrian and Ordovician invertebrates and their trace fossils.

Facts of interest: During the research, a dinosaur track and a fossil bird nest were found in the Czech Republic. Both topics are very popular among the journalists.

Selected output: **Mikuláš R**, Fatka O. Ichnogenus *Astropolichnus* in the Middle Cambrian of the Barrandian area, Czech Republic. **Ichnos**. 2017, 24: 283-290.

Past global geological events, climate changes and biotic crises *Information: P. Štorch, L. Slavík*

Complex geological research of changes and extinctions of biota during the geological past is trying to find causal connections and subsequent response of ecosystems.

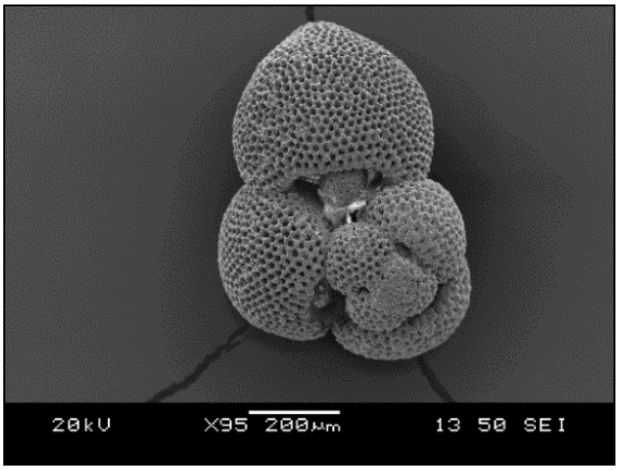
Facts of interest: Reconstructions of past biotic extinction events help to presume impacts and reactions of modern ecosystems under actual catastrophic conditions (e.g., climate change).

Selected outputs: **Štorch P**, Bernal JR, Gutiérrez-Marco JC. A graptolite-rich Ordovician-Silurian boundary section in the south-central Pyrenees, Spain: stratigraphical and palaeobiogeographical significance. **Geological Magazine.** 2019, 156, 6: 1069-1091.

Valenzuela-Ríos JI, **Slavík L**, Liao J-Ch, Calvo H, **Hušková A, Chadimová L.** The middle and upper Lochkovian (Lower Devonian) conodont successions in key peri-Gondwana localities (Spanish Central Pyrenees and Prague Synform) and their relevance for global correlations. **Terra Nova.** 2015, 27, 6: 409-415**.**

Microfossils as invaluable paleontological paleoecological and paleoceanographical indicators *Information: F. Scheiner, H. Weinerová, T. Weiner*

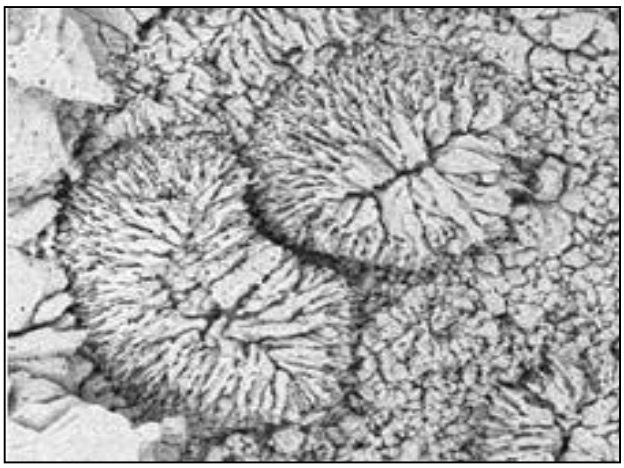
Reconstructions of paleo-circulation patterns and paleoceanographical settings including applications of various geochemical proxies in fossil environments. It also covers a study of biotic events: microfacies, biostratigraphy and changes in shallow-water biota.



Facts of interest: A description of water masses and paleocirculation regimes in the Paratethyan-Mediterranean marine realm during the Mid Miocene. Discussion of various microfossils from the Moravian Karst in the context of the Late Devonian Kellwasser Crisis.

Selected outputs: **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.

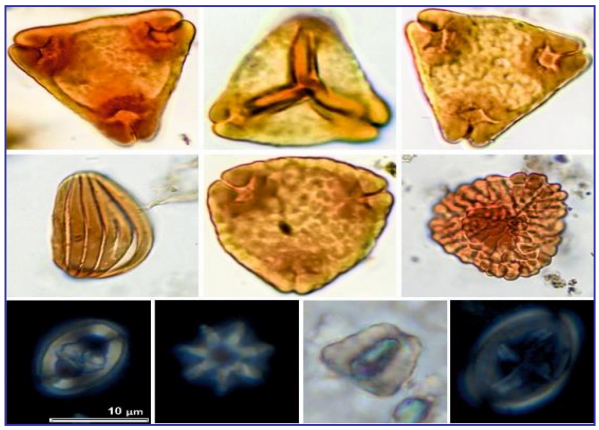
Weiner T, **Weinerová H**, Kalvoda J. Microproblematica, calcareous algae, and microbialites at the Frasnian-Famennian boundary interval in the Šumbera section (Moravian Karst, Czech Republic) and their significance in the context of the Kellwasser Crisis. **Facies**. 2018, 64: 26, 1-21.



Fossil marine nannoplankton – an important tool for dating sedimentary rocks

Information: A. Svobodová

Calcareous microscopic remnants of marine algae and palynomorphs provide useful biostratigraphic and paleoecologic data for the global correlation of Mesozoic and Cenozoic sedimentary rocks.



Facts of interest: Paleoecological and proxy paleoclimatic data spanning the Late Cretaceous have been reconstructed based on palynology and fossil plant morphology.

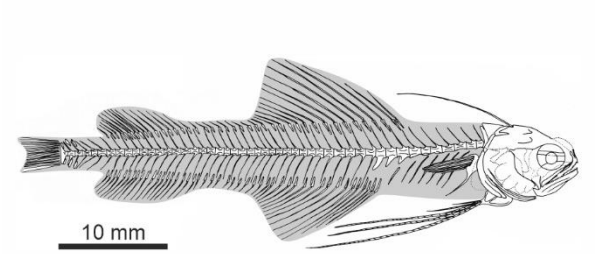
Selected outputs: Kvaček J, Halamski AT, **Svobodová M**, Durska E. Coniacian flora of the Sudetes (south-western Poland): Palaeoecological andinterpretativní palaeoclimatic interpretations. **Palaeogeography, Palaeoclimatology, Palaeoecology**. 2015, 436/15: 178-187.

Svobodová A, Švábenická L, Reháková D, **Svobodová M**, Skupien P, Elbra T, Schnabl P. The Jurassic/Cretaceous boundary and high resolution biostratigraphy of the pelagic sequences of the Kurovice section (Outer Western Carpathians, the norhern Tethyan margin. **Geologica Carpathica**. 2019, 70/2: 153-182.

Vertebrate paleobiology – 'lower vertebrate' studies

Information: T. Přikryl

The topic deals with a description of new taxa, their role in complex assemblage, study of evolution of selected Amphibia (especially Anura), Oligocene and Miocene marine ichthyofauna of the Paratethys and their relationship to extinct and extant relatives, or with freshwater European representatives of Teleostei from various stratigraphic levels.



Facts of interest: A complex revision and overview of fossil codlets (Bregmacerotidae), with anatomical and stratigraphic notes was carried out and presented.

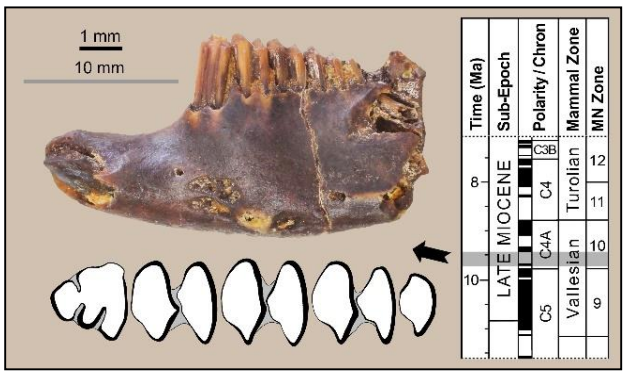
Selected outputs: **Přikryl T,** Brzobohatý R, Gregorová R. Diversity and distribution of fossil codlets (Teleostei, Gadiformes, Bregmacerotidae): review and commentary. **Palaeobiodiversity and Palaeoenvironments**. 2016, 96, 1: 13-39.

Roček Z, Boistel R, Lenoir N, Mazurier A, Pierce SE, Rage J-C, Smirnov SV, Schwermann AH, Valentin X, Venczel M, Wuttke M, Zikmund T. Frontoparietal bone in extinct Palaeobatrachidae (Anura): Its variation and taxonomic value. **Anatomical record**. 2015, 298, 1: 1848-1863.

Vertebrate paleobiology – mammal studies

Information: S. Čermák, J. Wagner

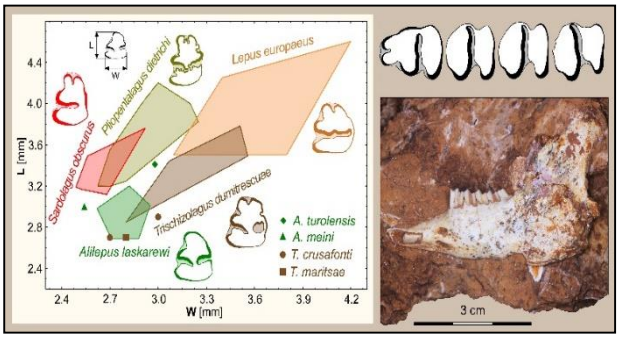
Intercontinental relationships of selected taxa and their dispersals within Eurasia are studied together with phenotypic changes in the framework of global paleoenvironmental events.



Facts of interest: Re-description of the earliest and least understood pika (*Ochotona*) brings a new view on the earliest evolution and dispersal of ochotonines in Eurasia. Ancient insular rabbit from Sardinia, described as the new genus *Sardolagus*, revealed a surprising tooth morphology indicating yet unknown evolutionary changes in leporid teeth.

Selected outputs: **Čermák S.** The Late Miocene species Ochotona kalfense (Mammalia, Lagomorpha) of Moldova: The oldest European record of the genus in the context of the earliest Ochotoninae. **Comptes Rendus Palevol.** 2016, 15: 927-940.

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: 506-522.



Environmental contamination with risk elements with a special focus on Mercury

Information: T. Navrátil, J. Rohovec, T. Nováková

Cycling of mercury (Hg) in the terrestrial environment – forest ecosystems, abandoned mining sites, active Hg emission sources and study of geochemical archives (tree rings, lake sediments, oxbow lake sediments: tracing past levels of atmospheric pollution in central Europe – Czech Republic, Slovakia, Germany

Facts of interest: The pioneering study of Hg in tree rings as an indicator of atmospheric pollution, pointing to possible issues with a radial shift of Hg; the first worldwide study denoting tree rings of European Larch as a reliable archive of air Hg pollution.

Selected outputs: **Navrátil T**, **Šimeček M**, Shanley JB, **Rohovec J, Hojdová M,** Houška J. The history of mercury pollution near the Spolana chlor-alkali plant (Neratovice, Czech Republic) as recorded by Scots pine tree rings and other bioindicators. **Science of the Total Environment.** 2017, 586: 1182-1192.

Navrátil T, Nováková T, Shanley JB, **Rohovec J, Matoušková Š, Vaňková M,** Norton SA. Larch tree rings as a tool to reconstruct 20th century central European atmospheric mercury trends. **Environmental Science & Technology.** 2018, 52: 11060-11068.

Environmental dynamics of elements

Information: T. Navrátil, J. Rohovec, T. Nováková

Several topics are solved: i) monitoring deposition pathways of risk and essential elements; ii) participation in the GEOMON network of catchments by Czech Geol. Survey, including the Lesní potok catchment (25-years geochemical and hydrology monitoring); iii) floodplain contamination by risk elements, transport of contaminants towards the aquatic environment.

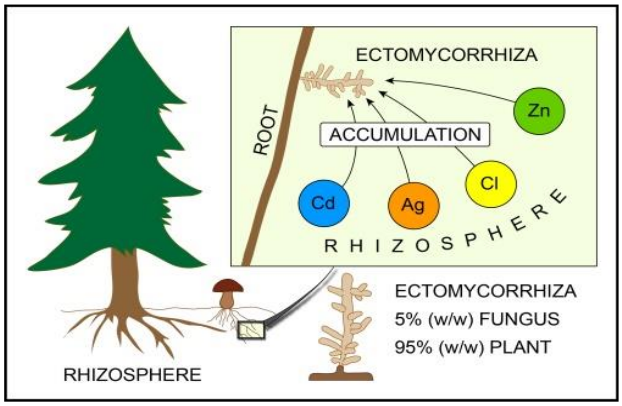
Facts of interest: A methodical paper was published giving support to scientists dealing with sample preparation prior to Hg analysis.

Selected output: Kotková K, **Nováková T**, Tůmová Š, Kisse T, Popelka J, Faměra M. Migration of risk elements within the floodplain of the Litavka River, the Czech Republic. **Geomorphology**, 2019, 15: 46-57.

Geomycology and hyperaccumulation of metals in mushrooms

Information: J. Borovička

A detailed research connects the geological and biological approaches in order to study interactions of macrofungi and the geological bedrock, particularly the phenomenon of metal (hyper-)accumulation in mushrooms and ectomycorrhizae.



Facts of interest: The first study of trace element accumulation in ectomycorrhizae determined by DNA sequencing; quantification of fungal biomass in ectomycorrhizal tips. Unique multielement speciation analysis (As, Cd, Cu, and Zn) of Cd-hyperaccumulating mushroom, a comparison between clean and polluted sites was provided.

Selected outputs: Cejpková J, Gryndler M, Hršelová H, Kotrba P, Řanda Z, Synková I, **Borovička J.** Bioaccumulation of heavy metals, metalloids, and chlorine in ectomycorrhizae from smelter-polluted area. **Environmental Pollution.** 2016, 218: 176-185.

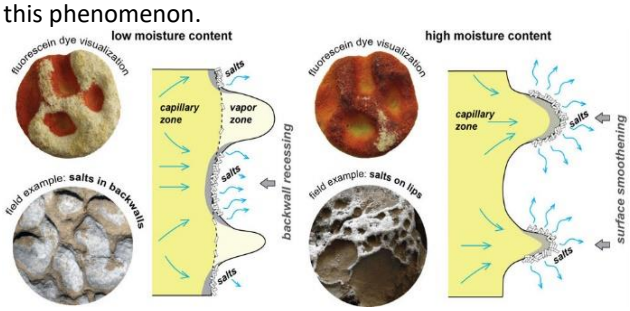
Borovička J, Braeuer S, Sácký J, Kameník J, Goessler W, Trubač J, Strnad L, **Rohovec J**, Leonhardt T, Kotrba P. Speciation analysis of elements accumulated in Cystoderma carcharias from clean and smelter-polluted sites. **Science of the Total Environment.** 2019, 648: 1570-1581.

The origin, development and degradation of sandstone landscapes and landforms

Information: M. Filippi, J. Adamovič, R. Mikuláš

Detailed long-term research of sandstone landforms (rock cities, towers, shelters, balanced rocks, honeycomb and tafone forms, etc.) includes a wide variety of complementary methods with the purpose to explain the origin and evolution of these landforms.

Facts of interest: A new weathering form (arcades) occurring in granular rocks around the world was introduced and its origin was explained. A significant contribution to understanding the origin of honeycombs; revealing the hydraulic field and the evaporation front as the main controlling factors for this phenomenon.



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

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.

Geological research in karst areas

Information: M. Filippi, K. Žák, P. Bosák

Complex research is aimed at documentation and understanding of processes in karst areas of various rocks (limestone, salt) and in non-karst caves in granite, sandstone, etc.

Facts of interest: Caves over the world were studied: the World's longest salt cave in Iran, the Africa's longest granite cave in Eswatini or gigantic caves in China.

Selected outputs: **Filippi M**, Bruthans J, **Skála R, Mészárosová N.** Speleothems of the granite Gobholo Cave in Eswatini. **Journal of African Earth Sciences**. 2020, 175: 103986.

Bruthans J, Kamas J, **Filippi M,** Zare M, Mayo AL. Hydrology and chemical/isotopic composition of salt karst waters under different cap soils and climate (Persian Gulf and Zagros Mts., Iran). **International Journal of Speleology**. 2017, 46: 303-320.

Cryogenic cave carbonates (CCC)

Information: K. Žák

Carbonates formed in caves during water freezing have been studied at GLI since 2004. These studies resulted in a discovery and explanation of a specific sub-type of CCC, formed in relation to permafrost. This discovery opened a new sub-field within the paleoclimatic study of speleothems, which was later joined by several institutions across the World.

Facts of interest: The leading position of GLI in these studies was reflected in the authorship of a review chapter on cryogenic cave minerals included in the book Ice Caves, which was published by Elsevier in 2018.

Selected output: **Žák K,** Onac BP, Kadebskaja OI, **Filippi M**, Dublyansky Y, Luetscher M. Cryogenic mineral formation in caves. **Ice Caves**. 2018, Book chapter, Elsevier. 123-162.

Paleomagnetic research of marine and terrestrial sequences and extraterrestrial bodies

Information: P. Bosák, P. Pruner, T. Elbra, P. Schnabl

The multi-proxy research deals with the following topics: principal stratigraphic Jurassic–Cretaceous and Cretaceous–Paleogene boundaries, compositional changes of Neogene and Quaternary limnic and karst sediments, reconstruction of tectonic history in karst and mountaneous areas, and meteoritic materials. The research involves paleomagnetism, magneto-stratigraphy, rock magnetism combined with geochemistry, isotopic composition of rocks and faunas, mineralogy and paleontology, numerical datings, cyclostratigraphy, etc. It also deals with the identification of primary magnetization, block rotations, paleopole positions, and sedimentation rates.

Facts of interest: Paleomagnetism is the best method for correlation of specific horizons between tropical and boreal environments.

Selected outputs: **Elbra T**, **Schnabl P**, **Čížková K**, **Pruner P**, **Kdýr Š**, Grabowski J, Reháková D, **Svobodová A**, Frau C, Wimbledon WAP. Palaeo- and rock-magnetic investigations across Jurassic-Cretaceous boundary at St Bertrand's Spring, Drôme, France: applications to magnetostratigraphy. **Studia Geophysica et Geodaetica**. 2018, 62: 323-338.

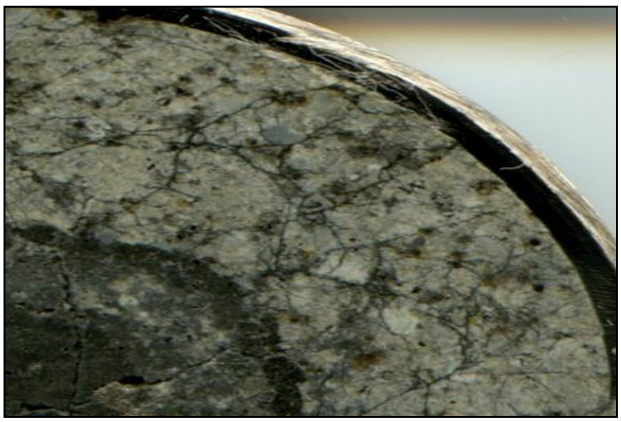
Elbra T, Bubík M, Rehaková D, **Schnabl P**, **Čížková K**, **Pruner P**, **Kdýr Š**, **Svobodová A**, **Švábenická L.** Magneto- and biostratigraphy across the Jurassic-Cretaceous boundary in the Kurovice section, Western Carpathians, Czech Republic. **Cretaceous Research**. 2018, 89: 211-223.

Bella P**, Bosák P,** Braucher R, **Pruner P,** Hercman H, Minár J, Veselský J, Holec J, Léanni L.: Multi-level Domica–Baradla cave system (Slovakia, Hungary): Middle Pliocene–Pleistocene evolution and implications for the denudation chronology of the Western Carpathians. **Geomorphology**. 2019, 327: 62-79.

Laboratory investigations and simulations of extraterrestrial materials

Information: T. Kohout

The research focuses on several topics, such as magnetic and optical properties of meteoritic materials; space weathering, shock darkening in ordinary chondrites; and magnetic minerals and anomalies on Mars.



Facts of interest: Asteroid 1986 RF3 was named "14351 Tomaskohout" in recognition of Tomas Kohout's research work. The Chelyabinsk meteorite was collected and studied within this topic.

Selected outputs: Petrova EV, Grokhovsky VI, **Kohout T**, Muftakhetdinova RF, Yakovlev GA. Shock-Wave Experiment with the Chelyabinsk LL5 Meteorite: Experimental Parameters and the Texture of the Shock Affected Material. **Geochemistry International**. 2019, 57: 923-930.

Determination of migration parametres of rocks with fracture permeability using fluorescent solutions

Information: J. Rohovec

Applied research realized together with private companies and other academic institutions (ISATECH, CVUT) is focused on the transport of tracing colorants in granites. In a laboratory model, we use a well defined fracture packed with inert filling, through which a yellowish tracer Fluorescein is passed.

The dissemination of the latest achievements of Earth sciences among wider public is one of the essential aspect of scientific work. Generally, selected popular-science outputs can be classified into several main sections by their character:

(1) television and radio broadcasts;
(2) contributions to magazines, journals, newspapers, books;
(3) lectures for popular audience;
(4) field and laboratory excursions;
(5) participation in exhibitions, science trades, web presentations, etc., and
(6) *ad hoc* explanations and comments of key discoveries worldwide.

Our strategy is to spread the results of research work at various levels so that the information reaches those who will welcome and appreciate it most. Routine research, if in any relation to certain areas of the Czech Republic, is continuously promoted in local media, museums or in the form of lectures on site. If the result is generally interesting (and we primarily focus on that type of results), it should be presented in nation-wide media. Several employees across teams routinely provide presentations of this kind, and also have contacts in the media.

In the case of an extraordinary discovery/result, our effort is to announce it through official channels (press department, official publications of the Czech Acad Sci, etc.) to achieve a wide awareness, including the world media. In addition, we always respond to calls from the Centre of Administration and Operations of the Czech Acad Sci, which is also dedicated to science promotion. This way, the Institute employees collaborated on films and exhibitions produced/organized by the Czech Acad Sci several times.

In the period of 2015–2019, employees of the Institute produced, or contributed to, more than 250 papers in popular journals, magazines or newspapers, and contributed to more than 35 books and over 50 book chapters.

The Czech Academy of Sciences
Strategy AV21
Top research in the public interest

The Institute is involved in the academic project “Strategy AV21”, which started in 2016. This project is defined as "top research focused on problems and challenges of contemporary society" or, more simply, “Top research in the public interest”, as expressed in its motto. In the course of five years, more than 10 employees were, or still are, involved in a close cooperation with other institutes of the Academy of Sciences in two programmes of the Strategy AV21.

These collaborations resulted in scientific and popular publications, lectures of professionals for the public and local governments, and presentation of the results in both local and national audio-visual media. Specifically, the Institute staff are involved in the following Programmes:

Dynamic Planet Earth. The dynamics of our planet is unique within the solar system: it involves extensive flows of matter within the Earth, between its inner spheres and the surface, and is also a prerequisite for the existence of life. It has enabled the development of human society, as it provides mineral and energy resources and is behind the diversity of our planet’s landscapes. At the same time, the dynamic behaviour of the Earth exposes humanity to a changing climate, earthquakes, dangerous atmospheric phenomena, volcanic eruptions, landslides and other events that pose risk to society. Conversely, the dynamics of planet Earth has been increasingly influenced by human activities.

The programme will concentrate on the elucidation of processes occurring within the Earth (Theme I: Energy within the Earth), on its surface (Theme II: Earth Surface Transformations) and in its atmospheric envelope (Theme III: Above the Earth). Each theme will also address the issue of preventing risks posed by Earth dynamics, and will support one of the prerequisites for successful research in these disciplines - the continuous collection of data by observatories, many of which are included in international monitoring networks. The fourth theme focuses on the consequences of the development of human society, such as the environmental impacts of mineral extraction and consumption, the search for alternative raw materials and the exploration of landscapes for their appropriate use and conservation (Theme IV: Footprints of Humankind).

The programme will contribute to the development of existing research activities in geological/geophysical sites that have prime importance both in the Czech Republic and worldwide. It will also support the internationally highly valued permanent observatories on our territory. A secondary, but important result of cooperation across the whole range of Earth sciences will be a closer and more efficient cooperation between institutes that address thematically related research problems. The programme will improve public awareness of the importance of the dynamics of our planet in all its spheres and, in particular, of the links between the functioning of human society and geological and atmospheric processes. (https://strategie.avcr.cz/en/programy/dynamicka-zeme)

Water For Life. Water is a basic prerequisite for the existence of life, an essential factor in the environment, a key natural resource, and an irreplaceable input in most economic branches. Any unsuitable intervention in the cycle or quality of water could cause a chain of serious consequences, which in extreme cases could end in the irreversible loss of some water resources. These resources are currently exposed to significant pressure due to ongoing climate change, unsuitable water management in the landscape, as well as increasing amount of chemicals in the environment. As a result, it is highly unlikely that their abundance and quality will be preserved for future generations, if the necessary measures are not implemented. For these reasons, an interdisciplinary, coordinated, and science-based approach to water management is highly important. The protection of water resources must be of primary interest to society, especially under the specific conditions in the Czech Republic. (https://strategie.avcr.cz/en/programy/voda)

Thank you for your interest

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