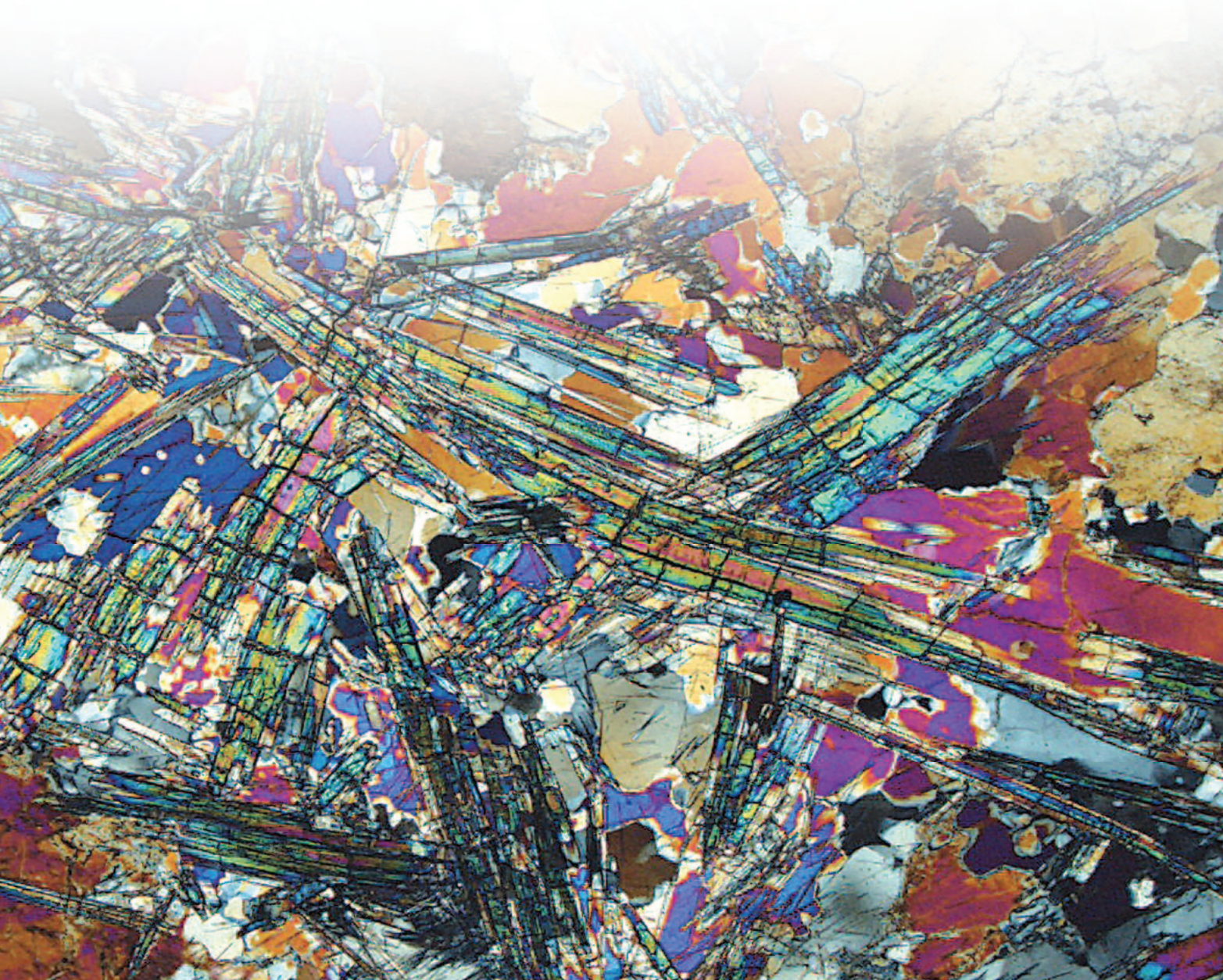




CZECH GEOLOGICAL SURVEY

Annual Report **2012**





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Organizational Structure

Advisory bodies	Directorate			Advisory bodies
Scientific Board Review Board Editorial Board CGS Map Approval Committee	Management Project Management Management and Administration of the Brno Branch	Zdeněk Venera Director zdenek.venera@geology.cz	Human Resources Section Internal Audit	Editorial Board of the Bulletin of Geosciences CGS Portal Board CGS Library Board
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Central Laboratory Prague Věra Zoulková Head of Department vera.zoulkova@geology.cz	General Economics Jana Kuklová Head of Department jana.kuklova@geology.cz	Regional Geology of Crystalline Complexes Jaroslava Pertoldová Head of Department jaroslava.pertoldova@geology.cz	Geological Documentation Milada Hrdlovicsová Head of Department milada.hrdlovicsova@geology.cz	CGS Publishing House Patrik Fiferňa Head of Department patrik.fiferňa@geology.cz
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Management



From the left: **Zdeněk Cilc** – Deputy Director for Economics, **Jan Pašava** – Deputy Director for Research and Head of the Geochemical Division and Central Laboratories, **Dana Čápková** – Deputy Director for Informatics, **Zdeněk Venera** – Director of the Czech Geological Survey, **Petr Mixa** – Deputy Director for Geology, **Vít Štrupl** – Head of the Geofond Division

Czech Geological Survey

The Czech Geological Survey is the state organization that compiles, stores, interprets and provides objective expert geological information for the state administration, the private sector and the public.

It is a state-funded body, the resort research institute of the Ministry of the Environment responsible for providing the state geological service in the Czech Republic. It is the only institution with the mission to systematically investigate the geological composition of the whole territory of the Czech Republic.

The well-established reputation of the Survey is based on the optimum combination of services to society with top-ranking research in geological science, natural resources, geological hazards and environmental protection. As an internationally respected scientific institution, it responds to the requirements of society for sustainable development and plays a significant role in education and in the popularization of geology.

Main fields of activity

- Geological research and mapping
- Rock environments and their protection
- Mineral resources and the environmental impact of mining
- Geological hazards, prevention and mitigation of their impact
- Geoinformation management and delivery

Mission

- Geological mapping and regional research within the territory of the Czech Republic
- Basic and applied research in geological hazards, mineral resources, rock environments and environmental protection
- Administration of the State Geological Service in accordance with Act No. 62/1988 Coll. (on geological work)
- Gathering, compilation and interpretation of data on the geological composition, mineral resources and geohazards on the territory of the CR
- Provision of geoscientific information and expert advice to support decision-making on issues of state and public interest
- International cooperation and foreign development aid
- Education in geosciences and environmental protection

Vision

Through innovative research and the use of the most up-to-date technology, the Czech Geological Survey will continue to provide the Czech State with the geoscientific information needed to make crucial policy decisions about energy, water and other critical resources, natural hazards and sustainable development, while working to maintain its position as a leading research institution in the field of Earth sciences.

Today, the CGS is a reliable partner working with other national geological surveys and commanding international respect

Interview with the Director of the Czech Geological Survey, Zdeněk Venera



Dr Venera, you have been the head of the Czech Geological Survey for nearly 10 years now. What vision did you have when you took charge and to what extent have your plans come true?

I took the Director's position in 2004. My vision was that the CGS must strengthen and develop its reputation as a leading geoscientific institution within the international community. At the same time it was necessary to ensure that we continued to provide the scientific support and information required by the State Administration to enable effective decisions about crucial strategic, environmental and economic issues. In many cases, only the Earth sciences can provide that information. I also knew that we would need to be proactive in keeping up with global trends, both in thinking and technology, so that an attractive working environment would be created for the best experts in our field. This also drove my desire to increase the salaries of the scientific staff. At that time, researchers and officers of the State Administration were paid very poorly by comparison with professionals in other fields. The next step was to increase the income of the CGS from external sources so that this could be used to supplement the funding from the Ministry of the Environment, by which the CGS is established. One way of achieving

this is to become a partner in international projects, which, in addition to boosting our budget, provides interesting work for our researchers and also promotes the good name of the Czech Republic and the Czech Geological Survey in all those countries where we operate. Moreover, I wanted the CGS to enhance geographical information systems that could be used as a modern tool for displaying the spatial distribution of geological features in areas that were being mapped and investigated. My aim was to encourage closer collaboration between geologists and GIS specialists, so that field geologists could begin using GIS as a standard procedure. Last, but not least, I accepted the position of Director convinced that, to ensure efficient management and effective communication, the geological survey must incorporate all the functions that at that time were being carried out by two separate organizations, the Czech Geological Institute and Geofond ČR. I became determined to pursue this goal in 1998 when working at the Ministry of the Environment. The two organizations were merged on the 1st of January 2012 to form the unified Czech Geological Survey. How much progress have we made in achieving the other aims? I believe that we are proceeding jointly in the right direction and we have had many a success during these past years. I think that our working conditions are notably better

than they were and wages have increased significantly, especially thanks to project funding. We continue to improve the quality of our laboratory equipment and we are increasingly productive in providing the state geological service as well as in the field of scientific research. This has recently gained us the first place among research organizations in the resort of the Ministry of the Environment, the first place out of all the 49 evaluated state organizations and the 22nd place among all 508 evaluated scientific institutions, including universities and the institutes of the Academy of Sciences of the Czech Republic. We must bear in mind that Rome wasn't built in a day! Most of our success has come recently, after years of effort and by overcoming many frustrations. Sometimes I am pleased and even excited when we manage to secure a project that will provide interesting and motivating work and wages for members of our staff. However, the search for excellence is a never-ending mission and there are always a lot of things that can be improved. My chief personal motivation is to ensure that our organization works efficiently and in a modern way, so that the staff can take pride in what they do. Personally, I am proud that several leading Czech geoscientists work for the CGS, together with a number of acknowledged experts who guarantee the professional delivery of the state geological service and who could easily find senior jobs in commercial geological companies.



Emergency accommodation during fieldwork on the Antarctic Peninsula (photo by J. Žák).



Geological mapping in East Azerbaijan Province, Iran (photo by R. Vodrážka).

In your opinion, what are the most important events that have affected our institution in 2012?

2012 is the first year of the reunited state geological survey. The process of unification and the commencement of work in this new structure took place in unfavourable conditions because of extreme pressure from the Government to reduce the expenditure of state organizations. Merging of the original CGS with the CGS – Geofond into a single institution also involved a reduction in staff by roughly 10% and reorganization of the structure of the institution and its workplaces. I am sure that we have managed to create an entity, which is stronger and more efficient than the two organizations were when they were separate. We now have a range of skills in the unified CGS that is comparable to that of other geological surveys in developed countries. Thanks to these changes, we are now able to provide all the services that had been carried out previously by two organizations, but for a lower total cost. However, I am particularly pleased that during the last few months, the worries and animosities that were evident before the merger have been overcome. New teams have been formed and are cooperating together successfully. This year we have succeeded in applications for two new international projects. One of them is the mapping of geological hazards and hydrogeological conditions in the East African Rift in Ethiopia and transferring our experience and methods to the members of the Geological Survey of Ethiopia. The other project will take place in Mongolia and will involve systematic geological mapping at a scale of 1:50,000 and the evaluation of the mineral resource potential in the western part of the Mongolian Altai Mountains. In addition, we have been working hard on the Review of Groundwater Resources project, which was approved under the terms of the Operational Programme "Environment" and is scheduled to last for the period 2010–2015. Moreover, at the request of the Minister of the Environment, we prepared an expert report to guide government policy on the potential for extraction of shale gas and underground gasification of coal. These were, in my opinion, the most important activities last year.

Recently, the budget allocated by the state to run the CGS has been steadily decreasing. How do you cope with this?

The trend in underfunding of the state geological survey is indeed becoming worse each year. One of the measures we took in response to this situation was to decrease the operational cost by merging two organizations into one. We have also worked hard to secure external project funding from various sources: The Grant Agency of the Czech Republic, Technological Agency of the Czech Republic, Operational Programme "Environment", the Ministry of Education, Youth and Sport (MEYS), the Ministry of Industry and Trade (MIT), Operational Programme "Cross-Border Cooperation", the European 7th Framework Programme, the Czech Development Agency and Norway Grants. However, we are still faced with the problem, which has been identified by an audit of the Czech system of research, development and innovation carried out by the British company Technopolis, namely that



Under Mt. Reece above the Prince Gustav Channel, Antarctic Peninsula (photo by I. Soejono).



Field mess room on the edge of the Victory Glacier, Antarctic Peninsula (photo by N. Halls).

the level of institutional funding is inadequate while the additional income from external projects covers too large a proportion of the operational costs. Although these circumstances motivate the CGS to maximize the number of projects in which it takes part, in the long term this would destabilize the institution. Therefore, our aim is to ensure that the proportion of the budget from the founder is adequate, especially to sustain the staff and expertise necessary to carry out basic research on the regional geology of the CR. Geological mapping, actually compilation of a comprehensive geoscientific information system in 4D (3D + evolution in time) together with all aspects of interpretation, remain central tasks of the CGS.

Can we say that twenty-five years after the revolution, the CGS is more or less on the same level as other western European geological surveys? Or do we still need to catch up with them? If so, in which areas?

It should be remembered that, even in 1989, the Central Geological Institute, the predecessor of the CGS, had a worldwide reputation for the quality of its work. Today, we are a reliable partner working with other geological surveys and commanding international respect.

This is evident from our membership of EuroGeoSurveys in which we play an active and important role. However, it is true that we still look to wealthier geological surveys in Western Europe and overseas, for inspiration in state-of-the-art 3D modelling of geological structures and for expertise in managing large international projects. There is a vast difference between the investments they have made in infrastructure, equipment and operational costs and those that we are able to make. On the other hand, we have the advantage that our field geologists have an excellent practical and theoretical background, which enables us to undertake regional mapping and geological synthesis anywhere in the world. Unlike, for instance, Scandinavian geological surveys or the Polish Geological Institute, the CGS suffers from an ongoing problem of underfunding for research on natural resources. This field has been neglected during the last 20 years at all levels, including that of university education. Only recently has the European Commission begun to realize the importance of re-evaluating its own resources to ensure the continued development of the European economy. A revival of interest is now slowly taking place and funding from both European and national sources is being released for research on energy supplies and natural resources.



MSc. Zdeněk Venera, Ph.D. (*1965), graduated in economic geology at the Faculty of Science of the Charles University in Prague and Translation and Interpreting (English, Russian) at the Faculty of Arts of the Charles University in Prague (1990). He worked as an assistant in the Department of Mineral Resources at the Institute of Petrology and Structural Geology at the Faculty of Science of the Charles University in Prague. The topic of his doctoral thesis was the magmatic and solid state deformation and structure of granitoids using examples of intrusive bodies in the Bohemian Massif, the Variscan massifs of Mt. Blanc and Aiguilles Rouges in the Alpine zone of extension, and finally in the Finnish Svecofenides. From 1998 until 2003, he was the Director of the Department of Geology at the Ministry of the Environment. Since 2004, he has been the Director of the Czech Geological Survey. He represents the Czech Republic under the terms of the International Antarctic Treaty on the Committee for Environmental Protection. During 2004–2005 he was awarded a Fulbright Fellowship at the University of California in Davis and in the U.S. Geological Survey at Menlo Park. During 2006–2009 he was elected the president and the member of EuroGeoSurveys – the Executive Committee of the Association of European Geological Surveys.

Geological and Thematic Maps

Geological maps provide comprehensive information about the geological composition of the territory of the Czech Republic. They are used especially for environmental protection, assessment of geohazards, mineral deposit exploration, evaluation of groundwater reserves and strategic or land-use planning. Explanatory texts, which are supplied with each map, give a detailed assessment of the mapped area based on a range of geoscientific disciplines such as e.g. petrology or hydrogeology, and they summarize the essential data acquired during compilation of the map.

Jaroslava Pertoldová

Project leader for geological mapping of the Czech Republic 1:25,000



GEOLOGICAL MAPPING

Geological mapping has been one of the main activities of the Czech Geological Survey since its foundation. Advances in research methodology, new imaging and archiving procedures, as well as the changing needs of society, have put increasing demands on research related to geological mapping of the Czech Republic. Significant improvements have been made in the storage of rock, soil and water samples, as well as in the archiving of all new data obtained during the mapping of individual sheets. The information is stored in a system of databases permitting verification so that it can be used in the future. During compilation and publication of map sheets, a unified and progressively updated legend is created for individual areas, enabling smooth correlation between adjacent map sheets.

CONTRIBUTIONS TO THE ECONOMY AND ENVIRONMENT

The selection and extent of areas to be mapped reflects the priorities of the state and local government. One of the top priorities is the adjustment of land use planning to both conventional and recently identified environmental geofactors. During the survey of a map sheet, a range of relevant factors are also studied, among them groundwater resources, evolution of the soils, the influence of the bedrock on the chemistry of the environment, the extent of anthropogenic contamination and possible conflicts of interest. As

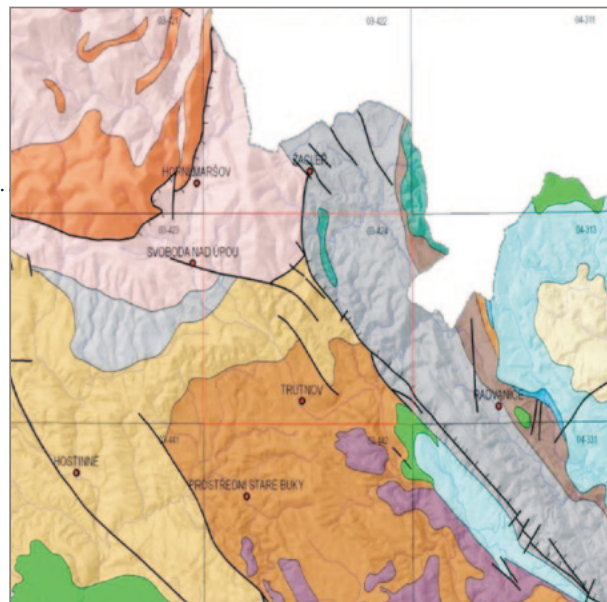
a result of increasing emphasis on the use of local mineral and energy resources, procedures are being developed to enable prompt access to the large amount of exploration-geological data that has not been easily accessible for many years. New geological maps also provide background data for assessing the potential of the rock environment for storing CO₂, disposing of dangerous waste and harvesting geothermal energy. These maps are therefore of interest to both private companies and government organizations.

DETAILED MAPS AT 1:25,000 SCALE

Detailed geological maps of the Czech Republic at a scale of 1:25,000 are compiled in accordance with a new procedure and consist of three main parts: the graphical part, the geological map itself, together with a legend, and separate graphical appendices. These are the fundamental components of the map, which are accompanied by the explanatory notes. Linked to the previous two parts is the third part, which is the database containing the information used to construct the map. This part, accessible online, is a multi-layer information system containing lithological, structural and geochemical data and in some cases relevant thematic maps. During mapping, the information about the rock environment is therefore being progressively entered into the National Geological Mapping Database and in this way, information base of the open geological server www.geology.cz is being created.

MAPPED AREAS

In 2012, the compilation of 15 map sheets was completed. These map sheets covered parts of 9 areas now being mapped: Krkonoše Mts, the Šumava Mts National Park and Protected Area, Brno Region, Moravian Karst Protected Area, Beskydy Mts, Doupov Mts, Čistá-Jesenice Massif, Křivoklátský Protected Area and Central Moldanubian Batholith. In addition to geological maps with explanatory notes and the appropriate layers of data, exploration-geological maps, geomorphological maps and maps of environmental geofactors were also completed. Examples of completed sets of maps cover the sheets Volary, Vimperk and Zbytín in the Šumava Mts area and sheets Trutnov, Svoboda nad Úpou, Vrchlabí and Žacléř in the Krkonoše-Jizera Area.



An example of a map showing geological units in an area covered by nine neighbouring map sheets.

DERIVED MAPS

In 2012, the first map in the series of maps of decorative stones of the Czech Republic, “Mapa dekoračních kamenů Prahy a Středočeského kraje” (Building and Decorative Stones of Prague and the Central Bohemian Region) was completed. This folded map received the “Map of the Year 2012” award in the category Single Cartographic Product. The Czech Geological Survey also collaborates in the IUGS international project *OneGeology*, the aim of which is to compile a unified geological map of the Earth at a scale of 1:1,000,000. One of the steps required to achieve this goal is the creation of a unified geological map of Europe. All the geological maps covering the area of the Czech Republic at the scales of 1:50,000 and 1:200,000 have been completed and harmonized and are now freely available on the map server of the CGS at <http://www.geology.cz/extranet/mapy>. Maps at larger scales (1:50,000 and 1:25,000) form parts of an interlinked geoinformatic system with specific database applications, for instance the database of important geological localities, the database of slope failures and the map of radon index.

FURTHER RESEARCH AND PRESENTATION OF RESULTS

As in previous years, new scientific observations made as a result of mapping have been published by the CGS in Geoscience Research Reports for 2012. Geological mapping and compilation of derived outputs is closely related to regional geological research and new research grant proposals. In the Šumava Mts area, individual map sheets are being incorporated into a general geological map of the area at a scale of 1:100,000. In addition, a new layer of tectonic information is being created for this map based on detailed structural geological measurements. Cooperation with the newly established National Geopark Železné hory has led to the inclusion of much new information in the databases of the CGS and to potential topics for new research. The Geopark also benefited from this cooperation by gaining access to the expertise and resources of the CGS.

The results of geological mapping are presented regularly at seminars and workshops for geoscientific and mining companies. New information about geological structures and their regional interpretation are published regularly in international journals with IF.



The map “Building and Decorative Stones of Prague and the Central Bohemian Region” won the “Map of the Year 2012” award.

Regional Geological Research

Research into the geological evolution of the Bohemian Massif and the Western Carpathians is inseparably linked to geological mapping and carried out in cooperation with other Czech and also foreign research institutes. The interpretation of the complex geological structures that have taken hundreds of millions of years to form, requires a multidisciplinary approach in which many specialists must collaborate.

Jaroslava Pertoldová, Head of the Department of Regional Geology of Crystalline Complexes

Lilian Švábenická Head of the Department of Sedimentary Formations



METAMORPHIC ROCKS

Research into metamorphic processes covers a wide range of themes that include answering fundamental questions raised by geological mapping, as well as more applied geological work.

During 2012, work on structural mapping of the Eastern border of the Bohemian Massif was carried out. This involved collecting samples for petrological, geochronological and geochemical analysis using laser ablation ICP-MS to date important Pre-Variscan events that shaped the geology of the region.

One of the main objectives was to determine the temperatures and pressures at which high-grade metamorphism and subsequent metamorphic events affecting the Běstvína granulite body took place, and to establish their geological age. The data obtained show that the Běstvína granulite body formed part of a subducted plate that was later exhumed from the lower crust to middle crustal conditions.

For the purpose of investigating the structure of the Earth's crust, field surveys in the Doupov Mountains and Eastern Bohemia were carried out using two independent methods: gamma ray spectrometry and magnetometry. These surveys are being used to define the main types of crystalline rock that form the basement beneath

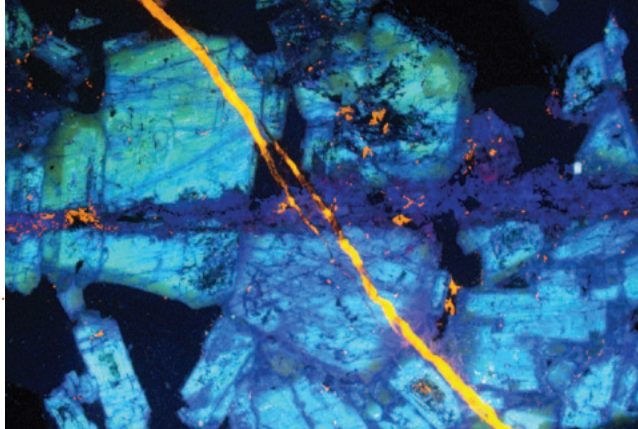
the Quaternary sediments and volcanoclastics. A high-sensitivity proton-magnetometer was used to measure the magnetic fields associated with the different rocks while a gamma ray spectrometer was used to measure the emissions from U, Th and K and the total radioactivity in order to test a new method for distinguishing between low grade metamorphic rocks of different ages.

Other topics of research during 2012 include investigations of the microstructures in alkali feldspars from the felsic granulite of the Blansko Forest. Methods enabling study of metamorphic processes at scales in the range of micro- to nano metre (TEM, FEG-EPMA, FIB-SEM) were used. The mechanisms governing the formation of exsolution lamellae in feldspar were identified by these methods.

IGNEOUS ROCKS

Igneous rocks cover very large areas of the Czech Republic and the scale of granite magmatism in the Bohemian Massif is unique in Europe.

On the basis of results from boreholes and the reinterpretation of existing geophysical data, a 3D model of the south-western part of the Upper Palaeozoic basement underlying the Doupov volcanic



Cathodoluminescence image of granodiorite from Mokrsko.

complex in the Žatec Basin was created. This revealed that the southern margin of the basin can be divided into distinct parts.

Structural and AMS analyses of the Čistá-Jesenice plutonic body were completed. A structural analysis of the terrain covered by the map sheets Bochoř and Žlutice was carried out and will be incorporated in the final maps. Two international books describing the petrogenesis of the Klenov pluton and an interpretation of emplacement of the central part of the Moldanubian batholith were finished.

The mechanisms and conditions governing the emplacement of intrusive bodies in the Central Bohemian plutonic complex are being defined through structural studies of the interaction between magmatic systems and regional tectonic processes. Applied structural studies in the area of Rožná have been carried out to identify parts of the granitic pluton suitable for use as underground repositories of various types. Detailed large-scale maps showing the tectonic segmentation of the area and the intensity and orientation of fractures in the granite have been published. AMS analyses of selected parts of the Brno Massif have been carried out in order to improve understanding of the tectonic development of Eastern margin of the Bohemian Massif. At present, the results of this work on the metamorphic and geotectonic development of the Bohemian Massif and the Polička and Zábřeh crystalline rocks are being compiled for publication. In cooperation with the Faculty of Science of Charles University in Prague, research on the internal processes of magma chambers is being carried out in the granite plutons of the Sierra Nevada (USA).

GEOSYSTEM MODELLING

Under the terms of the project *Research on thermally loaded rocks – prospects for underground storage of thermal energy* funded by the Ministry of Industry and Trade, work is being carried out on detailed 3D structural geological mapping of the Josef Gallery at Mokrsko in Central Bohemia. Simultaneously, special software for plotting structural and related measurements from rock outcrops and oriented core samples has been developed. The procedure, that also enables the automatic classification of the intensity of alteration of the granite, was tested in the Bedřichov water supply tunnel and the results were published in 2012. Quantitative information about structures, alteration and metamorphic changes in the rocks selected for thermal endurance testing in the TIP and TACR projects has been obtained using cathodoluminescence microscopy.

VOLCANIC ROCKS

Research of the volcanic rocks focused mainly on monogenetic volcanoes and sub-volcanic bodies of Tertiary age in Česká Lípa and on the volcanics of Ordovician age in the Barrandian. Attention was paid to variations in the type of eruptive activity and the dating of single eruptions, as well as the geometry and

extent of subvolcanic intrusions. Cooperation with the companies Metrostav and Arcadis proved very fruitful. It enabled to access the excavations made for the construction of the extension of the Prague underground railway network. Volcanic activity in the geological past significantly influenced the style and pattern of sedimentation, and therefore the synthesis of volcanological and sedimentological observations has helped in the reconstruction of the palaeoenvironments at those sites.

SEDIMENTARY FORMATIONS

Field survey was mainly aimed at the description and interpretation of the exposures created by excavations on the path of the Gazelle gas pipeline, which is part of the long-distance Nord Stream gas pipeline. The length of the Gazelle gas pipeline on the Czech territory is 150 km, and its path mainly runs through sedimentary rocks of Palaeozoic age (Carboniferous and Permian) in Western Bohemia and through Tertiary rocks in the North Bohemian Basin. These “rapid response” field survey provided unique information about the structure and composition of the bedrock along the path of the pipeline and a continuous record of depositional changes in the exposed lithostratigraphic units. Information was acquired about facies changes and contacts at particular levels in the stratigraphy, lacustrine sequences, tuff sequences, and palaeosol horizons.



Trench excavated for the Gazelle gas pipeline east of Kryry. View looking south along exposures of the lower sediments of the Líně Formation (Upper Carboniferous and Permian) in the western part of the Kladno-Rakovník Basin with the Tis granite massif in the background. Photo by Richard Lojka.

Biostratigraphic correlations and palaeoenvironmental interpretation of the sediments in the interval from the Upper Cenomanian to the Middle Coniacian have been carried out in the north-eastern part of the Bohemian Cretaceous Basin, using inoceramid macrofauna and calcareous nannofossils as part of the multidisciplinary research on stratigraphic type sections.

As part of an international cooperation project, the assemblages of calcareous nannofossils from the Southern hemisphere, namely from James Ross Island in Antarctica, were studied. The nannofossils were used to determine the relative age of the marine sediments of the Santa Marta Formation and to identify the source area for the terrestrial glacial sediments of the Mendel Formation. Nannofossils were also used to help date single phases of volcanic activity in the Western Pontides of Turkey.

Global Changes in the Past

In studies of global changes in the geological past carried out by the staff of the CGS, emphasis is placed on global events that had a major influence on the biodiversity of marine and terrestrial ecosystems (bioevents). This requires a multidisciplinary approach in which palaeontological, sedimentological and geochemical methods are employed to track the physical changes in the palaeoenvironment (e.g. changes in the temperature of marine water and the carbon cycle in marine ecosystems) and parameters which govern the development of palaeodiversity in the periods before, during and after global crises. The analysis of palaeodiversity involves painstaking taxonomic, palaeoecological and palaeobiogeographical research.

Jiří Frýda, Coordinator of the strategic plan for research into global changes

Holocene sediments of the Great Barrier Reef in eastern Australia are the subject of geochemical and taphonomic research by the CGS scientific team



In 2012 the scientific team concerned with global changes in the Earth's past consisted of 12 researchers, 7 Ph.D. students and 1 technician with a total working capacity of 9 man-years. The members of the team were Eva Břízová, Petr Budil, Pavel Čáp, Jana Drábková, Juraj Farkaš, Lenka Ferrová, Jiří Frýda, Tomáš Hroch, Jiří Kříž, Richard Lojka, Štěpán Manda, Daniel Nývlt, Marika Polechová, Zbyněk Šimůnek, Tomáš Štor, Alena Tichá, Petra Tonarová, Radek Vodrážka, Stanislava Vodrážková and Zuzana Tasáryová.

PUBLICATION ACTIVITIES

Members of the team published a total of 26 peer-reviewed papers in scientific journals with IF, 6 chapters in foreign scientific books and 12 peer-reviewed papers in journals without IF.

- In 2012 Jiří Frýda and Štěpán Manda were the leading scientific editors of the international journal *Bulletin of Geosciences*, in which 52 papers were published. The *Bulletin of Geosciences* was cited 253 times in the *Web of Science* database (Thomson Reuters)

and it is rated the 25th most important journal in its field of scientific interest (see also the chapter Publications Issued by the CGS).

- Petr Budil and Jiří Kříž were authors of the chapter on geological sites in the Czech Republic in the book *Geoheritage in Europe and its conservation*, published by ProGEO Publishers.
- In the book *Earth and Life – Global Biodiversity, Extinction Intervals and Biogeographic Perturbations Through Time* (Springer Verlag) dedicated to the Year of Planet Earth, Jiří Frýda was the author of the chapter on the phylogeny of the class Gastropoda.
- Jiří Kříž and Jiří Frýda co-authored two chapters which were accepted for the book *Ordovician and Silurian Palaeogeography and Palaeoclimate* published in the *Geological Society Memoir Series*.
- Juraj Farkaš co-authored two chapters which were accepted for the *Reading the Archive of Earth's Oxygenation. Vol. 3: Global Events and the Fennoscandian Arctic Russia – Drilling Early Earth Project*.



Central Nevada is one of the important locations where scientific research has been carried out by the team from CGS.



Emsian trilobite from central Nevada.

LIST OF PUBLICATION IN JOURNALS WITH IF

- The genus *Pseudocyrtodonta* from the Middle Ordovician of the Prague Basin was completely revised and its importance for the early evolution of Bivalvia evaluated (Steinová 2012).
- An extensive revision of the Bivalvia from the Ordovician Šárka Formation was published (Polechová *et al.* 2012).
- A description of the model for the development of subaerial volcanic activity in the Prague Basin was published (Hroch *et al.* 2012).
- A unique discovery of the gut of Ordovician trilobites was published (Fatka *et al.* 2012).
- The results of a study of the Sedgwickii Event and a proposed zonation of the biostratigraphy of the lower Silurian (Llandovery) were published (Štorch and Frýda 2012).
- A model for the formation of the most important hydrocarbon fields in Northern Africa and Arabia was published (Loydell *et al.* 2012).
- A description of the effects of the Silurian Kozłowski Event in the sedimentary record of the Prague Basin was published (Manda *et al.* 2012).
- A paper evaluating the influence of the Silurian Kozłowski Event on scolecodonts of the late Ludlow period from the Prague Basin was published (Tonarová *et al.* 2012).
- A paper on the facies development and records of palynomorphs through the interval of the Silurian Kozłowski Event (late Ludlow) was published (Gocke *et al.* 2012).
- An analysis of the anomalous ontogenesis of the Silurian cephalopod genus *Sphooceras* was published (Turek and Manda 2012).
- An analysis of the ontogenesis of Devonian phacopid trilobites was published (Budil *et al.* 2012).
- A paper on the ontogenesis and intraspecific variability of the conodonts *Polygnathus serotinus* and *P. bultyncki* from the Prague Basin and Nevada was published (Klapper and Vodrážková 2012).
- A description of the lingulate brachiopods fauna from the Basal Choteč Event was published (Mergl and Vodrážková 2012).
- A description of the early ontogenetic trends in the macroevolution of gastropods was published (Seuss *et al.* 2012).
- The results of a study of the Daleje Event and a proposed new biostratigraphic zonation of the Middle Ems were published (Ferrová *et al.* 2012).
- The results of a study of the Choteč Event were published (Vodrážková *et al.* 2012).
- The results of a study of the Devonian-Carboniferous boundary sections in Moravia and the Carnic Alps were published (Kumpán *et al.* 2012).
- A paper on the Pteridosperma (Medullosales) and comparisons of the FTIR characteristics of the species *Odontopteris cantabrica* from Bohemia and from Canada was published (Zodrow *et al.* 2012).
- A description of a new species of herbal *Lycopodiophytes* – *Selaginella amasrae* found in Turkey was published (Šimůnek and Thomas 2012).
- New morphotypes of Eocene fish scales from Seymour Island in the Antarctic were described (Přikryl and Vodrážka 2012).
- A description of the behaviour of Holocene glaciers on James Ross Island in the Antarctic was published (Carrivick *et al.* 2012, Engel *et al.* 2012).
- An analysis of the diversity and ecology of limnophilous diatoms on James Ross Island in the Antarctic was published (Kopalová *et al.* 2012).
- Palynological research carried out in the area of the Bohemian-Moravian Highlands resulted in a publication describing the development of Holocene vegetation (Břízová *et al.* 2012).

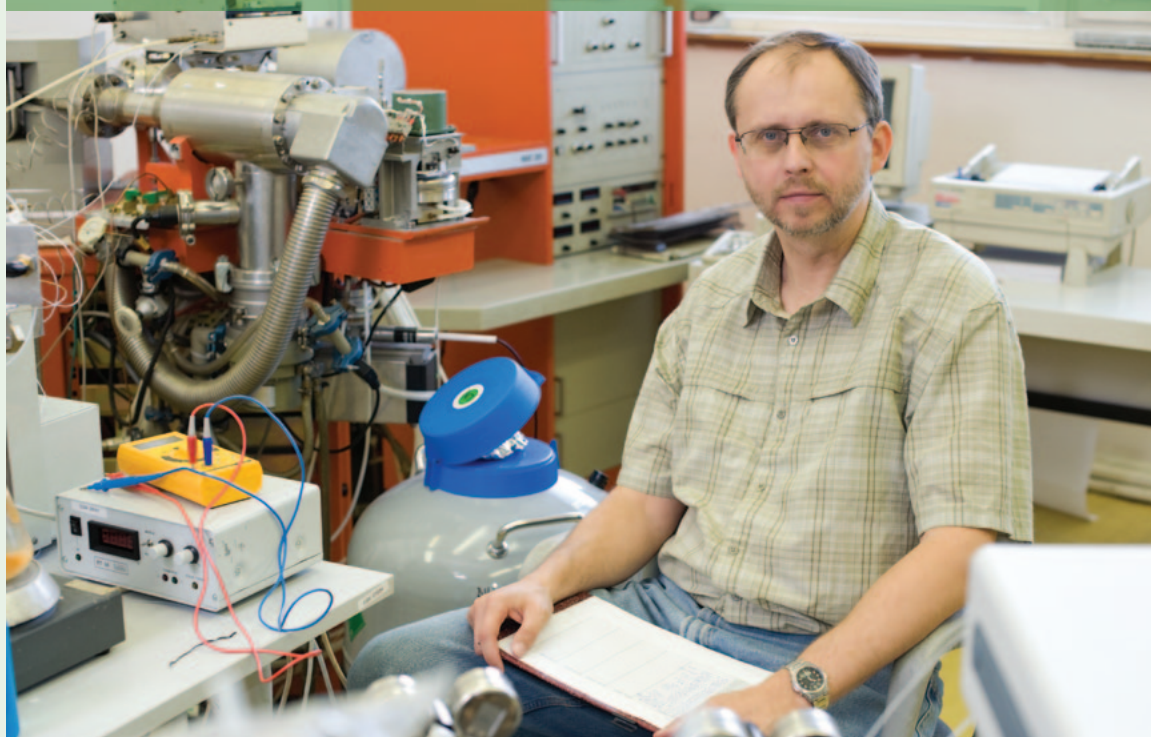
OTHER SIGNIFICANT SCIENTIFIC ACTIVITIES

- In July the international conference *The 5th Conference on Trilobites and their relatives* was held in Prague in cooperation with the Charles University. Petr Budil and Marika Polechová, representing the CGS, were co-organizers of the conference.
- In 2012 the 5-year project KONTAKT *Middle Palaeozoic climatic and sea-level changes and their influence on marine community evolution: a comparison of models from the Perunica microcontinent and the Laurasian continent* was completed. The results of this project were published in 20 papers in journals with IF and in 5 chapters of scientific books published abroad.

Analysis of the Vulnerability of Landscape

In the past two hundred years all ecosystems in the Czech Republic have been exposed to extensive anthropogenic influences. The CGS has a long tradition of monitoring the biogeochemical and hydrogeochemical responses of ecosystems throughout the country. All results from these investigations are made available to public institutions for use in a variety of different contexts. The research we carry out is focused on the processes that govern the pathways of environmentally important elements through the individual parts of ecosystems. Summarizing interdisciplinary studies are used to identify and quantify the risks to forests, soils, surface waters and groundwaters. In recent years the monitoring of slope failures across the country has been an important task. Information about these has now been made available to the public in a special register on the web page.

Martin Novák Head of the Department of Environmental Geochemistry and Biogeochemistry



GEOMON

Coordinated by CGS, and in collaboration with many other institutions, monitoring of the nutrient cycle and the balance of ecologically important compounds has been continuing in GEOMON, a network of fourteen small forest basins. The hydrological year 2012 (ending on 31st October) is the nineteenth successive annual record containing total analyses of precipitation, throughfall, outflow and other relevant hydrological data. The measurements are carried out using standardised sampling and analytical procedures and are used for hydrological and biogeochemical modelling.

HYDROLOGICAL MODELLING

The application of the PIHM (Penn State Integrated Hydrological Model) in the Lysina basin LYS (Slavkovský les) enabled the hydrological processes in the basin to be monitored in detail. The model calibrations proceeded on the basis of simulated and

measured data from closure profile and from measurements of groundwater in five piezometers in the basin. The model simulation proved the influence of changes in vegetation on the hydrological regime. The model shows that the systematic restoration of the forest production in Lysina so that stands of different ages are maintained could result in a slight increase in the runoff during the autumn months. This could be beneficial in the future, when global changes are expected to affect the hydrological regime causing a significant decrease in runoff during the summer and autumn seasons.

CARBON CYCLE

Forest soils are an important global reservoir of carbon. Changes in the global climate and the chemical composition of rainfall could result in destabilization of this bound carbon and its subsequent release into the atmosphere. The dynamic behaviour of carbon in forest soils is being studied by a combination of experimental field trials, long-term monitoring and biogeochemical modelling.



View showing position of devices for automatic measurement of throughfall in the Liz catchment.

MAPPING THE GEOCHEMICAL REACTIVITY OF MINERALS

Another important task of the CGS is to carry out interdisciplinary studies of the influence of contemporary climatic changes and pollution on terrestrial and water ecosystems. The chemistry of the underlying rocks and their geochemical reactivity fundamentally influence the natural chemistry of the soil and water in ecosystems. This has a direct bearing on the susceptibility of a landscape, basin or ecosystem to acidification and nutrient degradation. Therefore the main aim has been to prepare a map of geochemical reactivity of minerals for the Czech Republic and to provide information that can be of practical use in the conservation and utilization of the landscape. The map has been compiled using the extensive lithogeochemical database of minerals which links with the regional geological map series at a scale of 1:50,000.

STUDIES OF LEAD ISOTOPES

Two catchment areas, Lesní potok – LES (Benešovská pahorkatina) and Červík – CER (Beskydy) were chosen for a lead (Pb) isotope study. The criterion for selection was the difference between Pb isotopes of inputs (throughfall and open bulk precipitations) and outputs. The inputs of Pb to the CER catchment area analysed using ICP MS are two times higher than those for the LES catchment area, however the ranges of $^{206}\text{Pb}/^{207}\text{Pb}$ for both show a complete overlap in the range 1.153–1.163. The lead isotope composition of the outflows from the two localities are statistically different in terms of their of $^{206}\text{Pb}/^{207}\text{Pb}$ values. The outflow from the LES catchment area is higher than that from the CER catchment area. Most of the Pb released from the catchment areas originated from current atmospheric deposition or from old anthropogenic lead trapped in the upper organic horizon of forest soils. Lead from deeper soil horizons and from bedrock was found in surface runoff from the LES locality.

RADON RISK

Research on radon risk has been focused on monitoring the vertical distribution of radon in geological environments with thin soil and regolith cover. Measurements using gamma-ray spectroscopy were carried out on outcrops of Proterozoic shales and granitoids, and dose rates were determined. The data show that radon risk can be predicted using radiometric parameters and that the amount of radon increases with depth in the weathering profile. Following the completion of radon risk surveys on other rock types in the Czech Republic, the results will be processed systematically and published.

USE OF STABLE ISOTOPES IN BIOGEOCHEMISTRY

The multicollector plasma mass spectrometer in the Laboratory of the CGS is being used to measure the stable isotopes of chromium

in the environment. This is enabling natural and artificial reducing processes that cause the attenuation of the highly toxic hexavalent form of chromium to be evaluated. The natural attenuation of hexavalent chromium is being traced in geological reservoirs and it has been demonstrated that artificially induced reduction by cheap agromaterials is a crucial step in the final treatment of groundwater polluted with hexavalent chromium by anthropogenic activities. Sources of contamination by the toxic metal cadmium in the environment are also being traced systematically using the differences in the abundance of cadmium isotopes.

SLOPE FAILURES

Since 1st January 2011 the Czech Geological Survey has assumed responsibility for maintaining the Register of Slope Failures in the Czech Republic (RSF CR) following on from the fifty-year period during which records of slope failures were kept by Geofond CR. The Register of Slope Failures is accessible online to the public and professional organizations through the attractive user portal (<http://www.geology.cz/svahovenestability>), where information about slope failures and also maps with descriptions of slope failures, photos and archive materials can be found.

By the end of the year 2012, 15,702 records of slope failures with 4,092 attachments (photos and diagrams) had been registered in RSF CR. The register is continuously updated and field inspections of sites are carried out regularly in order to ensure that the most recent information about them is entered in the register. During 2012, detailed mapping of the Chřiby area continued. This covers 6 map sheets at 1:10,000 scale. The main aim is to comprehensively



Interception area behind the retaining wall separating the road from the rock landslide at Umhausen in the Tyrol (photo by O. Krejčí).

evaluate all the slope failures in the Chřiby area and identify the settlements and constructions such as dams, roads and pipelines that are at risk. The most endangered settlements are located in Halenkovice (22.5% of the village area) and Košíky (31.2% of the village area). The overall percentage of endangered areas for the whole Western Carpathian region is only 4.385%.

Two important workshops focused on detailed study and evaluation of slope failures took place in 2012. The first was the workshop *Current trends in recording and monitoring slope failures*. It was held on 22–23 May 2012 with participation by speakers from the Department of Engineering Geology of State Geological Institute of Dionýz Štúr in Bratislava. Practical demonstrations were held at the type locality in Halenkovice in Chřiby. The second field workshop concerned with slope failures was held on 17–20 June 2012 in the Eastern Alps of Austrian Tyrol with the cooperation of the Austrian Geological Survey (Geologische Bundesanstalt) in Vienna. Dr F. Agliardi from the Università di Bicocca in Milan, Italy, was the invited speaker.

Groundwater

Hydrogeological research carried out by the Czech Geological Survey is motivated by the need to understand the mechanisms that govern the pattern of groundwater flow in geological structures. An important field of investigation is the impact of human activities on natural groundwater resources. The results are used to make quantitative and qualitative evaluations of groundwater resources in various aquifers and for determination of their potential use for water supply. Favorable conditions for groundwater abstraction and measures for quantitative and qualitative protection are defined for selected hydrogeological zones. Applied hydrogeological research is focused on hard rock areas with low permeability to evaluate environmental impacts caused by geological disposal of wastes and raw materials on the rock environment.

Lenka Rukavičková | Coordinator for the strategic plan for research in hydrogeology



REVIEW OF GROUNDWATER RESOURCES

The sustainable use of groundwater resources depends on a balance between the groundwater exploitation and recharge. Groundwater flow and accumulation in aquifers are variable in time and space. Periodical reviews of groundwater resources are therefore in progress.

The main aim of the project *Review of Groundwater Resources* is to reassess groundwater supply in 56 selected hydrogeological zones, which cover approximately one third of the territory of the Czech Republic. The assessment started in 2010 and should be completed in 2015. The project is financed by the European Regional Development Fund, the State Environmental Fund of the Czech Republic and the Ministry of the Environment of the Czech Republic.

A literature review relating to each of the hydrogeological zone was carried out in 2012. Archive data on individual hydrogeological zones were verified to suit geological models. An application extension of the gdBase5 was implemented at the beginning of 2012 in order to process this data. This extension enables researchers to repair the data and process them according to chosen criteria appropriate for statistical and graphical outputs, including export to GIS. Observations obtained by remote sensing using the ALOS-PALSAR satellite were also incorporated in the geological models.

For the purpose of the project, 80 gauging stations were built on small streams to supplement the existing net of gauging stations installed by the Czech Hydrometeorological Institute. The discharge of streams



Field measurement of the hydraulic properties of rocks in a borehole at Tis near Blatno being carried out as part of project MIT FR-T11/367 (author: O. Myška).



Field measurement and sampling of groundwater from a spring at Radvňovice being carried out for the project *Review of Groundwater Resources* (author: Z. Novotný).

has been monitored at these gauging stations to determine groundwater baseflow.

The evaluated archive data were used to outline ranges for the hydrogeological regions and to construct more precisely the bases and tops of aquifers. This spatial information is used to design conceptual models for the hydrogeological zones under investigation.

A review of the tectonic structures of evaluated hydrogeological zones was started simultaneously. This was essential to determine the boundary conditions for the models.

Drilling of 134 hydrogeological boreholes and 56 geological core boreholes is planned during the next stage of the project. Hydrogeological boreholes will be used to monitor groundwater level and water quality in hydrologically important aquifers. Core boreholes (10 to 600 m deep) will improve our knowledge of the geological structures. The CGS processed both the geological and technical part of the operational designs for all of the 190 proposed boreholes.

Analyses of tritium activity were processed during 2012 to determine the residence time of groundwater samples from 215 sites in the Cretaceous hydrogeological zone.

The tritium activity of groundwater in the Western Bohemian Cretaceous Basin is less than 0.5 TU in 50% of boreholes and in 6% of springs. The tritium activity ≥ 4 TU was found in 30% of boreholes and in 74% of springs.

Residence times in the order of a few decades are typical in shallow groundwaters (springs), whereas groundwater tapped by deeper boreholes in deeper aquifers infiltrated before 1950.

Preferential flow paths of groundwater through fractures and other kinds of "channels" have been verified in the Northern and Eastern Bohemian Cretaceous Basin during studies of the hydraulic properties of the rock.

The preliminary results of the project were presented at the 34th International Geological Congress in Brisbane, Australia.

HYDROGEOLOGICAL MAPPING

Hydrogeological mapping was carried out in areas of the Krkonoše, Jizerské hory, Doupovské hory, Beskydy and Šumava Mountains, in the Moldanubian Pluton and in the surroundings of Kokořín and Brno. Available information about the aquifer dynamics, groundwater origin and quality of water in the geological structures was compiled for each map sheet.

Resulting hydrogeological maps, hydrogeological sketches and explanatory notes describing the hydrogeological conditions are an integral part of the CGS program of geological mapping at a scale of 1:25,000. The hydrogeological data obtained are used for constructing maps of environmental geo-factors.

APPLIED HYDROGEOLOGY

Applied hydrological research was focused on hard rock areas suitable for underground repositories and reservoirs of different types. Hydraulic properties of the rock matrix and fracture networks were investigated by means of hydrodynamic and dye tests in boreholes.

The results are helping to improve our understanding of the patterns of groundwater flow, the dispersion of solutes in the rock matrix and the permeability of the rocks. The aim is to assess the potential for leakage of pollutants from the repositories into the biosphere.

Development of new equipment for making field measurements also formed an important part of the work. Special technical equipment was developed for hydrodynamic testing and for the collection of undisturbed samples of groundwater from deep boreholes.

The CGS has registered three new utility models for field equipment with the Industrial Property Office during 2012. Applications have been made for patents to be granted on the design of this new equipment.

Mineral Resources

During 2012, research on mineral resources was mainly directed towards improving awareness of the possibilities for utilization of the mineral base of the Czech Republic, monitoring trends in the investigation and exploitation of mineral resources in relation to the preparation of recommendations for common European legislation and preparing the groundwork to improve procedures for decision-making.

As part of the statutory duties of the state geological survey in the Czech Republic, tasks relating to the collection, processing and provision of information service about mineral resources, their protection and utilization were carried out. Attention was also paid to the mineralogical and geochemical assessment of mineral resources, with emphasis on the possibilities of mining waste utilization. A significant part of the work carried out during 2012 was concerned with evaluating the impact of mining on the environment and with the history of mining within the territory of the Czech Republic.

Economic geologists from the CGS also worked abroad on a number of projects evaluating the mineral resource potential of developing countries and the influence of mining on the environment.

Bohdan Kříbek : Coordinator of the strategic plan for research on mineral resources
Jaromír Starý : Head of the Department of Mineral Resources



RAISING AWARENESS OF THE POSSIBILITIES FOR UTILIZING THE MINERAL BASE OF THE CZECH REPUBLIC

During 2012, the economic geologists of the CGS continuously updated the materials for the State Mineral Policy.

At the conference *Mineral policy and security of the Czech Republic*, public presentations were given about the extraction and use of aggregates and industrial minerals together with information about the European Raw Material Initiative. A summary evaluation of mineral potential in the Czech-Saxon borderland carried out in 2012 under the terms of the project

Assessment of the potential of mineral resources on the Saxon-Czech border – cross-border register of mineral resources was completed.

DEVELOPMENT OF MINERAL POLICY IN SPECIFIC REGIONS OF THE CZECH REPUBLIC

As part of the work on updating the mineral policy of the Liberec region a register of deposits and extractive operations was compiled. The register is based on a GIS map service that is accessible to both the administrative authorities and the public on the Internet. Information about the mineral resources of the region and their evaluation is provided,

together with recommendations for land-use planning and the conservation of mineral resources and the environment.

COMPILATION OF MAPS OF MINERAL RESOURCES

Part of the applied geological work undertaken in 2012 involved evaluation of environmental geofactor maps and the compilation of mineral resources maps as a contribution to the programme of geological mapping of the Czech Republic at a scale of 1:25,000. During 2012 fourteen map sheets were completed.

URANIUM – AN ANALYSIS OF THE POTENTIAL FOR THE USE OF AVAILABLE PROCESSING TECHNOLOGIES UNDER THE CONDITIONS IN THE CR

The Department of Mineral Resources Research and Policy directed by P. Rambousek and the Department of Mineral Resources directed by J. Starý took part in a commodity review of uranium. The first part of the study gives a summary of the use of uranium as a source of energy and information about the classification and distribution of world uranium resources, together with data on production and the market value of uranium and its use in the nuclear industry. The second part describes the history and present state of uranium mining in the CR, including descriptions of the location and geological setting of Czech deposits and their prognostic resources. The third part deals with the technology used in processing uranium ores in the Czech Republic and abroad and reviews the environmental impact of mining and processing in the CR. Based on the results of the study, recommendations have been made concerning future development of the extraction, processing and use of uranium in the CR.

EVALUATION OF THE POTENTIAL FOR EXTRACTING GAS FROM COAL BEDS AND CARBONACEOUS SHALES IN THE CZECH REPUBLIC

In a cooperative project between GACR-DFG and RWTH Aachen, the methane and carbon dioxide sorption capacities of coal beds in the Upper Silesian Basin were evaluated. The results obtained were used to produce numerical models of covering and erosion of Upper Carboniferous formations and their exposition to heat flow during the last 380 Ma.

Risk factors involved in the exploration and extraction of gas from shale in different geological structures of selected regions of the Czech Republic were evaluated by comparing similarities and differences between the Devonian and Carboniferous sequences in the USA and in the Czech Massif.

MINERALOGICAL AND GEOCHEMICAL RESEARCH ON MINERAL DEPOSITS

New information about minerals from ore deposits in the Czech Republic and their occurrence has resulted from research carried out by the mineralogists at the CGS. At Jáchymov, the new secondary uranium mineral adolfpateraite has been



Surveying underground workings at Dippoldiswalde as part of the project *Archeomontan* (© Landesamt für Archäologie).



The conference *Mineral policy and security of the Czech Republic* held on December 10, 2012, at the National Technical Museum in Prague (more on www.top-expo.cz).

Mineral Resources

described. The structure of pseudjohannite and the crystal chemistry of the natural uranyl carbonate, grimselite, were also investigated. Experimental work on natural and synthetic Pt-metal systems led to the characterization of two new minerals – jacutingaite (Pt_2HgSe_2) and zaccariniite (RhNiAs).

EXPERT CONTRIBUTIONS TO FOREIGN PROJECTS AND INTERNATIONAL COOPERATION

As participants in the AMIRA-WAXI project during 2012, a team of economic geologists from the CGS studied the processes that govern the distribution of gold and accessory minerals in the soils and laterite of Western Africa.

Investigations of the paragenesis and geochemistry of gold mineralization at the Ouro Fino deposit in Brazil were carried out with the aim of defining the p-T conditions under which mineralization took place. In Uzbekistan, research on

the Amantaytau deposit has shown that gold mineralization took place in two distinct stages.

The study of trace elements and the isotope geochemistry of the late Archaean carbonaceous shales in the area of mineralization around Carajas in Brazil has shown that the Cu, Mo, As and Bi in the mineral deposits originated from the sediments.

Studies of the influence of mining and mineral processing on the environment were carried out in several places in Zambia and Namibia. The CGS is coordinator of the project IGCP/SIDA 594 *Mining and the Environment in Africa*.

ACTIVITIES WITHIN THE EUROGEOSURVEYS

As part of the contribution made by the association of European geological surveys EuroGeoSurveys (EGS) to the European Raw Material Initiative the economic geologists of the CGS were closely involved in the DG project *Study of Structured Statistical Information about the Quality and Quantity of Raw Materials Deposits* within the EU. As part of the EGS consortium, the CGS also assisted in formulating the *Minerals 4EU* project. Geologists from the CGS are now carrying out a study of contamination of urban soils by hazardous metals under the *URGE* (Urban Geology) project.

STATE GEOLOGICAL SURVEY

The administration of the *state geological survey* (SGS) in the Czech Republic is funded by the Department of Mineral Resources (DMR), and consists in *gathering, processing and providing information* about natural mineral resources, their *protection and utilization*. These data are used by government and local administrative authorities to support decisions on political, administrative, ecological and economic issues, as well as by scientists, commercial organizations and the general public.

The Ministry of the Environment of the Czech Republic also delegates to DMR the responsibility for fulfilling a number of statutory tasks required by law. Not least, the DMR is required to provide information to support selected activities of the Ministry of Industry and Trade of the Czech Republic (MIT) as stipulated in the agreement between the Ministry of the Environment of the Czech Republic and the Ministry of Industry and Trade of the Czech Republic about the use of the Geofond CR.

MINERAL INFORMATION SYSTEM

The main sources of data and information are maps, diagrams, tables and text documents containing the results of geological works. It is mandatory for all legal and natural persons carrying out such work to submit reports for permanent storage in the CGS. Other sources are state statistical records and administrative decisions, as well as the results of the geological work carried out by the CGS and open access sources. The information is processed and entered in the Mineral Information System (SuriS), which forms the basis for information and service provided directly by the staff of the CGS or via the CGS web application.



Selective weathering of claystones of the Cypress Formation in the overburden of the Antonín coal seam in the Družba lignite mine in the Sokolov Basin. The claystones were studied with respect to their potential commercial use, as well as from the point of view of palaeoclimatic development (photo by B. Kříbek).



Velké Meziříčí – Lavičky, reserved deposit of feldspar mineral, protected and registered by the CGS.



Economic geologists participate in the analysis of mining activities, protection and registration of lignite deposits in the North Bohemian, Sokolov and Cheb basins. The photograph shows the Družba lignite mine near Nové Sedlo in the Sokolov Basin (photo by I. Knésl).

TASKS OF THE DMR

Tasks of the DMR carried out on behalf of the Ministry of the Environment:

1. *Registration of new geological works* (about 3,000 per year) as required by § 7 of Act No. 62/1988 Coll.
2. Fulfilling its duties according to § 10, section 2 of Act No. 44/1988 Coll., to provide *protection and registration of 409 unexploited reserved mineral deposits* as authorized by § 8 of Act No. 44/1988 Coll. Areas of protection (CHLÚ) have been defined for 340 mineral deposits.
3. Maintaining a *register of the reserves* contained in all 1,497 *reserved mineral deposits* under § 29 section 4 of Act No. 497/1992 Coll., on the registration of reserves of reserved mineral deposits. On the basis of this and the Geo(MoE)V3-01 resort statistical reports, the CGS publishes annually a *Review of Reserved Mineral Deposit Reserves of the Czech Republic*. The CGS registers all 1,089 *protected mineral deposits* (§ 29, section 2 of Act No. 44/1988 Coll.).
4. Maintaining the *archive of prognostic resources* and the *archive of non-reserved deposits* according to § 13, section 3 of Act No. 62/1988 Coll. and §15 of Act No. 497/1992.
5. Providing selected information about specific areas of the Czech Republic to local planning authorities for regional planning and background analysis (§ 27, section 3 of Act No. 183/2006 Coll. and § 15 of Act No. 497/1992), including publication of *maps of protected mineral deposits*. This service is provided through the CGS web applications.

REVIEW OF MINERAL RESERVES AND RESOURCES

On the basis of the state statistical reports Hor(MPO) 1-01, as delegated by the MIT, the DMR compiles *Summary of Mineral Reserves in Mining Leases and Other Exploited Deposits of Non-Reserved Minerals* and *Register of Non-Reserved Mineral Deposit Reserves of the Czech Republic*. In addition, DMR carries out investigations and analysis and provides the information required to support MIT activities related to state mineral and energy policy and to regional mineral policy and utilization of the mineral base. A technical report entitled *Changes in Reserves of Reserved Mineral Deposits* is published annually over the previous ten-year period.

MINERALS IN THE CZECH REPUBLIC

The Czech Republic is one of those countries in Europe and elsewhere in the world that systematically provides public information about the utilization of its domestic mineral base and about foreign trade in mineral, including prices in the mineral market. For this purpose, the DMR annually compiles and publishes *Surovinové zdroje ČR* and its English version *Mineral Commodity Summaries of the Czech Republic*.

This definitive publication is exchanged with other foreign geological surveys and guarantees a respected position for the CGS as a member of the international consortia competing for funding under the EC *Raw Material Initiative* call.

Mine Workings and Mining Waste

Under the authority of the Ministry of the Environment, the Czech Geological Survey maintains the Impacts of Mine Workings Database as one of its duties forming part of the state geological survey. This is carried out under the terms of § 35 of the Act No. 44/1988 Coll., on protection and use of mineral resources (Mining Act), and the decree of the MoE CR No. 363/1992 Coll., on the survey of old mine working and maintaining a register of them. Since May 2012, the Inventory of Hazardous Waste Facilities has also been compiled.

Vít Štrupl Head and Deputy Director of Geofond Division



IMPACTS OF MINE WORKINGS

A mine working impact, as defined in the Mining Act, refers to an abandoned underground mine working, the original operator or legal successor of which is unknown or does not exist. According to an amendment in 2002, it also refers to abandoned open pits, whose original operator or legal successor is unknown or does not exist.

All reported mining impacts are added to an inventory of mine working impacts, which is a part of the Geological Information System of the CGS. The inventory contains files with data sheets, maps showing the location of mine workings, assessments prepared by the Czech Geological Survey for the MoE, all correspondence and other related documents. The inventory also contains a “documentation section”, which includes safeguarding

plans, final technical reports and other supplementary reports and assessments.

Information about mine workings is permanently available to the public through the new map application GIS-Viewer on the web site of the CGS (<https://mapy.geology.cz/gisviewer>).

In addition, the CGS also manages the assessments of reported sites and compiles expert reports for the MoE. The basic information contained in these reports is obtained from other databases managed by CGS. These are mainly the Database of Abandoned Mine Lands (to 31st December 2012 it contained information about 5,594 features), the Database of Mine Workings (to 31st December 2012 it contained information about 26,320 mines and 20,574 digital photos) and the Database of Mining Maps (to 31st December 2012 it contained scans of 12,551 maps and related data).

INVENTORY OF HAZARDOUS WASTE FACILITIES

After the mining and extraction of minerals, many waste tips, tailings ponds, dumps and spoil tips remain in the landscape. Sometimes these are an attractive addition to the topography forming special environments with their own unique flora and fauna and are thus welcome recreational amenities, but in other cases they can create hazards for the environment and human health. In 2012 the CGS completed work on the project *Identification and classification of closed and abandoned mining waste facilities posing serious environmental or health hazards*. The project was carried out from 2010 to 2012 under the Operational Programme Environment (Priority axis: Improving Nature and the Landscape – The prevention of landslides, monitoring geofactors and the impacts of mining and extractive activities). The main aims were to develop the procedures for the evaluation of risks, detailed interpretation of the results and analytical investigations of representative localities, and the establishment of the Inventory of Hazardous Waste Facilities. In the Database of Waste Dumps, 6,136 records were revised. Detailed surveys were carried out at 300 localities. Final reports were compiled for each disposal site investigated. The newly created Inventory of Hazardous Waste Facilities is now the part of the CGS information system and, since 1st May 2012, it is available to the public as a separate web application (<http://rroum.geology.cz>). It contains information about the type and level of risk at each of the investigated sites. It is published in Czech as well as in English and is continuously updated. Access to the map application is in the CGS web page (www.geology.cz/extranet).



Detail of mine workings at Stará Vožice, the map dates from the beginning of the 19th century, author Georg Gold, CGS – Geofond, Kutná Hora.



Collapsed depression of the Růženec (Rosenkranz) silver mine shaft in Stará Vožice (Tábor region).



Sampling the dump of the medieval Šafary silver mine at Kaňk (Kutná Hora region).

Environmental Technologies

Research into environmental and geo-energy technologies is driven by the need for geoscientists to react to the local and global challenges of our era. The issues of climate change, energy security and planning for a low-carbon economy have led to new themes of research that will promote innovative ways of utilizing the geological environment.

Vít Hladík : Coordinator for research into environmental and geo-energy technologies



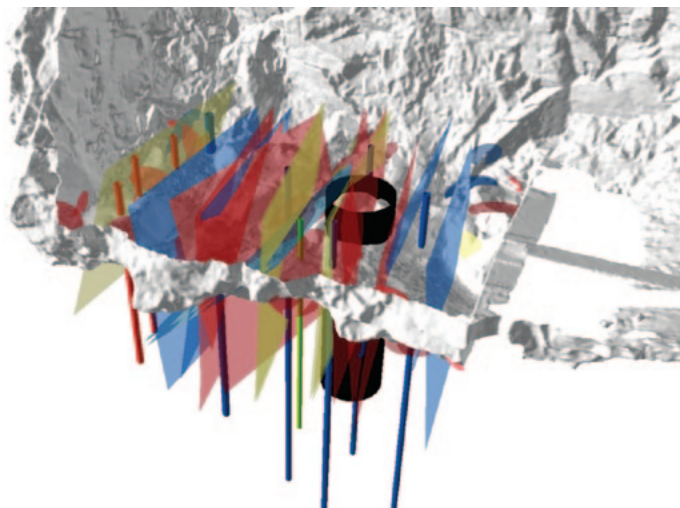
ENERGY STORAGE IN THE ROCK ENVIRONMENT

Energy storage in rock environment has become an important research topic of the CGS. During 2012 work continued on the project *Research on thermally loaded rocks – prospects for underground storage of thermal energy*. A key part of this work consists of *in situ* experiments involving detailed analyses of the effects of cyclical heating on the rock environment and reversal of the flow of thermal energy for industrial use to test the efficiency and safety of energy storage and recovery. In 2012 the technical works of installing and starting these experiments in the Josef Gallery near Mokrsko, in the environment of granitoid rocks ca 120 m below the surface, were completed.

Within the project *Reversible storage of energy in the rock massif* the CGS participates in experiments aimed at identifying rock types in the Czech Republic, which would be potentially suitable for use as underground reservoirs of thermal energy in the rock environment.

RADIOACTIVE WASTE DISPOSAL

In 2012, the CGS began work on the AHYMO project, the main aim of which is to develop the hydrogeological procedures and tools for research into rock environments suitable for the safe storage of spent fuel and to investigate the possibilities for energy storage and industrial utilization of underground spaces. The construction of a new type of pump for taking undisturbed groundwater samples from low-permeability fractures and fracture zones in granitic rocks has been completed. The pump is designed to sample water from narrow boreholes with a diameter of 76 mm down to depths of lift height of 250 m, while the contact between the air and the water samples is eliminated. This enables the reliable measurement of physicochemical properties such as pH and redox potential Eh on undisturbed samples, avoiding the changes that would take place rapidly in contact with the atmosphere or other sources of groundwater. The design of this instrument has been registered with the Industrial Property Office of the Czech Republic and an application has been made for the grant of a patent.



Structural model of the *Bentonites 95* experimental project site with the proposed main wide-diameter borehole and surrounding monitoring boreholes.

During 2012 the CGS also began cooperation on a project to investigate the stability of bentonite *in situ* at temperatures up to 95 °C and the interaction of bentonite with the surrounding rock environment and the groundwater present in it. The main *in situ* experiment is situated in the Josef Gallery near Mokrsko. The primary purpose of the project is to develop procedures that will enable bentonite to be used to seal future deep radioactive waste repositories.

UTILIZATION OF UNDERGROUND SPACES CREATED BY MINING ACTIVITY

In 2012 the CGS started a project to investigate the possibilities for industrial utilization of underground spaces created by mining of raw materials. During the first stage literature survey was completed and document files relating to 11 mining objects were selected for further evaluation.

The underground spaces in abandoned mines in the Czech Republic are currently used as repositories for fly ash, mine tailings, radioactive waste and natural gas and as a source of mine gas (methane) for the production of electrical energy and, at some historic sites, the workings are maintained for touristic purposes. Underground mine water is sometimes used as a source of heat for buildings and in sporadic cases for therapeutic balneological purposes, as well as for the extraction of dissolved uranium.

The investigation has shown the significant potential of mine waters as a source of thermal energy. In some cases these waters reach temperatures up to 32 °C. In the case of the 11 selected mining operations this amounts to an impressive energy resource of 14.4 GWh per year. Mine waters may also provide an accessible resource in places that suffer from a deficit of groundwater because 10–15 years after flooding of the mine these waters reach a low level of total dissolved content similar to common groundwaters. This means that they can easily be treated for use as drinking water. This can also be used as a cheap water supply for industrial purposes.



Water outlet from ČDV Příbram II into the Kocába stream.



The location of the experimental site and instrumentation in the Josef Gallery near Mokrsko used for the project *Research on thermally loaded rocks*. The picture shows the site before isolation of the wide-diameter heating borehole and surrounding monitoring boreholes.

GEOLOGICAL STORAGE OF CARBON DIOXIDE AND CCS TECHNOLOGIES

In 2012 cooperation within the framework of the *CGS Europe* coordination action continued, the main aim of which is the formation of a durable pan-European group of experts in the area of CO₂ geological storage. The CGS is a member of the steering committee of this initiative, responsible for dissemination activities. As part of these activities, the CGS also was a co-organizer of the international workshop *CO₂ Capture and Storage* in Ankara, Turkey.

Cooperation continued with ÚJV Řež on procedures for measuring the permeability of rock samples to supercritical CO₂. These measurements will be used for evaluation and certification of future CO₂ storage sites. The procedures will be submitted to the Czech Mining Authority for certification next year. Work also proceeded on establishing guidelines for risk analysis of storage sites, in the form of basic and alternative scenarios of their development. Guidelines for public communication during the negotiations of the location of potential CO₂ storage sites were also developed.

Regional Geological Administration

In addition to carrying out research, publishing maps and scientific papers, promoting geological education, and other related activities, the Czech Geological Survey provides a geological service for the state, in accordance with its legal framework. The regional geologists and specialists in mineral deposits, hydrogeology and engineering geology from the CGS provide professional assessments of geological matters across the whole Czech Republic and compile reports that enable the state and local administration to take appropriate decisions in the public interest. This statutory duty of the Czech Geological Survey is embodied in the Law on Geological Work. The organization and procedures used to carry out this service are the responsibility of the Regional Geological Administration within the CGS.

Jan Čurda : Head of Regional Geological Administration



REPORT WRITING

The most frequent task carried out by the regional geologists at CGS is the compilation of professional reports. These reports are concerned with a wide range of topics including hazardous geofactors, conflicts of interest, land-use planning, impacts of construction and technology on the environment, management of construction sites, remediation of old ecological burdens, proposals for nature conservation etc.

Continuous acquisition, storage and processing of scientific data on the geological composition and structure of the country, on the protection and use of natural resources and

on geological hazards and necessary preventive measures guarantee that the information essential for making political, economic, judicial and ecological decisions affecting land use is available.

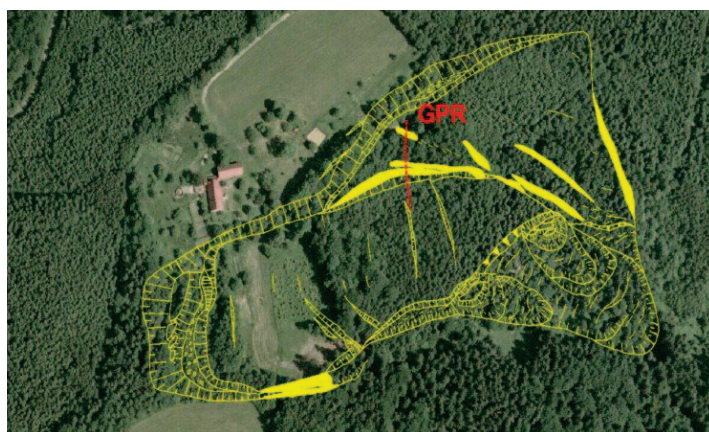
ACTIVITIES UNDERTAKEN, CONTRACTING AUTHORITIES AND WORKING TEAMS

In 2012, a team of three members of the Regional Geological Administration coordinated 574 tasks carried out for state and local administrative bodies,

courts, universities, museums, non-profit making and non-governmental organizations and other customers. Partial teams of specialists were also subcontracted to carry out these activities. Specialists were chosen from a total of 38 regional geologists, 14 regional specialists in mineral deposits and 6 specialists in hydrogeology, cooperating as required with 3–5 engineering geologists working across the whole Czech Republic.

EXPERT OPINIONS ON PROJECTS SUBMITTED TO THE OPERATIONAL PROGRAMME THE ENVIRONMENT (OPE)

In accordance with the *Consolidated version of the Directive of the Ministry of the Environment No. 3/2011, under the terms of Appendix 1, on submitting an application for financial support for projects from the Operational Programme the Environment, including co-finance from the State Environmental Fund of the Czech Republic and from the state budget of the Czech Republic – chapter 315 (the environment)*, regional specialists from the CGS compiled 82 expert assessments concerning individual projects within the OPE, *Priority axis 6 – Improving the state of nature and the landscape, Area of Intervention 6.6 – The prevention of landslides and rock avalanches, the monitoring of geofactors and the impacts of mining and extractive activities, and the assessment of non-renewable natural resources, including groundwater resources.*



Geomorphological map of the landslide near Oznice superimposed on an aerial photograph showing the position of the georadar profile (author I. Baroň).



Regional geologists also survey terrain under flood conditions (photo by P. Maděra).



Main scarp of the landslide at Moravany (photo by P. Petrová).

Geological Information System

The collection, administration, and provision of geoscientific information is one of the key functions of the Czech Geological Survey. The statutory duties of the Survey entail the interpretation and compilation of this information in the form of databases, maps, and reports, as well as scientific papers, so that it can be delivered to the state administrative bodies, local planning authorities, the wider scientific community and the public. This is achieved by means of a comprehensive purpose-designed geological information system. The system used by the CGS is compatible with Czech and EU legislation governing access to information and embodies international standards that enable interoperability of data. The CGS is now helping to create the national and European infrastructure of spatial information.

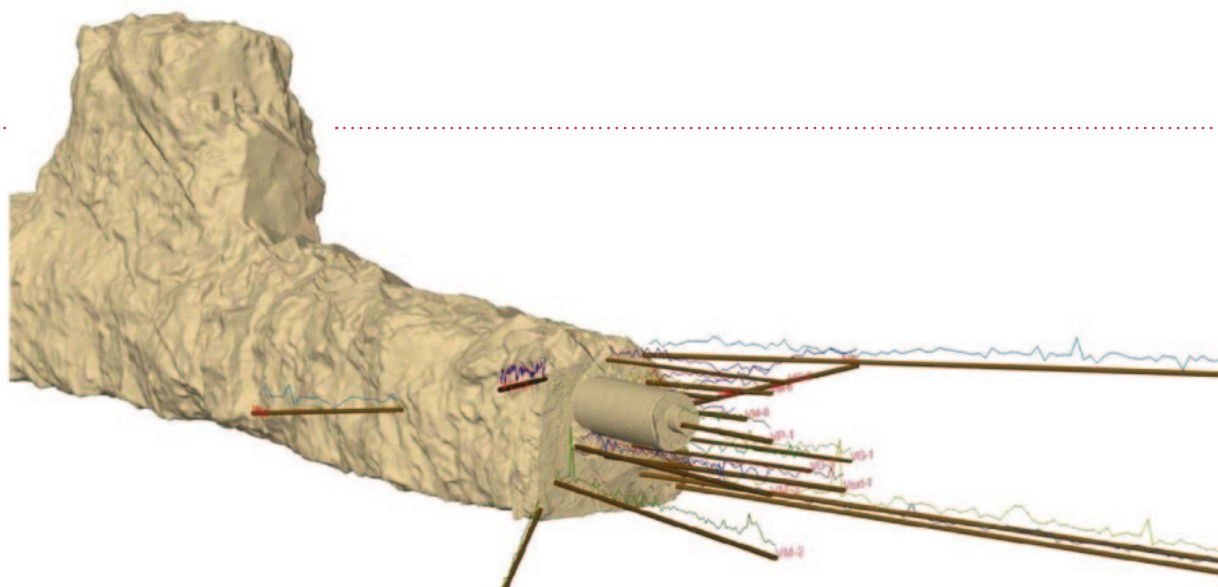
Zuzana Krejčí : Head of the Department of Information Systems



INSPIRE AND THE INTEROPERABILITY OF GEODATA

The purpose of the INSPIRE Directive (2007/2/EC) of the European Parliament and of the Council of 14 March 2007 was to establish an infrastructure for spatial information in Europe to support community environmental policies, and policies or activities which may have an impact on the environment. The CGS, as the statutory provider of geoscientific information (geology, hydrogeology, soils, geohazards) for the Czech state is required to follow this directive. It is obliged to supply metadata describing the information held in the CGS system in the agreed format and, subsequently, the data itself will also be made available. From 1.1.2012 the CGS also assumed responsibility for the tasks undertaken by the former CGS – Geofond. Today, the CGS is also obliged to supply actual metadata for data sets and spatial data services that were formerly provided by the CGS – Geofond.

The staff of CGS are actively engaged in formulating the implementing rules of the INSPIRE directive in the Czech Republic, in particular as members of the working groups KOVIN (metadata, data specifications, network services etc.), and in testing and commenting on the proposed INSPIRE documents. During 2012, comments on Annexes II and III of EU Regulation No. 1089/2010 for implementing Directive 2007/2/EC relating to the interoperability of spatial data sets and services were compiled and a Czech translation of the regulation was prepared. These documents will determine the structure of published data in the future and define the requirements for the development of the content of CGS data sources. In cooperation with other specialists in the implementation of the INSPIRE Directive, the creation and testing of standardized web services (WMS, WFS) has continued. In 2012, most of the services published in older systems that are no longer supported were transformed to ESRI ArcGis Server 10.0 technology.



3D visualization of magnetic susceptibility measurements, created in the CGS.

THE GEOLOGICAL INFORMATION SYSTEM OF CGS

The *Geological Information System (GeolS)* was designed by the CGS to be compatible with the national and international directives, JISŽP and INSPIRE.

The heart of GeolS is the *Central Data Storage (CDS)*, which contains over 50 thematic databases (www.geology.cz/geodata), graphical information (maps, geological sections and schemes) and tabular descriptions (legends, code lists, results of chemical analyses, archive data, operational databases etc.). The GeolS contains several large thematic subsystems: geological maps – *National Geologic Map Database (NGMD)*, geohazards – the subsystem mainly relating to slope failures and radon risk, mineral resources – *Information System on Mineral Resources (SURIS)*, mining waste – *Inventory of Hazardous Waste Facilities*, a subsystem for hydrogeology etc.

As part of the review and updating of metadata, the application for metadata management and accessibility (micka.geology.cz) of the CGS *metainformation system (MIS)* was developed and improved. Through this application, users have access to information about the type, quality, and availability of data held in the CGS. The CGS system forms part of the larger Information System of the Ministry of the Environment and is based on the international standards EN ISO 19115, 19119 and 19139 and ensures compatibility with the INSPIRE Directive. Moreover, it contains standardized information on map services and web applications. Through harvesting, the updated metadata on CGS data sources are also available daily on the national INSPIRE Geoportal (geoportal.gov.cz).

DEVELOPMENT OF THE TECHNOLOGY AND CONTENT OF DATA SOURCES

During 2012, data structures were reviewed in relation to the processing requirements for different projects and

the coherence of the separate thematic parts of the CDS. The presentation component of the CDS was put into operation, in which all data are stored in an optimized data structure, which can be presented to the public through a map service. For automatic conversion of the data presented, a group of models was set up. This enables export of data from GeolS to the presentation geodatabase. It guarantees the consistent presentation of data sets and avoids the errors that can be introduced by manual export of data.

A suite of synchronizing scripts and tools were introduced. These enable the data in the GeolS to be edited, not only in the database environment but also in the GIS environment. This significantly increases working efficiency. Editing of data in both systems is synchronized automatically.

GEOGRAPHICAL INFORMATION SYSTEM

A *Geographical Information System (GIS)* has been progressively developed by CGS over a number of years. It is the tool used by the whole organization to process, compile and access spatial data. In 2012, extensions were added to the tools used by field geologists to access the NGMD and process the data used to compile geological maps (tools for preliminary analysis of tectonic data, creation of the graphic presentation of the map legend from the data stored in the NGMD, batch processing of the spatial calculations etc.). Emphasis is put on combining field observations with the use of GIS and information gathered by remote sensing. These methods 3D modeling and digital cartography tools are routinely used by geologists mapping at 1:25,000 scale and/or when working on other major projects in the Czech Republic (*Review of Groundwater Resources, Research on thermally loaded rocks – prospects for underground storage of thermal energy*), as well as on projects in Iran and Ethiopia.

Geological Information System

The map part of the publication *Building and Decorative Stones of Prague and the Central Bohemian Region* was created in the GIS environment and gained the prestigious award The Map of the Year 2012 in the category "Single Cartographic Product". This prize is awarded annually by the Cartographic society of the Czech Republic. In 2007, the Geological Map of the Czech Republic at a scale of 1:500 000 won a prize in the same category.

PROVIDING ACCESS TO GEO-SCIENCE DATA AND INFORMATION

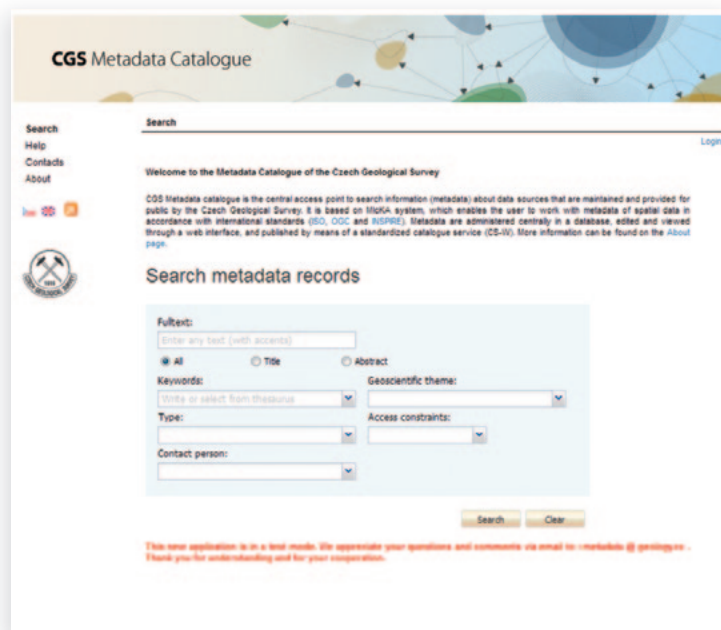
The *Information Portal of CGS (IP CGS)* is the integrated platform for information from GeoS containing more than 100 thematic applications. One of the most visited parts of IP CGS is the **Map Server** by means of which spatial data stored in the archives of CGS and NGMD can be accessed free of charge. In the Maps section on the Czech and English web-sites a signpost for the map applications on the CGS map servers was created which integrates the map applications of CGS and the former CGS – Geofond (for more details see <http://mapy.geology.cz> and <http://maps.geology.cz>). In 2012 the revision of map applications continued. In comparison to former versions, they have many new features, that are accessible in the ArcGIS Server and ArcGIS Viewer for Flex technologies (the new applications for Hydrogeological regions, the Soil map at a scale of 1:50 000, Maps of the radon index, Registers of landslides and slope failures and Decorative stones). Most of these applications have recently been linked to the current acquisition of data. New functions were added to the internal application of CGS e.g. the map outputs in the digital geological and hydrogeological documentation logbook. During 2012 the information from the web-page of the former CGS – Geofond and changes based on the new CGS Strategic Plan for Research were integrated on the web page of the Czech Geological Survey.

Public awareness of the work of CGS was raised by the creation of the websites related to Geohazards, Coal deposits and Groundwater (for details see the section on the CGS webpage). During the last quarter of the year 2012, work began on connecting the webpage of CGS with MIS CGS in order to automate the continuous creation of lists of data, services and applications using new generations of XML and XLS technologies.

As part of the management and provision of information from databases of significant geological localities, 358 descriptions of new localities, mainly from Southern and Eastern Moravia, were added in 2012. Public access was given to the English version of the new search application (<http://locality.geology.cz/d.pl?item=1&l=e>).

INFORMATION AND COMMUNICATION TECHNOLOGIES

In 2012, ICT development was concerned with the integration of the infrastructures of the CGS and the CGS – Geofond. The first stage was to incorporate the staff of the CGS – Geofond in



Metadata catalogue of the CGS for searching information on data sources (metadata), managed and provided to the public by the CGS. It is based on the MICKA system. This system enables management of metadata in the central database, their editing and browsing through web interface, and their publication by means of standardized catalogue service.

the management database applications (intranet, e-mail, monthly reporting, document management service etc.) and convert the e-mail addresses of the geofond.cz domain to geology.cz and link the infrastructures via optical fibers.

In the second stage, transmission between networks and permission for mutual sharing of information between clients and servers was arranged so that map services and applications using new technologies could operate across the whole information system. Both organizations use the ArcGIS Server and Oracle technologies, so there were no serious problems in unifying the two systems.

INTERNATIONAL COOPERATION

Representatives from the CGS play significant roles in the *International Geoscience Information Consortium (GIC)*, and also manage its web pages. They also take part in the activities of *EuroGeoSurveys (EGS)*, especially the Spatial Information Expert Group. Since the project *OneGeology-Europe (1G-E)* ended in 2010, the CGS has been entrusted to manage and maintain the multi-lingual metadata catalogue (one.geology.cz). At the end of 2012 at the 33rd Meeting of directors of EGS member organizations, the initiative *OneGeology-Europe Plus* was agreed. It follows on from the work of the project 1G-E and its main task is to complete the coverage of Europe by harmonized geological maps at the scale of 1:1,000,000 of countries which were not involved in the original project. The coordination of this initiative was entrusted to the CGS.

Remote Sensing

Remote sensing is nowadays the most widespread method of acquisition of spatial data regarding the Earth's surface and objects introduced by new space programmes and rapidly developing technology. In addition to the fact that remote sensing data provide a synoptic view of the studied area, the main benefit is the possibility to combine spatial and thematic information (qualitative values of the studied objects) and also temporary details (systematically acquired archive data enable assessment of the time sequence of images).

Veronika Kopačková Head of the Remote Sensing Centre



ACTIVITIES OF THE REMOTE SENSING CENTRE

The Remote Sensing Centre (<http://www.remotesensing-geology.ic.cz>) specialises in the application of image spectroscopy (IS) techniques using optical and thermal hyperspectral (HS) data (0.45–13.00 μm) for geological purposes. Within the frame of several research projects (GACR 205/09/1989-HYPSO: <http://www.geology.cz/project619100>, FP7-EO-MINERS: <http://www.eo-miners.eu>, EUFAR-DeMinTIR: <http://www.remotesensing-geology.ic.cz/projects/demintir.html>), the HS data from HyMap, CASI and AHS sensors were obtained for the testing locality of Sokolov Basin. The obtained data were used for further investigation of the relationship between the chemical composition of the soil substrate and the health of vegetation growing on it, by using quantitative methods of IS. The results have been published continuously in international peer-reviewed scientific journals with IF. Mathematical models for determining the gradient of pH and the content of selected heavy metals across an area and for assessing the physiological conditions and general health of forest cover are among the main outputs from these research activities.

In addition to the HS technologies described above, the Remote Sensing Centre is engaged in other research. New procedures for classifying topographical features and interpreting their subsequent geomorphological development have been created, as well as a new method enabling updating of tectonic and hydrogeological features using ALOS PALSAR satellite radar data. Within the frame of the project PANGEO (FP7: <http://www.pangeoproject.eu>), tens of new polygons with potential risk of vertical movements were detected for Prague and Ostrava, on the basis of radar interferometry results.

REMOTE SENSING RESEARCH AT THE CGS IS CARRIED OUT IN COOPERATION WITH THE FOLLOWING PARTNERS

- Faculty of Sciences, Charles University in Prague
- CzechGlobe, Academy of Sciences of the Czech Republic
- German Aerospace Centre (Deutsches Zentrum für Luft und Raumfahrt, DLR)
- Tel Aviv University
- French Geological Survey (Bureau de Recherches Géologiques et Minières, BRGM)

International Activities and Cooperation

The international cooperation includes a wide range of activities, such as development cooperation, joint publications with foreign authors, participation in international conventions, symposiums and congresses, membership in international organizations and working groups, organization of international conferences and collaboration in international scientific projects.

International development cooperation of the CR aimed at environmental geology in Ethiopia
(photo by J. Šebesta)



INTERNATIONAL PROJECTS IN 2012

Capacity building in environmental geology – Mapping of geohazards including hydrogeological conditions in Dila and Hosaina areas, Ethiopia

With funding from the Ministry of Foreign Affairs under the terms of the development cooperation programme of the CR administered by the Czech Development Agency, in 2012 the Czech Geological Survey launched a project to survey and assess the geohazards and hydrogeological environment in Dila and Hosaina. The main aim of the project was to transfer scientific expertise in research on volcanic, seismic, erosional and hydrological risks to the staff of the Geological Survey of Ethiopia. Czech-Ethiopian teams worked together in the field and in the office compiling maps and carrying out detailed studies of natural hazards in the southern part of the Ethiopian rift.

The growth of continental crust and construction of continents based on the example of Central Asian Orogenic Belt

In the context of the gravimetric, magnetometric and geological investigation of southern Mongolia, a programme of palaeomagnetic measurements on rocks from the Gobi desert has been completed. During 2012 an expedition was made to the Mongolian Altay where detailed investigations of the

Khantaishire Ridge and the areas of Tseel and Tsogt were carried out. These domains are interpreted as wide magmatic arcs of Cambrian and Devonian ages. Petrological and structural studies of these domains show that there has been wide synconvergent transfer of magma through the crust – a mechanism which is known to have occurred elsewhere only in the Japanese island arc.

INMON: Innovative methods for monitoring the state of health of the common spruce in the Krušné hory Mountains using hyperspectral data

The aim of this Czech-American cooperative project is to monitor the state of health of forest ecosystems in the “black triangle” of Central Europe by using the common spruce (*Picea abies*). This monitoring is based on the use of modern methods of spectroscopic imagery. The state of health of stands of common spruce is evaluated on using biochemical and biophysical parameters (leaf pigments, lignin, LAI: Leaf Area Index) and modelling their surface gradients on images obtained from hyperspectral data. The current project follows on from research carried out from 1998 to 2004 at the Faculty of Sciences of Charles University in Prague in cooperation with the NASA Goddard Space Flight Centre (GSFC). For the purpose of this research, the hyperspectral air image data from ASAS sensors were provided. This provided a unique opportunity to compare the changes in the state of health of stands of common spruce using data captured in 1998 and 2003.

The influence of mining and mineral processing on the environment in Namibia: Modelling the migration of pollutants in soils, plants and groundwater

Under the terms of a project funded by the Grant Agency of the CR, the contamination of soils and vegetation at Tsumeb and around the abandoned mineral processing plant at Kombat and Berg Aukas in Namibia have been studied. The investigations at Tsumeb showed that the soils in the vicinity of the smelting works are very strongly polluted by lead and copper and especially by arsenic. Dendrochemical studies of trees close to the smelting works showed an increase in the concentration of arsenic in xylem during recent years. At the abandoned tips of the Kombat mine the variation in the isotopic composition of copper was used to determine the depth of contamination in soil profiles.

Sudetes Georoute – geological tourist guidebook

This project is funded under the Operational Programme for Czech Republic – Republic of Poland Cross-Border Cooperation 2007 to 2013. The main aims are to increase the opportunities for tourism in the trans-border region of the Czech Republic and Poland by creating a route for geotourism along the Sudetes Mountains from the town of Bogatynia in the west to Opava in the east. Attention is being drawn to important geological phenomena and sites of special scenic and scientific interest that can be found in the region. The natural and cultural inheritance of different parts of the region is being illustrated by information boards, information leaflets, the website www.geostrada.eu and printed guidebook.

The role of Palaeozoic accretionary and collisional orogens in the formation and growth of continental crust (ROPAKO)

In 2012 the concepts of continental subduction and gravitational inversion of the crust in the Bohemian Massif were advanced by numerical modelling. Thermo-mechanical modelling and petro-structural studies of different parts of the Variscan Belt (Morocco, the Pyrenees, the Massif Central in France and the Bohemian Massif) show that there is a disconnection between the suprastructure and the deep infrastructure of the orogenic belt due to late collisional processes. New research shows that the European Variscan system is formed by two loaded orogenic processes, which are the result of large-scale changes in the configuration of the lithospheric plates.

Disparity and ontogenesis in trilobites: characteristics of morphological changes

Significant progress has been made in the study of the ontogenesis of phacopid trilobites from the Lower and Middle Devonian of the Prague Basin (Barrandien locality) using innovative quantitative methods. Lukáš Laibl, MSc., has been trained by Dr. Crónier in the use of these techniques. As a result of this work, two papers have been published in journals with impact factors (IF) of 1.1 and 1.5 respectively, and one paper in a peer-reviewed



Participants of the Annual Workshop of the IGCP project SIDA 594 *Environmental and health impacts of mining in Africa*, which took place in Windhoek, Namibia in July 2012.

international journal together with five abstracts for important international conferences including the 5th International Conference on Trilobites and the 34th International Geological Congress in Brisbane, Australia.

Environmental and health impacts of mining in Africa

The Czech Geological Survey is taking part in the UNESCO IGCP project SIDA 594, the Annual Conference of which took place in Windhoek, Namibia in July 2012. More than fifty delegates from universities, geological surveys and mining companies from twenty African and European countries attended. As part of the conference, a training course on the application of geochemical modelling to environmental problem solving in relation to mining and processing of raw material in Africa was organized for African university students. The best papers presented at the meeting were chosen for publication in the *Journal of African Earth Science*.

Tectonic development and prediction of the raw material potential in Western Africa

Contributing to the international project AMIRA-WAXI (West Africa Exploration Initiative) in 2012, the Czech Geological Survey took part in the evaluation of the raw material potential of Burkina Faso and Mali. The work involved studies of the primary and secondary geochemical aureoles around ore deposits and contributed new information about the factors governing the dispersion of the major and trace elements in the host rock and overlying soils. It was found that gold in the rocks and soils of the weathering mantle is accompanied by a wide range of other metals, especially arsenic, copper, antimony, tungsten, tellurium and selenium. The pattern of abundance of accessory elements is determined specifically by the chemistry of the primary parageneses of ore minerals and the temperature-pressure conditions under which they were formed. High arsenic contents are associated with deposits formed at high temperatures whereas those deposits formed at lower temperatures show increased amounts of antimony, lead and mercury.

PanGeo: GMES-Copernicus System for accessing geological information

The international project PanGeo is being carried out within the Copernicus (former GMES) and the Seventh Framework Programme of the EC. It is concerned with the monitoring of hazards

International Activities and Cooperation

caused by movements of terrain (uplift and landslides) in the vicinity of large urban agglomerations. The study is based on the use of radar interferometric methods. The target of the project is to publish an online catalogue of these geohazards for the 52 biggest cities within the EU-27 countries. Two cities from each country have been selected, with the exception of Luxembourg and Cyprus. In the Czech Republic Prague and Ostrava were the chosen cities. As a result of monitoring by radar interferometry, tens of new polygons with potentially hazardous vertical movements have been identified. The data obtained are accessible to the public through web page and map services.

SoilTrEC

Three brook catchment areas in the Slavkov Forest with geochemically different bedrocks (granite, serpentinite and amphibolite) form a critical zone observatory of the network for European project SoilTrEC. The work involves monitoring the cycle of water and chemical compounds in the zone between the unweathered rock and the treetops and their effect on weathering processes and the state of biota. Sampling of rocks from boreholes and soils from pits was carried out. Sampling of atmospheric precipitation and throughfall, soil water from five depths and surface water are continuing. These data are also being used to test newly developed biogeochemical models.

Evaluation of the environmental impact of surface excavations based on analysis of data from a hyperspectral sensor

The influence of the geochemical composition of the soil substrate on the health of vegetation is being studied with the help of hyperspectral (HS) image data obtained using the airborne HyMap sensor. Models of the total health of spruce stands based on imaging the surface gradient of pH have been developed. This important innovation compliments classical environmental monitoring methods and could replace them in the future. The dependence of the physiological state of different tree species (birch, pine and spruce) on the chemistry of soils outside and in the vicinity of lignite basins has also been investigated. The results of this research are published regularly in peer-reviewed international journals with IF.

CGS Europe

CGS Europe is a pan-European coordination action focused on international cooperation and networking related to CO₂ geological storage. This is a project within the EU 7th Framework Programme for research, technological development and demonstration activities, carried out from 2010 to 2013. A total of 34 research institutes from 28 European countries are active in this project. CGS is a member of the Management Board.

The main aim of the project is to create a reliable, independent and durable pan-European expert group, which will be able to support implementation of new technologies for CO₂ capture and storage (CCS) to European industry.

EO-Miners: The methods of Earth observation as tools to monitor the environmental and socioeconomic impacts caused by mineral resources extraction

This international project funded by the EC under framework FP7 is concerned with the observation of the environmental and socioeconomic impacts of mining mineral resources. Methods of remote sensing of the Earth are being used. In addition to the Sokolov Basin, which is the designated European test site, investigations are also being carried out at the Witbank coal mining area in South Africa and the Makmal gold mine in Kyrgyzia. On the basis of field trials, parameters indicative of erosional processes and pollution of air, water and soil that could be studied by remote sensing were selected. On this basis, maps and information layers are created using a wide range of satellite (ASTER, WorldView, Quickbird) and airborne hyperspectral data (HyMap, AHS, CASI) and these will be made accessible to the public after the project is completed.



Ore deposit Obuashi in Ghana (AMIRA-WAXI project). The scientists from the Czech Geological Survey investigated the dispersion of the elements accompanying gold in the regolith.

Study of the provenance of metamorphosed sedimentary rocks

In 2010, the Czech Science Foundation approved funding for the research project *Deciphering the pre-convergence history of crustal domains in deeply eroded orogenic belts using detrital zircon populations*. The project will be carried out between 2011 and 2013 in the Bohemian Massif and the Kaoko Belt in south-western Namibia. The purpose of the project is to test methods of dating detrital zircons for use in interpreting the tectonic history of different highly metamorphosed clastic sedimentary units. Work in the Bohemian Massif is focused on determining the provenance of migmatitized sediments of the Moldanubian Unit and their relationship to the (meta)sediments of the Teplá-Barrandian Unit and the Brunovistulian Unit. The study in the Kaoko Belt in Namibia is designed to identify the provenance of the clastic material in highly metamorphosed sediments in the cover of the Congo Craton and in the back-arc basin in collision with it.

Glacial retreat in the northern part of James Ross Island

This project was scheduled for the period 2009–2012. Under the terms of this project, changes in the volume and the area covered by

small glaciers in the northern, mostly deglaciated, part of James Ross Island were surveyed using remote sensing methods and glaciological field measurements. It was observed that glaciers in this part of the island are retreating as a result of an increase in temperature that is several times higher here than in other parts of our planet. The project is financed by the Czech Science Foundation.

Training of staff from the Moravian Branch of CGS in new approaches to carrying out and managing research and development

During this project, started in 2009 and completed in August 2012, a system for further education of scientific staff was developed. Three pilot sessions of training were organized. A team of instructors from within the CGS was selected and trained systematically. The focus was placed on modern methods of geological research and project management, the presentation of the results of research and their popularization and on effective communication and team cooperation. Training in leadership and management of scientific research was given to all the executive staff. The project was carried out under the terms of the Education for Competitiveness Operational Programme.

OTHER PROJECTS CARRIED OUT IN COOPERATION WITH FOREIGN PARTNERS

Thermo-chronological history of development of the sediments in the Eastern parts of Magellanes backarc area (bilateral Czech-Argentinean scientific technical cooperation under the terms of the MOBILITY initiative).

R&Dialogue – interdisciplinary project on the boundary of technical, natural and social sciences focusing on social dialogue related to the transition to low-carbon economy (Co-ordination and Support Action in the framework of EU-FP7).

Experimental investigations of the ternary systems: silver – Pt-group metals – chalcogen (bilateral project of scientific technical cooperation between the Czech Republic and the Russian Federation in the framework of the KONTAKT II programme).

Natural and synthetic minerals of the Pt-group: their comprehensive characterization by innovative methods and explanation of their genesis under different geological conditions (bilateral Czech-Austrian project of scientific technical cooperation under the terms of the MOBILITY initiative).

Middle Palaeozoic climatic and sea-level changes and their influence on marine community evolution: a comparison of models from the Perunica microcontinent and the Laurasian continent (project of bilateral Czech-American scientific and technological cooperation).

Assessment of the potential of mineral resources on the Saxon-Czech border – cross-border register of mineral resources (project in terms of the Ziel 3 Programme that supports cross-border cooperation between the Czech Republic and the Free State of Saxony 2007–2013).

INTERNATIONAL GEOLOGICAL CORRELATION PROGRAMMES OF UNESCO (INTERNATIONAL GEOSCIENCES PROGRAMME – IGCP)

In terms of scientific research in 2012 the staff of CGS also participated in the following IGCP projects:

IGCP 540 – Gold-bearing hydrothermal fluids in orogenic deposits.

IGCP 575 – Pennsylvanian terrestrial habitats and biotas in southeastern Europe and northern Asia Minor and their relation to tectonic and climate.

IGCP 580 – Application of magnetic susceptibility as a palaeoclimatologic indication in Palaeozoic sedimentary rocks and characterization of the magnetic signal.

IGCP 591 – The Early to Middle Palaeozoic revolution (Š. Manda – national representative).

IGCP 594 – Environmental and health impacts of mining in Africa (B. Kříbek – international leader).

IGCP 596 – Climate change and biodiversity patterns in the Mid-Palaeozoic (S. Vodrážková – national representative).

The scientists from CGS also participated in management of the Czech National Committee for International Geoscientific UNESCO IGCP Programmes (J. Pašava – chair, A. Vymazalová – secretary).

MEMBERSHIP IN INTERNATIONAL ORGANIZATIONS

EuroGeoSurveys – gathering of 32 European geological surveys

ICOGS – International Consortium of Geological Surveys

Central European Initiative – gathering of Central European geological surveys: Czech, Slovak, Austrian, Hungarian, Polish and Slovenian

ENeRG – European Network for Research in Geo-Energy (member of the Steering Committee and website editor V. Hladík)

SGA – Society for Geology Applied to Mineral Deposits (executive secretary J. Pašava, student representative A. Vymazalová) – a scientific society gathering over 1000 specialists in the field of geology and mineral deposits from over 80 countries around the world

AAPG – American Association of Petroleum Geologists – currently the world's largest professional geological society gathering over 35 000 specialists – geologists, geophysicists, CEOs, managers, consultants, students and academicians from over 150 countries all around the world (President of the European Region V. Dvořáková).

INQUA – International Union for Quaternary Research

ProGEO – European Association for the Protection of Geological Heritage

KBGA – Carpatho-Balkan Geological Association

EAGE – European Association of Geoscientists and Engineers; affiliated member is the Czech Association of Applied Geophysicists (member of the steering committee D. Čápravá)

CGMW – Commission for the Geological Map of the World

GIC – Geoscience Information Consortium (chairman R. Tomas) – a consortium gathering the managers of informatics of 26 geological surveys around the world

IAGOD – International Association on the Genesis of Ore Deposits (leader of the Czech team B. Kříbek)

SEG – Society of Exploration Geologists (member of the steering committee J. Pašava)

SRG – The Society of Resource Geology (Japan)

CETEG – Central European Tectonic Groups

Laboratories

Vojtěch Janoušek | Deputy Head of the Department of Rock Geochemistry

Věra Zoulková | Head of the Central Laboratory in Prague **Juraj Franců** | Head of the Central Laboratory Brno



CENTRAL LABORATORY PRAGUE

The Central Laboratory is located in Barrandov, Prague. It is responsible for the chemical analysis of minerals, rocks and sediments as well as the biogeochemical analysis of organic materials such as conifer needles, wood, and peat. Analysis of water is also carried out. The laboratory has been accredited since 1993 and regular national and international interlaboratory tests of analytical quality have consistently given good results.

Analyses of solid samples

Silicate analysis is the main service requested by the CGS and other clients. The analysis of major elements provides fundamental information about the stoichiometry of minerals and the chemical composition of rocks. In addition, the contents of trace elements are determined using a variety of instrumental methods (ICP-MS, FAAS, HGAAS and RFA). Special procedures are also available for fire assay of gold and platinum group metals (PGM).

Water analyses

The analysis of groundwater and precipitation is an important duty of the laboratory at Barrandov. The contents of metals and anions, total carbon and nitrogen dissolved in water are important environmental indicators. Aquifers and surface waters

must be monitored regularly. Analysis of trace elements is carried out using ETAAS and ICP-MS.

CENTRAL LABORATORY BRNO

The work of the Central Laboratory in Brno is focused on organic and gas geochemistry.

Rocks

The analytical equipment is used to determine the organic and mineral carbon and total sulphur in suspended particulate matter (SPM), sediments and rocks and the molecular composition of extractable compounds, especially biomarkers in rocks and crude oils. Visible organic constituents (macerals) of terrestrial plant and algal origin in carbonaceous rocks are characterized using fluorescence and reflected light microscopy. The vitrinite reflectance is measured and used as a calibration parameter in the numerical models of burial and thermal history of sedimentary basins.

Ecology

An important aspect of the environmental studies carried out at the Central Laboratory Brno is the analysis of persistent organic pollutants. Understanding the origin

and degradation of these pollutants in the soils and lake sediments has a direct bearing on the quality assessment of water supplies. Special attention is paid to the sorption and transport of pollutants on solid particles in the atmosphere, their precipitation and distribution in surface waters.

Gases

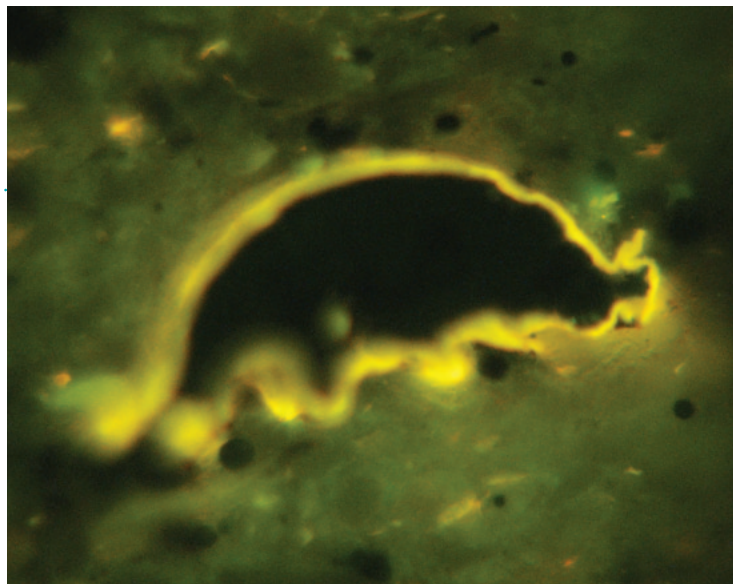
Field measurements of gas composition are carried out using ECOPROBE-5 and combined with detailed chromatographic analyses of 20 compounds in the laboratory. Chemical composition of gases (including helium and argon) together with isotopic composition of the carbon in methane and higher hydrocarbons measured in the CGS laboratory at Barrandov serves as a basis for evaluation of the gas origin and migration pathways.

Projects

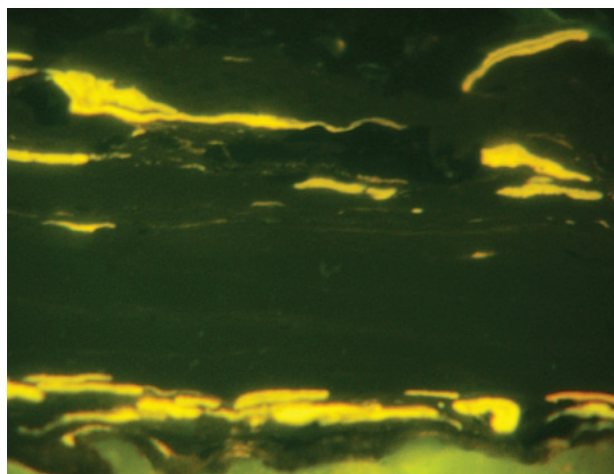
Organic geochemistry in the sedimentary units of the Bohemian Massif, the Carpathians, Moesian Platform and the Dacian Basin in Romania is used to interpret the changes in palaeoenvironment and palaeoclimate recorded in the geological archives of these sedimentary basins. Petroleum systems efficiency in the Czech Republic and abroad is evaluated using the basin evolution concepts with source rock potential, favourable thermal and migration history, and well sealed traps. Oil-oil and oil-source rock bitumens and gas-gas correlations provided helpful tools in exploration. Methods of gas flow measurements were improved and assistance was provided to gas-tightness monitoring of the underground gas storage assets. Regional gas emissions from the soil into the atmosphere were studied in order to improve the green house gas inventory. In cooperation with RWTH Aachen, desorption of methane and CO₂ from coal seams has been investigated. The results suggest that during the period after the tectonic emplacement of the Carpathians on the Bohemian Massif, a redistribution of the gases of coal, petroleum and microbial origin occurred in Carboniferous and Miocene formations in the Upper Silesian Basin. During 2012, soil pollution map layers were generated within the mapping campaign in Brno district. A joint publication with RECETOX (MU) summarizes the mineralogical, chemical and toxicological characteristics of pollutants sorbed on solid particles in urban air in Brno.

SPECIAL LABORATORIES

The range of analytical facilities provided by the Special Laboratories forms the backbone of the Department of Rock Geochemistry. X-ray diffraction (XRD) is used to determine the lattice structure that defines the morphology and other properties of crystalline minerals. The chemical composition and zoning of minerals are studied using the scanning electron microscope (SEM); microstructures can be visualized by using the electron backscatter diffraction (EBSD) attachment. The P-V-T-X conditions



Planktonic algae filled with pyrite (photomicrograph in fluorescent light, obj. 60x).



Coal layer containing vitrinite (black) and sporinite (yellow) obj. 60x.

of hydrothermal fluids are studied in our Fluid Inclusions Facility. Phase relations within the S, Te, Se and PGE-bearing systems are the subject of research in the Experimental Mineralogical Laboratory. The thermal ionization mass spectrometer (TIMS) is capable of measuring the isotopic ratios of several elements applicable to petrogenetic and geochronological studies (Sr, Nd, Ca and Os). The influence of global palaeoenvironmental changes on the evolution of marine and terrestrial communities is the subject of research in the Laboratory of Ecostratigraphy and Palaeobiology.

The workers in the Special Laboratories are not only responsible for providing primary geochemical data, but are often also established scientists, taking an active part in multidisciplinary projects, regularly publishing their results and being involved in teaching.

Library and Collections

The services of the Library and Collections are used not only by specialists from the Czech Geological Survey and other scientific institutions, but also by students, private researchers, and the general public. Researchers can use two well-equipped modern study rooms to consult and examine materials from the holdings of the Library and Collections of the CGS.

Hana Breiterová Head of the Department of Information Services and Head of the Geological Library



LIBRARY

The Library of the CGS is the largest geological library in the Czech Republic. It holds a unique collection of geological literature from around the world. The study rooms offer not only printed materials, but also electronic resources. Referencing, interlibrary and search services are also provided in both conventional and electronic forms.

The Library provides access to the databases of the CGS as well as to worldwide fulltext (Science Direct, SpringerLink, Wiley Interscience, Blackwell, GeoscienceWorld) and bibliographic databases (Web of Knowledge, Scopus, GeoRef and GeoBase, Environment Complete). These sources are available to all registered readers. The resources of electronic information held by the CGS Library are the most comprehensive of all the libraries within the Ministry of the Environment.

Other activities of the Library

In addition to providing the library services described above, the members of the geological library staff undertake other

special tasks. One of these is the processing and submission of data for the Register of Information of the R&D&I Council. The geological bibliography from earlier annual reports is also being processed retrospectively and the National Geoscientific Bibliography is now being progressively updated. Training courses for individuals, as well as lectures and presentations for groups of users, are held regularly.

On the 31st December 2012, the decision was taken by the Ministry of the Environment (MoE), not to maintain its own library and transfer of the holdings to the CGS was negotiated. A plan was prepared so that the necessary steps could be taken to incorporate the collection in the CGS library catalogue and make it accessible in the CGS study room. The success of the transfer depended on the conversion of the catalogues from the system used by the Library of the MoE to the Clavius library system used by the CGS Library. It was necessary to classify the range of documents being transferred to the CGS Library so that they can be presented as a scientific collection concerned with the protection of the environment and related fields. It was also necessary to convert the format of the bibliographic data used by the MoE Library

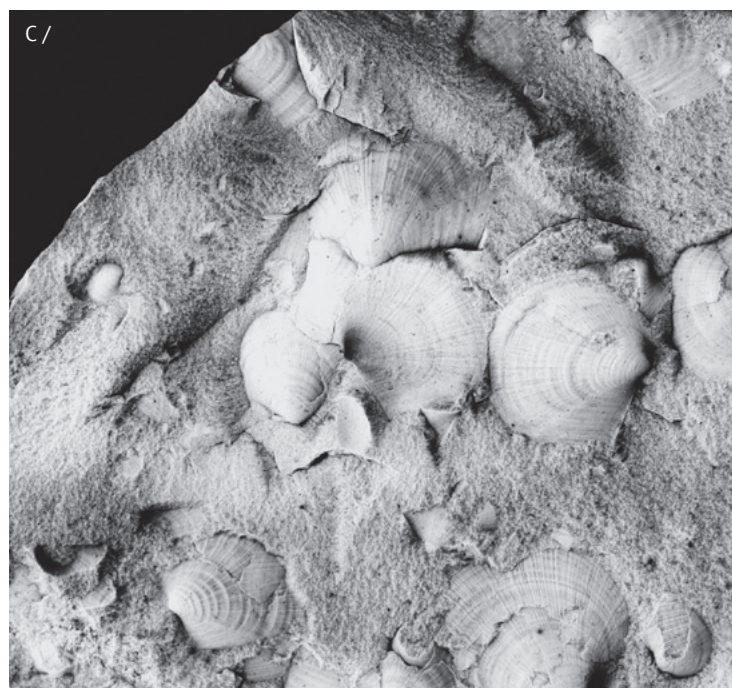
to the UNIMARC format, used by the CGS Library. The actual transfer of the MoE Library collection and the conversion of the library catalogues will take place during 2013. The catalogues will be made available on-line and the whole collection will then be accessible.

COLLECTIONS

The Department of Geological Sample Collections stores and provides access to fossils, samples of minerals and rocks, drill cores, thin sections and other geological samples collected by researchers from CGS and other organizations. The most valuable specimens from the scientific point of view are located in the geological, mineralogical, and palaeontological collections. Selected material from the collection is stored, made accessible and registered in the CES national register under the terms of Act No. 122/2000 Coll. and Decree No. 275/2000 Coll. These specimens are stored, made accessible and lent under strict conditions defined by the regulations cited above. Material documentation (geological and palaeontological samples from geological mapping, cores and thin sections from logged diamond drill holes) is stored under the terms of Act No. 62/1998 Coll. as amended by Act No. 66/2001 Coll.

Significant new additions to the CGS Collections

The transfer of Silurian and Devonian bivalves from the personal collection of Dr Kříž to the CGS continued during 2012 and is now nearly complete. This collection of over 16,000 Palaeozoic bivalves is one of the largest and the most scientifically important in the world. The Czech Geological Survey is honoured to have received this collection and to be responsible for making it accessible to the wider community of palaeontologists as well as the scientific staff of the CGS. Purchase of the collection of Mr V. Frank from Mušlovka near Řeporyje and the collection from Počápy near Králův Dvůr made by P. Kácha were also important acquisitions. Unique specimens of injured trilobites and slightly mineralized fauna from the Cambrian of Central Bohemia were donated by Mr F. Knížek, Dr J. Zajíc presented some Permo-Carboniferous ichthyoliths, and Mr V. Vokáč transferred documentary material for his publication. Original type specimens of Moravian Palaeozoic trilobites from the collection of Mr T. Weiner, as well as fauna from Opatov collected by Mrs H. Poukarová, were also transferred to the CGS. Under the terms of internal project No. 335400, important fossil material from Antarctica (silicified wood of Jurassic and Cretaceous age) was described and catalogued. The Antarctic samples, as well as other new additions of type material to the CGS museum, were registered in the Central Register of Collections of the Ministry of Culture of the CR. In addition to the care of approximately 300,000 stored items, intensive scientific publication activities accompanied the curatorial responsibilities. At the end of 2012, a grant project under the MEYS programme KONTAKT



A, B – *Coxiconchia britannica* (Rouault, 1851),
A – CW 3a, inner core;
B – CW 2, right valve (collection of Mr Vladislav Kozák). Ordovician, Darriwilian, Šárka Formation, Osek near Rokycany.

C – *Pterinopecten (Pterinopecten) cybele cybele* (Barrande, 1881), sample JK 9946 (collection of Jiří Kříž). Silurian, Přídolí, Požáry Formation, Praha-Dvorce, southern face of the cement quarry.

was completed successfully. The purpose of this project was the exchange of palaeontological information between the Université de Lille 1, the CGS and Charles University. Several scientific papers were published and Mgr. L. Laibl was trained in new techniques for the study of trilobite ontogeny.

Geological Documentation

In accord with § 12 of Act No. 62/1988 Coll. (on geological work) and §§ 12 to 16 of the Act and Decree No. 368/2004 Coll. (on geological documentation) of the Ministry of the Environment, the main task of the Geofond Department of the Czech Geological Survey is to gather, store, expertly process and provide access to geological documentation and the results of geological projects submitted to the Geofond by both natural and legal persons.

Milada Hrdlovicsová | Head of the Department of Geological Documentation



GEOFOND ARCHIVE

The Geofond Archive, now a specialized archive of the Czech Geological Survey, provides permanent storage and access to a collection of over 220,000 unpublished documents, further divided into separate thematic funds. In 2012, over 3000 of new geological reports were submitted to Geofond in accordance with the act on geological work. These reports were then incorporated into the bibliographical ASGI database, making them searchable on-line. Archive funds are used as a source of information mainly by local authorities, government departments, educational and scientific organizations and also by professionals and the wider public. Every year, about 10,000 documents are provided by request to readers in the study room of the CGS.

Systematic digitization of archive funds is carried out at specialized workplaces in Prague and Brno. The main purpose is to guarantee permanent preservation and access to old, unique geological documents the legibility and condition of

which deteriorate with age. About 30,000 documents have been digitized so far and are now accessible on-line, and by request subject to payment of an appropriate fee.

EXPERT AND MAP ARCHIVE OF THE CGS

This archive contains the documents produced by the CGS itself, together with documents and manuscripts obtained from other sources. The members of the archive also digitize and add to the unique collections of geoscientific maps and make them available to the public.

DEVELOPMENT OF THE ARCHIVE SERVICES

After the unification of Geofond with the CGS, it became possible to integrate the separate archives of the two organizations. The goal is to unify and simplify the management of all the information sources in both archives

and to provide a comprehensive, high-quality service from one centre. For this purpose, during 2013, all the archive funds will be merged and services centralized. Transformation of the current databases into a unified ASGI system will be also start.

GEOLOGICAL SAMPLES HELD BY GEOFOND

A unique collection of more than 30,000 metres of drill core is housed in a special system of containers in local stores of the CGS. This collection contains samples from described geological intersections and complete drill cores from structural test holes and other important boreholes drilled in the area of the Czech Republic since 1920. When samples are being selected for inclusion in the archive, their scientific importance and regional-geological provenance are taken into account. All the geological samples are also linked to written descriptions in the document archive of Geofond.

INFORMATION ABOUT BOREHOLES AND HYDROGEOLOGY

It is a legal requirement that reports on the results of geological works be submitted to the CGS for permanent storage. These, together with information about geological samples, are incorporated into the scientific databases (registers) of the geological information system of CGS.

In accordance with § 2d of Act No. 365/2000 Coll., on public administration information systems, this system provides effective remote access to the geological data, either via a local network or via other electronic communication services. The geological system serves as a source of basic information about geological exploration works in the area of Czech Republic and enables users to obtain the best available information about the geological composition of areas of interest.

The **Register of geologically documented objects (boreholes) – GDO** contains the following essential information about registered boreholes: name and type of object, location, inclination and azimuth and the way it was surveyed, the depth, the year the borehole was drilled, its purpose, whether the information is restricted or not and the code under which the object is registered. By the 25th of October 2012, the register contained 680,030 records. The other registers listed below contain information linked to this.

The **Register of descriptions of geological profiles – GEO** contains geological descriptions of rocks intersected in each metre of the borehole.

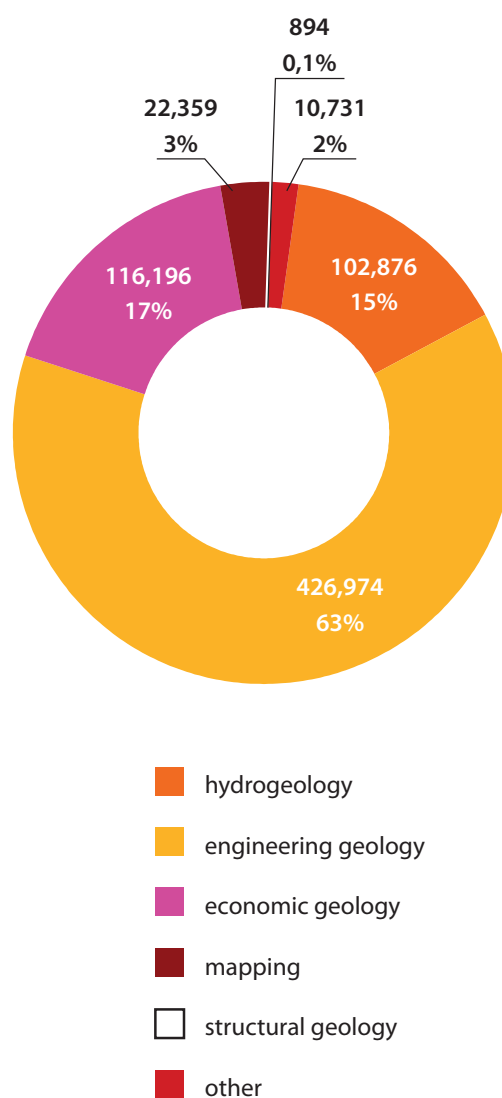
The **Register of hydrogeological properties – HYD** contains data about tested intervals of the borehole, the results of pumping tests and chemical analyses. By the 31st of December 2011, this register contained 87,926 entries.

The **Register of geological samples – HMD** contains information about borehole samples from 1,530 objects.

The **Register of borehole logs – KAR** contains borehole logging records from 5,334 objects and inclinometric measurements from 2,844 objects.

The **Register of technical parameters – TECH** contains information about the technical parameters of boreholes. This register currently contains information about 3,431 objects.

Geologically documented objects (GDO) according to their purpose



Publishing House and the Promotion of Geology

Publishing scientific books, journals and maps has been an essential activity of the Czech Geological Survey since its foundation. During the past twenty years, over a thousand publications have been published. Nowadays, a wide range of educational and promotional activities take place alongside publishing. The public is informed and addressed by means of geoscientific exhibitions, fairs, conferences and popular educational competitions. Information is accessible at the Information Portal of the Czech Geological Survey, which is being improved and becoming more and more attractive and is visited annually by over 70 thousand unique users.

Patrik Fiferka Head of the Publishing House of the CGS



PUBLISHING ACTIVITY

In 2012, the Czech Geological Survey published a fundamental monograph on the hydrogeology of the Czech Republic. This book with the title *Groundwater in the Czech Republic. Regional hydrogeology of groundwaters and mineral waters* was written by Jiří Krásný and co-authors.

In 2012, publishing of individual sheets of *Geological Base Map of the Czech Republic at 1:25,000 scale* with explanatory notes continued. Sheets 12-143 Rakovník, 12-144 Lány, 12-321 Panoší Újezd, and 12-322 Hudlice were published this year.

Among other significant scientific publications during 2012, the following should be mentioned: *Geoscience Research Reports for 2011*; J. Pešek, M. Sivek: *Uhlonosné pánve a ložiska černého a hnědého uhlí České republiky* (Coal-bearing basins and brown and black coal deposits of the Czech Republic); V. Majer, J. Hruška, V. Zoulková, P. Holečková, O. Myška: *Atlas chemismu povrchových vod České republiky, stav v letech 1984–1996 a 2007–2010* (Atlas of the chemistry of surface waters in the Czech Republic, status at 1984–1996 and 2007–2010). In total, 37 publications were issued.



J. Krásný *et al.*: Groundwater in the Czech Republic. Regional hydrogeology of groundwaters and mineral waters.

The publication summarizes the results of over 50 years of regional hydrogeological research and mapping. The scope of this book ensures its importance for future generations. The last comparable work was published over 40 years ago in 1961 by Ota Hyníe.



B. Dudíková Schulmannová and J. Valečka: Stavební a dekorativní kameny Prahy a Středočeského kraje (Building and Decorative Stones of Prague and the Central Bohemian Region).

The map received the award "Map of the Year 2012" in the category of Single Cartographic Product. This is the second time the CGS has won this award. In 2007, the *Geological Map of the Czech Republic at a scale of 1:500,000*, by Jan Cháb, Zdeněk Stráník and Mojmír Eliáš, was also awarded this prize.



Z. Kuka, V. Čechová, P. Gürtlerová, O. Man: Mapa geologických zajímavostí (Map of geologically interesting features).

This popular scientific map is directed to everyone, interested in exploring the natural beauty of the Czech Republic.



A thousand-page monograph about groundwaters of the Czech Republic was launched by the authors in the Břevnov Monastery in Prague. During the ceremony, the book was officially sprinkled with water from the Vojtěška Spring, one of the sources of the Brusnice Brook.



The Geological Bookshop of the CGS served as the venue for the launches of two books: V. Rapprich: *Za sopkami po Čechách* (Through the volcanoes of Bohemia) and J. Pešek and M. Sivek: *Uhlonosné pánve a ložiska černého a hnědého uhlí České republiky* (Coal-bearing basins and brown and black coal deposits of the Czech Republic). The Bookshop also hosted the following exhibitions: *Gotland* – an exhibition of photographs by Pavel Čáp; *Norské světlo* (Norwegian Light) – an exhibition of photographs by Ivana Frolíková; *Obrazy a obrázky z Maroka* (Paintings and pictures from Morocco), an exhibition of paintings by Miloš Lomoz; *Geomorfologie Sečurské pouště v Peru* (Geomorphology of the Sechura Desert in Peru) – an exhibition of photographs by Jiří Šebesta and also an Exhibition of Minerals and Fossils for sale.

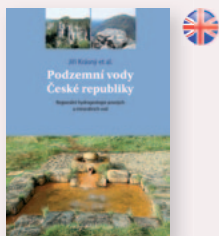
POPULARIZATION OF GEOLOGY

During 2012, the Czech Geological Survey once again acted as coordinator of the *Week of Science and Technology* – the biggest scientific festival in the Czech Republic. The CGS prepared many activities for the festival. In addition to the Open Doors Day, which took place at three workplaces (Klášrov, Barrandov and Brno), the CGS organized two lectures at the premises of the Academy of Science. The CGS was also a partner in *GIS Day Liberec 2012*, took part in a book fair in Havlíčkův Brod and, for the 6th year, again organized the painting contest *My Piece of Earth*.



To mark the 25th anniversary of the signing of the Montreal Protocol, the theme of the painting contest *My Piece of Earth* was the protection of the ozone layer. The award of prizes to the winners took place in the Prague Planetarium, attended by Tomáš Chalupa, the Minister of the Environment.

Publications Issued by the Czech Geological Survey



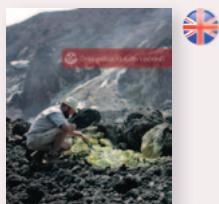
J. Krásný *et al.*

Groundwater in the Czech Republic.
Regional hydrogeology of groundwaters
and mineral waters



J. Pešek, M. Sivek

Coal-bearing basins and brown and black
coal deposits of the Czech Republic



P. Maděra (ed.)

Czech Geological Survey Abroad



B. Dudíková Schulmannová

Use of Czech stone in art and architecture

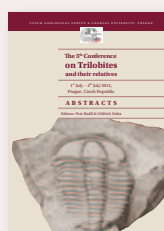


K. Pošmourný, Z. Kukul

Canary Islands – Volcanoes
on a Hotspot



Š. Mrázová, V. Pecina, D. Skácelová,
Z. Skácelová, R. Šarič, J. Večeřa
Landscapes of the Staré Město
and Jesenice regions



O. Fatka, P. Budil, M. Polechová

The 5th Conference on Trilobites and their
relatives – Excursion guide; Abstracts;
Mid-conference field trip guide



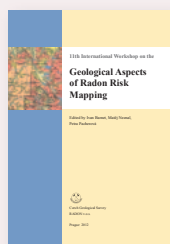
V. Satttran, J. Kovanda, V. Čechová

Reminiscences from Café Barrande II



R. Jírů, A. Čejchanová, P. Rojík

Description of the brown coal mine in
the archbishopric estate of Světec



I. Barnet, M. Neznal, P. Pacherořová

Geological Aspects of Radon Risk
Mapping – 11th International Workshop



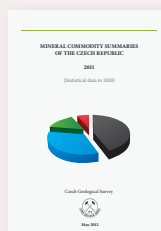
J. Starý, P. Kavina, I. Sitenický, T. Hodková

Changes in Reserves of Reserved
Mineral Deposits 2002–2011



V. Čechová (ed.)

Geoscience Research Reports
for 2011



J. Starý, I. Sitenický, T. Hodková

Mineral Commodity Summaries
of the Czech Republic 2011



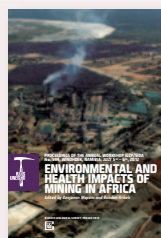
J. Starý, P. Kavina, I. Sitenický, T. Hodková

Mineral Commodity Summaries
of the Czech Republic 2012



A. Kiflu, J. Šíma

Explanatory notes – hydrogeological
and hydrochemical maps of
Asela NB 37-3



B. Mapani, B. Kříbek

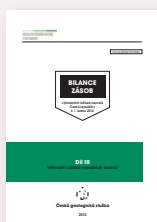
Environmental and health impacts
of mining in Africa



J. Starý, J. Novák, A. Horáková,
J. Mojžíš, J. Novák ml., L. Richterová
Inventory of Reserves of Non-Reserved
Mineral Deposits of the Czech Republic



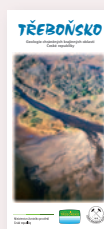
J. Starý, J. Novák, A. Horáková,
J. Mojžíš, J. Novák ml., L. Richterová
Register of Mineral Deposit Reserves
of the Czech Republic – Deposits of
Ores, Trace Elements, Fuel and Energy
Resources



J. Starý, J. Novák, S. Žáčková
Register of Mineral Deposit Reserves
of the Czech Republic – Reserved
Nonmetallic Deposits



Z. Kukul, V. Čechová,
P. Gürtlerová, O. Man
Map of geologically interesting features.
140+1 interesting places



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M. Hártle, M. Králová
The Třeboň Region – Geology of the
Protected Landscape Areas in the
Czech Republic



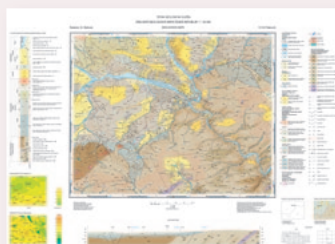
B. Dudíková Schulmannová, J. Valečka
Building and Decorative Stones of Prague
and the Central Bohemian Region



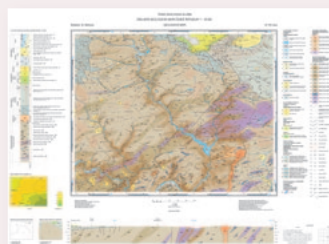
V. Majer, J. Hruška, V. Zoulková,
P. Holečková, O. Myška
Atlas of the chemistry of surface waters
in the Czech Republic, status at
1984–1996 and 2007–2010

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MAPS



Geological Base Map of the
Czech Republic at 1:25,000
scale with explanatory notes
12-143 Rakovník
M. Stárková *et al.*



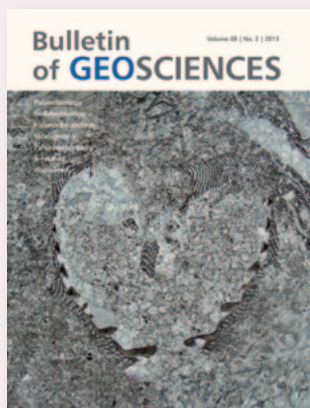
Geological Base Map of the
Czech Republic at 1:25,000
scale with explanatory notes
12-144 Lány
T. Vorel *et al.*



Geological Base Map of the
Czech Republic at 1:25,000
scale with explanatory
notes 12-321 Panoší Újezd
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Geological Base Map of the
Czech Republic at 1:25,000
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12-322 Hudlice
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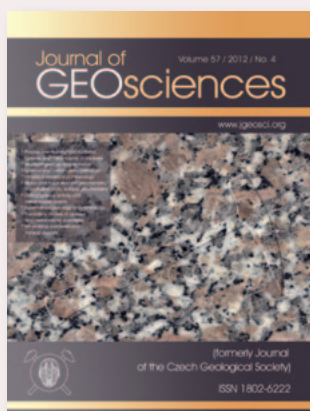


The Bulletin of Geosciences is the most significant scientific journal published by the Czech Geological Survey. This journal – formerly called “Věstník” – was founded at the request of the scientists from the State Geological Survey of the Czech Republic. The first volume was issued in 1925. Since then, thousands of scientific papers have been published in the journal and it now constitutes an archive of the most important scientific research on the geology of the Bohemian Massif.

Since 2001 the Bulletin has published papers in English only. In 2006, the Editorial Board set the focus of the journal on palaeoenvironmental research and the evolution of life on Earth. In 2007 the Bulletin of Geosciences was included with other international scientific journals in the most prestigious scientific databases.

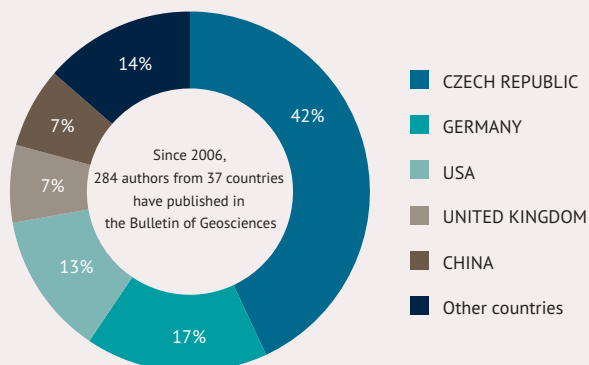
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In 2010, on the basis of the high quality of its scientific content, the prestigious American company Thomson Reuters awarded the journal an impact factor. Thanks to the long-term efforts of the current Editorial Board, the Bulletin of Geosciences is one of the top 10 most important scientific journals published in the Czech Republic and it has the highest impact factor of all geo-science journals.

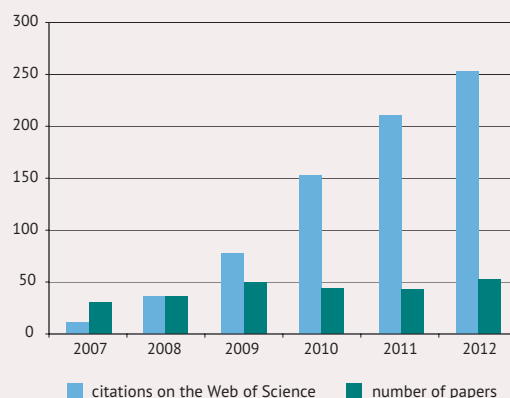


The Czech Geological Survey is also co-editor of the **Journal of Geosciences**. This journal publishes papers mainly concerned with mineralogy, structural geology, petrology and the geochemistry of igneous and metamorphic rocks. In addition to regular volumes, special thematic issues are also published. The journal maintains a high scientific standard and is indexed by a number of databases, including the prestigious Web of Science and Scopus. In 2011, the journal was awarded an impact factor, which is now 0.804.

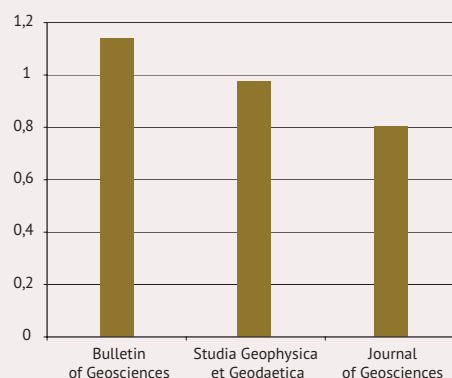
Countries from which papers were submitted for publication in the Bulletin of Geosciences



Number of citations on the Web of Sciences



Impact factor value for 2012



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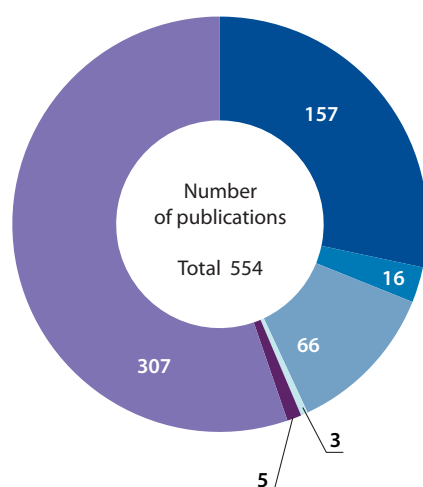
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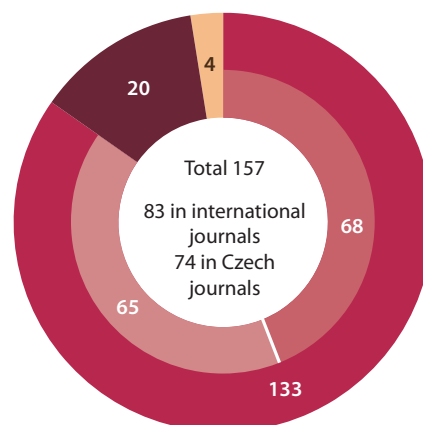
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Zodrow, E. L. – D'Angelo, J. A. – Helleur, R. – Šimůnek, Z. (2012): Functional groups and common pyrolysate products of *Odontopteris cantabrica* (index fossil for the Cantabrian Substage, Carboniferous). – *International Journal of Coal Geology* 100, October, 40–50.



Total publishing activity

- Papers in journals, total
- Papers in reviewed proceedings
- Papers in unreviewed proceedings
- Scientific book
- Chapter in a book
- Maps



Number of papers in journals

- Articles in peer-reviewed journals
- in journals with impact factor
- in journals without impact factor
- Papers in unreviewed scientific journals
- Articles in popular scientific periodicals and newspapers

Financial Review



In 2012, the successful integration of the state geological survey within the resort of the Ministry of the Environment was carried out. The functions of the disbanded state organization CGS – Geofond, together with its staff and assets, were incorporated within the management structure of the Czech Geological Survey.

The main aim of this restructuring of CGS was to simplify management and eliminate non-essential costs and activities. This process will continue during 2013. A total saving of 65% in the budget of the former CGS – Geofond will be attained.

Budget * (mil. CZK)	2008	2009	2010	2011	2012
CGS contribution	36.9	40.1	40.0	35.5	22.4
Geofond contribution	49.6	50.7	52.8	37.1	25.7
Total contribution	86.5	90.8	92.8	72.6	48.1

* Without financial funds of the Department of Geology of the MoE

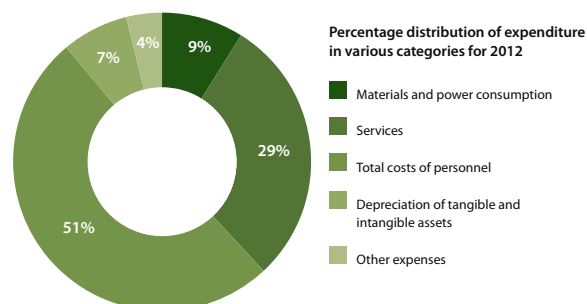
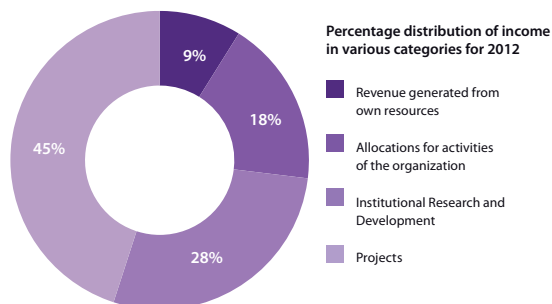
The years activities have included the successful completion of current projects as well as preparations for new projects, together with the fulfilment of the statutory tasks of the state geological survey and development of research initiatives. Despite some administrative complications from the State Environmental Fund of the Czech Republic (SEF), good progress has been made for the third year on the project *Review of Groundwater Resources*. This is the most

important project in terms of staff involvement and scale of work and is due to be completed in 2015.

The CGS continues to face the problem of the shortfall in funding from the government to support the staff and infrastructure required to carry out the statutory duties of the state geological survey and the wide-ranging programme of regional mapping and research on the environment and natural resources that is the central scientific activity of the CGS. The financial resources of the CGS consist of the statutory government grant, funds for specific research and development projects and income earned through contract work. In 2012, the deficit at the end of financial year was made up by income generated by the CGS from contracts and research grants.

At present, the efficient fulfilment of the statutory tasks of the state geological survey and the scientific work of the CGS depends on the internationally acknowledged skills of the staff of CGS and their commitment to research of high quality, combined with the capacity of the CGS to generate income through grants and contracts.

By combining appropriate and innovative research activity and new projects in the Czech Republic and abroad with the award of commercial contracts, it is anticipated that it will be possible to carry out the basic tasks of the state geological survey and ensure the funds required for the future development of the CGS so that it continues to provide the high quality of service expected by the government and public of the CR.



OVERVIEW OF MAIN INDICATORS OF PERFORMANCE (IN THOUSANDS CZK)

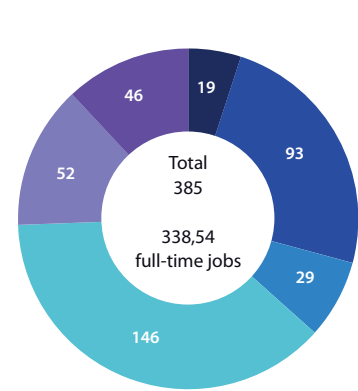
Year	2012*	2011	2010	2009	2008
INCOME GENERATED BY CGS ACTIVITIES	28 859	40 535	43 623	48 034	52 259
of this: revenue from sale of own products and services	10 009	13 618	14 257	13 945	17 434
revenue from sale of property and material	84	499	562	38	0
activation of internal services	0	8 854	10 621	18 715	18 305
change in inventory	0	1 098	493	521	546
clearing account for funds	8 374	11 446	3 878	4	987
other income	10 392	5 020	13 812	14 811	14 987
OPERATIONAL GRANT	297 443	243 247	210 081	208 493	189 849
of this: 1) from the Ministry of the Environment	148 387	194 651	181 934	177 853	162 588
of this: allocation for activities of the organization	58 490	35 457	36 982	40 113	36 893
for institutional Research and Development	0	97 083	76 011	78 204	84 395
special R&D projects	1 137	16 346	26 328	23 118	20 447
ISPROFIN	41 817	30 736	20 207	1 725	3 116
other (geological activities)	14 019	4 036	6 884	9 996	9 625
other NAR + Norway (lim)	28 924	9 064	9 386	22 448	0
from other sources (Norway + OP)	4 000	1 928	6 136	2 249	8 113
2) from other sources (from state budget)	122 908	25 033	11 085	14 097	17 339
of this: for R&D	121 619	22 971	11 085	14 097	17 339
3) income from specific grants to individual researchers	9 617	20 006	13 580	9 401	5 574
of this: for R&D	8 787	20 069	13 580	9 401	5 574
4) foreign funding	11 355	3 557	3 482	7 142	4 348
5) income from SEF	2 060				
accrued items	3 116				
TOTAL INCOME	326 302	283 782	253 704	256 527	242 107
ECONOMIC OUTCOME	3 845	9 043	91	2 773	59
TOTAL EXPENDITURE	322 457	274 739	253 613	253 754	242 048
of this: material and power consumption	30 494	26 769	23 922	22 431	23 112
services	94 472	66 543	70 147	83 677	86 043
change in inventory	-707				
total costs of personnel	164 183	144 239	127 327	129 451	125 951
depreciation of tangible and intangible assets	22 248	15 011	12 190	12 563	2 497
taxes and fees	283	254	193	319	307
other expenses	11 484	21 923	19 834	5 313	4 137
INVESTMENTS	18 799	20 508	20 249	59 410	20 785
of this: construction work	3 750	7 338	3 162	40 071	13 864
other expenditure: tangible assets	13 750	10 340	16 562	18 938	6 107
other expenditure: intangible assets	1 299	2829	525	401	815
FINANCOVÁNÍ INVESTIC	18 799	20 508	20 249	59 410	20 785
1) grant from the Ministry of the Environment	18 018	12 620	17 751	55 461	16 114
2) from own resources	781	7 888	2 498	3 949	4 672

* in 2012 including former CGS – Geofond

Human Resources

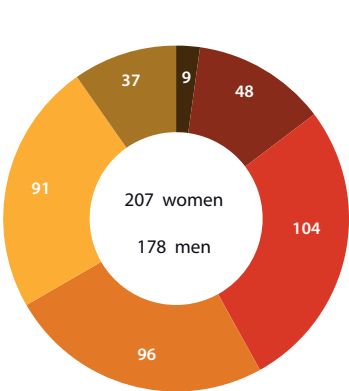
In 2012, the Czech Geological Survey had a total of 385 employees, the equivalent of 338,54 persons working full-time. The notable increase in the number of staff by 86 employees was due the incorporation of the disbanded state organization CGS – Geofond into the Czech Geological Survey.

Helena Žemličková Head of the Human Resources Section



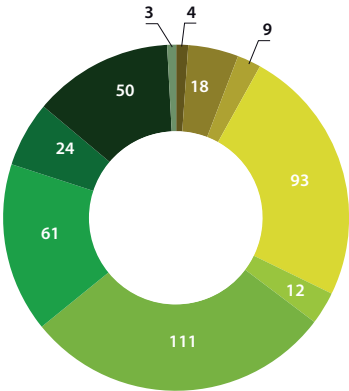
Graph showing CGS subject fields

- Directorate
- Geochemistry and Laboratories
- Economic Division
- Geological Division
- Division of Geofond
- Division of Informatics



Graph showing the age structure of CGS staff

- over 70 years 9
- under 70 years 48
- under 60 years 104
- under 50 years 96
- under 40 years 91
- under 30 years 37



Graph showing the educational qualifications of CGS staff

- Basic
- Apprentice
- Apprentice with graduation exam
- Secondary education with graduation exam
- University – Bachelor's degree
- University – Master's/Engineer's degree
- University – title RNDr. (Doctor of natural sciences)
- University – title RNDr. CSc. (Candidate of sciences)
- University – title Ph.D.
- University – title Prof.

Principal Events in 2012

January

Geofond has become a part of the Czech Geological Survey



After several years of negotiations, Geofond and the Czech Geological Survey have eventually merged to form a single institution, as has long been intended. The Ministry of the Environment disbanded the state Czech Geological Survey – Geofond as of 31st December 2011 by Act No. 3/11 and through Act No. 5/11 the Charter of Foundation of the partly state-funded organization Czech Geological Survey was amended.

On the 1st January 2012, the majority of the former staff of Geofond joined the Czech Geological Survey. A new division, No. 600, was established in the organizational structure of the Czech Geological Survey and RNDr. Vít Štrupl was appointed as the Deputy Director of the Czech Geological Survey responsible for this division. The division is still located in its original headquarters in Kostelní 26, Prague 7, together with the library through which access is provided to the geological reports and results for all geological works carried out in the Czech Republic. By merging these two organizations, the state geological survey can now be provided by a single institution and improvements in the efficiency and coordination of their tasks has resulted.

27th January

Geology for the Region



The results of geological research and mapping in the UNESCO Geopark Český ráj were presented at the conference *Geology for the Region*, which took place in Turnov. Nearly a hundred representatives of municipalities, state administration, local administration and the public were informed not only about the geological features that provide the focus for geotourism in the region, but also about geohazards, environmental geofactors, hydrogeology, mineral resources, the possibilities of utilizing geothermal energy etc. The presentations were delivered in an entertaining and intelligible form. Five sheets of the geological base map at the scale of 1:25,000 (sheets 03-324 Turnov,

03-413 Semily, 03-341 Kněžmost, 03-342 Rovensko and 03-431 Lomnice) and thematic maps related to them (mineral deposits, geofactors of the environment and exodynamic phenomena), were exhibited at the conference. Geoscientific lectures were supplemented with talks on folk architecture in Pojizeří, new archaeological finds near Turnov, the mission of geoparks and the protection of the biosphere. The conference was organized by the company Geopark Český ráj, o.p.s., in cooperation with the Czech Geological Survey, the Nature Conservation Agency of the Czech Republic and the Museum of Český ráj in Turnov.

March

27th March

Exhibition of photographs by Ivana Frolíková



The exhibition of photographs by Ivana Frolíková titled *Once upon a time in the West* was opened in the Geological Bookshop of the Czech Geological Survey.

May

4th May

Gotland in photographs by Pavel Čáp



The exhibition of photographs by Pavel Čáp titled *Gotland* was opened in the Geological Bookshop of the Czech Geological Survey.

9th May

Guided tours by Ing. Rybařík finished by examining the building stones of St. Vitus Cathedral



An excursion to the cathedral of St. Vitus, St. Wenceslas and St. Adalbert in Prague was organized by the Department of Crystalline Complexes of the CGS and by the Czech Geological Society. Although some historical facts were mentioned briefly, the excursion was mainly concerned with the stones used to construct and decorate the buildings. Approximately fifty participants had the opportunity to learn facts that would be difficult to find in any academic publications, whether on history, architecture or geology. As usual, the excursion was led by Ing. Václav Rybařík, the leading expert in building and carving stones used in Bohemia. During the past five years he has attracted numerous participants on excursions to the National Monument at Vítkov, to Vyšehrad, to the National Museum, the National Theatre, to the Old Town Hall and around the Old Town, to the gardens of

Prague Castle and to Charles Bridge. The excursion to the cathedral, lasting nearly three hours, was the last of this series of guided tours led by Ing. Rybařík to different sites in Prague.

14th May

Talk given by Dr Niedermann on the isotope geochemistry and cosmochemistry of noble gases



At the CGS headquarters in Klárov, Dr Samuel Niedermann (GFZ Potsdam) gave a talk on the isotope geochemistry and cosmochemistry of noble gases "Noble gases as tracers of the origin and age of rocks and fluids". The noble gases are key elements used in tracing some of the fundamental processes taking place in the Earth's mantle, e.g. recycling of the lithosphere, detecting inhomogeneity in the mantle and degassing. The study of the isotopic composition of H, He, Ne, Ar, Kr and Xe in extra-terrestrial materials plays a crucial role in understanding the processes that governed the early stages of formation of the Solar System.

17th May

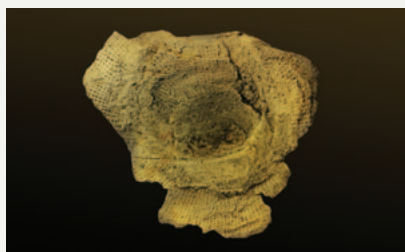
A geologist wearing a tuxedo



The Czech President, Václav Klaus, and his wife Livia invited Vladislav Rappich, a geologist from the CGS, to a state dinner that was organized in honour of His Excellency Ólafur Ragnar Grímsson, the President of the Republic of Iceland, and Lady Dorrit Moussaieff, in the Rudolph Gallery at Prague Castle. Vladislav Rappich was invited as guest of honour because of the objective commentary he provided for the Czech media so that the public could understand the impact of the Eyjafjallajökull volcano eruption in 2010 on the Icelandic people.

21st May

A sponge from Antarctica rules the world



The first fossil sponge ever found on the Antarctic continent instantly became the object of attention of scientists around the world. *Laocoetis piserai* n. sp. (Porifera, Hexactinellida) from the Middle Cretaceous sediments on the James Ross Island was described by Radek Vodrážka and his colleague from the British Antarctic Survey, Cambridge, in the paper Vodrážka, R. and Crame, A.J. (2011): First fossil sponge from Antarctica and its palaeobiogeographical significance. *Journal of Palaeontology* 85, 1, 48–57. In May 2012, the article ranked among the five most widely read papers published in this prestigious journal.

July

1st–4th July***The 5th Conference on Trilobites and their relatives***

The Science Faculty of Charles University at Albertov in Prague hosted the international conference *The 5th Conference on Trilobites and their relatives*, which was dedicated to the memory of the founder of modern research on trilobites, Harry Whittington. This prestigious meeting was attended by approximately seventy participants from twenty two countries around the world, many of them leading experts in their field. Previous conferences took place at the University of Oslo (1972), Brock University (1997), the University of Oxford (2001) and the University of Toledo (2008). It is unlikely that the current generation of Czech scientists will be able to attend such a significant conference on trilobites in the Czech Republic again.

The Czech Geological Survey was co-organizer of the event together with the Faculty of Science of Charles University (Dr O. Fatka). From 26th to 30th of June, field trips related to this conference took place in the Czech Republic and from 5th to 9th July in Sardinia, Italy, led by Prof. Gian Luigi Pillola.

August

7th August**Prof. Jan Petránek celebrated his ninetieth birthday**

The Director of the CGS, Dr Zdeněk Venera, was able to congratulate Prof. Jan Petránek, one of the outstanding scientists of the CGS, on his ninetieth birthday. Prof. Petránek was presented with a specimen of barite and marcasite on a decorative pedestal to mark the occasion.

Prof. RNDr. Jan Petránek, DrSc., graduated in geology at Charles University in Prague and then spent a year at Princeton University. After returning from the USA, he taught at Charles University and later at the VŠB – Technical University Ostrava. In 1954, he joined the Central Geological Institute in Prague (now the Czech Geological Survey). At the end of the 1960s (during the Prague Spring) he returned to Charles University, but was forced to leave during the “Normalization”. In 1992 he was rehabilitated and named a professor of Charles University.

His special field of research is the geology of sedimentary deposits, in particular coal deposits and sedimentary iron ore deposits. He is the author and co-author of several books and numerous scientific papers published both in the Czech Republic and abroad. He has worked in many countries and given lectures on his researches in Ethiopia, Iraq and Tunisia.

September

The Skryje museum has a new geological display on its façade

There is now an interesting addition to Joachim Barrande's Monument in Skryje. Examples of typical sedimentary and volcanic rocks from the surroundings of Skryje and Týřovice have been fixed on its façade.

Strata of Cambrian age, the oldest period of the Palaeozoic, crop out on the surface in the Berounka River valley. Various types of rocks of this age can be found in the area including rhyolites, dacites, andesites, shales, greywackes, conglomerates and others approximately half a billion years old. Even older lydites and spilites underlie them. Information about the precise age of these rocks and their classification into different formations is given on a placard with a geological time scale and a legend.

The display was the idea of Dr Oldřich Fatka from the Faculty of Science of the Charles University together with Ing. Jan Jedlička, a forester from the Protected Landscape Area Administration Křivoklátsko. Dr Petr Hradecký and Dr Tomáš Vorel from the Czech Geological Survey contributed greatly in bringing the idea to life. They are well-acquainted with the area because of their geological mapping and related research so that they were able to provide the majority rock samples from their personal collections.

17th September

Closing ceremony of the competition *My Piece of Earth 2012*

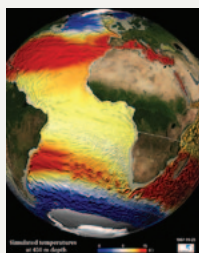


The art competition *My Piece of Earth 2012* for children and young people ended with the presentation of awards to the winners at the closing ceremony held in the Starvid Theatre at the Prague Planetarium. The theme of the contest, organized last year under the auspices of the Minister of the Environment Tomáš Chalupa, was the protection of the ozone layer. The prizes were awarded to the children by Minister Chalupa, Dr Zdeněk Venera, Director of the CGS, and Roman Hrdý from the company Esto Cheb. At the ceremony, a plaque was also formally awarded to the CR by the Executive Secretary of the Ozone Secretariat, Marco González, for the outstanding contribution that has been made to the protection of the Earth's ozone layer.

October

23rd October

Lectures on isotope geochemistry



Two lectures were given on aspects of isotope geochemistry by prof. Anton Eisenhauer (GEOMAR – Helmholtz Centre for Ocean Research, Kiel, Germany). These were held in the laboratories building of the CGS at Barrandov and in the Mineralogy Lecture Room in the Faculty of Science of the Charles University in Albertov.

24th October

The Czech Geological Survey as a partner in the *Week of Science and Technology*



The Czech Geological Survey maintained its tradition of partnership for the twelfth year in the *Week of Science and Technology* organized by the Academy of Sciences of the CR. The theme "Energy of Science" was chosen in view of the International Year of Sustainable Energy declared by the UN. The CGS prepared open days, excursions and thematic exhibitions. Moreover, specialists from the CGS gave talks on topics of current interest: "Unconventional natural gas – future or fiction in the Czech Republic?" by V. Dvořáková, and "What shall we do with carbon dioxide? Store it underground!(!)" by V. Hladík.

November

Now English-speakers from other countries can search interesting geological localities in the CR



The on-line English version of the search application for the database of important geological localities has now been completed. It is based on the Czech version of the application that has been accessible to the public since 2010. It provides information about the geologically interesting localities in the CR. The English version was developed using bilingual code lists created by the CGS for stratigraphy, regional geology, rocks, geological phenomena and other criteria defining the character of each of the localities. Geological descriptions of each locality are provided in a short English abstract.

12th November

The ambassador of the Republic of Peru opened the exhibition by Jiří Šebesta



The ambassador of the Republic of Peru, Mrs Marita Landaveri Porturas, accompanied by her cultural attaché Mr Luis Galindo Galecia and the former ambassador of the Czech Republic in Peru, Mrs Věra Zemanová, opened an exhibition of photographs by Jiří Šebesta called *Sechura Desert* attended by the director of the CGS, Dr Zdeněk Venera. The exhibition consisted of a display of geomorphological maps of the area and photographs of the natural beauties of the Sechura Desert. In her short speech, the ambassador highlighted the contribution made by Czech geologists to the investigation of natural hazards in Peru and expressed her interest in further cooperation.

20th–22nd
November

GIS Days Liberec 2012



GIS Days 2012 took place in the Regional Scientific Library in Liberec. The aim was to make students, as well as the wider public, more aware of the applications of geographic information systems. This event was organized for the twelfth time by the Liberec Region, the Technical University, Gymnázium F.X. Šaldy high school, the Fire Brigade of Liberec and the producers of Children's Television Liberec. The Czech Geological Survey was a partner in this event for the third time. Pavla Gürtlerová, David Čížek and Jana Karenová from the GIS Department not only explained how geological maps are created by the CGS and demonstrated the information related to them that is available on the new map server of the CGS, but they also gave an intelligible and intuitive introduction to some geologically interesting sites in the Liberec Region for those who were interested.

27th November

Launch of the book *Groundwater in the Czech Republic*



A ceremony to launch the book *Groundwater in the Czech Republic* by Jiří Krásný *et al.* was held in the unique environment of the Břevnov Monastery. The Břevnov Monastery is the most ancient male monastery in the Czech Republic and it was founded in 993 close to the Vojtěška Spring. It was therefore appropriate that this book, which describes groundwater from all parts of the Czech Republic, was symbolically sprinkled with water from Vojtěška. The ceremonial "baptism" was performed by the "godfather" of the book, the first Deputy Minister of the Environment, Martin Frélich. The Director of the Czech Geological Survey, Zdeněk Venera, highlighted the significance and timelessness of this publication that provides a synthesis of the hydrogeological conditions of groundwaters throughout the Czech territory. Zdeněk Kukal, the scientific editor

of the book, and Jan Čurda, who reviewed the book, confirmed the scientific value of the publication and wished the book every success. The launching ceremony culminated with a performance by the Marjanka mixed choir and, as a surprise, the guests were invited to join a tour around selected areas of the Břevnov Monastery.

29th November

The well-known Czech geologist Zdeněk Kukal celebrated his 80th birthday



The geologist, oceanographer, teacher and inventive promoter of Earth sciences Dr Zdeněk Kukal celebrated his eightieth birthday. His career has been closely connected to the Czech Geological Survey, where he was employed immediately after his graduation from the Faculty of Science of the Charles University. From 1992–1997 he was its director and he has continued to work for the CGS up to the present. His speciality is sedimentology, but the oceans have always fascinated him. He has taken part in research voyages across the Atlantic Ocean, the Persian Gulf and the Black Sea and his book on oceans is still considered a standard work by oceanographers.

Dr Kukal is one of the most productive authors in the history of Czech geology. He has been continuously active in the promotion of geology and science in general; he gives talks for the public and writes about

interesting natural phenomena and disasters. In his books he likes to provide rational explanations for mysterious legends about Atlantis and the Bermuda Triangle right. For decades his books have been popular with readers, in fact a note was once put up in one of the Prague bookshops saying "Hrabal, Páral and Kukal are no longer in stock". His latest paper on the history of geology in the Czech Republic forms an important chapter in a book of two volumes devoted to the history of Czech science.

Zdeněk Kukal is also known as an enthusiastic sportsman. Up until today he continues to play tennis and even participates in tournaments. Moreover, he is a gifted musician. When he was young, he even began studies at the conservatory, an interest he has kept ever since. He was probably the only director of a geological survey who had a piano in his office. And, mind you, not just as a piece of furniture! Visitors from other countries were honoured when he played their national anthem for them.

December

5th December

Launch of the book *Coal-bearing basins and black and brown coal deposits of the Czech Republic*



The book by Jiří Pešek and Martin Sivek titled *Coal-bearing basins and black and brown coal deposits of the Czech Republic* was launched at the Geological Bookshop in Klárov in Prague. The ceremony was performed by Vladimír Prouza from the Czech Geological Survey, whom the authors have chosen as the godfather of the book. A speech in verse was also given by Zdeněk Kukal from the CGS.

Projects

Abbreviations:

AS CR – Academy of Sciences of the Czech Republic; **MIT** – Ministry of Industry and Trade; **MEYS** – Ministry of Education, Youth and Sports; **MU** – Masaryk University; **MoA** – Ministry of Agriculture; **MoE** – Ministry of the Environment; **R&D** – Research & Development Council; **TACR** – Technology Agency of the Czech Republic

Comprehensive regional and deep investigation of the lithosphere

• Special studies, methods of research, Ph.D. theses and dissertations, CGS, 2007, continuing investigation	RNDr. Eva Břízová, CSc.
• Print of geological and applied maps, CGS, 2010, continuing investigation	RNDr. Pavel Hanžl, Dr.
• Preparation of methods for the Mapping Directive ZGM 25, CGS, 2009–2013	RNDr. Zuzana Krejčí, CSc.
• The database of decorative stones, CGS, 2009, continuing investigation	RNDr. Barbora Dudíková Schulmannová
• Development and application of the Re-Os method using the negative thermal-ionisation mass spectrometer (N-Tims) Finningan MAT 262, CGS, 2010–2012	Mgr. Lukáš Ackerman, Ph.D.
• Completion of basic geological maps of “Geopark Český ráj”, CGS, 2011–2012	RNDr. Lilian Švábenická, CSc.
• Publication of the results of the International Development Cooperation project in Costa Rica, CGS, 2011–2012	RNDr. Vladimír Žáček
• Professional support for a supranational network of geoparks in the Czech Republic, CGS, 2011–2012	Mgr. Veronika Štědrá, Ph.D.
• Characteristics of microdiamonds and other UHP phases from high-pressure granulites of the Bohemian Massif, CGS, 2011–2012	doc. RNDr. Jana Kotková, CSc.
• Biostratigraphical correlation of type sections in the Jizera development of the Bohemian Cretaceous Basin based on the study of calcareous nannofossils, CGS, 2011–2012	RNDr. Lilian Švábenická, CSc.
• Research on basalt volcanism and associated phenomena on James Ross Island, CGS, 2012–2013	Mgr. Vojtěch Erban
• Genesis of the central alkaline belt of the Brno Massif, CGS, 2012–2013	RNDr. Pavel Hanžl, Dr.
• Preparation of a guide to the most significant karst localities of Moravia and Silesia, CGS, 2012–2013	RNDr. Jiří Otava, CSc.
• Geochronological research on skarns from the Moldanubian and the Kutná Hora Crystalline Complex and their relationship to the geological evolution of the Bohemian Massif, CGS, 2012	RNDr. Jaroslava Pertoldová, CSc.
• Volcanic systems II: origin and evolution of magma, fragmentation and sedimentation of volcanoclastic material, CGS, 2012–2014	Mgr. Vladislav Rappich
• Pre-Variscan development of the units on the Eastern and Northern margins of the Moldanubian Zone: dating and structural-metamorphic analysis of schists and surrounding units, CGS, 2012–2014	Mgr. Igor Soejono
• 3D Modelling of the development of individual component formations, horizons and deposits of bituminous claystones in the Krkonoše Piedmont Basin, CGS, 2012–2013	RNDr. Marcela Stárková
• Co-organization of the international conference “The 5th Conference on Trilobites and their relatives”, Prague, Czech Republic, and Sardinia, Italy, 1 st July–4 th July 2012, CGS, 2012	RNDr. Petr Budil, CSc.
• The state of geological structure and environmental geofactors in the Beskydy Mountains, 25-233 Valašská Bystřice, CGS, 2012–2013	Mgr. Roman Novotný
• Public dissemination of information about geological heritage held by the CGS: phase 1 – methodical, technical and professional support, CGS, 2012–2013	Mgr. Veronika Štědrá, Ph.D.
• Preliminary editing and printing of geological maps, special maps of exodynamic phenomena and explanatory notes for the area of the Bohemian Paradise, CGS, 2012–2013	RNDr. Lilian Švábenická, CSc.
• Map of the environmental geofactors in the area of the Doupovské hory Mountains, CGS, 2012	RNDr. Igor Dvořák, Ph.D.

<ul style="list-style-type: none"> Biostratigraphical and palaeoenvironmental correlation of pilot sections in the Jizera development of the Bohemian Cretaceous Basin based on the study of calcareous nannofossils, CGS, 2011–2012 	RNDr. Lilian Švábenická, CSc.
<ul style="list-style-type: none"> Origin and metamorphic and structural record of lower crustal rocks – implications for the interpretation and timing of processes in orogenic roots, Czech Science Foundation P210/10/P475, 2010–2012 	Mgr. Martin Racek
<ul style="list-style-type: none"> Granulitization of the Moldanubian lower crust: geochemical constraints on protoliths and metamorphic changes in the course of the Variscan orogenic cycle, Czech Science Foundation P210/11/2358, 2011–2013 	doc. Mgr. Vojtěch Janoušek, Ph.D.
<ul style="list-style-type: none"> Deciphering the pre-convergence history of crustal domains in deeply eroded orogenic belts using detrital zircon populations, Czech Science Foundation P210/11/1904, 2011–2013 	Mgr. Jiří Konopásek, Ph.D.
<ul style="list-style-type: none"> Crustal growth and construction of continental crust: the example of the Central Asian Orogenic Belt, Czech Science Foundation, P210/12/2205, 2012–2015 	prof. RNDr. Karel Schulmann, CSc.
<ul style="list-style-type: none"> Continental lithosphere as a source of differentiated alkaline lavas and the genetic role of basic magmas determined through volcanism of the Ohře Graben, Czech Science Foundation, P210/12/1990, 2012–2015 	Dr.sc.nat. Tomáš Magna
<ul style="list-style-type: none"> Formation of phosphate minerals and their importance for dating of diagenesis and fluid activity in sedimentary rocks, Czech Science Foundation, P210/12/2114, 2012–2014 	doc. RNDr. Jan Košler, Ph.D.
<ul style="list-style-type: none"> Geological composition and geofactors in the environment in the Frenštát Area, OOHPP MoE, 2011–2012 	Mgr. Roman Novotný
<ul style="list-style-type: none"> Recent deglaciation of the northern part of James Ross Island, Antarctica; in cooperation with MU, Brno, Czech Science Foundation 205/09/1876, 2009–2012 	Mgr. Daniel Nývlt, Ph.D.
<ul style="list-style-type: none"> The origin of compositional and textural zoning in shallow-level granitoid plutons: a quantitative approach, Czech Science Foundation P210/11/1168 (cooperation with the Faculty of Sciences of the Charles University), 2011–2013 	doc. Mgr. Vojtěch Janoušek, Ph.D.
<ul style="list-style-type: none"> Geological base mapping of CR at a scale of 1:25,000, CGS, 2008–2014 <ul style="list-style-type: none"> Krkonoše Šumava Brněnsko Beskydy Jeseníky Doupovské hory Křivoklátsko Central pluton 	RNDr. Jaroslava Pertoldová, CSc.
	Mgr. Karel Martínek, Ph.D.
	RNDr. Vladislav Žáček
	Mgr. David Buriánek, Ph.D.
	Mgr. Roman Novotný
	RNDr. Vratislav Pecina
	RNDr. Bedřich Mlčoch
	RNDr. Tomáš Vorel
	RNDr. Kryštof Verner, Ph.D.
<ul style="list-style-type: none"> Preparation of methods for the Mapping Directive ZGM 25, CGS, 2009–2012 	RNDr. Pavel Hanžl, Dr.
<ul style="list-style-type: none"> Preparation of the journal Geological Research in Moravia and Silesia, CGS, 2010–2012 	Mgr. David Buriánek, Ph.D.
<ul style="list-style-type: none"> Editing of scientific publications, CGS, 2010, continuing investigation 	doc. Mgr. Vojtěch Janoušek, Ph.D.
<ul style="list-style-type: none"> Editing and preparation of the printed and electronic versions of the Bulletin of Geosciences, CGS, 2010, continuing investigation 	prof. RNDr. Jiří Frýda, Dr.
<ul style="list-style-type: none"> Membership of the European Polar Board and European Polar Consortium (EPB, EPC) and fulfilling the duties of membership (programme of MEYS, in cooperation with MU Brno), LA-09046, 2009–2012 	Mgr. Zdeněk Venera, Ph.D.
<ul style="list-style-type: none"> Sudetes Georoute – geological tourist guidebook (project under the terms of the Operational Programme Cross-Border Cooperation 2007–2013, in cooperation with the Republic of Poland, funded by EU and CR), 2010–2013 	RNDr. Štěpánka Mrázová, Ph.D.
<ul style="list-style-type: none"> Enabling access to geological information in support of GMES, 7th Framework Programme of the EU, FP7-SPACE-2010-1, 2011–2014 	Mgr. Veronika Kopačková

- ArchaeoMontan, Operational Programme of Cross-Border Cooperation 2007–2013 with the Free State of Saxony, funded by EU and CR, 2012–2014
- The role of Palaeozoic accretion and collisional orogens in the formation and growth of continental crust (ROPAKO), MEYS – Programme NÁVRAT, LK11202, 2012–2016

RNDr. Vladimír Šrein, CSc.

prof. RNDr. Karel Schulmann, CSc.

Research into global changes in the geological past and the development of life

- Biostratigraphy, analysis of stable isotopes and microfacial analysis of the “upper dark interval” of the Acanthopyge limestone in the area around Koněprusy (Middle Devonian, Eifelian), CGS, 2011–2012
- Palaeoecological and climate changes at the end of the Carboniferous (Stephanian C) in the Krkonoše Piedmont Basin, CGS, 2011–2012
- Isotope thermometry of magnesium (Mg) and calcium (Ca) in carbonate minerals, CGS, 2011–2012
- Isotopic composition of chromium ($^{53}\text{Cr}/^{52}\text{Cr}$) in sedimentary rocks as an indicator of palaeo-redox conditions during deposition, 2012
- Geochemical fossils in soils and lacustrine sediments as indicators of the biological origin of organic compounds, CGS, 2011–2012
- Research into Palaeozoic global changes and the development of biodiversity, CGS, 2012–2014
- Comparison of Holocene palaeoclimatic and paleoenvironmental changes on the Northern margin of the Antarctic Peninsula and the High Arctic based on multi-proxy records from lacustrine sediments, CGS, 2012
- Palaeontology of the Antarctic Peninsula: physical processing and scientific assessment material documentation held by the CGS, 2012–2014
- Cordaitalean and pteridosperm cuticular analysis and their “in situ” prepollen, Czech Science Foundation P210/10/0232, 2010–2014
- Multidisciplinary approach to assessment of the Middle Palaeozoic – Devonian Daleje and Kačák bioevents (Prague Basin, Czech Republic), Czech Science Foundation, P210/12/2018, 2012–2016
- Magnesium isotope composition of Phanerozoic marine carbonates: Implications for chemical evolution of seawater and the formation of massive dolomites, Czech Science Foundation, P210/12/P631, 2012–2014
- A new European reference section to study mid-Cretaceous sea-level change, palaeoceanography and palaeoclimate: drilling the Bohemian Cretaceous Basin (in cooperation with the Geophysical Institute AS CR, v.v.i.), Czech Science Foundation P210/10/1991, 2010–2013
- Climatic archives recorded in the Late Palaeozoic basins of the Bohemian Massif: proxies for reconstruction of climatic changes, Czech Science Foundation P210/11/1431 (in cooperation with the Faculty of Sciences of the Charles University), 2011–2014
- Integrated stratigraphy of the late Silurian (Ludlow-Přídolí) in the Prague Synform, in cooperation with the Institute of Geology AS CR, Czech Science Foundation, 205/09/0703, 2009–2013
- Changes in the floristic record in the basins of the Bohemian Massif as a consequence of climatic development during the Late Palaeozoic ice age, in cooperation with the Institute of Geology AS CR, Czech Science Foundation, P210/12/2053, 2012–2015
- Middle Palaeozoic climatic and sea-level changes and their influence on marine community evolution: a comparison of models from the Perunica microcontinent and the Laurasian continent, ME 08011, MEYS, 2008–2012
- Disparity and ontogeny in trilobites (Arthropoda): a characteristic of morphological changes, MEB 021122, MEYS, 2011–2012
- Innovative methods for monitoring the health of stands of common spruce in the Krušné hory Mountains using hyperspectral data, in cooperation with the Faculty of Science, Charles University Prague, MEYS, LH 12097, 2012–2015
- Thermochronological constraints on the evolution of the sediments of the eastern Magallanes foreland basin, cooperation for the Institute of Geology AS CR, v.v.i., 7AMB12AR024, institutional support of MEYS, 2012–2013

Mgr. Stanislava Vodrážková, Ph.D.

RNDr. Marcela Stárková

doc. Mgr. Juraj Farkaš, Ph.D.

doc. Mgr. Juraj Farkaš, Ph.D.

RNDr. Juraj Franců, CSc.,
Ing. Daniela Máčová

prof. RNDr. Jiří Frýda, Dr.

Mgr. Daniel Nývlt, Ph.D.

Mgr. Radek Vodrážka, Ph.D.

RNDr. Zbyněk Šimůnek, CSc.

Mgr. Stanislava Vodrážková, Ph.D.

Mgr. Juraj Farkaš, Ph.D.

Mgr. Stanislav Čech

Mgr. Richard Lojka

RNDr. Štěpán Manda, Ph.D.

RNDr. Zbyněk Šimůnek, CSc.

prof. RNDr. Jiří Frýda, Dr.

RNDr. Petr Budil, Ph.D.

Mgr. Veronika Kopačková

Mgr. Daniel Nývlt, Ph.D.

Analysis of the vulnerability of the landscape to natural and anthropogenic processes

<ul style="list-style-type: none"> Reserves of soil potassium under conditions of permanent negative nutrient balance in grain production systems, in cooperation with the Crop Research Institute, v.v.i., R&D Q191C118, MoA, 2009–2013 	Mgr. Magdaléna Koubová, Ph.D.
<ul style="list-style-type: none"> Chromium isotopes as an indicator of natural attenuation of water pollution: Introducing mass-spectrometry based technology, TA01021055, TACR, 2011–2014 	RNDr. Martin Novák, CSc.
<ul style="list-style-type: none"> Forest soil conditions as a determining factor governing the state of health, biodiversity, wood-production and other functions of forests, in cooperation with the Forestry and Game Management Research Institute, v.v.i., QI 112A168, 2011–2014 	RNDr. Irena Skořepová, CSc.
<ul style="list-style-type: none"> Register of Slope Failures, 2011, continuing investigation 	Ing. Jan Šíkula, Ph.D.
<ul style="list-style-type: none"> Contribution to specific parts of the research plan of CGS by the Department of Geochemistry of the Rock Environment, CGS, 2007–2012 	Mgr. Jakub Haloda
<ul style="list-style-type: none"> Development of laboratory methods for separation of Ca from natural materials and analysis of Ca isotopes in the eluate obtained using the multicollector thermal ionization mass spectrometer (TIMS), CGS, 2010–2012 	Mgr. Lucie Erbanová
<ul style="list-style-type: none"> Isotope mass balance of lead in small catchment areas, CGS, 2010–2012 	Mgr. Markéta Štěpánová
<ul style="list-style-type: none"> Vertical changes of radiometric parameters in areas with a thin cover of soil and earth – a basis for radon index evaluation in extreme geological conditions, CGS, 2012–2013 	RNDr. Ivan Barnet, CSc.
<ul style="list-style-type: none"> Research on radon hazards in the environment of the CR, CGS, 2012–2013 	RNDr. Ivan Barnet, CSc.
<ul style="list-style-type: none"> Compilation of a map of soils and soil-forming substrates at 1:50,000 scale for the map sheets 12-34 Hořovice, 13-33 Benešov, 21-24 Klatovy and 22-22 Sedlčany, CGS, 2011 	Ing. Jana Janderková, Mgr. Jan Sedláček
<ul style="list-style-type: none"> Mapping of the natural productivity and ecological potential of soils at 1:50,000 scale – compilation of two model map sheets, CGS, 2012 	Ing. Jana Janderková, Mgr. Jan Sedláček
<ul style="list-style-type: none"> Creation of a system for the classification of soil-forming substrate for soil maps at 1:50,000 scale, CGS, 2012 	Ing. Jana Janderková, Mgr. Jan Sedláček
<ul style="list-style-type: none"> Evaluation of factors governing the chemistry of surface waters in the CR, CGS, 2012–2013 	RNDr. Jakub Hruška, CSc.
<ul style="list-style-type: none"> Monitoring of mass elements fluxes in the GEOMON network of small catchments and its application, CGS, 2012 	RNDr. Daniela Fottová
<ul style="list-style-type: none"> The development of efficient new methods for isotopic tracking of mercury in the environment: The combination of plasma mass spectrometry with single-purpose mercury analysis, CGS, 2012 	doc. RNDr. Vladislav Chrástný, Ph.D.
<ul style="list-style-type: none"> Monitoring POP in the air on James Ross Island, Antarctica, CGS, 2012 	Ing. Daniela Mácová
<ul style="list-style-type: none"> Application of mathematical modelling of the rock massif to assess the feasibility of restoring the National Natural Landmark at Lanek, protecting the rock outcrop and ensuring its long-term stability, CGS, 2012 	Ing. Jan Malík
<ul style="list-style-type: none"> Procedures for geological documentation of geodynamic processes and phenomena in exposures along linear constructions for the specification of geofactors of the rock environment 	Ing. Jan Malík
<ul style="list-style-type: none"> Geochemical mapping of the City of Prague, II. phase, CGS, 2012 	RNDr. Michal Pořávič
<ul style="list-style-type: none"> Register of Slope Failures in the Czech Republic (RSN ČR) – mapping of slope failures in the area of the Chřiby Mountains, CGS, 2012 	Ing. Jan Šíkula, Ph.D., RNDr. Oldřich Krejčí, Ph.D.
<ul style="list-style-type: none"> Compliance of the CR with the International Convention on Distant Transport of Pollutants – The National Centre for Effects, OOO MoE, 2012 	RNDr. Irena Skořepová, CSc.
<ul style="list-style-type: none"> Documentation of the redistribution of ¹³⁷Cs and other selected radionuclides in near-surface rock layers in the area of Žulová, OOHPP MoE, 2011–2012 	doc. RNDr. Pavel Müller, CSc.
<ul style="list-style-type: none"> The evaluation of recent trends in the development of geological knowledge and their application to the rock environment in the Czech Republic, 2012, OG MoE 	RNDr. Petr Mixa

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| <ul style="list-style-type: none"> Relationship between atmospheric N deposition and N accumulation in rain-fed peat bogs: Insights from a ^{210}Pb-^{15}N isotope study, Czech Science Foundation P504/12/1782, 2012–2014 | RNDr. Martin Novák, CSc. |
| <ul style="list-style-type: none"> The influence of irrigation and precipitation on the mobility of arsenic in the soil profile (in cooperation with the Institute of Chemical Technology in Prague), Czech Science Foundation P210/10/0938, 2010–2012 | Ing. František Bůžek, CSc. |
| <ul style="list-style-type: none"> The fate of legacy mercury in forest ecosystems in the area of the Black Triangle, Czech Republic, Czech Science Foundation P210/11/1369 (in cooperation for the Institute of Geology AS CR, v.v.i.), 2011–2014 | RNDr. Pavel Krám, Ph.D. |
| <ul style="list-style-type: none"> Influence of disturbance of the regime of a natural temperate forest on the variability of soils and pedogenesis on a rough spatial scale, Czech Science Foundation P504/11/2135 (in cooperation with the Silva Tarouca Research Institute for Landscape and Ornamental Gardening, v.v.i.), 2011–2013 | RNDr. Jakub Hruška, CSc. |
| <ul style="list-style-type: none"> Activities within the SGA; INGO programme, LA-09022, MEYS, 2009–2012 | RNDr. Jan Pašava, CSc. |
| <ul style="list-style-type: none"> Soil Transformations in European Catchments – Soil TrEC (FP7-ENV-2009-1, grant agreement number 244118), 2009–2014 | RNDr. Martin Novák, CSc. |
| <ul style="list-style-type: none"> Capability building in environmental geology – Mapping of geohazards including hydrogeological conditions in Dila and Hosaina areas, Ethiopia, Ministry of Foreign Affairs of the Czech Republic, 2012–2014 | Mgr. Vladislav Rapprich |

Research and evaluation of state of groundwater resources (amounts, limits, quality)

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| <ul style="list-style-type: none"> Review of Groundwater Resources in the Czech Republic (State Environmental Fund, under the terms of OPŽP, priority axis 6, financed by EU and CR), 2010–2015 | RNDr. Petr Mixa |
| <ul style="list-style-type: none"> AHYMO: Development and testing of devices designed by CGS for precise hydraulic measurement and recovery of intact groundwater samples from narrow diameter boreholes in rocks with fissure permeability | prof. RNDr. Tomáš Pačes, DrSc. |

Research on mineral resources and the influence of mining and processing on the environment

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| <ul style="list-style-type: none"> Risk factors in the exploration and mining of gas from shales under the conditions in geological structures of selected regions of the Czech Republic, CGS, 2012–2014 | RNDr. Juraj Franců, CSc.,
RNDr. Vlastimila Dvořáková |
| <ul style="list-style-type: none"> Specification of an inventory and current state of utilization of non-reserved mineral deposits in the CR based on the statement of mining- technical and operational data HOR (MIT) 1-01 for updating of the raw material information system (Surls), CGS, 2012–2013 | Ing. Josef Godány,
RNDr. Petr Rambousek |
| <ul style="list-style-type: none"> Research into the content and form of occurrence of elements of technical interest in flotation tailings remaining after processing of polymetallic ores – pilot project, CGS, 2012–2013 | RNDr. Petr Rambousek |
| <ul style="list-style-type: none"> Abandoned basalt quarries in Česká Lípa territory and their educational value and the potential for the preservation of greater landscape geodiversity, CGS, 2012–2013 | Mgr. Vladislav Rapprich,
Ing. Josef Godány |
| <ul style="list-style-type: none"> Field verification and the subsequent completion of a database of mine workings based on historical archive data – Rudice territory, CGS, 2012–2013 | RNDr. Josef Večeřa |
| <ul style="list-style-type: none"> Selected platinum-group minerals and their experimental approach, Czech Science Foundation P210/11/P744, 2011–2013 | RNDr. Anna Vymazalová, Ph.D. |
| <ul style="list-style-type: none"> Assessment of mining related impacts based on the application of the ARES Airborne Hyperspectral Sensor, Czech Science Foundation 205/09/1989, 2009–2012 | Mgr. Veronika Kopačková |
| <ul style="list-style-type: none"> Impact of mining and processing of ore on the environment in Namibia: Modelling migration of pollutants in soils, plants and groundwaters, Czech Science Foundation P210/12/1413, 2012–2014 | doc. RNDr. Bohdan Kříbek, DrSc. |
| <ul style="list-style-type: none"> Pattern of occurrence and community composition of deep subsurface microflora in Miocene clay and claystones and their importance in situ and after exploitation; in cooperation with the Biological Centre of AS CR, v.v.i., Czech Science Foundation 206/09/1642, 2009–2012 | doc. RNDr. Bohdan Kříbek, DrSc. |
| <ul style="list-style-type: none"> Earth Observation for Monitoring and Observing Environmental and Societal Impacts of Mineral Resources Exploration and Exploitation, FP 7, 2010–2013 | Mgr. Veronika Kopačková |

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| <ul style="list-style-type: none"> Activities within the AAPG (American Association of Petroleum Geologists), LA 10025, MEYS, 2010–2012 | RNDr. Vlastimila Dvořáková |
| <ul style="list-style-type: none"> Natural and synthetic minerals of the Pt group; their comprehensive characterization by innovative methods and clarification of their genesis in various geological conditions, MEB 061113, MEYS, 2011–2012 | RNDr. Anna Vymazalová, Ph.D. |
| <ul style="list-style-type: none"> Experimental study of ternary systems: Ag – PGE – (Se/Te/S), LH 11127, MEYS, 2011–2014 | RNDr. Anna Vymazalová, Ph.D. |
| <ul style="list-style-type: none"> Identification and classification of closed and abandoned mining waste facilities (SFŽP under the terms of OPŽP priority axis 6, financed by the EU and CR, 1.7.2010 – 30.11.2012) | RNDr. Vít Štrupl |

Research on environmental and geo-energetic technologies

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| <ul style="list-style-type: none"> Research on the influence of intergranular porosity on disposal into deep geological formations and the methodology for developing measuring apparatus, in cooperation with Stavební geologie-Geotechnika, a.s. (provider MIT, TIP Programme), FR-TI1/367, 2009–2013 | Mgr. Lenka Rukavičková, Ph.D. |
| <ul style="list-style-type: none"> The industrial potential of underground spaces left after mining of raw materials, a case study of selected mining districts and mines, CGS, 2012–2013 | RNDr. Josef Klomínský, CSc. |
| <ul style="list-style-type: none"> Research and development of methods and technologies for capture of CO₂ from fossil-fuelled power plants and CO₂ storage in geological formations in the Czech Republic, in cooperation with ÚJV Řež (provider MIT, TIP Programme), FRTI1/379, 2009–2013 | RNDr. Vladimír Kolečka |
| <ul style="list-style-type: none"> Pan-European coordination action on Geological Storage of CO₂ (FP 7), 2010–2013 | RNDr. Vít Hladík, MBA |
| <ul style="list-style-type: none"> R&Dialogue – Research and Civil Society Dialogue towards a low-carbon society, 7th Framework Programme of the EU, 1. 6. 2012–2030. 11. 2015 | RNDr. Vít Hladík, MBA |
| <ul style="list-style-type: none"> Reversible storage of energy in the rock massif, cooperation with ISATech Ltd., TA01020348, TACR, 2011–2013 | Mgr. Jan Franěk, Ph.D. |
| <ul style="list-style-type: none"> Research on thermally loaded rocks – prospects for underground storage of thermal energy, FR– TI3/325, MIT, 2011–2014 | Mgr. Jan Franěk, Ph.D. |
| <ul style="list-style-type: none"> In situ experimental investigation of bentonite stability during long-term heating up to 95 °C, in cooperation with WATRAD, s.r.o. (funded by the MIT, TIP Programme), FR-TI4/497, 2012–2015 | Mgr. Jan Franěk, Ph.D. |

Building of the integrated geo-science information system

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| <ul style="list-style-type: none"> Development of the www Information Portal of the CGS, CGS, 2009, continuing investigation | Ing. Radek Svítal |
| <ul style="list-style-type: none"> Data sources and metainformation system of the CGS, CGS, continuing investigation | Ing. Jan Sedláček |
| <ul style="list-style-type: none"> System for protection of geological sites, CGS, 2010–2012 | RNDr. Pavla Gürtlerová |
| <ul style="list-style-type: none"> Maintenance and development of the digital archive of CGS, CGS, 2010–2011 | Ing. Jan Sedláček |
| <ul style="list-style-type: none"> Creation of an electronic data collection of rock and rock-forming minerals, CGS, 2011–2012 | RNDr. Radmila Nahodilová |
| <ul style="list-style-type: none"> Development and maintenance of the National Geologic Map Database of the Czech Republic, CGS, 2011, continuing investigation | RNDr. Zuzana Krejčí, CSc.,
RNDr. Pavel Hanžl, Dr. |
| <ul style="list-style-type: none"> Implementation of the European INSPIRE Directive in CGS, 2012–2015 | Ing. Lucie Kondrová |
| <ul style="list-style-type: none"> Complete upgrade of the CGS Map Server, 2012 | Ing. Martin Paleček |

• Integration of the infrastructures ICT CGS and CGS – Geofond, 2012	Richard Binko
• GIS – launching of web data provision and 2.5 D web service viewer and mobile applications, CGS, 2012	RNDr. Roman Kujal, Ph.D.
• Organization of the survey archive GP Rýmařov, CGS, 2012	RNDr. Josef Večeřa
• Educational project Brno, MEYS, 2009–2012	RNDr. Vlastimila Dvořáková
• Review and analysis of data sources of geo-physics subsystems – proposals for incorporation of data in the CGS information system, CGS, 2012	RNDr. Eva Hudečková
• Optimization and coordination of the CGS information system: formulation of standards for processing and accessing collections and material documentation – I. phase, CGS, 2012	RNDr. Petr Budil, Ph.D.
• Digitization and incorporation of the geophysical archive from the Brno workplace in the information system of CGS, OG MoE, 2012	RNDr. Eva Hudečková
• Digitization of documents from the register of old mine workings, II. phase, OOHPP MoE, 2012–2013	RNDr. Pavel Šír
• Review of drill core acquired from the archive of material documentation of Litvínovská uhelná, a.s., for systematic incorporation in the archive of material documentation of CGS – Geofond, OG MoE, 2012	RNDr. Alan Donát
• Assessment of the significance of inanimate natural phenomena – creating a register of significant geological localities in Natural parks and natural landmarks in southern Moravia, 2012, Department of Special Natural Territory and Landscape Protection MoE	RNDr. Pavla Gürtlerová

Advisory and expert services

• Geological composition as a factor determining usage and development of the territory of CR, CGS, 1998, continuing investigation	RNDr. Jan Čurda
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New web pages

Web

Czech Geological Survey website www.geology.cz

State Geological Survey
www.geology.cz/extranet-eng/sgs

Science and Research
www.geology.cz/extranet-eng/science

Services www.geology.cz/extranet-eng/services

Maps www.geology.cz/extranet-eng/maps

Publishing activity
www.geology.cz/extranet-eng/publications

Promotion
www.geology.cz/extranet-eng/geology-for-all

About us www.geology.cz/extranet-eng/about-us

Thematic portals

Portal of Geohazards
www.geology.cz/geohazardy

Georeports www.geology.cz/georeporty

Slope Failures
www.geology.cz/svahovenestability

My Piece of Earth – webpage for children
and young people mujkousekzeme.geology.cz

Geological Research on Antarctica
www.geology.cz/antarktida

Journals

Bulletin of Geosciences
www.geology.cz/bulletin

Journal of Geological Sciences
www.geology.cz/sbornik

Special Papers www.geology.cz/spec-papers

Geoscience Research Reports
www.geology.cz/zpravy

Web applications

Map Server www.geology.cz/extranet-eng/maps

Geological Encyclopedia
www.geology.cz/encyklopedie

Dictionary of Geology E-C and C-E
www.geology.cz/slovník

Virtual Museum muzeum.geology.cz

Geological Localities lokalita.geology.cz

Decorative Stones
dekoracni-kameny.geology.cz

Other web presentations

On-line shop obchod.geology.cz

The CGS channel on YouTube
www.youtube.com/geologycz

www.geology.cz

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Fax: +420 251 818 748

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geochemistry) | Geochemistry |
Special Laboratories



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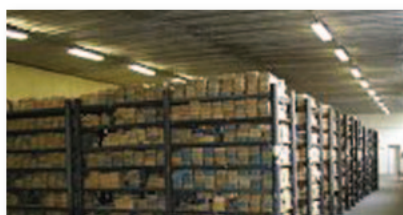
Geofond – Section for the Impacts
of Mining Activity



Workplace **Jeseník**

Erbenova 348, 790 01 Jeseník,
Phone/Fax: +420 584 412 081

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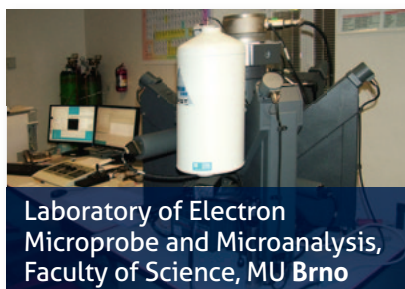
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Brno Branch

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Laboratory of Electron Microprobe and Microanalysis, Faculty of Science, MU **Brno**

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Joint Microprobe Laboratory of Masaryk
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Regional Museum and Centre for Documentation of Gold Deposits **Jílové**

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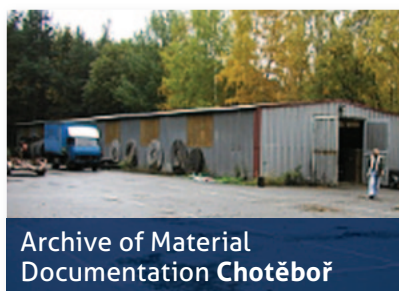
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Archive of Geological Samples

ISBN 978-80-7075-852-6



Czech Geological Survey Annual Report 2012

Edited by Petr Maděra

Executive editor: Šárka Doležalová

English language editor: Chris Halls

Translation: Lucie Čápová, Lukáš Janků & Petra Janovská

Graphic design: Stanislava Karbušická, Eva Šedinová

Photo on the cover: Radmila Nahodilová

Printing: Reprographic centre of the Czech Geological Survey

Published by the Czech Geological Survey, Prague 2013

03/9 446-450-13

ISBN 978-80-7075-852-6

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