



CZECH GEOLOGICAL SURVEY

Annual Report **2009**



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The Czech Geological Survey is the state organization with the statutory responsibility to gather, store and interpret geological information for the purposes of the state administration, for the commercial sector and for the wider public. Throughout the 90 years since its foundation, it has gained a high reputation for the impartial delivery of expert services and advice to the government and to the public.

The Czech Geological Survey is established under the Ministry of the Environment. The society-oriented service that it delivers depends largely on top-ranking research in geology, natural resources, geological hazards and environmental protection. For this reason, research and public service are both complimentary and inseparable. The Czech Geological Survey is an internationally recognized scientific institution responding to the requirements of society for sustainable development and playing a significant role in education and the popularization of geology.

Mission

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

Main fields of activity

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



Director's Introduction

The highlight of the year 2009 in the Czech Geological Survey was the 90th anniversary of the founding of the State Geological Institute of the Republic of Czechoslovakia, the legal precursor of the Geological Survey that exists today. The founders evidently recognized the essential strategic and economic role of a national geological survey because it was established as one of the first governmental and scientific institutions shortly after the foundation of the Czechoslovak state. It is, perhaps, no surprise that the original mission of the institute remains valid to this day. It is based on the need of all developed countries to carry out systematic research into the geological composition of their territories so that resources of raw materials can be identified, measured and managed and the environment monitored and protected. Of course, the priorities embraced by this important task do change, and a significant part of the work of the Survey now is concerned with the protection of the environment and the water resources and natural amenities that are crucial for a healthy and sustainable society. The practical investigations and research carried out by the Survey, both in the Czech Republic and abroad, are the source of much new scientific information and one of the important functions of the institution is to publish objective scientific reports, maps and specialist monographs, as well as popular literature that can raise awareness of the importance of the Earth sciences among the wider public.

Nowadays, the Czech Geological Survey is established by law within the Ministry of the Environment and in this capacity it fulfils two essential tasks. As part of the information base of the Ministry of the Environment, the Czech Geological Survey is required to provide expert services for the state and public administration, the private sector and the public. Simultaneously, the provision of these services depends on the expertise acquired through ongoing research in the geological sciences. It is the inseparable link between these two spheres of activity that guarantees the quality of scientific support that the CGS provides to the state administration. This principle marks the fundamental difference between the state geological survey and other institutions dedicated to academic research.

In the field of research, the Czech Geological Survey has been responsible for significant contributions over many years. According to the assessment of research results carried out by the governmental Council for Research, Development and Innovation, the Czech Geological Survey is the most productive of the scientific institutions established by the Ministry of the Environment and, of all 373 bodies in the Czech Republic that were assessed, it ranked in the 31st place. The survey thus earned a research status above that of a number of institutes of the Academy of Sciences of the Czech Republic and several universities. Since 1925, the CGS has published a scientific journal currently called *Bulletin of Geosciences*. In 2007, this journal was incorporated in the Web of Science – Thomson ISI database and during the year 2009 it achieved an impact factor of 0.983! This is an accolade for the Survey, its Publishing Department and its editorial staff, as well as the scientists who have contributed to the content of the journal, a significant number of whom are members of the CGS.

Like many other institutions, the Czech Geological Survey has been affected by the current difficult economic situation. In these circumstances, it is of paramount importance to establish financial strategies that will maintain the working strength and scientific capability of the state geological survey. I believe that, by marketing the skills and resources that it has demonstrated so ably in the past, funding must be sought to enable the CGS to carry out national and international projects. The project *Reassessment of Groundwater Reserves* financed from the Operational Programme Environment, which is planned to take place during the years 2010–2015, will be extraordinarily beneficial. It will provide an updated survey of the resources and dynamics of groundwater in the Czech Republic, a subject of vital strategic importance in the face of climate change that is affecting the Czech Republic and all other countries in Europe. This project is an excellent example of how the multidisciplinary competence of the Czech Geological Survey can be applied to the study of an important resource using both its state-of-the-art laboratory facilities and information technologies that have been developed recently.

Management of the Czech Geological Survey



Photo P. Neubert

Oldřich Krejčí

Zdeněk Čilc

Jan Pašava

Dana Čápková

Petr Mixa

Zdeněk Venera

Zdeněk Venera

Director of the Czech Geological Survey since 2004. He began his career as an assistant lecturer in Structural Geology at the Faculty of Sciences, the Charles University where he was engaged in teaching students and research on magmatic intrusions in the Alps and elsewhere. Later, he became the Head of the Division of Geology at the Ministry of the Environment. Subsequently, he received a Fulbright fellowship at the United States Geological Survey and University of California, Davis. He actively represents the CGS in EuroGeoSurveys, the association of European geological surveys. He is currently involved in structural geological research in the Antarctic Peninsula and represents the Czech Republic on the Committee for Environmental Protection in the Antarctic Treaty System.

Petr Mixa

Deputy Director of the Czech Geological Survey, Deputy Director for Geology and Head of the Geology Division, responsible for the functioning of the state geological service. His scientific specialisation is geology of ore deposits and base geological mapping. He is the head of the Review Board of CGS. Currently he is the leader of a multidisciplinary project in Antarctica and is also responsible for the operation of the project *Reassessment of Groundwater Reserves*. He has wide experience in management of both commercial and scientific affairs.

Dana Čápková

Deputy Director for Informatics and Head of the Division of Informatics. Her research centres on the conceptual design of information systems for geological purposes. She has wide experience in the compilation and use of geological data. Currently she is involved in further development of the geological information system of the CGS to ensure compatibility with other national and international geoinformation systems. She is a long-serving member of the GIC (Geoscience Information Consortium) and a member of the Council of the Czech Association of Geophysicists, o.s.

Jan Pašava

Deputy Director for Research and Head of the Geochemical Division and Central Laboratories. He specializes in the study of processes leading to the genesis of mineralization in black shales and on the impacts of their mining and processing on the environment. He has led a number of national and international projects concerned with these problems. He is currently studying the mechanisms responsible for the concentration of platinum group elements in various geological environments and participates in the development of methods for Re/Os dating. He currently holds the office of Executive Secretary of the SGA (Society for Geology Applied to Mineral Deposits).

Zdeněk Čilc

Head of the Economic Division and Deputy Director for Economy. In his capacity as a member of the Board of Management of the CGS since 2007, he has been involved in the financial restructuring of the main activities of the organization, decreasing the operating costs and increasing the income generated through services provided under commercial contracts with domestic and foreign clients.

Oldřich Krejčí

Director of the Brno Branch of the Czech Geological Survey. Regional Geologist for the West Carpathians. He has been involved for many years in the exploration and evaluation of oil and gas deposits in the foreland basins of the Carpathians in Moravia. Since 1997 his work has focused on the engineering-geological mapping of slope failures and preparing reports on these for the state administration. At present he is the leader of a project monitoring slope failures in Moravskoslezské Beskydy, sponsored by the Ministry of the Environment.

Czech Geological Survey Organizational Structure



Geological and thematic maps



Photo P. Neubert

Geological mapping provides comprehensive information about the geology of the Czech Republic and forms the basis for further geological research. The maps with explanatory text are utilized in a range of geoscientific disciplines, namely for the assessment of environmental impacts, the evaluation of water reserves and mineral resources, the identification of geohazards and for strategic planning of land-use. Geological mapping has been one of the fundamental tasks of the CGS since its foundation. The CGS remains the only institution with the statutory task of mapping the geology of the Czech territory.

Selection of the areas for mapping reflects the priority given to environmental or development-related issues by the state and local authorities. The mapping involves compilation of geological and thematic maps at various scales together with the collection, assessment, and provision of access to supplementary data and material documentation. The related research is driven by new geological concepts and the advanced analytical techniques that are now available. These enable depiction of the conditions under which soil horizons have formed in different climates and terrains, thus enabling analysis of the natural environment and related ecosystems and biotopes that govern the ecology of the landscape. The economic benefits that result directly from this mapping include new indications of mineral resources, the re-evaluation and protection of energy sources (coal, geothermal energy), water and industrial minerals, as well as the identification of potential sites for storage of gas or hazardous waste.

Jaroslava Pertoldová

Head of the Department of Regional Geology of Crystalline Complexes.

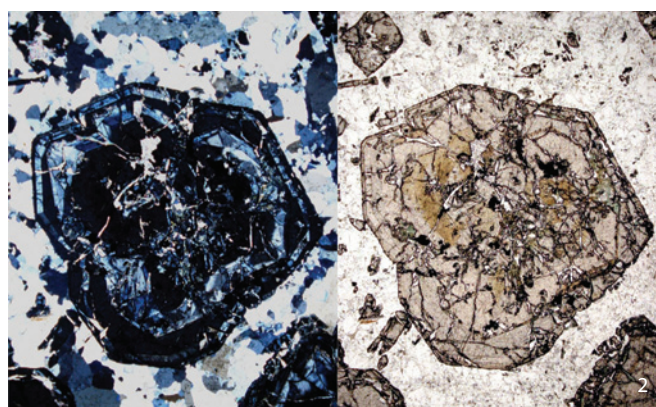
As a research worker with previous broad experience in the exploration of gold deposits, she presently focuses her research on detailed 1 : 25,000 geological mapping throughout the whole Czech Republic and the interpretation of her favourite skarn rocks.

In the CGS, mapping activities are based on the project for detailed geological mapping of selected areas in the Czech Republic at a scale of 1 : 25,000. Each map sheet at a scale of 1 : 25,000 consists of three fundamental parts: (i) the geological map, (ii) an explanatory text and (iii) an information system. All the newly acquired data and records are stored in the National Geological Mapping Database of the CGS, which is designed to enable the creation of fully digitised map layers. Syntheses of the new data acquired through mapping and related research are published in journals with international impact. In addition, the CGS continues to work in cooperation with foreign geological institutions on a variety of mapping programmes in other countries. It also participates in the *OneGeology* project, the goal of which is to create a digital geological map of the Earth at a scale of 1 : 1,000,000.

During the current cycle of work from 2008–2014, geological mapping of the following ten areas has been initiated: the Krkonoše Mts, the Šumava Mts, the Brno region and the neighbouring Moravian Karst, the Beskydy Mts, the Jeseníky Mts, the Doupov Mts with the Čistá-Jesenice Massif, the Křivoklát protected area, the Moldanubian Batholith, the Bohemian Paradise UNESCO European Geopark and the Ústí-Děčín region. According to the new directive for geological mapping of the Czech Republic at a scale of 1 : 25,000, two map sheets were finalized in 2009: 13-324 Kutná Hora and 32-233 Černá v Pošumaví. Further mapping proceeded on 33 map sheets, which will be finished during the next three years. Some of the scientific results of this mapping were presented during a geological excursion organized for members of the Mining Union and during a workshop at a congress of the Czech and Slovak Geological Society. In cooperation with the Faculty of Sciences at the Charles University, the CGS also organized a two-week field mapping course for students in the second year of the Geological Sciences degree.

Geological research closely related to regional mapping projects is concerned mainly with the geodynamic evolution of the Bohemian Massif. In the Šumava Mts, a comprehensive programme is aimed at creating a geological and structural map at a scale of 1 : 100,000 supported by an explanatory text that will complement a similar map of the neighboring Bavarian region. Structural and petrogenetic relations in the Moldanubian Batholith have been investigated. Protoliths and subsequent tectonometamorphic evolution in the Krkonoše-Jizera Crystalline Complex are being analysed. In the Křivoklát area, research is focused on the petrogenesis of Upper-Proterozoic and Cambrian volcanites, associated dykes and the sedimentological analysis of Upper-Cambrian strata. In the Jeseníky Mts, the problem of the lithostratigraphic subdivision of the Andělská hora sequence is being resolved.

The specialists from our department have made a significant contribution to the scientific activities of Czech geological organizations during 2009. Veronika Štědrá successfully com-



- 1/ Fieldwork and sampling are not restricted to the summer season only (photo by J. Franěk).
- 2/ Photomicrograph of a grossular-rich garnet showing strong compositional zoning both in PPL and under crossed polarizers (photo by J. Pertoldová).
- 3/ The travelling exhibition *Planet Earth: Mighty and Vulnerable* during the opening ceremony at the headquarters of the AS CR (photo by V. Štědrá).

pleted the presentation of the mobile exhibition dedicated to the International Year of Planet Earth, organized by the Czech National Geological Committee in which she played a leading role. In 2009, Kryštof Verner was elected to the Presidency of the Czech Geological Society.



Photo P. Neubert

Geological research in the Bohemian Massif and the Western Carpathians is closely linked to geological mapping and undertaken in cooperation with other Czech and foreign scientific institutions. It is focused mainly on the tectonometamorphic evolution of crystalline units and their isotopic dating, the processes governing emplacement of magmatic bodies, and the lithostratigraphy and biostratigraphy of sediments and the tectonosedimentary evolution of the basins that contain them, including palaeoenvironmental and palaeogeographical interpretations. The results are presented at international conferences and published in reviewed journals or in monographs.

Research on the crystalline basement ranged widely from applied topics through research based on geological mapping (e.g. Verner et al. 2009) to the investigation of problems of purely mineralogical interest (e.g. Žák et al. 2009).

A major project concerned with the interpreting the geological development of the region along the NE periphery of the Moldanubian Zone (No. 6352) was completed in 2009. Apart from other outcomes, it resulted in the publication of a thematic volume of the *Journal of Geosciences* (2/2009).

A monograph edited by J. Klomínský summarizing the geological parameters of granitoid and orthogneiss bodies across the Bohemian Massif has been published.

Lilian Švábenická

Head of the Department of Regional Geology of Sedimentary Formations.

Micropalaeontologist (calcareous nannofossils), she is engaged in biostratigraphic and palaeoenvironmental studies of marine deposits within the range of ages from Cretaceous to Tertiary. Recently, she was appointed leader of geological research in the UNESCO Geopark Bohemian Paradise.

Jaroslava Pertoldová

Head of the Department of Regional Geology of Crystalline Complexes.

Detailed work in the field and on archived material has continued with the aim of identifying a suitable site for a deep underground repository for the disposal of nuclear waste. This year has seen the completion of a 6-year long programme of geological monitoring in two tunnels at Bedřichov in the Jizera Mts. The intention was to evaluate the long-term stability of granites *in situ*, together with the influence of damage caused by various excavation techniques and the interaction of the rock with the surrounding environment. The results have enabled improvements in the quantitative description of granitoid massifs and the formulation of numerical models which simulate evolution of the rock environment during the construction of underground facilities (e.g. storages for gas or nuclear waste). A project for the long-term monitoring of thermal damage to the natural rock environment was submitted in 2009. If financial support is received for this, research in the following years will focus on storage of excess heat in the rock mass, e.g. that available from alternative energy sources, and the ways in which this stored energy can be returned and re-used. As part of an international cooperation agreement with Namibia, a project on the tectonometamorphic evolution of the Kaoko orogenic belt in NE Namibia was successfully completed.

Research on sedimentary formations and volcanics

Geological research and mapping, including works under the terms of the Research and Development project *UNESCO Geopark Bohemian Paradise* provided valuable material for further research:

Studies of the amphibole lamprophyres emplaced within the Čistá-Jesenice Massif, W Bohemia, have led to the recognition of two distinct groups. The Ti contents of the southern group are lower than those of the northern group, and the southern group also contains magnetite.

The Ordovician volcanics of the Barrandian exposed in the Zaječův quarry have been shown to contain distinctive accretionary lapilli indicative of eruption of magma into shallow water.

A digital elevation model of the crystalline basement and the Permo-Carboniferous surface has been constructed to enable further interpretation of the tectonosedimentary evolution of the Intrasudetic Basin.

Based on new palaeobotanical material collected near Rakovník, a new interpretation of the sedimentary environment of the Lubná coal seam in the Kladno-Rakovník Basin has been made.

The influence of subsidence, eustasy, palaeoclimate changes and flow regime on the geometry of clastic sequences in the Bohemian Cretaceous Basin has been investigated. It has been shown that the palaeodrainage pattern was governed by inherited fault systems and basement lithology (Uličný et al. 2009).

The polygenetic history of phosphatic intraclasts within the shallow-water hemipelagic strata of the Upper Turonian in the Bohemian Cretaceous Basin has been reconstructed (Vodrážka et al. 2009).

Analysis of heavy mineral assemblages has demonstrated that the source area for the clastic material of the Cretaceous Vysoké Mýto syncline was the Svratka Crystalline Complex.



1/ Low-grade Proterozoic siltstones in the Teplá-Barrandian Unit, demonstrating overprint of a steep foliation by a younger crenulation cleavage (photo by J. Franěk).

2/ Fragment of pinnate pteridosperm (*Dicksoniites plukenetii*) from the Lině Formation, Klobuky Horizon, Carboniferous, Stephanian C at Klobuky (photo by Z. Šimůnek).

The tectonic evolution of the architecture of the Eger Graben continental rift basin has been reconstructed using sedimentary geometries and interpretation of geophysical data (Rajchl et al. 2009).

Preserved relics of Late Miocene volcanic activity were identified in the České středohoří Mts (Cajz et al. 2009). A lithostratigraphic division of the Cenozoic volcanites of the Bohemian Paradise area has also been proposed.

Gamma-spectrometry has been used successfully to trace the outcrop of K-rich dykes in the Doupovské hory Volcanic Complex (Skácelová et al. 2009).

Global changes during geological history

During the year 2009, the team of scientists investigating global changes that have taken place in the Earth's past consisted of 5 researchers, 9 Ph.D. students, 1 Masters student and 2 technicians. They are: Stanislava Berkyová, Eva Břízová, Petr Budil, Jana Drábková, Lenka Ferrová, Jiří Frýda, Naďa Hrdličková, Tomáš Hroch, Leona Koptíková, Jiří Kříž, Richard Lojka, Štěpán Manda, Zbyněk Šimůnek, Marika Steinová, Alena Tichá, Petra Tonarová and Radek Vodrážka.

Publications by the group

The research team published a total of 26 reviewed scientific publications incorporated in the *Web of Science* database, 3 chapters in foreign scientific books and 8 reviewed scientific publications without IF.

Summary of chief activities and results

- Systematic study of the lamellibranch genus *Kenziniana* Liljedahl, 1989, belonging to the family Spanilidae Kříž, 2007, occurring in the Silurian of Bohemia, Sardinia and Gotland (Kříž 2010) was completed.
- The lamellibranch fauna from the Upper Hirnantian (Upper Ordovician) of Bohemia was studied and classified and the significant global community of *Hirnantia sagittifera* – *Sluha kosoviensis* was redefined. This supports the view that the Prague Basin was located in warm subtropical latitudes between 30° S and 45° S during the uppermost Ordovician. The results of this study (Kříž and Steinová 2009) provide evidence for the renewal of the environment during marine transgressions in the uppermost Ordovician that followed the global glaciation during the Upper Ordovician.
- The succession of lamellibranch-dominated communities from the Upper Silurian of south-west Sardinia, Perunica and other areas of peri-Gondwana (Montagne Noire, Armorican Massif, France and the Carnic Alps, Austria and Italy) were correlated. The results of this study (Kříž 2009) show that there were close relationship between the geology and faunas of these different areas.
- The evolution of nautiloids in the Lower Devonian was studied in relation to global events. Special attention was given to the morphology of the shell and its significance for the reconstruction of the predator-prey interactions in the biota (Manda and Turek 2009a).
- The pattern of evolution of shell colours and systems of musculature in Silurian nautiloids was investigated and the phenomenon of convergence in these features was described (Manda and Turek 2009b, c).
- A study of the conodont fauna of the Lower and Middle Devonian of the Prague Basin was published. In addition to aspects of taxonomy, the biostratigraphy was also investigated, especially the possibility of correlating environmental changes during the Middle Devonian (Berkyová 2009).
- Changes in the temperature of sea-water in Nevada and Perunica have been correlated using the results of palaeotemperature determinations based on the composition of oxygen isotopes in apatite from conodont faunas. These provide evidence that the transgression-regression events in these separate areas were probably driven by glacio-eustatic processes (Elrick et al. 2009).
- A study of inarticulate brachiopods from the Chýnec Beds was published (Mergl and Ferrová 2009).
- Phosphatic intraclasts in hemipelagic sediments from the Bohemian Cretaceous Basin were described as a unique source of palaeoecological, taphonomic and biostratigraphic data (Vodrážka et al. 2009).
- An analysis of the phylogenetic position of platyceratoid gastropods based on the discovery of protoconchs from Devonian sediments in France was published (Frýda et al. 2009a).
- A monograph on Devonian dalmanitid trilobites of the Prague Basin was published (Budil et al. 2009).
- A study on malformation of agnostid trilobites from the Cambrian of central Bohemia was published (Fatka et al. 2009).
- A study on an enigmatic articulate *Zonozoe drabowiensis* was published (Rak et al. 2009).
- A taxonomic study of scolecodonts from the Silurian rocks of the Prague Basin is in the process of completion (Tonarová, in prep.).
- A new model for sedimentation of Silurian "hot shales" in Jordan was published (Loydell et al. 2009).
- A study of the crystallographic texture of nacre in the Triassic gastropod *Wortheniella coralliophila* was published showing that the molecular mechanisms driving the formation of molluscan nacre have been temporally stable for more than 200 million years (Frýda et al. 2009b).
- Changes in Carboniferous plant communities within the sedimentary sequence of the Upper Silesian Basin were investigated (Gastaldo et al. 2009a, b).
- Floristic changes in communities from the uppermost Pennsylvanian and Lower Permian (Cisuralian) of the Boskovice Basin were studied (Šimůnek and Martínek 2009).
- Two studies of the composition of a coal-forming forest which was buried under volcanic ash at Ovčín in the Radnická Basin, and on conservation of plant remains in pyroclastic rocks were published (Opluštil et al. 2009a, b).
- A new species *Spencerites leismanii* sp. was described from Bolsov at Tlustice, and its reconstruction was illustrated. The palaeoecology of species of the genus *Spencerites* from the Czech Republic was discussed (Bek et al. 2009a). These are the only compressionally conserved occurrences known in the world so far.
- On the basis of spores discovered *in situ* at Bolsov in the Kladno-Rakovník Basin, and the general habitat of the plant, a new

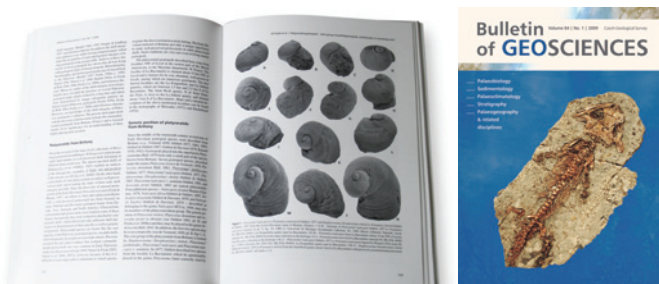
species of herbaceous lycopod *Selaginella labutae* sp. nov. has been described. Fossilized plants of the genus *Selaginella* are very rare elsewhere in the world. The occurrence of this Czech material of the genus *Selaginella* has even enabled some palaeoecological interpretations (Bek et al. 2009b).

- A new bisporangiate lycopsid cone genus *Thomasostrobus* gen. nov. from the Stephanian of the Intrasudetic Basin has been described. This is apparently related to sigillarian cone species *Sigillaria brardi* which is abundant in the Euroamerican province. Also, the microspores of *Cadiospora magna* species have been found to be a stratigraphically important component in disperse communities all around the world (Opluštil et al. 2009).
- Discoveries of fossil remains of the gymnosperm genus *Cordaite* at Ovčín in the Radnická Basin enabled the reconstruction of the whole plant of *Cordaite borassifolius* including its leaves, seeds, male and female fruiting bodies, and *in situ* pollen and to make plaster casts of the medullary cavities. This species was preserved *in situ* within the volcanic tuff which buried the coal-forming flora at Ovčín (Šimůnek et al. 2009a).
- Detailed investigation of the sedimentary environments, palaeontology and climatic indices of the grey Klobuky Horizon in the Kladno-Rakovník Basin has revealed that there was a more humid climatic interlude in the prevailing arid conditions. This enabled the evolution of a distinctive flora and fauna in a shallow lake and later the formation of a bed of coal (Šimůnek et al. 2009b).
- Analysis of sediments from the Mšeno Beds (Stephanian B, Carboniferous) formed in a large fresh-water lake occupying the central-Bohemian and west-Bohemian basins has provided information about the balance between cycles of precipitation and seasons in the central part of tropical Pangea. These cycles had a direct effect on the evolution of the environment and composition of the vegetation (Lojka et al. 2009).
- A study of the biostratigraphic evolution of sediments deposited in the former Čejčské lake, southern Moravia, during the period from the last glaciation (Pleistocene) up to the Recent (i.e. ca 15,000 years) was published. Results of pollen analysis from the youngest strata are compared with historical records of changes in vegetation (Břízová 2009a).
- A study of the dynamics of evolution of the forest vegetation in the Českomoravská vrchovina based on palynological investigations was published (Břízová 2009b).

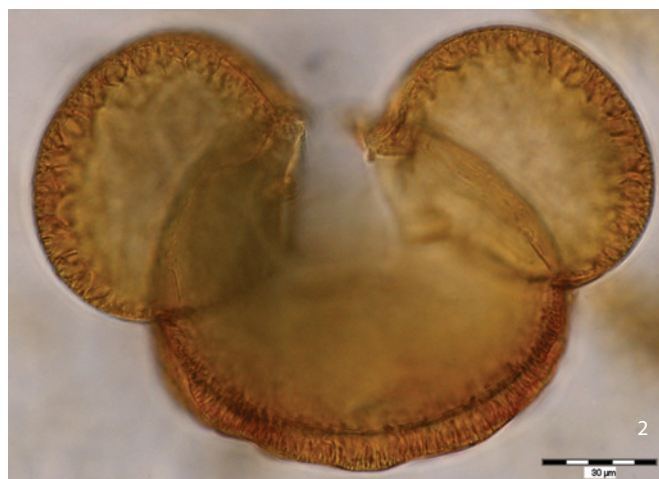
In addition to the papers cited above, the team published a number of other papers and presented the results of their research at a number of international scientific meetings.

Projects undertaken

Grant for Czech-American collaboration Amvis-Kontakt (ME08011); grants GAČR: (205/06/1367), (205/08/0062), (205/09/0619), (205/09/0703), (205/06/0842); grants GAAV: (KJB307020601), (A300130703), (KJB307020602).



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1/ Members of the scientific team of CGS who study global changes that took place on Earth in the past, manage and create the international scientific journal *Bulletin of Geosciences*. The international editorial board of this journal consists of experts from several Czech institutions and from 13 other countries around the world. For the year 2009, the calculated impact factor was 0.983 and thus, based on this IF, the *Bulletin of Geosciences* was ranked the tenth in order of the scientific journals published in the Czech Republic (according to the ISI Web of Science).

2/ A pollen grain of fir (*Abies* sp.), from a depth of 1.50 m in the former lake Stará jímka, Šumava (photo by E. Břízová).

3/ Velké Dářko, profile VD-D4, sediments of the late Pleistocene and lower Holocene from a depth of 7,70–8,20 m, approximate age 14,000 BP (photo by E. Břízová).

Environmental geochemistry and biogeochemistry

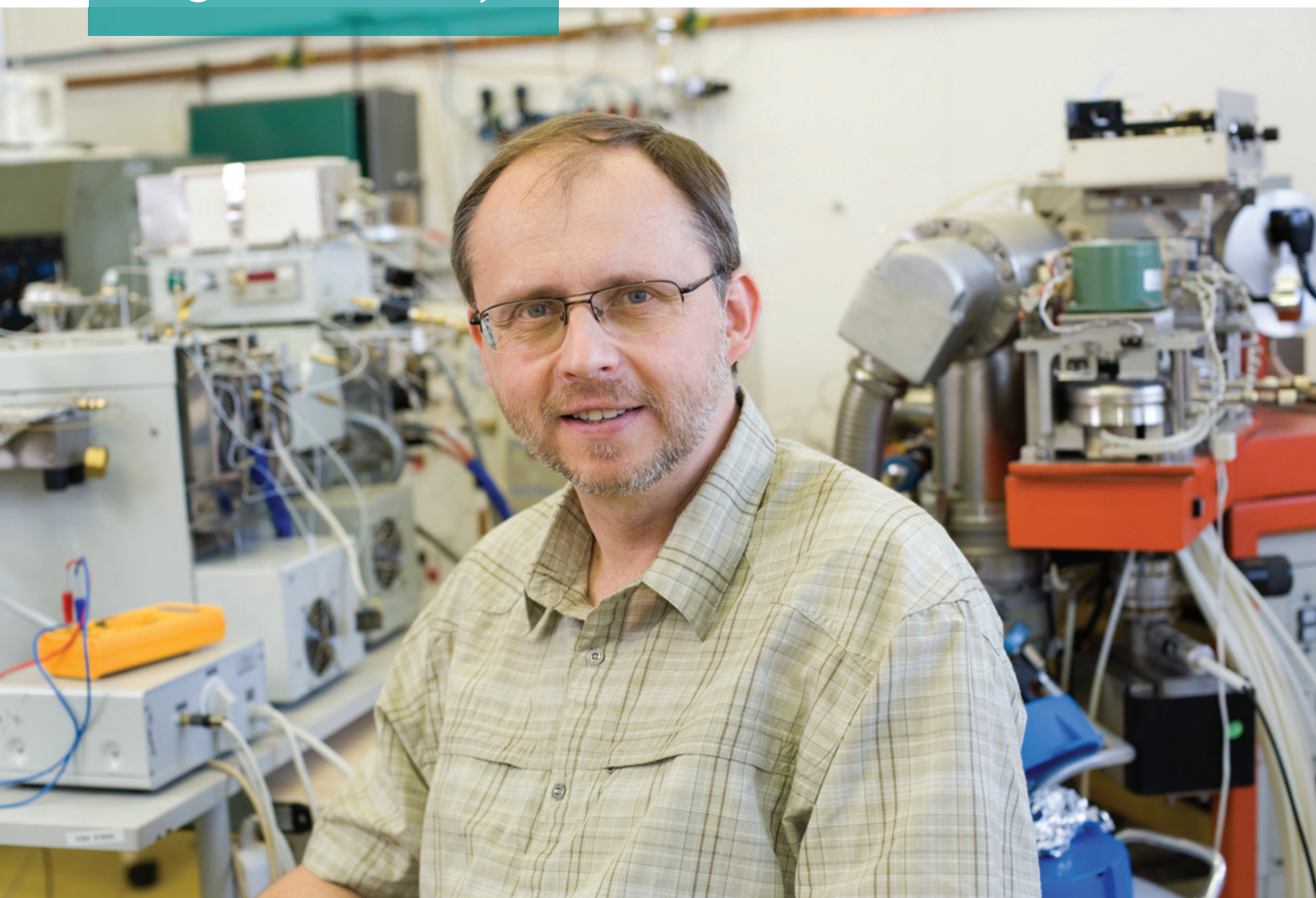


Photo P. Neubert

The chief research and monitoring activities of environmental geochemistry and biogeochemistry are interdisciplinary projects combining ecotoxicology, pedomeristry, hydrogeochemistry, isotope biogeochemistry and geochemical modelling. In addition to monitoring and mapping of the state of the environment, in 2009 investigations of the changes in acidification and microbial processes in forest ecosystems were carried out. A major contribution to the analytical facilities during the last year has been the installation of a multicollector inductively coupled plasma mass spectrometer used for determining the ratios in the abundances of stable isotopes.

Unconventional isotope systems

At the end of 2009, a multicollector inductively coupled plasma mass spectrometer (MC ICP MS) was installed in the laboratories of the Czech Geological Survey. This instrument is used to determine the ratios of the abundance of stable isotopes of certain elements that would be almost impossible to analyse using conventional methods, for example isotopes of the elements Li, Fe, Cr, Zn and Cu. For these elements, fractionation of their isotopes caused by natural processes is very low. By monitoring such low levels of fractionation using ICP MS, biogeochemical and petrogenetic processes can be interpreted with much greater confidence and precision.

Martin Novák

Head of the Department of Environmental Geochemistry and Biogeochemistry.

He has served for many years as editor of the journal *Geochimica et Cosmochimica Acta*. His research is concerned with isotope biogeochemistry and global climate change. Currently he is involved in the preparations for the 21st Goldschmidt Conference in 2011, when Prague will be the venue for one of the largest gatherings of the World's geochemists.

Regional geochemistry

The resampling of the whole surface drainage system in the Czech Republic to enable comparison of contemporary water chemistry with that of samples collected and analysed during the mid 1980s is heading towards successful completion. By the end of 2009, sampling of the Morava, Dyje, Odra, Ohře, Labe and lower Vltava basins was finished. The results of the analyses have been presented in detailed geochemical maps. The results from the Danube Basin have been compiled as part of the *Danube Basin* project. A rapid increase in the concentration of platinum and palladium in soils of urban areas subjected to a higher intensity of car traffic was recorded under the terms of the project *Geochemistry of dust from urban areas*. Very small particles (PM_{10} – $PM_{2.5}$) containing these metals are deposited from the catalysts of vehicles. In order to determine the health hazard posed by these particles, it will be necessary to continue monitoring the patterns of their abundance in urban dust and soils.

Reversal in acidification

Anthropogenic acidification of natural mountain forests is being monitored at specially designated research sites in the Ukraine. These areas provide a valuable reference because historical data on their soil chemistry dating from the beginning of the 20th century are available. During 2009, precipitation and soil water from the Javorník and Pop Ivan sites were sampled. In addition, samples of assimilation organs and wood were also collected. Investigation of the effect of calcification on acidified forest soils in the Krušné hory Mts is still in progress. Sites in spruce woods (calcified and reference site) and beech woods are sampled at monthly intervals. The precipitation in open areas and under the canopy as well as soil water from the humus horizon at depths of 30, 60 and 90 cm are sampled. The contents of cations, anions and pH are measured and recorded.

Monitoring in the network of small drainage areas GEOMON

Secular monitoring of the flux of ecologically significant elements and compounds, some of which occur only in trace amounts, in 13 small forest drainage areas is being evaluated on the balance between hydrochemical input and output. Sampling and analysis has been carried out on a monthly basis since 1994 using unified procedures for sampling and analysis. Recently, special attention has been given to the effects of climate change, increased flood hazards and to the proposal of remedial measures. Proposals for the ecostabilization of four selected areas in the GEOMON network were made. The temporal pattern of precipitation has changed, precipitation is now more intensive while periods without precipitation are longer so that the danger of sudden rapid floods has increased.

Critical loading

Empirical evaluations have been made of the critical load of nitrogen sustained by forests and other types of ecosystems in the Czech Republic. Currently, the extent to which atmospher-



Heavy frost on a frost deposit collector, at the Zaječí vrch site in the Krušné hory Mts, winter 2009 (photo by F. Veselovský).

ic deposition of nitrogen during the last 15 years has exceeded the empirical estimates of critical loading is being evaluated and trends in the emissions of nitrogen compounds during this period are being investigated. A more detailed evaluation of nitrogen critical loads in selected areas is being prepared. This will be based on an investigation of species of vegetation from both forest and non-forest plant communities and of the chief soil parameters that have a direct effect on biodiversity in the affected areas.

Global climate change at present

Reciprocal transplantation of peat monoliths between areas with different mean annual temperature and different levels of contamination is being used to test hypotheses concerning the stability of the organic carbon reservoir in wetlands. It has been discovered that environmental parameters have a more significant effect than the type of organic compounds in the reservoir. It has been shown that individual sites adapt over the short term to changes in the emissions of greenhouse gases.

Minerals and environmental impacts of mining



Photo P. Neubert

The economic geologists of the Czech Geological Survey are involved in investigations of mineral resources, both within the Czech Republic and abroad. The core activities of economic geology are to provide advice on the existing status of earth resources and their protection and on optimum strategies for their extraction and use so that the environmental impacts of mining are minimized. By means of this advice, the mineral policy of the Czech Republic can be developed in accord with the principle of sustainability. Through the work of regional economic geologists, the knowledge of mineral resources is being continuously reviewed and expanded so that objective information can be made available to government and local authorities. An equally important part of this task is to educate and inform professionals and the wider public about the role of mineral resources in society and the environmental implications of their extraction.

Zdeňka Petáková

Head of the Department of Mineral Resources. Her current scientific work is dedicated to creation of a comprehensive and sustainable strategy for the use of mineral resources. She is also concerned with the promotion of geological science to the wider public.

Assessments

Expert opinions and proposals regarding mineral extraction, remediation of the impacts of mining, and the relation between mineral deposits and land-use planning were prepared for the state administration and local authorities. The CGS also played an active part in the negotiations of the informal working group, the *Independent Commission for Assessment of Long-Term Energy Needs of the Czech Republic*.

Environmental impacts of mining

The review of the current security status of old mining sites continued in cooperation with the Czech

Geological Survey – Geofond as authorised by the Ministry of the Environment. A total of 455 objects were selected for field inspection. The information about the status of old mine workings gathered during this review procedure is essential for the safety of local inhabitants.

The regional mineral policy for the Liberec region has been updated. This embodies the strategic concepts governing exploitation of mineral resources that will guarantee minimal environmental impact and enable sustainable mining. The final report on the project *Environmental impacts of mining, processing and manufacturing of minerals* was completed.

At six localities, investigations of the contamination of the rock environment by hazardous elements and the role of organic substances in their dispersion were carried out. The impacts of mining on each area were also monitored using geophysical methods and remote sensing.

The project *Research into the long-term possibilities for the elimination of mining hazards in the Horní Benešov and Horní Město mining districts* carried out in collaboration with VŠB – Technical University of Ostrava (funded by the Czech Science Foundation) was completed. A conference and exhibition were held in Bruntál. The output from this project serves as technical support for the national implementation of EU Directive No. 2006/21/ES on management of mining waste.

Field methods have been developed to enable the application of X-ray fluorescence spectroscopy to geological and environmental surveys.

Minerals

The compilation of mineral resources maps at a scale of 1 : 25,000 for the Geopark Český ráj, Krkonoše, Central Bohemia and the Krkonoše Piedmont has been initiated. The mineral resources map of Kutná Hora, together with explanatory notes, has been completed.

A teaching module *Development of mineral exploitation in the territory of the Czech Republic* has been published in digital format (<http://dum.rvp.cz/materialy/vyvoj-vyuzivani-nerostnych-surovin-na-uzemi-cr-2.html>) and an essay *On the meaning of science* was also published. A lecture on the use of minerals by the Celts in the Železné hory Mts was presented to experimental archaeologists in Nasavrky.

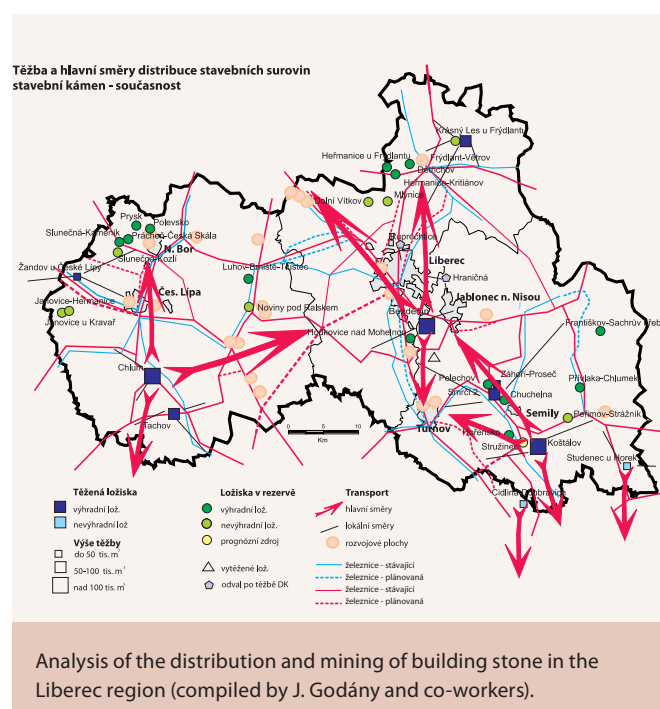
Geochemical logging was successfully used for the first time in the Czech Republic to interpret the tectonic and climatological evolution of the brown coal basin. This study was undertaken as part of the Czech Science Foundation project *Sokolovsko* on the Sokolov Region.

The distribution of platinum minerals in unmineralized rocks of the Letovice metaophiolite complex was investigated.

A database of decorative stones of the Czech Republic has been compiled; recently with a new version in English (www.geology.cz/dekoracni-kameny).

Foreign expertise and international collaboration

The geological mapping and production of maps of mineral occurrences in northern Iran have led to an improved under-



standing of the metallogenic evolution of the region that will enable more effective local development of mineral resources. The results were presented at the Geological Survey of Iran. Mapping in the Ndola area, Zambia, was carried out under the terms of the cooperative development project *Assessing the impact of exploitation and processing of ores on the environment and human health in selected areas of the Central Province and Copperbelt in Zambia*. The area of the town strongly contaminated by dust from cement works and lime kilns has been delimited in cooperation with the civil association *Citizens for a better environment*.

Papers on the geochemistry of tailings ponds and a paper on the fern *Pteris vittata* which accumulates arsenic and copper in the tailings ponds in Zambia have been prepared.

As member of the EuroGeoSurveys, the CGS contributed to documents defining the new European mineral strategy. The analysis by the CGS of the access to minerals in Europe was presented at the international conference *Mineral resources for Europe* during the term of the Czech presidency of the EU and was published on the web (www.euroresources2009.eu). The CGS has provided an expert Czech representative for the Commission of the European Mineral Initiative.

As a member of the European association Europamines, the CGS promotes the preservation and sustainable use of mining monuments and important mines in the Czech Republic and is actively involved in conserving the mining heritage of the Zlaté Hory, Nový Knín and Kutná Hora regions.

Economic geologists from the CGS continue to participate in the activities of international scientific organizations such as the SGA, SEG and IAGOD.



Photo P. Neubert

During 2009, following the long-term plan of the CGS, the Applied Geology Division continued with hydrogeological, economic-geological, engineering-geological, geophysical and geochemical investigations and research. During recent years, the most significant work of the division has been concerned with geohazards, in particular slope failures. Following the extreme rainfall in 1997, about 10,000 slope failures and landslides occurred in various places across the Czech Republic. The main investigations carried out during 2009 were in the area of the Jeseníky Mts and Nový Jičín. The Czech Geological Survey also took part in the investigation of the major floods of June 2009 and contributed to the final report dealing with this event. Another important topic of investigation has been the distribution of the radioisotope ^{137}Cs in the soils of various areas in the Czech Republic. Significant progress has been made in the programme of investigation of the geological and geotechnical parameters of granitoid massifs to determine their suitability for use as deep repositories for spent nuclear fuel; surveys of the distribution of natural radon in different geological units are also being made. Under the auspices of the project GEOMIND, geophysical metadata have been incorporated into a multilingual database. In addition, the first stage of research into the static and dynamic sorption of selected elements in various types of rock environment has been completed.

Oldřich Krejčí

Director of the Brno Branch of the Czech Geological Survey. Regional Geologist for the West Carpathians. He has been involved for many years in the exploration and evaluation of oil and gas deposits in the foreland basins of the Carpathians in Moravia. Since 1997 his work has focused on the engineering-geological mapping of slope failures and preparing reports on these for the state administration. At present he is the leader of a project monitoring slope failures in the Moravskoslezské Beskydy Mts sponsored by the Ministry of the Environment.

Hydrogeology

During 2009, the near-surface dynamics of the Quaternary ground waters in the Polabí area were monitored using natural tracers and the levels of pollutants related to agricultural activities were determined. Routine fieldwork and laboratory tests and analyses including hydrometry, records of precipitation, measurements of the ground water regime and water sampling, chemical analyses of the ground water, and the determination of the contents of stable isotopes and other tracers in ground water and precipitation have been carried out. In the area of Cretaceous outcrop, using geochemical models, the average period of ground water residence in the near-surface zone of weathering has been shown to range from 18 up to 20 years. At present, the ratio of infiltration of precipitation during the fully vegetated season to that of the infiltration in the out-of-season period is being evaluated.

Meanwhile, work has also continued on the creation of the National Hydrogeological Informational Layer in GIS format. During the first half of 2009, the compilation of data covering the north and northwestern parts of Bohemia was completed. At present, the work of compiling the data for other areas is being completed and a conceptual hydrogeological model for the western part of the Bohemian Cretaceous Basin is being created using archived data. The first stage was to evaluate the regional hydrogeological databases from the qualitative and quantitative point of view to enable reliable hydrogeological and hydrochemical characterization of the rock environment. Because of the limited time available, only the initial stage of the English-Czech hydrogeological dictionary was completed. During 2009, a number of papers on hydrogeological topics were published in scientific periodicals and presentations were made at workshops (10th International Czech-Slovak Hydrogeological Congress). The review and statistical processing of hydrogeological data has continued throughout the year so that geochemical models enabling the prediction of the evolution of the chemical composition of ground water can be tested. Mathematical programmes and procedures for modelling the hydrogeological properties of the rock environment and entering them into the database were also progressively improved.

Geohazards and engineering geology

During 2009, a map of the dangerous geological phenomena (geohazards) affecting the district of Frýdek-Místek was compiled using a quantitative procedure for assessing the risk of landslides. The area has been classified into four categories of susceptibility using a coloured code. The categories indicate the relative probability of slope failures and the limitations imposed on land use by such risks. The next step in this geohazard risk-assessment will be to classify the various known slope failures in order to evaluate the risks to existing buildings and to those buildings planned or under construction. This will help planners and investors to understand what kind of risks there are and the type of damage that can be anticipated if slope failures of different types take place. Such evaluations are bound to be subjective to some extent, but this informa-



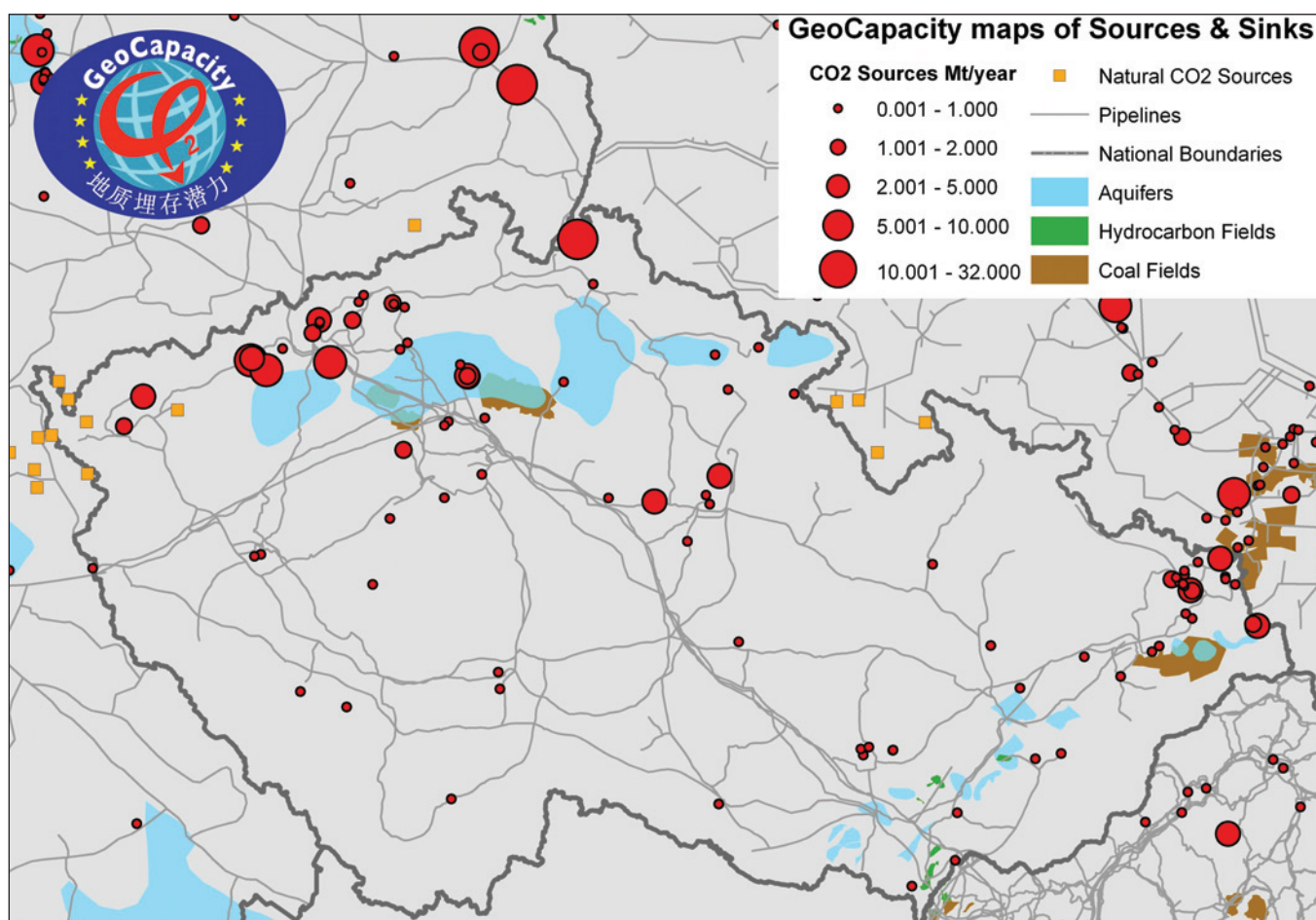
1/ Subsidence above the railway tunnel at Mosty near Jablunkov (photo by O. Krejčí, November 2009).



2/ Landslide at Tomíkovice (photo by O. Krejčí, July 2009).

tion is needed so that maps of the susceptibility of different areas to slope failures can be compiled and used for planning purposes. A descriptive legend is added to complete the final map so that attention can be drawn to any uncertainties that exist. This evaluation process is essential to ensure that the maps can be used effectively for practical purposes.

A detailed study of the dangerous slope failure at Jambor Farm in Halenkovice in the district of Zlín has been made. Changes in the profile of the slope in this area have been monitored by CGS experts since 1997. Climatic data are also being used to evaluate the possibility of chemical diffusion arising from the decomposition of undetonated explosives originally placed in the shallow boreholes that were drilled during the seismic survey of this area. In addition, an interpretation of the very deep slope failure that took place at Hluboče near Brumov-Bylnice in 2006 has been made and the results have been published. The monitoring of slope failures at model localities such as these enable general criteria about the processes governing slope failures and the rates at which they move over geological time to be established. Mineralogical and petrographical studies of the clay minerals in areas of slope failures have been carried out in order to understand how changes in the state of hydration and the fabric of the clays in the rock and soil can contribute to the initiation



A map of sources and prospective disposal sites for CO₂ (photo by V. Hladík).

of landslides. Papers have been presented on the theoretical mechanics of overconsolidated Badenian clays from a site in Brno (Medlánky and the tunnel at Dobrovského street). Studies of the mineralogical parameters affecting the mechanical behaviour of clays are continuing in order to provide constraints on geomechanical criteria for engineering construction. Systematic mapping in areas where slope failures (after 1997) remain undescribed has continued so that the Register of Slope Failures on the CGS Portal of geohazards can be completed. Mapping of the areas where extraordinarily heavy precipitation took place in June 2009 include the Jeseníky Mts, the Šumava Mts and the Nový Jičín area. The new information recorded during this mapping programme has been progressively incorporated into the Register of Slope Failures. Systematic description and classification of each slope failure, together with specific details of the local geological structure, are entered in the register. Following Directive No. 6/2009 of the CGS: Collection, management and presentation of the data in the new Central Register of Slope Failures in the Czech Republic becomes the responsibility of the CGS.

Three engineering geological maps at a scale of 1 : 10,000 covering the NE part of the Beskydy Mts were published by the

CGS in 2009 (map sheets 25-22-13, 25-22-18 and 26-11-16). In 2009, all of the planned fieldwork was carried out in the area of Frýdek-Místek. Some more detailed surveys at 1 : 5,000 scale were also carried out in order to create interpretative maps of slope failures near the Krkonoše Mts.

Applied geophysics

Radon risk programme

During 2009 the concept for a new type of predictive map showing the radon index in relationship to administrative areas was developed in which the radon data from individual sites has been integrated. In relation to this project, the reclassification of the deeper basement was begun using the new geological map of the Czech Republic at a scale of 1 : 500,000. This reclassification has enabled comparisons between the radon characteristics of the basement underlying the Quaternary sediments and the indoor radon content of buildings. Papers dealing with the radon in the contact metamorphic part of the Blovice Proterozoic and the intermediate radon index along profiles on the flanks of the Middle Bohemian pluton have been published. The Applied Geophysics Group also

participated in the European Radon Mapping Project with the publication of a paper by the CGS team and a presentation at the workshop for French experts held at the State Institute of Nuclear Safety (SÚJB) in May 2009.

In fulfilment of the CGS scientific plan, measurements of radon emissions from the basement beneath the Quaternary sedimentary cover were made and compared with indoor radon. Measurements have been made on a profile along the Svitava River in the area of Brněnec-Olomučany. Three other profiles along the rivers Ležák, Žejbro and Desná on the northern flank of the Železné hory Mts were also surveyed. Along all of the profiles only small variations in the average volumes of radon activity were observed, both in the village as a whole, and inside the buildings located only on Quaternary sediments. These observations were supplemented by measurements obtained from the bedrock beneath the Quaternary sediments of the alluvial plains in the residential areas of the villages. The sites chosen for measurement were selected to avoid anthropogenic influence (backfill). Based on the statistical parameters of the survey, the closest correlation was found to exist between the volume of indoor radon activity and the maximum radon indices measured in the basement rocks underlying the Quaternary sediments. Data from the profiles cutting across outcrops of rocks with contrasting radon activity showed that lateral transport of material along the streams has little effect on the final radon index. This confirms the results of the survey carried out along the same profiles along the edge of Central Bohemian pluton in 2008.

International system GEOMIND

In 2009 the test run of the portal GEOMIND, an international bilingual Internet system for geophysical data searches (www.geomind.eu), was carried out and some technical errors were corrected.

Applied geochemistry

In 2009, research into carbon dioxide capture and storage continued. Thanks to membership of the international exchange networks EneRG and CO2NET, there was some input of international expertise into this research. CGS is the coordinator of CO2NET EAST, an international project initiated under the 6th Framework Programme of the EU. The project focuses on expanding international cooperation in the field of CO₂ capture and storage (CCS) to the new EU Member States and Associated Candidate Countries, both by transfer of knowledge and experience and by raising awareness of the importance of CCS.

In 2009, two new CCS research projects were launched. The Czech-Norwegian TOGEOS project, financed from the EEA and Norway Grants, targets research on geological structures that are promising for CO₂ storage, namely the Permo-Carboniferous of the Central Bohemian Basin and the (semi-)depleted oil fields in south-eastern Moravia.

The project entitled *Research and development of the methods and technologies for capture of CO₂ from fossil fuelled power plants and CO₂ storage in geological formations in the Czech*



A view of the landslide at Žulová (photo by O. Krejčí).

Republic, financed from the TIP Programme of the Ministry of Industry and Trade, is the first national research project integrating both the fundamental parts of CCS, namely CO₂ capture and its geological storage. Within this framework, CGS concentrates on research into CO₂ migration and its interactions with the host rock environment, as well as on the methodology of risk analysis for assessing the safety of CO₂ storage.

An ongoing survey of organic pollutants and the contents of heavy metals in recent soils, river and water reservoir sediments in sites throughout the CR is still in progress. The determination of the level of anthropogenic loading of these pollutants is based on a detailed analysis of homologous series of saturated and aromatic hydrocarbons using gas chromatography (GC-FID, GC/MS) and elemental analysis. The results of these analyses and the conclusions derived from them have been presented regularly in publications, workshops and seminars and at Czech and international conferences. In the area of the Beskydy Mts (map sheets 25-142, 25-144, 25-231) a survey of the contamination of the upper part of the geosphere has been carried out. The contents of polyaromatic hydrocarbons and toxic metals were analysed.

Chemical analysis of the rocks from caves at a number of selected sites have been carried out in order to determine the extent of contamination of the underground environment by transportation of products from local smelters and to assess the history of contamination of caves by spills of explosives and waste. An investigation of the composition and chemical balance in sedimentary material from the Vír dam and the surrounding river drainage system has been completed. A programme of research into the static and dynamic sorption of selected elements (Cu, Cd, Zn, Cr, Be) in various types of rocks has also been completed. In addition, an investigation of the ecological load caused by uranium mining in the area of Harrachov and Medvědí in the Krkonoše Mts has begun and is still continuing. The project on the area of Horní Město-Horní Benešov ended with a conference in Bruntál. Field excursions to both these areas were organized and a final report was submitted.

Regional Geological Administration



Photo P. Neubert

The Regional Geological Administration (RGA) ensures that the organization and procedures involved in the provision of the state geological service by the Czech Geological Survey conform to the Law on Geological works. The professional activities of regional geologists and specialists in mineral deposits, hydrogeology and engineering geology, together with the reports describing this work, cover the whole area of the Czech Republic. The territory is divided into a number of defined regions, for which a competent regional geologist or specialist is responsible. The regional geologists and specialists follow a protocol that defines the procedures to be followed in each type of work. This ranges from basic geological mapping, surveys of mining works and their environmental impact, surveys of slope stability and geological hazards, compilation of reports and other relevant activities. The protocol is designed to ensure that a unified set of standards governs the recording and storage of information and the procedure for reporting on the work undertaken.

The writing of professional reports is one of the most important tasks undertaken by regional geologists. At the request of the State or Public Administrative authorities, the regional geologist may be required to carry out investigations of hazardous geofactors, conflicts of interest arising in land-use planning caused by the effects of building works and services

Jan Čurda

Head of the Regional Geological Administration.
He manages 60 regional geologists and specialists from his Klášov office. They are responsible for providing the State Geological Service. CGS was founded for this purpose and continues its statutory duties under the terms of the Law on Geological Works enacted by the Ministry of the Environment.

on the environment, area management and building control, remediation of old ecological burdens, and plans for conservation of areas of protected landscape.

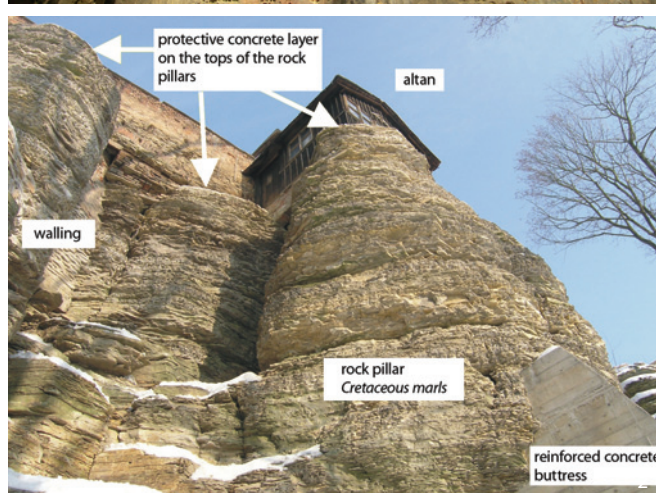
The continuous recording and safe storage of the geological data gathered during these studies forms the foundation of the professional reports that are subsequently used to guide the political, economic, and ecological policies adopted by the state and local government authorities, as well as the legal decisions taken in the courts that affect land-use planning, protection of the environment, remediation of old ecological burdens, stabilization of slope failures, and the protection of the landscape and natural resources. The information gathered relates to the geological composition of the territory of the Czech Republic, the conservation and use of natural mineral and groundwater resources, and geological hazards. In order that the public can also have access to this information through the Internet, the development of innovative and reliable procedures for digital processing, storage and delivery of the data in user-friendly formats is given high priority.

The Regional Geological Administration has three permanent members of staff. During 2009, 410 tasks were undertaken for the State and Public Administrative authorities, courts, universities, non-government and non-profit organizations and for other customers. To cope with this workload, other staff were contracted to join the team on a part-time basis. They were selected, as required, from the total of 38 regional geologists, 14 experts in mineral deposits and 6 specialists in hydrogeology and, when necessary, work was carried out in cooperation with 3–5 specialists in engineering geology who work throughout the area of the Czech Republic.

At the turn of the year 2009/2010, the regional specialists were mostly involved in the compilation of 67 expert reports based on Directive No. 5/2008 of the Ministry of the Environment concerning various projects initiated under the *Operational Programme Environment, Priority axis 6 – Improving the State of Nature and the Landscape, Area of support 6.6 – The prevention of landslides and rock avalanches, the monitoring of geological hazards and the impacts of mining and extractive operations, and the assessment of nonrenewable natural resources, including groundwater resources.*

To manage this large and heterogeneous team of regional geologists and specialists, and take account of changes in personnel during 2009, it was necessary to update Directive No. 2/2004 issued by the Director of the CGS relating to reporting and service activities undertaken by regional geologists. Amendment No. 9/2009 was introduced, nominating Ing. Karel Rýda to the post of Regional Specialist in Mineral Resources for the Hradec Králové Region.

During 2009, the process of transferring the entire archive of written and graphical documents produced by the RGA into digital format continued to enable access via the Internet. This



- 1/ So called "Bird houses" at Úštěk, built on top of unstable fragile silicified sandstones of the Jizera Beds (photo by J. Krupička).
- 2/ An example of stabilization of marl limestone rock pillars at Nové Město nad Metují (photo by J. Krupička).

work was carried out under the terms of Project No. 350000. The complete agenda for the work of the Regional Geological Administration during the year 2009 was made accessible online through the Internet portal of CGS and regularly updated. The system used for running the agenda was continuously improved during the year in close cooperation with the staff of the Division of Informatics. In particular, improvements in the management of documents and files have been made based on the new List of Procedures which has become the definitive regulation governing the progress of all documents within the organization. Rules for the Storage and Shredding of Documents in CGS have also been introduced. The eGovernment programme is now being implemented in the Czech Republic. As a result, a new system for handling documents is also needed by the RGA. Preparations have been made to enable the management of the archive of RGA documents using "data boxes". Documents will thus be accessible directly in digital format using this new procedure.

Geological information system



Photo P. Neubert

The effective operation of the State Geological Service depends on the systematic compilation of geological information gathered during the surveys and scientific research projects carried out by the different branches of the CGS in fulfilment of their statutory duties. The information system (GeoS) is the tool through which the information is provided to support all levels of the State Administration and the research and other scientific activities of the CGS. The conception and development of GeoS was designed to be compatible with the legislation governing access to information, both within the Czech Republic and throughout the EU. The implementation of internationally agreed standards ensures the interoperability of the systems used to manage data resources in different countries and is enabling the creation of a national and European spatial data infrastructure, following the European INSPIRE directive.

Zuzana Krejčí

Head of the Department of Information Systems. She has been working over a long period to create the unified geological information system (GeoS) of the CGS. At present she is the coordinator of the National Geological Map Database and the technical editor of geoscientific maps produced by CGS.

Data management

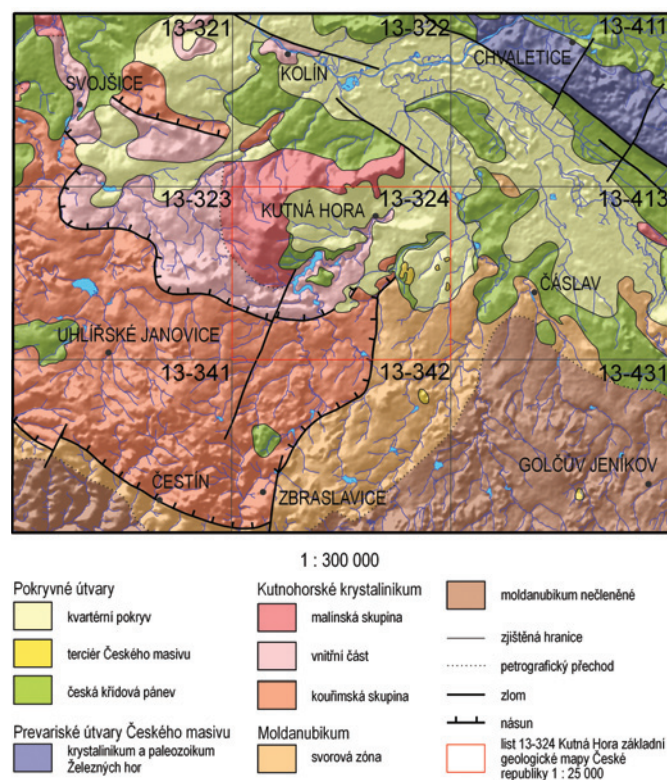
In 2009, the implementation of a new data management concept continued. This is designed to guarantee the technical procedures and standards governing the systematic organization of data gathered by the CGS so that they can be integrated within the unified geological information system GeoS. An important part of this work is the progressive introduction of a unified policy governing the handling of data.

GeoS, as developed at CGS, is based on the concept of the Unified Information System for the Environment (JISŽP – MŽP, CE-NIA). The heart of the system is the **Central Data Storage (CDS)**, a relational database founded on the Oracle database system, which enables centralized management of all data gathered by the CGS. The CDS contains 52 thematic databases linked to unified coded indices. Procedures for protecting, processing and effective long-term storage and backup of the data are standardized. The data is accessed via specially designed applications located on the Information Portal of CGS.

Operation and development of the **metainformation system (MIS)** of CGS is important, because it is the fundamental tool used for the registration and classification of data. The existing system forms part of the MIS of the Ministry of the Environment (MŽP). It is based on a geological profile of metadata (ISO 19115, 19119, 19139) that is fully compatible with the rules agreed for the implementation of the European INSPIRE directive. In 2008, advances in the content and technical development of the CDS were closely linked to work on the **National Geological Map Database (NGMD)**, the register of slope failures and the registers of the palaeontological collections. The development of specific applications enabled on-line access to a fuller range of information about the collections and the results of applied research carried out by CGS. Emphasis was placed on the modular structure and technical standardization of the applications.

A significant step in the direction of a unified policy for the management of data was the adoption of a directive for procedures to be followed in the compilation of the Geological Base Map of the Czech Republic at a scale of 1 : 25,000. This document comprehensively defines the procedures for acquisition and storage of data, as well as the outputs required to create geological and thematic maps. The NGMD is designed to be a comprehensive knowledge system, within which the separate databases of geoscientific maps at various scales (GEOČR 25, 50, 500) and their index codes form part of the larger database of geoscientific maps and related documentation held in the archive of CGS. The structure and operation of the NGMD conforms to the principles used by other countries in developing their national databases of geological maps.

In 2009, further development of the NGMD focused on improving the integration of data and information concentrated in the CDS of CGS and the development of special interactive tools to enable more effective use and on-line access for end users. A major breakthrough was the development of the NGMD database model using PostgreSQL DB and the introduction of procedures that allow information from the database to be published on the world wide web. A number of other procedures were developed and modified. These were used specifically for creating the register of slope failures and other applied layers. This work formed part of the Research and Development projects *Creation of an interactive map of slope and rock failure hazards in the Czech Republic* and *Principles governing interaction in the system "water/rock/landscape" and their application to groundwater protection in the Czech Republic*.



Overview of geological units from the Geological Base Map of the CR at 1 : 25,000 scale, sheet 13-324 Kutná Hora. Generated from the National Geological Map Database.

Access to, and delivery of geoscientific data and information

The development of **geographical information systems (GIS)** as a universal tool for processing and giving access to spatial data has provided the impetus for the construction of the NGMD. In 2009, a new three-layer architecture for the GIS used by the Survey was under development; methods used for collecting data were verified and the range of tools available to field geologists for use of the NGMD at all stages of map creation was extended. Special emphasis was placed on establishing closer links between mapping procedures, GIS, Remote Sensing and related techniques for analysis of spatial data. Spatial analysis of data in GIS format, 3D modelling and digital cartography are now routinely used by staff working on 1 : 25,000 scale geological mapping projects in the Czech Republic, as well as abroad in Iran, Nicaragua and Costa Rica. Tools for synchronization of editing procedures used for the central management and maintenance of the comprehensive GIS were continuously improved in 2009.

Information portal of CGS (IP CGS) is the integrated information platform of GeoS containing 65 thematic applications. In 2009, the application **Digital Geological Field Logbook** (the central application for acquisition of geological and thematic data within the NGMD) was further modified, and the appli-



Homepage of the recently developed geoportal OneGeology-Europe. Displayed is the harmonized geological map of Europe at a scale of 1 : 1,000,000; this is linked to a multilingual catalogue of metadata in 17 European languages.

cation, **Documentation of Slope Failures** (<http://www.geology.cz/app/dbsesuvy>), was made accessible to the public. The application **Photoarchive** (<http://www.geology.cz/fotoarchiv>) was modified, providing thumbnails of over 10,000 images from the archive of CGS. Members of the public make, on average, 300 visits per day to this site and the application for collection and central management of the archive has been improved so that photographs can be used in other portal applications.

The **map server** is an integral part of the IP CGS. In 2009, not only did CGS make spatial data from the archive of CGS and the NGMD freely accessible through the map server, but they were also developed for use in research projects, in the Internet shop and in the digital field logbook. The **Portal of the State Geological Service** (<http://www.geologickaslužba.cz/>) is a distributed web system run by the CGS. It connects the data sources and map services of CGS, CGS – Geofond and CENIA so that the virtual data and information held by these three organizations can be shared. The **Portal of geohazards in the CR** provides information to the public on-line concerning radon in the bedrock, instability of the terrain and the vulnerability of groundwater in different areas, depending on the topic of interest. A system of Internet applications and web services is used to provide this service, including a reporting application **GeoReports**. A structured catalogue of geohazards is also located on the portal.

Interoperability of management systems for geoscientific data – implementation of the WMS, WFS and GeoSciML standards

CGS has long been involved with other organizations (MŽP, CENIA, AOPK etc.) in the development of a system for sharing

geoscientific maps. It is also cooperating actively in the creation of national and global spatial information infrastructures under the European INSPIRE directive and the e-Government, GMES and GEOSS programmes. The objective is to achieve interoperability in both technology and content.

At CGS, the geologists have been actively participating in OneGeology, the worldwide initiative of geological surveys. In 2009, CGS placed special emphasis on the introduction of procedures for creating standardized (ISO, OGC) map services (WMS, WFS). In addition to beginning work on both the Czech and English versions of the WMS 1 : 500,000 scale Geological Map of the Czech Republic as part of the *OneGeology* project, raster equivalents of the 1 : 1,000,000 and 1 : 250,000 scale hydrogeological maps were also compiled as a contribution to the European eWATER project. A number of other layers of information have also been added (<http://wms.geology.cz>).

GeoSciML markup language, which is a geoscientific extension of GML language (under the auspices of OGC), is presently being developed for description and exchange of geological data. CGS is participating in the creation and development of user systems and environments that will be able to work with this new data format in the context of the international projects *OneGeology* and *OneGeology-Europe*. The combined General Geological Map of the Czech Republic and Slovakia was compiled in the environment of the Postgres SQL database with PostGIS extension using the OGC/CGI/IWG standard. As a result, two web servers present the General Geological Map of the Czech Republic and the General Geological Map of the West Carpathians (Slovakia). They are accessible to the wider public on the Czech and Slovak node: <http://onegeo.geology.cz> or <http://onegeo.geology.sk>.

Information and communication technologies

The development and maintenance of information and communication technologies at a high level underpins all aspects of the work of a modern geological survey. By the end of 2009, the hardware base of the intranet of CGS consisted of 24 servers (OS Linux and MS Windows) and 503 computers and laptops (OS MS Windows). Technical development of ICT at CGS was directed mainly towards improving the security of the computer net, the central management of the network components and increasing the power and flexibility of the server facilities. Practical benefits are expected in 2010 when the system should be fully integrated and operational.

International cooperation

Specialists from the CGS continued their international activities as members of the Geoscience Information Consortium GIC and the EuroGeoSurveys organization and were also members of the team working on the *OneGeology* initiative. In 2009, work on two important international projects continued: *OneGeology-Europe* (eContentPlus) and *AEGOS – African-European Georesources Observation System* (FP7). Further information is given in the chapter on International cooperation.

Veronika Kopačková

She has been employed at CGS since 2003. Her recent work has been concerned with the application of remote sensing as a tool for the assessment of geological hazards; she is leader of the project funded under grant GACR 205/09/1989 (HYPSO: hyperspectral Sokolov), and is also responsible for the CGS contribution to FP7 project (EO-MINERS).

Remote sensing of the Earth

Thanks to new space programmes and continuous technical innovation, the observation of the Earth by remote sensing methods has now become the most effective and widely used technique for obtaining spatial data from the surface and immediate subsurface of the Earth without the need for direct physical contact. These data are used not only to create synoptic images of areas under investigation using the visible parts of the electromagnetic spectrum as well as the infrared and microwave wavelengths, but also to provide the reference framework on which sets of thematic data (information specifically related to chosen groups of objects) and temporal information (archived data that can be used to compile images as time series for systematic study) can be combined. The remote sensing specialists across the CGS are involved in a wide range of national and international projects.

In 2009, a new research project (GACR 205/09/1989) started. This concerns the application of hyperspectral technologies for multidisciplinary assessment of the effects of opencast mining on the environment. The aim of this project is to develop a new methodology for airborne acquisition and analysis of hyperspectral data that will be tested using the area of the Sokolov Basin as a model. The Sokolov Basin is ideal for this purpose because the opencast extraction of lignite over a long period of time has resulted in significant environmental burdens. The new methods under development will enable characterization of the geochemical processes associated with mining and the interaction between the biota and the abiotic parts of the environment using both ground-based and remotely acquired spectroscopic data.

Other activities of the Remote Sensing Centre in 2009 can be grouped under the following themes:

Study of the spectral characteristics of rocks and minerals (mineral spectroscopy) by the combined use of ground-based spectrometry and satellite data: The technique of LSU (Linear Spectral Unmixing) has been used for this purpose; this is based on an algorithm that enables linear resolution of the multispectral content of pixels. Acid weathered surfaces containing jarosite and lignite were classified using ASTER satellite data. The results obtained show a very good spatial correlation with field measurements of pH made *in situ*.

Evaluation of natural hazards using multidimensional statistical methods: A new procedure has been developed for creating maps of slopes vulnerable to landslides. A model map cov-

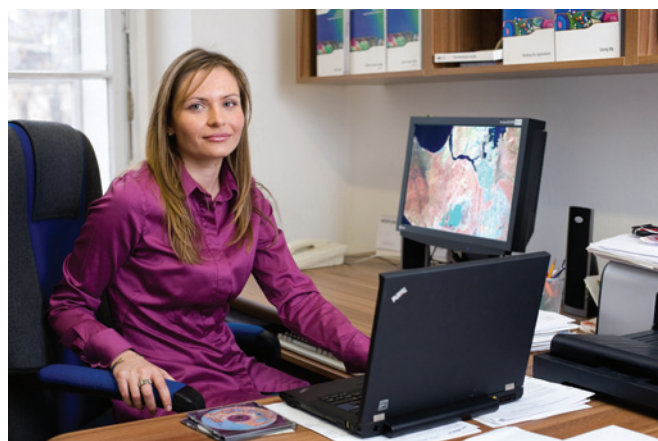
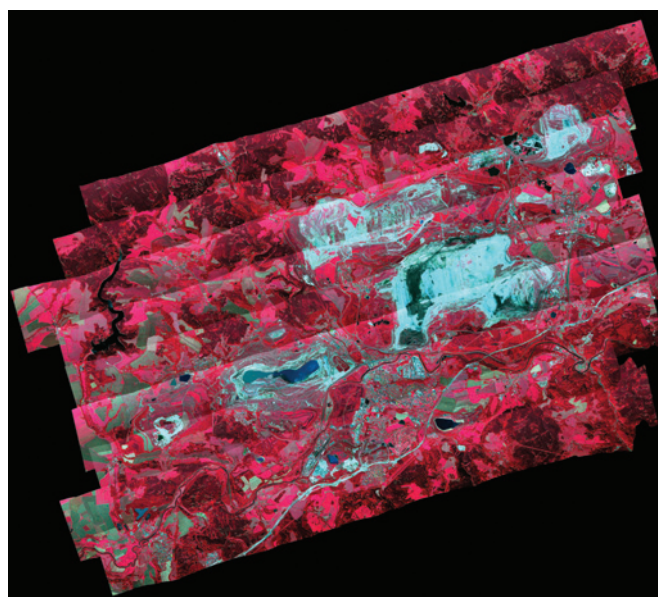


foto P. Neubert



Airborne hyperspectral data from Sokolov obtained using the HyMap sensor (9 bands).

ering the area of the capital of San Salvador and its surroundings has been compiled using this new procedure.

International collaboration

- BRGM – France (spectroradiometry, mineral spectroscopy, hyperspectral technology).
- Martin Luther University of Halle-Wittenberg – Germany (hyperspectral technology).
- The Remote Sensing Centre participates in FP7 of the EU project (EO-MINERS: Earth Observation for Monitoring and Observing Environmental and Societal Impacts of Mineral Resources Exploration and Exploitation), which has been funded from the beginning of 2010.



International cooperation by the CGS takes the form of joint publications with foreign authors, participation in international conventions, symposiums and congresses, membership of international organizations and working groups, organization of international conferences and collaboration in international scientific projects. International research and cooperation form an integral part of the Research Plan of the Czech Geological Survey for the years 2005–2010. The following are the most important activities in which the CGS participated in 2009: The Czech Government International Development Assistance Programme, Geological Research in Antarctica and Iran, international scientific projects and a number of educational activities. Some exhibitions and public briefings were organized under the auspices of the International Year of Planet Earth.

Geological research into natural hazards in Latin America and Zambia

The International Development Assistance Project of the Czech Republic in Mesoamerica continued during 2009 with its third and last part. As in previous years, research was carried out simultaneously in collaboration with foreign partners in Nicaragua (Instituto Nicaragüense de Estudios Territoriales INETER in Managua), Costa Rica (Dirección de Geología y Minas DGM in San José) and El Salvador (Oficina de Planificación del área metropolitana OPAMSS in San Salvador).

In three Central America countries, the project *Geological Study of Natural Hazards* continued with support from the Czech Ministry of the Environment and headed by Petr Hradecký.

In **Nicaragua**, the Jalapa region in the Province of Nueva Segovia close to the border with Honduras was studied as requested by the state institution. The aim was to assess natural hazards, especially landslides that have recently threatened infrastructure and development of in the area. The bedrock geology is formed by a Mesozoic granitic pluton intruded into metamorphic rocks of

Palaeozoic age overlain by a thick cover of Cenozoic sands and mud. Faulting is widespread and has contributed to the instability of steep slopes that have already been deforested.

As part of the programme of field investigations, the Czech team were asked to carry out an immediate assessment of the geomorphology and structure of the area of San Juan del Río Coco, south of the Jalapa region where there has recently been a swarm of seismic activity. Seismic activity was centred on the regional faults and, due to the weathered state of the metamorphic rocks and granitoids, some material damage was caused.

After three years, the project has now ended, and a comprehensive report containing the results of the investigation and the recommendations based on them will be submitted to the Nicaraguan authorities in 2010.

Fieldwork on the map sheets of Juntas and Chapernal in **Costa Rica** was completed in 2009. Thus, a survey the whole area of 1500 km² on the south-western slopes of the Cordillera Tilaran was completed. This area was not as prone to landslides as the area around Miramar that was surveyed in previous years. Because old gold mines are located in the area of Juntas de Abangares, the gold-bearing district was mapped and the contamination and associated hazards caused by undermining were assessed. This proved to be a rewarding project carried out in collaboration with our Costarican partner DGM, a tradition enriched by the opportunity to train students from the UCR (Universidad de Costa Rica) in techniques of field mapping and geological risk assessment. The field project culminated with the publication of geological maps of all three areas (Miramar, Chapernal, and Juntas) that will now be available for use by the local authorities and the wider public of Costa Rica.

In 2009, final work on *Special Studies for the Definition and Prediction of Natural Dangers in the area of the AMSS* (Área Metropolitana de San Salvador) was completed in **El Salvador**. Special purpose geological mapping of a selected area in the Cordillera de Balsamo south of San Salvador was completed, dynamic analysis and engineering-geological assessment of catastrophic debris flows from El Picacho and the Carretera de Oro landslide were carried out and polythematic data from San Salvador and its surroundings was analysed geostatistically in order to assess the susceptibility of the area to slope failures.

Compiled maps have been: Geomorphological map of the AMSS, Geomorphological predisposition to slope failures in the AMSS and Geomorphological evolution of the AMSS and its relation to seismic activity. These maps have been adopted as an integral part of the official Decret No. 4 (COAMSS *Reformas al reglamento a la ley de desarrollo y ordenamiento territorial del amss y de los municipios aledaños*) that forms an amendment to the regulations governing planning and land-use in the AMSS and its outskirts.

In addition to local specialists who were trained during the joint field programme, Ing. Alex Chavez from OPAMSS (Oficina de



- 1/ Measuring fumaroles in the crater of the Poas volcano in Costa Rica (photo by P. Kycl).
- 2/ Returning to the J.G. Mendel polar station during a snowstorm – quickly sweep away the snow and hurry back to the warmth (photo by P. Mixa).
- 3/ The southern part of the terrain on James Ross Island mapped by the CGS is dominated by Sekyra Peak named after our famous colleague Josef Sekyra (photo by P. Mixa).
- 4/ Studying Pliocene sequences of ash tuffs and pillow lavas on Egg Island (photo by P. Mixa).

Planificación de AMSS) joined the team to gain experience in the study of natural hazards. At the present time Ing. Chavez is on an internship at the Faculty of Civil Engineering of the Czech Technical University in Prague carrying out research for a Ph.D.

During 2009, fieldwork was also carried out in **Peru** where the principal area of investigation was the terrain in the middle and lower reaches of the Piura River. The main aim was to study the hydrogeology of the Piura drainage and to identify and map the chief geological hazards. In addition, the dynamic factors governing the topographic evolution of the area and the drainage of the Piura river system were investigated. Proposals were made for flood-protection on the Piura River based on the detailed assessment of a number of sites. Particular attention was paid to the dangers arising from lateral erosion on the banks of the Piura River where slopes below roads, railways and residential buildings were undercut. Hydrogeological investigations involved mainly field measurements of hydraulic conductivity and the collection of data on the quality of groundwater and piezometric conditions in the lower reaches of the Piura River. At the request of the Peruvian Ministry of the Environment (El Ministerio del Ambiente), the results of the project were presented at the Fourth National Seminar on Land-Use Planning (IV Curso Nacional de Ordenamiento Territorial) held in Ayacucho during 25–29 May 2009. The results of the project based on the use of new remote mapping and field methods were presented at the end of November in Bonn at the 3rd *Workshop of the EARSeL Special Interest Group on Land Use and Land Cover* and at the IAEA conference *Regional Upgrading of Uranium Exploration, Exploitation and Yellowcake Production Techniques Taking Environmental Problems into Account*, that took place during 7–10 Dec. 2009 in Lima.

In **Zambia** fieldwork around the town of Ndola was carried out under the terms of the project *Evaluation of the impacts of copper and cobalt ore mining on the environment and health of inhabitants in selected areas of the Central and Copperbelt Provinces*. The most important outcome of this project was the determination of the environmental hazards caused by dumping of toxic waste from chemical processing of copper and cobalt ores at the Bwana Mkubwa concentrator. The project has also provided the basic information enabling the extent of the area contaminated by fallout of dust from powerplants and limekilns in Ndola to be determined.

International scientific projects

In 2009, the Czech Geological Survey participated in the following international projects:

- **Eurolimpacs** – evaluation of the impacts of global change on freshwater ecosystems (Integrated Project under the 6th Framework Programme of the EU).
- **CO2NET EAST** – extending existing European international cooperation in the field of capture and storage of CO₂ to new member and candidate countries of the EU (Coordinated Action under the 6th Framework Programme of the EU).
- **SoilCritZone** – mobilization of researchers and developers

with the aim of proposing a European Strategy for Research and Innovation in the field of soils (Specific Support Action under the 6th Framework Programme of the EU).

- **AEGOS** – preparatory stage of creation of the African-European Georesources Observation System focused especially on mineral resources, groundwater and energy (Support Action, under the 7th Framework Programme of the EU).
- **SoilTrEC** – a contribution to formation of a worldwide network of soil observatories that will monitor biogeochemical processes in the era of global climate change (Large-scale Integrated Project under the 7th Framework Programme of the EU).
- **OneGeology** – making geological spatial data at a scale of 1 : 1,000,000 for the whole world accessible and contribution to the creation of a global information infrastructure for environmental data.
- **Evaluation of the effects of the Göteborg protocol on acidified and eutrophic waters and soils** (supported by a grant from Iceland, Lichtenstein and Norway through the Financial Mechanism of the EEA and the Norwegian Financial Mechanism).
- **Monitoring trans-border air pollution by isotope fingerprinting of sources** (supported by a grant from Norway through the Norwegian Financial Mechanism).
- **TOGEOS** – increasing the level of knowledge of the most promising structures potentially suitable for geological storage of CO₂ in the Czech Republic (supported by a block grant from Iceland, Lichtenstein and Norway through the Financial Mechanism of the EEA and the Norwegian Financial Mechanism).
- **Fractionation of platinoids in different types of geological environment using selected ore deposits in the Polar Urals as examples** (a bilateral Czech-Russian cooperative project).
- **Sources, transport and fractionation of platinoids in giant gold and copper deposits in Uzbekistan** (a bilateral Czech-Uzbek cooperative project).
- **Middle Palaeozoic climatic and sea-level changes and their influence on marine community evolution: a comparison of models from the Perunica microcontinent and Laurussia continent** (a bilateral Czech-American cooperative project).

International Geosciences Programme – IGCP

An important part of the scientific research carried out by the CGS in 2009 involved active participation in the following six projects:

- IGCP 497 – The Rheic Ocean: Its origin, evolution and correlatives.
- IGCP 580 – Application of magnetic susceptibility as a palaeoclimatic proxy on Palaeozoic sedimentary rocks and characterization of the magnetic signal.
- IGCP 499 – Evolution of ecosystems and climate in the Devonian.
- IGCP 502 – Global comparison of volcanic-hosted massive sulphide districts: the controls on distribution and timing of VMS deposits.

IGCP 503 – Ordovician palaeogeography and palaeoclimate.
IGCP 510 – A-type granites and related rocks through time.

Memberships and services to international organizations

The scientific staff of the CGS participate in the activities of a number of international specialist geological groups and professional societies. In addition to membership of these societies, some hold posts as officers responsible for coordinating and administering the scientific activities of these societies. The *Society for Geology Applied to Mineral Deposits* (SGA) has a membership of 900 economic geologists representing 80 countries. In 2009, the post of Executive Secretary was held by J. Pašava (CGS) and the Students Representative was A. Vymazalová (CGS). The CGS also participated in chairing the Czech Committee for the International Geosciences Programme of the UNESCO (IGCP).

During 2009, the post of President Elect of the European region of the *American Association of Petroleum Geologists* (ER AAPG) was held by V. Dvořáková (CGS). This duty follows on from the previous term of service as Secretary and Treasurer of the European Region of AAPG.

The CGS is also a member of EuroGeoSurveys, the International Union of Geological Sciences (IUGS), the International Union for Quaternary Research, the European Association for the Conservation of Geological Heritage (ProGEO), the Carpathian Balkan Geological Association, the Central European Initiative, the European Network for Research on Geoenergy (EneRG), CO2NET and a number of other European and international organizations.

Geological research in Iran and the Antarctic

In 2009, work on 4 map sheets in East Azerbaijan province, northern Iran, was completed. Each sheet covers an area of 10 × 15 km. On the sheets covering areas around Avan and Esh-tobin, some mineral exploration and environmental mapping was also carried out. These activities mainly involved sampling and monitoring of spring water and sampling of river sediments and soils. A similar range of investigations was carried out on the Ahar and Ghalandar map sheets but, in accordance with the terms of the project, mineral exploration was replaced by mapping of geohazards. Both map sheets were also surveyed to identify prospective deposits of industrial minerals and rocks. Some samples were also selected for technical testing so that their suitability for use as building materials or decorative stone could be assessed. In the area of the Ghalandar map sheet, a strong gold anomaly was found. Investigation of this anomaly is continuing. A total of 15 researchers from the Czech and Slovak geological surveys took part in the field programme together with a similar number of Iranian colleagues. The teams worked together in the field for periods of up to 3 weeks.

The research project in **Antarctica** – VaV SPII 1a 9/23/07 – continued with another campaign of fieldwork at the break of years 2008 and 2009. Special emphasis was placed on palaeo-climatological investigations and palaeogeographical reconstructions of the evolution of the icesheet during the Holocene



- 1/ Weathered granites form a large part of northern Nicaragua – Jalapa (photo P. Hradecký).
- 2/ During the rainy season in Nicaragua: Research in the gorge of the Malacatoya River (photo by P. Hradecký).
- 3/ Workshop at Ispra concerning the technical architecture of the future AEGOS geoinformation system for Africa (June 2009).

(D. Nývlt, Z. Engel), on geological mapping at a scale of 1 : 25,000 of the ice-free part of James Ross Island (B. Mlčoch), investigation of the evolution of the structure of the magmatic arc of the Antarctic Peninsula (Z. Venera, J. Žák, V. Janoušek, I. Soejono) and palaeontological research on Cretaceous sediments (R. Vodrážka, J. Kvaček). In addition to the nine geologists, two ornithologists also took part in the expedition. Despite the unfavourable weather conditions that persisted throughout the expedition, some unique observations were made. Of particular interest was the first discovery of Cretaceous sponges in the Antarctic made by the palaeontologists. Good progress was also made in the construction of a geomorphological map of the ice-free part of James Ross Island. During the fieldwork, samples of soil and regolith and air were taken to enable identification of persistent pollutants occurring in the Antarctic environment.

International Year of Planet Earth (IYPE)

The final year of the worldwide promotion of Earth sciences and their role in science, resources, energy and the understanding of global processes led to growing interest from the countries of the third world. For many of these countries the IYPE educational programme was important because it provided the first contact with the International Union of Geological Sciences and its member institutions that are capable of offering help to solve their environmental and economic problems. Czech representatives took part in a number of meetings of IYPE and attended the closing ceremony in Lisbon where the results of this three-year programme were presented. In 2009, the Czech contribution continued with the installation of the geoscientific exhibition *Planet Earth: Mighty and Vulnerable* in Turnov, Liberec, Semily, Brno, Jindřichův Hradec and Moravské Budějovice. The painting contest *My Piece of Earth*, which has now been organized for the third successive year by the Czech Geological Survey, has turned out to be a very successful way of promoting awareness of the Earth sciences within the wider community in the Czech Republic. The pinnacle of all the Czech events organized under the auspices of IYPE was the extraordinary geoscientific exhibition *The Story of Planet Earth* at the National Museum in Prague. This proved to be extremely popular with the Czech public. The Czech Geological Survey participates actively in the international project *OneGeology*, which has been initiated thanks to IYPE, and is currently taking part in discussions about the form of future activities inspired by the IYPE concept.

OneGeology-Europe

Under the terms of the two-year project of the European Commission (EC/DG Information Society & Media) *OneGeology-Europe*, CGS is the leader of a workpackage that will create a multilingual metainformation system. This system is based on a newly defined geological profile that will give access to information about data available in the national geological and applied maps from 26 European countries. This profile is

fully compatible with the EN ISO 19115 standard and the INSPIRE directive. The Czech Geological Survey held two project meetings in 2009 attended by 34 representatives of 19 European geological surveys.

GIC

CGS is one of the 26 members of the *Geoscience Information Consortium* (GIC). The main aim of this consortium is to provide a forum in which the managers and designers of the informatics from geological surveys worldwide can share information and coordinate activities within the worldwide network of geoscience information systems. Participation in the activities of the consortium guarantees the effective sharing of information at an international level and the opportunity to shape future policy. The chair of the GIC and a member of the Steering Committee are scientists from the CGS. In 2009, the 24th consortium meeting was held in Tsukuba, Japan.

AEGOS – African-European Georesources Observation System

This project was initiated under the FP7 programme and involves 23 European, African and international organizations. The aim is to create a proposal for a geoscientific information system for Africa that will help the development of infrastructure, the sharing of knowledge, the best use of human resources and provide maximum access to geological information and data sources from the African countries by means of web technologies.

In this project, CGS leads a team responsible for a workpackage proposing the specifications for the technical architecture of the future information system. During the first stage of the work in 2009, an inventory was made of the infrastructure and the function of existing subsystems containing geoscientific information about Africa. Information has been collected about the current state of the technical infrastructure (hardware, software, network interface) and applications in use, the procedures employed to compile, manage and distribute data, the levels of system support and security, and the number and qualifications of the staff dedicated to IT at the different institutions.

After the analysis of the current situation is completed, the second stage of the project will proceed to the creation of a technical proposal based on standardized principles of distributed architecture with Internet access, using a reference model which is being developed throughout Europe and worldwide under related initiatives. By developing interoperable user-friendly services it is the intention that existing African data will be secured and effective management and access to information will contribute to the sustainable development and use of geological resources throughout Africa.

Laboratories



Věra Zoulková

Head of the Central Laboratory.

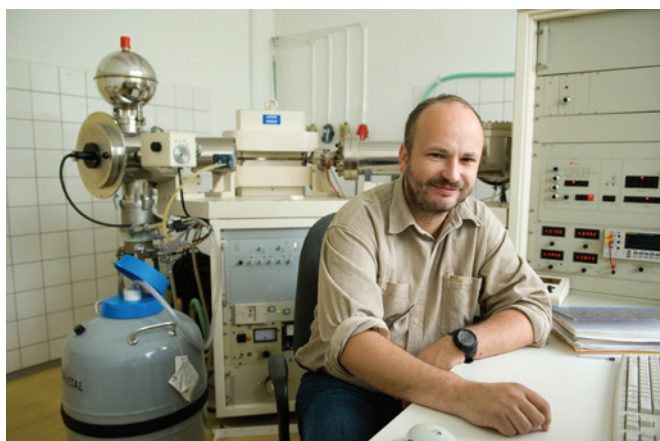
After joining the laboratory she worked in the department of classical chemistry for a short period. After that she worked in the Department of Spectral Analysis (ICP-OES, ETAAS) for several years. She has been the head of the Central Laboratory since 2002.



Eva Franců

Head of Testing Laboratory Brno.

Her speciality is the investigation of changes in the composition of organic matter in rocks by thermal degradation during the geological past and the study of interactions between anthropogenic matter and natural organic matter. At present she leads a project studying transport of suspended material in the drainage of the Dyje and Svatka rivers.



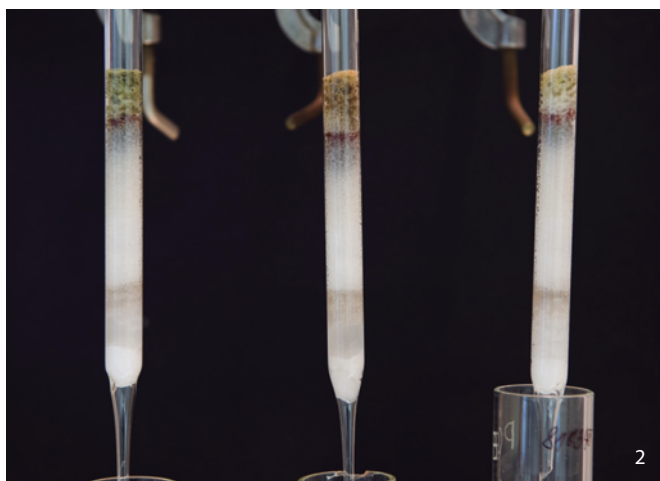
Vojtěch Janoušek

Deputy Head of the Department of Rock Geochemistry.

He is engaged in studying the petrology, chemical composition and genesis of magmatic and highly metamorphosed rocks, especially those found in subduction zones (e.g. those in the Bohemian Massif, Namibia, California, Nicaragua and on the Antarctic Peninsula). He is the Editor in Chief of the *Journal of Geosciences*.

Photo P. Neubert

The analysis of rocks, minerals, hydrocarbons, soils, and water supplies the chemical information required to enable interpretation of Earth processes and the impact of human activity on the environment. The laboratories are therefore an essential part of the Czech Geological Survey. In addition to the Central Laboratory in Prague, where various inorganic materials are analysed, there is a laboratory of organic geochemistry in Brno, as well as special geochemical laboratories carrying out research on the rock environment that are also part of CGS. The first two laboratories mainly undertake routine analyses of samples submitted by the scientific staff of the CGS and other institutes, whereas the specialist laboratories are dedicated to research. The Brno laboratory not only provides chemical analyses of organic compounds in various materials, but also carries out basic research as well.



1/ Filtration and preparation of gases in the laboratory for analysis by gas chromatography (photo by P. Neubert).

2/ Preparation of rock extracts for analysis using liquid chromatography (LC) in the laboratory of organic geochemistry in Brno (photo by P. Neubert).

CGS Central Laboratory

The CGS Central Laboratory has the benefit of long experience in the analysis of minerals, rocks, sediments, and atmospheric and surface waters. It also undertakes the analysis of the inorganic components in plant materials and organic sediments (conifer needles, peat, wood etc.) In the category of solid samples, the main demand from customers is for silicate analysis. Comprehensive analyses of various surface and atmospheric waters are carried out in the water analysis department. Apart from this, the laboratory is concerned with the determination of the trace element contents in a wide range of mineral substances and organic materials, various types of tests and other special forms of chemical analysis (especially metallurgical techniques for assaying Au and Platinum Group Metals – PGM).

The following instruments are used for the various analytical procedures:

- Retsch jaw crushers BB1, BB2 and BB3, Retsch SK-1 hammer mill and Siebtechnik TS 100A vibrating mill – for sample preparation;
- Perkin-Elmer Analyst 100 and 3100 atomic absorption spectrometer – for the analysis of major and trace elements;
- Perkin Elmer 4000 atomic absorption spectrometer – equipped with hydride generator for analysis of As, Sb, Bi;
- Advant 9400 XP ARL wavelength-dispersive X-ray spectrometer – for trace element determination: Sn, Nb, Y, Cr, Zn, Cu, Ni, Pb, As, Mo, Zr, Sr, U, Rb, Ti, V, Bi, Th, W;
- AMA 254 Altec mercurimeter – for Hg determination;
- Eltra CS 500 analyser – for determination of C, S, CO₂;
- Perkin Elmer Hitachi 200 or Perkin Elmer Lambda 10 spectrometers – for Fe, P, and ammonium ion measurements.

In October 2009, a new instrument was purchased for the Central Laboratory – mass spectrometer Xseries II, which can be used for analysing both water and solid samples (e.g. REE or trace elements).

This laboratory also makes complete analyses of various types of precipitation and surface water.

In addition to the instruments already mentioned, several others are used:

- Alltech 650 chromatograph for determination of anions;
- Perkin Elmer 4100 atomic absorption spectrometer equipped with electro-thermal atomisation – for trace element determination;
- Radelkis pH-meter;
- pX-meter and conductometer;
- Tekmar-Dohrmann Apollo 9000 complete carbon and nitrogen analyser.

In addition to working on internal projects during 2009, the laboratory collaborated in research and development projects funded by the Grant Agency of the Czech Republic and the Ministry of the Environment, and also participated in projects with other research centres as well as in international projects. These included International Development Cooperation projects and research carried out under the terms of the Gothenburg protocol amongst others.

The analytical laboratory in Brno

In 2009, the project MŽP-OOHPP-87/08/GP to assess the level of contamination in the sediments of the Bílina River was completed. The river was systematically sampled from its source to its mouth and the contents of organic and inorganic pollutants were analysed. On the basis of these analyses, line cartodiagrams were constructed, showing the level of concentration of individual contaminants.

In addition, the development of procedures for sampling suspended matter was completed. A cost-effective procedure was designed to enable sampling of matter in rivers with low water levels. There are almost no practical limitations on sampling sites because the samplers are easy to deploy and several profiles in the river system can be monitored in detail and sampled simultaneously. The methodology has been thoroughly tested and certified and descriptions of the procedure have been published. In relation to this, a dissertation on fluid engineering (2301T036) was compiled and submitted at the Technical University of Brno using the name *Integral Sampler*. The theme of this diploma work was to assess the efficiency with which suspended material was captured by the sampler, based on the analysis of water flow.

Using the geochemical analyses of river sediment samples, the distributions of selected organic pollutants and heavy metals were also assessed under the terms of the project.

For the purposes of geological mapping, thematic environmental layers were created for the 1 : 25,000 scale map sheet Valašské Meziříčí.

Special laboratories

The special laboratories form the backbone of the Department of Rock Geochemistry. The staff are not only responsible for providing primary geochemical data, but are also established scientists, taking an active part in multidisciplinary research projects, regularly publishing their results and also teaching at universities and institutes.

The key laboratories are those listed below:

The Laboratory of Mineralogy and Special Methods:

- separation laboratory;
- thin section laboratory;
- fluid inclusions laboratory with a microscope heating and cooling stage for microthermometric measurements of P-V-T-X parameters.

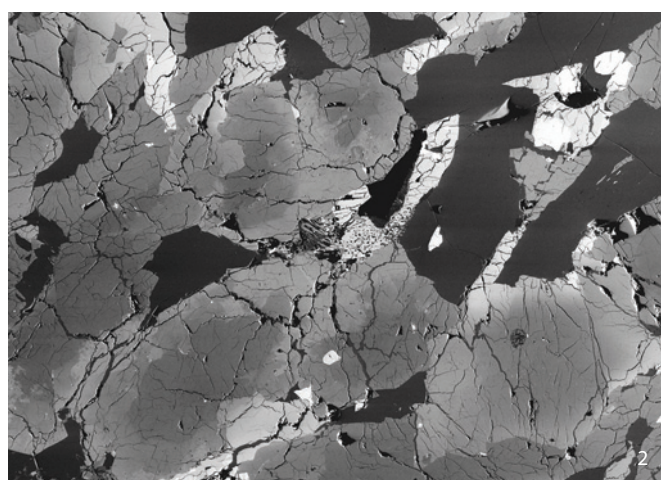
Laboratory of X-ray diffraction:

- Philips X'Pert powder diffractometer.

Experimental Mineralogy Laboratory

Laboratory of X-ray microanalysis (LAREM):

- CamScan CS 3200 scanning electron microscope;
- Link ISIS 300 microanalytical system with an energy-dispersive Si Li spectrometer (Oxford Instruments);



1/ A swarm of microgranular mafic enclaves in the hybrid Sázava tonalite, Teletín quarry, Central Bohemian Plutonic Complex (photo by V. Janoušek).

2/ An image of a lunar basalt sample Northeast Africa 003-B with zoned pyroxenes (backscattered electron image by J. Haloda).

- WDX 3PC microanalytical system with wavelength dispersive spectrometer (Microspec);
- NORDLYS II (HKL Technology) electron backscatter diffraction (EBSD) attachment.

Radiogenic Isotope Laboratory:

- clean laboratory (ISO 7 class) with laminar boxes (ISO 5);
- Finnigan MAT 262 thermal ionization mass spectrometer (TIMS).

The department hosts the editors of two prominent Czech geoscientific journals with an established international readership. The *Bulletin of Geosciences* is focused on sedimentary geology, stratigraphy and palaeontology, while the *Journal of Geosciences* is dedicated to mineralogy, structural geology, petrology and geochemistry of igneous and metamorphic rocks.

Library, Archive and Collections



Photo P. Neubert

The Department of Information Services serves as a modern information centre for scientists, including those from the Czech Geological Survey and other institutions, as well as for students, amateur researchers and the wider public. It includes a library, an archive of maps and documents and collections of geological samples. The efficiency with which information can be accessed has increased progressively as the integration of services and facilities for users have improved. Researchers can use two well-equipped modern study rooms with study materials available from the holdings of the library, archive and collections of CGS. Additions to all holdings are continuously being processed and the older holdings are edited as much as possible. The information service is maintained by specialists in this field – librarians, archivists, palaeontologists and geologists.

Hana Breiterová

Head of the Department of Information Services, in this capacity also the Head of the Geological Library. She is responsible for providing access to information resources and information supporting scientific and research activities. Currently she is the leader of the project for *National Geoscientific Bibliography*.

Library of the CGS

The library of CGS is the largest geological library in the Czech Republic. Its holdings include a unique collection of geological literature from around the world and it now contains 167,000 library items. In the study room, access is provided not only to the databases of CGS, but also to worldwide fulltext databases (ScienceDirect, SpringerLink, Wiley InterScience, Blackwell, GeoScienceWorld) and bibliographic databases (Web of Knowledge, Scopus, Georef and

Geobase, Environment Complete). In addition to electronic resources, access to printed books and documents is also available. Referencing and interlibrary search services are provided in print and electronic formats. Recently the holdings of the Brno Branch of CGS have been fully integrated to form part of the main information facility.

Activity carried out on the R&D project National Geoscientific Bibliography in 2009

- Further development and administration of the GeoPub application for collecting data on the publication activity of employees of CGS;
- Creation of an output from GeoPub in XML exchange format;
- Development of a new search form for the library catalogues in Oracle environment;
- Conversion of the database of reports and maps into the Clavius library system – building a software extension which will provide repeated updates of the databases of maps and reports and enable the loan services and searches on the Internet to function more efficiently;
- Import of records from CGS and cooperating organizations into a central data storage;
- Compiling conversion charts from XML format into UNIMARC format;
- Creation of a deduplication key.

Archive of the CGS

The scientific archive manages one of the largest collections of hand-drawn and printed geoscientific maps covering not only the territory of the Czech Republic, but also various areas from almost two hundred countries all over the world. The digitised map holdings can be accessed using the browsing applications on the Information Portal of CGS (Map server) and in the public study room of the archive and library. The archive also contains copies of all official documents written by the staff of the CGS (e.g. results of international projects, technical and scientific reports, grant reports) as well as a historical collection of manuscripts, letters and bequests. Since 2007 it has been following the new procedures for management and disposal of documents within the CGS.

Main activities and services carried out during 2009

- Maintenance and management of archive databases and applications within the Information Portal of CGS;
- Providing services and outputs from the digital map archive (raster files, searches, access from the browsing application);
- Preparation of the databases of the archive for conversion into the CLAVIUS library system and making loan and search services more efficient;
- Publication in A3 format *Geological maps of the České středohoří Mountains* by Josef Emanuel Hibsč, which is a unique collection of 22 map sheets at a scale of 1 : 25,000 covering this area, originally published between years 1896 and 1930.

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Worldwide fulltext and bibliographic databases accessible in the study room of the CGS Library.

- Cooperation with the Slovak Cartographic Society and participation at the conference *Historical Maps* held in Bratislava in September 2009;
- International cooperation in the INHIGEO commission (the annual report on this activity was published in the Newsletters for 2009).

Collections of the CGS

The Department of Collections of Geological Samples of CGS processes and provides access to geological and palaeontological material acquired by researchers from CGS and other organizations. The collections presently number approximately 300,000 samples. Maintenance of the stored material and curation of older parts of the collections continued during 2009. Significant progress has been made in enlarging the databases for the palaeontological and mineralogical collections as well as the databases of thin sections, rock samples and drill-core. The most important material was entered in the central register of the Ministry of Culture of the Czech Republic. Curation and research based on the collections has resulted in a number of publications. In 2009, the first paper was published in an impact journal, 3 papers were published in the *Bulletin of Geosciences*, 3 in *Geoscience Research Reports*, and one article was published in the *Český kras* magazine. In addition, 1 book was published and 11 abstracts were submitted to conferences.

List of grant projects in which curators and researchers from the Department of Collections took part in 2009

- 2008–2011: R&D MK ČR – *Building of the Information System of the Czech Geological Survey – revision and palaeontological investigation of selected older funds from the CGS collections.*
- 2009–2011: GACR – *Feeding strategy from the Cambrian until the mid-Ordovician in the Teplá-Barrandien Unit.*
- 2009–2011: GAAV – *Faunal dynamics in communities at the climatic stage of the Upper-Ordovician before the global crisis caused by climatic changes: evidence from the Královodvorské Formation in the Barrandien.*

Publishing House and Promotion of Geology



Photo P. Neubert

The Publishing House of the Czech Geological Survey has continued its programme of publication of both scientific and popular science titles intended for the wider public. A total of 23 geological publications were produced and, following the policy established in previous years, emphasis was given to making all the scientific periodicals of the CGS available on-line.

Promotional activities were focused on the 90th Anniversary of the Czech Geological Survey that was celebrated through the organization of two significant all-republic events.

A new Bizhub PRO C 6501/e digital printing machine was purchased for the reprographic workstation. This is now in use for printing limited editions in small print runs, and for research reports and other technical output required by the staff of the CGS.

Publishing activity

In 2009, publication of the *Bulletin of Geosciences* (IF 0.983) and *Geoscience Research Reports* continued, together with additional sheets of the Geological Base Map of the CR at 1 : 25,000 scale with accompanying legends. During 2009, six new sheets of the geological map and legends were published. The following popular science titles were also published: *At the source of the Volta River* (V. Sattran), *Trilobites – stony crayfish* (P. Budil, J. Marek, R. Šarič), *Memoires from Café Barrande* (V. Sattran) and *On the meaning of science* (Z. Petáková).

Patrik Fiferna

Head of Publishing House of CGS. In addition to supervising the publication of scientific papers, books and maps he is responsible for the operation of the reprographic centre of the CGS. He is also responsible for promoting and marketing the services offered by the Czech Geological Survey. Since 2009 he has also served as the Chair of the Drafting Committee of the Information Portal of CGS.

The Publishing House of CGS continued to make progress in enabling access to scientific publications on-line. The titles already available on the CGS website include *Bulletin of Geosciences* (www.geology.cz/bulletin), *Geoscience Research Reports* (www.geology.cz/zpravy) and *Czech Geological Survey Special Papers* (www.geology.cz/spec-papers). Now the *Journal of Geological Sciences* (www.geology.cz/sbornik), including all its thematic fields (anthropozoic, geology, hydrogeology, mineral resources, palaeontology, technology, applied geophysics), has been added. As a contribution to the celebrations of the 90th Anniversary of the Czech Geological Survey, some 8000 additional pages of scientific text from various noted publications of the CGS, now out-of-print, were made accessible on the website (www.geology.cz/1919).

Popularization of geology

As part of its promotional activities, the Publishing House of the CGS places major emphasis on drawing the research work and services undertaken by the Czech Geological Survey to the attention of the scientific community and the wider public. Particular attention is given to engaging the interest of young people because the future of earth sciences and, in fact, the sustainable future of planet Earth depends on them.

Thanks to these activities, the CGS became a partner in two important all-republic events: Week of Science and Technology 2009 and Days of GIS Liberec 2009. At the Week of Science and Technology 2009, scientists from CGS gave lectures, CGS had its open day and the Academy of Science of CR hosted the exhibition *Fossilized secrets of Antarctica* which illustrated the geological research carried out by CGS in Antarctica. Days of GIS Liberec 2009 gave an opportunity for the members of the Division of Informatics to present their work in lectures and exhibitions and to organize a scientific competition.

Over the past two years, the Publishing House of CGS has been co-operating closely with the Czech Working Group of the International Year of Planet Earth. This has been a worldwide activity with a diversity of contributions from participating nations that has raised popular awareness of the evolution of Planet Earth over geological time and the dependence of life on the delicate balance between climate, geological processes and resources. During 2009, the Museum of the Bohemian Paradise in Turnov and the gallery in Jindřichův Hradec hosted the travelling exhibition *Planet Earth: Mighty and Vulnerable* which was created under the initiative International Year of Planet Earth. Another activity related to this initiative was the third year of the painting contest for schoolchildren called *My Piece of Earth* organized in cooperation with the Ministry of the Environment. In 2009, more than 1000 children from almost 100 schools took part in the competition. All the works submitted are available in digital format on the website of the competition (<http://soutez-2009.geology.cz>), which has been visited by over 16,000 individuals so far.

The Publishing House of CGS presented the results of research carried out by CGS at several other significant events in the CR and abroad. These included the conference *Mineral Resources*



1/ During the Open day at the Czech Geological Survey, many specialists from the CGS gave lectures. In addition, visitors were able to inspect the advanced analytical equipment in the Barrandov laboratories and see various workplaces at the headquarters of CGS in Klárov (photo by P. Fiferina).

2/ A lecture on the research by the Czech Geological Survey in Antarctica being given by Zdeněk Venera, the Director of CGS, under the auspices of the Week of Science and Technology 2009 (photo by P. Fiferina).

for Europe, held in Prague, the presentation of posters illustrating the work of the CGS at a conference in Iraq, the Joint Geological Congress of the Czech and Slovak Geological Societies in Bratislava, *Joachim Barrande* – an exhibition organized by the French Institute, the 19th Autumn Book Fair in Havlíčkův Brod and the exhibition *Josef Sekyra, the first Czech at the South Pole* in Nové Město nad Metují.

In 2009, the Czech Geological Survey celebrated the 90th anniversary of its foundation. This grand jubilee was promoted by publications, posters, web pages and the Annual Report at most of the geological events that took place during the year, and at the end of the year the celebrations culminated with a festive reception for the employees of CGS at the Kaiserštejn Palace.

Issues published by the Czech Geological Survey in 2009



Books and journals

- Bulletin of Geosciences 1–4.
- Čejchanová, A., Cajz, V.: Geological maps of the České středohoří Mountains by Josef Emanuel Hibsich.
- Budil, P., Marek, J., Šarič, R.: Trilobites – stony crayfish: a tribute to Czech quarry men of the past centuries.
- Hanžl, P. et al.: Guidelines for compilation of the Geological Base Map of the Czech Republic at the scale 1 : 25,000.
- Hradecký, P., Kycl, P., Žáček, V.: Gran Cañón de Somoto/Grand Canyon of Somoto.
- Maděra, P. (ed.): Annual Report CGS 2008.
- Mlčoch, B., Nývlt, D.: Czech Geologists in Antarctica.
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- Rambousek, P., Řepka, V.: Mining activity and its effects in the Hornobenešovský and Hornoměstský districts. Collection of abstracts and a CD-ROM of the conference proceedings.
- Sattran, V.: Memories from Café Barrande.
- Sidorinová, T.: Ninety years of the Czech Geological Survey.
- Geoscience Research Reports in 2008.

Maps

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- Štědrá, V., Břízová, E., Fűrých, V., Hanžl, P., Kadlecová, R., Kirchner, K., Lysenko, V., Rambousek, P., Roštinský, P., Skácelová, D., Skácelová, Z., Mrnková, J., Valigurský, L., Verner, K., Zelenka, P.: Geological base map of the Czech Republic at scale 1 : 25,000 with Legend, sheet 23-221 Žďirec nad Doubravou.
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- Tomanová Petrová, P., Adamová, M., Bubík, M., Gnojek, I., Havlíček, P., Hubatka, F., Kycl, P., Novák, Z., Havlín Nováková, D., Šíkula, J., Břízová, E. (2009): Geological base map of the Czech Republic at scale 1 : 25,000 with Legend, sheet 34-223 Hodonín.
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Financial review



Photo P. Neubert

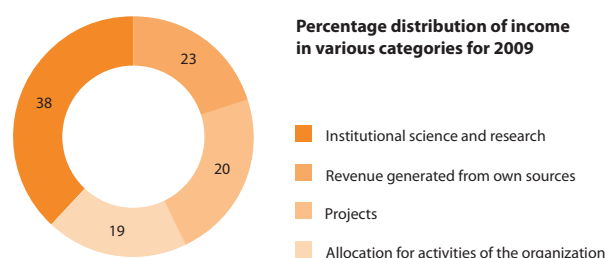
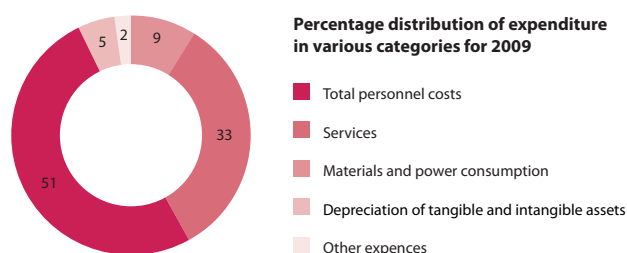
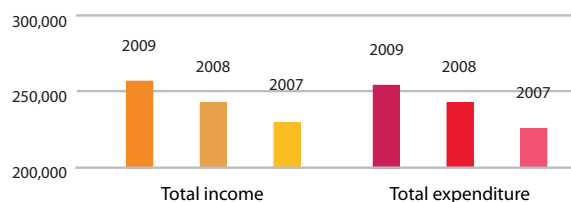
In 2009, the Czech Geological Survey fulfilled its statutory obligations as the provider of the state geological service and every effort was made to use the funds received to support research and development in a focussed and efficient manner. In terms of contracted activities, the accounting year 2009 ended with a positive financial balance. The total earned before payment of tax was 2,772.48 thousand CZK. Economic activity during the accounting period January–December 2009 showed a profit amounting to 137.96 thousand CZK.

Zdeněk Cilc

Head of the Economic Division and Deputy Director for Economy. In his capacity as a member of the Board of Management of the CGS since 2007, he has been involved in the financial restructuring of the main activities of the organization, decreasing the operating costs and increasing the income generated by services provided from commercial contracts with domestic and foreign clients.

The Czech Geological Survey will continue to strive during the coming year for the best outcome from its programme of research and development and to use the results effectively in the relevant fields of applied geology, risk assessment and environmental monitoring. Future development of the CGS depends on securing the appropriate level of funding from institutional sources to support basic science and research and from the Ministry of the Environment to support its statutory activities in carrying out the duties of the state geological service.

Total income and expenditure (in thousands CZK)



The CGS plans to generate more income through contracts and services during the coming financial year. This will be used to bridge the gap between income and expenditure and to help to fund the research and development programme. The principles underpinning the future developments in the CGS are as follows:

1. Preservation, development and effective use of the intellectual resources of the CGS.
2. Professional fulfilment of the state geological service.
3. Maximizing the research rating of the CGS and the scores obtained for published scientific output in the most cost-effective way.
4. Increasing contract income through commercial agreements for technical training and services with institutions and corporate customers in the CR and abroad.

Economic performance of the organization (in thousands CZK)

YEAR 2009 2008 2007 2006

INCOME GENERATED BY CGS ACTIVITIES

of this: Revenue from sale of own products and services	13,945	17,434	19,101	30,546
Revenue from sale of properties and material	38	0	10	4,776
Capitalization of internal services	18,715	18,305	18,136	11,222
Change in inventory	521	546	1,611	874
Clearing account for funds	4	987	388	728
Other income	14,811	14,987	9,157	13,415

OPERATIONAL GRANT

of this: 1) Statutory grant from the Ministry of the Environment	177,853	162,588	154,917	143,510
of this: allocation for activities of the organization	40,113	36,893	29,324	24,882
for institutional science and research	78,204	84,395	84,545	95,670
for special science and research projects	23,118	20,447	16,341	6,894
ISPROFIN financial programme	1,725	3,116	5,000	4,400
other geological activities	9,996	9,625	13,707	11,664
other NAR + Norway (lim)	22,448	0	0	0
from other sources (Norway + OP)	2,249	8,113	6,000	0
2) From other sources (from Slovakia)	14,097	17,339	17,768	13,613
of this: for science and research	14,097	17,339	17,768	13,613
3) Funds received from Grant of specific subsidies recipients	9,401	5,574	2,478	2,070
of this: for science and research	9,401	5,574	2,478	2,070
4) Foreign funding	7,142	4,348	5,411	797

TOTAL INCOME

256,527 242,107 228,977 221,551

ECONOMIC OUTCOME

2,773 59 4,056 7,268

TOTAL EXPENDITURE

253,754 242,048 224,921 214,283

of this: Material and energy costs	22,431	23,112	21,310	23,981
Services	83,677	86,043	81,331	72,939
Total costs of personnel	129,451	125,951	116,986	109,316
Depreciation of tangible and intangible assets	12,563	2,497	1,566	3,809
Taxes and fees	319	307	294	383
Other expenses	5,313	4,137	3,434	3,855

EXPENDITURE ON BUILDINGS AND EQUIPMENT

of this: Construction work	40,071	13,864	17,855	5,645
Other expenditure: tangible assets	18,938	6,107	6,315	1,642
Other expenditure: intangible assets	401	815	2,152	3,466

FINANCING OF EXPENDITURE

1) From the statutory grant	55,461	16,114	21,873	3,561
2) From income earned by the CGS from own resources	3,949	4,672	4,449	7,192

Human resources

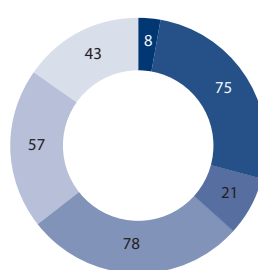


Photo P. Neubert

Helena Žemličková

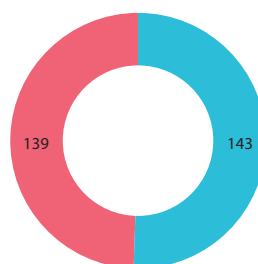
Head of Human Resources Section.

In 2009 the Czech Geological Survey had 282 employees in total, some of whom were employed on a part-time basis. When recalculated to an equivalent number full-time employees, this amount gives the result of 265.2 persons. Throughout its entire range of activities, the CGS places emphasis on the principle of equal opportunities, regardless of gender and age. This policy ensures that women returning to their posts from maternity leave are offered part-time work, and employment is also available to retirees and postgraduate or Ph.D. students.



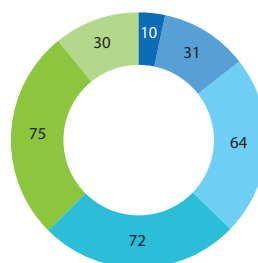
Number of employees in various divisions

- Directorate
- Geochemistry and laboratories
- Economics
- Geology
- Brno Branch
- Informatics



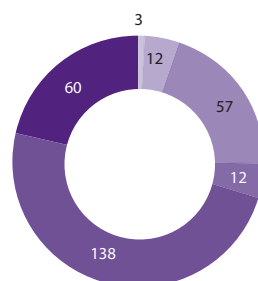
Gender ratio of the CGS employees

- Women
- Men



Age structure

- over 70
- 60–69
- 50–59
- 40–49
- 30–39
- 20–29



Education

- Ph.D.
- University education
- B.Sc.
- Complete secondary education
- Skilled
- Elementary

We study other planets but do not know what is happening 10 kilometres below us



Interview with the respected Czech geologist, Arnošt Dudek

I must admit that the opportunity to interview Dr. Arnošt Dudek was a great honour for me. There are few geologists in the Czech Republic who can command the same respect. I met him for the first time when attending one of the palaeontology lectures given in the Faculty of Science at Charles University. I was impressed by his attention to the topic and the perceptive comments he whispered during the lecture. Shortly after that I started attending his lectures on the regional geology of the Bohemian Massif and Carpathians. At that time, immediately after the Velvet Revolution, not many lecturers could draw an audience as large as he could. Together with Professor Chlupáč and Professor Čepěk, Dr. Dudek was one of a trio of geologists whose lectures were eagerly attended, and who had the ability to explain complicated problems in a clear and original way. Probably, nobody cared that their exams were quite a challenge! Later, I realized that few geologists had had such an impact on recent developments in Czech geology as Arnošt Dudek. It is probably no exaggeration to say that his contributions rank with those of Radim Kettner, Odolen Kodým and Bedřich Bouček.

Arnošt Dudek was born on 8 May 1928 in Turčanský Sv. Martin. In 1951 he finished his studies at the Faculty of Science of Charles University in Prague and a year afterwards he presented his dissertation on biotites from Bohemian granitoids. During his studies, in 1950 he became an assistant at the Petrographic Institute in the Faculty of Science of Charles University and in 1955 he began research under the supervision of Professor Kettner. This resulted in the presentation of a thesis on the crystalline rocks of the Thaya Dome. After that he began his career in the Central Geological Institute (now the Czech Geological Survey), where he worked most of his professional life in various, mainly managerial positions. Finally he proceeded to the Faculty of Science at Charles University where he continued as researcher and as lecturer. After retirement, he returned to the Czech Geological Survey and over many years he has been patiently and most thoroughly describing and cataloguing the large collection of thin sections held in the archive of the CGS. He has also served as a consultant on a wide range of geological problems and as a referee for many important publications and theses. In carrying out this work, he has applied his peerless knowledge of the regional geology of the Czech Republic, counting on the wide network of other earth scientists who number among his collaborators and personal friends, some of whom, sadly, have now died. The magnificent collection of samples that are now housed in the CGS are a testament to this scientific collaboration. It is remarkable how, with his indelible memory, Dr. Dudek

continues to search out older data and draw attention to the relevance of this information in current research.

Dr. Dudek has always been remarkably active in publishing the results of his research. He is the author of a number of distinguished scientific papers published in both Czech and foreign journals. Of these, I personally value above all others the definition and description of the Brunovistulikum as an independent geological unit of the first order. I must also mention his valuable studies on the Proterozoic of the Barrandian area, which he compiled together with Dr. Ferry Fediuk. In addition, Arnošt Dudek was the editor of the journal *Krystalinikum* for many years. Probably everyone who came across geology during their studies used the essential coursebooks and publications such as the *Petrographic Tables*, *Geology of the Bohemian Massif* or the *Atlas of Rocks*, which were co-authored by Dr. Dudek. Moreover, he was extraordinarily active in the geological mapping of our republic. In addition to these very visible contributions to Czech geology, he carried out less obvious, yet still very important work, by compiling reports and carrying out reviews. Many would regard him as a formidable referee and examiner who refuses to overlook factual errors or faults of logic, though in fact he is very tolerant. These two features of his character, combined with his extraordinary intellectual capacity and courtesy of manner, have led Prof. Fediuk to describe him as a versatile, educated, communicative and charismatic person. I cannot improve on this, except to say that Arnošt is a marvellously entertaining friend, always ready with wise and witty comments on both political and social events as well as apt judgements on scientific publications, maps and lectures. This is a sign of the mental agility that has been typical of Arnošt throughout his scientific career, and which most of us can only envy.

Arnošt's scientific and human qualities literally projected him to the highest positions in the Czech and international geological communities. He was the "Secretary General" of the 23rd International Geological Congress in Prague in 1968. Despite the distressing political events that took place, the Congress was a scientific success. Many participants, including those from foreign countries, still have happy memories of this congress, and especially of its excellent organization. Arnošt was one of the twelve candidates for the presidency of the International Geological Union. He was for many years an active member of the IUGS Subcommission on the Systematics of Igneous Rocks. In 2009, Arnošt Dudek was awarded the Prof. Dr. h. c. Cyril Purkyně Medal. This is an appropriate tribute to many years of creative work, always innovative, yet founded on the most rigorous scientific principles.

Petr Budil



Arnošt, you are a senior Czech geologist, even though you reject such a label. Could you try to summarise and evaluate the developments that have taken place during the last half century?

Perhaps, like other “whitebeards”, I reckon that one hundred years ago everything was better, and more human, both in relation to the field of study we are engaged in, and in relation to the people involved. Although I know this cannot be the truth, I probably have such thoughts in my subconscious and they inevitably influence what I say. In common with other natural sciences, the progress in geological sciences has been enormous, especially in the development of chemical and physical methods of analysis and our ability to see the Earth from the outside, from satellites and, indeed, to obtain a truly global view of our planet. However, I am not sure whether the huge amount of objective data gathered with an efficiency and precision we never dreamed of before, and all the new information and concepts that have evolved, have been accompanied by the necessary progress in skills of interpretation. When reading some papers (if I understand them correctly) I cannot quite rid myself of the impression that a number of statements are familiar to me, even though they are clothed in new, more “modern” terminology...

Your work has always been concerned with mapping and regional geology. Do you think the approach to such work has changed a lot? After all, information technologies have become a central theme in the mapping business, so nowadays no map can be produ-

ced without thorough processing of data and the creation of a Geographical Information System. Have so many things really changed? How would you compare, in general terms let us say, the quality of output in the 1960s with what is being produced now?

I am afraid that the increased possibilities for field research provided by technical progress have not had too big an impact on map production and the standard of graphics used for presentation. This is apparent in both geographical and geological maps. For example, if you have a look at a synoptic map of Bohemia at the scale of 1 : 500,000, you will find out that the map shows the same number of settlements, or even fewer than those depicted on the map compiled by Komen-ský at the beginning of 17th century, now almost 400 year old. Also, if atlases published in the 1930s are compared with the modern ones – the quality of the recent maps lags far behind that of the older ones. The detail, graphic design, colours and printing of the first edition of general geological maps of the Czech region published in the 1960s were of the highest quality and commanded the respect of the geological community worldwide (even though we know that the level of detail on individual sheets or parts of them was sometimes uneven). Technology is really seductive and so many options are available (what beautiful colours, and what a wide greyscale!) but maps in modern publications are often less legible than the old maps with their bold cross-hatching. No doubt, money, time and some other economic factors are responsible for this, but it is evident that maps produced today rarely reflect the oppor-



Geological excursion in 1948.

tunities afforded by our state-of-the-art technology. We must bear in mind that a geological map should be accurate, but that it can also be beautiful, in fact a piece of art. Unfortunately, I must admit, I was not particularly good at that either, but look at the maps made by Kettner, Poubá, and Losert and, for example, the recent work of Synek.

What led you to study geology? Your father was a surgeon, didn't he want you to follow in his footsteps?

I had great parents who were very conscientious about my education, but never tried to influence me or force me into anything. They taught me to appreciate fine art and music and my mother especially (armed with a rod) made me learn languages. This had a huge effect on my future life and enabled me to participate in many international activities. Since childhood I have read and loved popular scientific publications, I studied damselflies and dragonflies and I read a lot about geology and mineralogy in the magazine *Naší přírodou* (Our Nature). I think this was the greatest influence on me because, during the war, I was brought up in Zlín on land underlain by flysch which is not exactly a paradise for lovers of minerals and rocks (at least not for a beginner). My father never got involved in my choice of what to study, but he helped me to obtain foreign literature; mum would certainly have preferred me to become a doctor as she and most of my aunts and cousins were doctors too, but she never ever insisted. I am indeed extremely grateful to them for such a great

atmosphere of tolerance and for the support they gave me. Unfortunately, I did not express my gratitude to them in time.

How do you evaluate Czech universities, or schools generally, and the level of geological education provided by them?

It is the fashion nowadays to complain about our educational system, especially when compared with education abroad, but in my opinion that is not right. The acid test of the standard of our education was the emigration of our graduates, especially after 1968 – and it turned out that they mostly gave a good account of themselves in the field of research, at universities and in practice as doctors, physicists, geologists, biologists etc. A number of them achieved remarkable success. The legendary Prof. Odolen Kodým once stated: “If the student is smart, not even the worst tutor can spoil him, but if he is dumb, not even a genius can help him.” It can surely be claimed that the credit for success belongs to the individual student and not to the school, but the basic knowledge and the work habits they acquired there must also have a significant effect. The lack of modern equipment and limited international cooperation over a long period were obstacles to development, but the enthusiasm which, at least in natural sciences, has always prevailed here, has been the main factor leading to success. Progressive “reforms” served little purpose. In the 1950s, each year of geology students in the Faculty of Science at Charles University studied according to a different “reform”. With astonishment I found out that even in the 1970s these “reforms” continued and in some respects it is like this even now. I am rather sceptical about the results of this policy. Progress in cognition is achieved only by the dedicated work of the tutors in cooperation with the students themselves.

As a university lecturer you have raised generations of students (for example, you also taught the current director of the CGS). Do you keep abreast of their scientific work? Have you been delighted or surprised by them or have there been some disappointments?

As I've already mentioned, the role of a tutor was perhaps best characterised by Prof. Kodým, and so I don't think I had a significant influence on anyone. I still try to keep informed about what is happening in geology and, of course, I am interested in the work of the new generation of geologists, especially those to whom I lectured. I am really pleased if they are doing well and achieve success – which many of them actually have, thank God. I was only really fed up with perhaps one, and what wound me up was not a lack of ability but simple ignorance and laziness.

Has there been some recent revelation in geology that has really left you breathless?

What you mean by “recent” should be specified. The theory of plate tectonics has indeed been responsible for a great revolution in thinking – today it is more or less proven and is generally accepted as a fact. It led to changes in a number of concepts and it took some time before it was accepted (though even now there are critics). But since the advent of plate tectonics, nothing so



1/ Arnošt Dudek with Jan Zoubek in Teletín quarry.
2/ Conference in 1972.

significant has happened. However, new revelations are in progress and will surely lead to some more revolutionary ideas.

In your opinion, has everything essential been published already and are all current papers just reworking older information, or is the time just about to come when fundamental and radical departures from existing scientific clichés will take place, and if so, in which fields?

Everything substantial definitely hasn't been published yet, but nowadays there is an explosion in publications that is being exaggerated by ways of "assessing scientific work" that are not highly meaningful. This merely contributes to this "publication diarrhoea". I don't feel qualified to identify the fields of geology where the time has come for changes and revolutionary hypotheses, but I am enjoying new observations and revelations that, surprisingly, from time to time emerge in areas that were considered familiar and thoroughly explored.

In which fields of geological sciences do you think there are still problems that have remained unsolved for many years?

I used to study the deep structure and composition of the Bohemian Massif. That is a topic which has almost disappeared from the field of geological research – it is probably too expensive, relatively slow and does not bring immediate results that can be published in high-impact journals. We fly into space, study planets of the Solar System and look for planets of stars that are many light years away from Earth, but we still don't know what is happening 10 kilometres under our feet. This might turn out to be unfortunate (see for example the science fiction tale by A.C. Clark about the town of Calastheon in the glowing depths of the Earth).

Is Czech geology in crisis, or has the crisis passed or is it still about to come?

The crisis is not in geology, it is in society itself. The stage has been reached when no really significant project can be carried out. For seventeen years it has been a huge problem to build even three kilometres of motorway. No resources can be exploited and even exploration has stopped, no power plant can be constructed and neither can a retirement home or a young persons home be built. The reaction is "we don't want to be surrounded by elderly people, do we!" and "children would make noise" etc. Everyone is in favour, but only if the magic condition, NIMBY ("not in my backyard") is fulfilled. Even though some visionary proposals like "Blueprint for survival"* are somewhat extreme or premature, global development is inevitably leading to a scarcity of natural resources, especially water. Yes, all resources can be purchased, but we need to have something to pay with, so these developments shouldn't be allowed to catch us unprepared.

* An ecological text published in 1972, in which some scientists appealed for a restructuring of society into small decentralized and deindustrialized communities following the example of aboriginal tribes; this, it was believed, would stop the decline of civilization and the irreversible changes leading to the destruction of all life on Earth (editor's note).

You have met many influential geologists in your life, of whom do you have the fondest memories?

Thanks to the fact that I was able to communicate with a number of researchers in their native language, I was accepted even by older and more important people. Of all Czech scientists I was probably most influenced by Prof. Kodým, whose capacity for geological synthesis was extraordinary, and of course, I was also influenced by Professors Slavík, Kettner, and Koutek, not just because of their intellectual gifts, but especially because they were enthusiasts and strong characters. And I can't leave out Prof. Záruba, with whom I cooperated for several years on the National Geological Committee. What I probably most admired about him was his absolute dedication to the subject; after some tedious paperwork was done he would suddenly brighten up and look ten years younger as he talked, for example, about the causes of the disasters at the Longarone or Fréjus dams. Among the foreign geologists, I must mention Prof. E. Wegmann from Neuchatel who was full of fascinating knowledge and observations about Greenland. Even as a star geologist, he still treated me, a juvenile as I was then, in the most friendly and understanding way. Then there was Prof. Bearth from Bern who humiliated me with the energy and fitness he displayed during excursions in the mountains, being 35 years older than me. I cooperated with Prof. A. Streckeisen on nomenclature and classification of magmatic rocks for almost twenty years and we actually became true friends, despite the large difference in our ages. I also had the opportunity to meet a number of the great petrologists including P. Eskola, J. Jung and M. Roques, and the leading "plate tectonist" J. Tuzo Wilson as well as F. Delany from the Committee for the Geological Map of the World. She worked for many years in Saudi Arabia, despite being a woman! In addition, together with her female colleagues, she climbed a number of peaks over 6000 meters high in the Himalayas. These were all people who knew a lot and did their best to pass their knowledge to the greenhorns behind the Iron Curtain and help them. I could name tens of others, usually from smaller countries – the Finns, the Norwegians and the Dutch, who knew several languages, had seen more of the world, and did not have the elitist attitude associated with those from the larger nations and superpowers. I am always conscious of what our geology students were missing at that time because of the restrictions on travelling abroad and the lack of opportunities to carry out fieldwork in settings beyond Bohemia and the Carpathians. Geological features can't be studied like specimens in a herbarium or pickled in crude spirit – they have to be visited and studied *in situ* around the world.

What advice would you give to young geologists beginning their careers?

To learn as many languages as possible and to seize the opportunity to travel whenever it comes – a geologist must experience different terrains and get to grips with the problem of interpreting the geology on the ground, not just from a computer. Excursions are not enough, it is necessary to recognize



Arnošt with Ferry Fediuk during a field excursion for foreign colleagues.

and meet the geological challenges that difficult terrains can present, such an experience is irreplaceable. Countries where we could operate fruitfully 40 years ago are becoming inaccessible now (Iraq, Afghanistan, many Muslim countries, and numerous African countries etc.), however new opportunities continue to open up for us.

What is your opinion about the future of the Czech Geological Survey? You have always had the closest professional ties to the Survey, so what do you wish for it in future years?

I have always been convinced that CGS has been the most important and definitely the most effective geological workplace in our country. Though, for some period of time, less emphasis has been placed on applied activities such as engineering geology, geophysics, drilling and remote sensing, this situation is now progressively improving. During the last two or three decades, most countries, including ours, have made serious cuts in the resources available to their geological surveys. This has been due to the perception that there is a surplus of raw material resources and that their exploitation in already developed countries causes "devastation" of the landscape and has a negative impact on the environment. However, this situation will certainly change soon. I am sure "Pedro el Checo" (Dr. Květoň) was right when he claimed that, during exploitation, it is important to restore the natural environment, and to have a model for this prepared well in advance so that all extractive operations are not blocked at the planning stage. So, my wish is that our institutions are fully prepared for the challenges of today and the future: namely to provide the expertise that will enable the responsible use and sustainable exploitation of our natural resources while minimising the impact on our environment. At the same time, I wish to see the impetus of geological mapping and research continue along an innovative path that will lead to a deeper knowledge of the varied composition and intricate geological evolution of the Bohemian Massif. With the techniques now at our disposal, and because the quest for knowledge will carry us to greater depths in the Earth's crust, even the lack of outcrop will not be an obstacle.

Principal events in 2009

January



● Radek Vodrážka, a palaeontologist from the CGS, found a unique collection of fossils close to the Johann Gregor Mendel scientific station, **on James Ross Island**. This collection included the very first fossil sponge found on the Antarctic continent.

During the Antarctic “summer” season at the turn of year 2008–2009, 7 geologists from the CGS, together with a researcher from the Faculty of Sciences of Charles University, one from the National Museum and 2 ornithologists from the Faculty of Science of the Palacký University in Olomouc, took part in the programme *Research and Development SP II 1a9/23/07: The Contribution of the CR to stabilize the condition of the Earth's ozone layer and solar UV radiation in Antarctica, palaeoclimatic and palaeogeographical reconstructions of a selected area in Antarctica and related geological studies and mapping (2007–2011)*. The last members of the expedition returned at the beginning of March.



● 28 January

A new bookshop selling geoscientific literature and maps was opened at the CGS headquarters in Klárov, Prague. The shop also serves as a centre for promoting the mission and activities of the CGS to visiting professionals and the public. In addition to the publications of the CGS, the bookshop now offers more than a hundred geological titles on consignment from other publishers.



● Some **uniquely preserved fossil remains of the placoderm fish *Asterolepis ornata*** Eichwald, 1840 held in the collections of CGS were made accessible to the scientific public. The remains are of Upper Devonian (Frasnian) age and were discovered in the Gauja formation in the clay pit at Lode.

February



● 12 February

The travelling exhibition *Planet Earth: Mighty and Vulnerable* was installed in the gallery of the Bohemian Paradise Museum at Trutnov by the working group of the International Year of Planet Earth. The exhibition was supported by the CGS, the Ministry of the Environment of the Czech Republic, SČD (Severočeské doly), the Bohemian Paradise Museum, UNESCO Geopark Bohemian Paradise, TOP GEO Group and the Academy of Sciences of the Czech Republic. The programme of the Year of Planet Earth consisted of both short-term events and permanent exhibitions designed to encourage public interest in the geological sciences and in the geological heritage of the Czech Republic.

March

● 27–29 March

The second year of the Imperial Barrel Award (IBA) was held at the Albion hotel in Prague. The contest was organized by the American Association of Petroleum Geologists (AAPG) through its European regional office in London. This contest took place under the auspices of CGS and 13 teams from universities across Europe took part. The winning team was from the Lomonosov University which then proceeded to the world final of this competition in Denver, where they became the winners.

May

● 13–15 May

The Czech Geological Survey, together with the Institute of Rock Structure and Mechanics of the Academy of Sciences of the Czech Republic organized the **International Conference on Slope Failures in Pseudokarst** at Vsetín. There were 60 participants from the Czech Republic; representatives from Austria and Serbia also attended. In addition to presentation of the results of recent research, the main aim of this conference was to bring together engineering geologists, quaternary geologists, geomorphologists, practical speleologists, students and officers of the state and regional administration to share information and encourage cooperation. The meeting was held in the lecture theatre in the castle at the Valašsko Regional Museum in Vsetín. During field trips, visits were made to several famous slope failures in the Vsetín region.

● 16 May

On-line electronic searching of the catalogues of the CGS Library has recently been made available; this facility enables either simultaneous searches of all the catalogues or the option to search a single catalogue. The geological library of the CGS is gradually being transformed into a modern Internet library providing information services to scientists and the wider public. A comprehensive range of Earth sciences publications from around the world are collected and stored in both printed and electronic form in the CGS Library.

● 30 May

The Czech television station, Česká televize, featured the **publication of a Special**

Edition of the Review of Palaeobotany and Palynology in the main news. This issue of 250 pages is dedicated to the work of the Czech Carboniferous Group, which has recently provided new insights into what animal and plant life was like in a Carboniferous forest some 300 million years ago. Papers by Czech palaeontologists from the CGS, including Zbyněk Šimůnek (Division of Sedimentary Formations) and Jana Drábková (Head of the Palynological Laboratory in Barrandov), are cited in a new textbook on the evolution of plants that has recently been published in the USA.

June



● 25 June

Publication of a combined general geological map of the Czech Republic and Slovakia has been achieved under the terms of a meeting of Working Groups 4, 5 and 6 of the international OneGeology-Europe project. Publication of this map is based on the use of modern information technologies, the recommendation of OGC and the future recommendation of the INSPIRE directive. The map is published on the Internet in WMS and WFS formats using GeoSciML. The application synthesising the data from the Czech and Slovak nodes was developed at the CGS using only freely accessible software.



● 30 June

The Centre for Ecological Education and Ethics Rýchory – Sever in Horní Maršov asked Dr. Z. Šimůnek and Dr. V. Prouza, geologists from the CGS, to organize a geological-palaeontological

excursion to the Carboniferous and Permian of the Krkonoše Piedmont and Intra-Sudetic basins for teachers specializing in natural sciences. They visited localities with fossil plants and araucarian remains of Carboniferous age (Kryštofovy kameny near Odolov, and the tips of the Ida Mine at Malé Svatoňovice), also sites of ancient fluvial and volcanic activity (Hrádeček with ruins of Břecštejn castle, Hřebínek quarry near Babí) and the Hronov-Poříčí fault near Malé Svatoňovice. The highlight of the programme was the visit to the tip at the abandoned Ida Mine, where members of the field party were able to collect a number of fossilized fragments of clubmosses, horsetails, ferns and seed-ferns.

July

● 10 July

A new **website with information on slope failures** ("landslides") throughout the CR was introduced on the CGS Portal of Geohazards. The site includes information about the specialists from CGS who work on these problems, as well as relevant events, projects, and the publications and legislation relevant to this category of geohazard. The basic terminology relating to slope failures and the procedures for accessing the information held by CGS concerning slope failures is explained. The Register of Slope Failures in the Czech Republic is currently being compiled; when complete it will be accessible on this website under the terms of Science and Research project SP/1c5/157/07 of the Ministry of the Environment.



The Publishing house of CGS increased the number of **scientific publications available on-line**. In addition to the *Bulletin of Geosciences*, *Geoscience Research Reports* and *Special Papers*, papers on the main topics published in individual issues of the *Journal of Geological Sciences* were included – *Geology*, *Palaeontology*, *Mineral Resources and Mineralogy*, *Anthropozoic*, *Hydrogeology and Engineering Geology*, *Applied Geophysics*, *Technology and Geochemistry* (www.geology.cz/sbornik).



A thematic issue of the *Journal of Geosciences*, Vol. 54/2009/No. 2 (www.jgeosci.org) devoted to the *Geological development of the region at the NE periphery of the Moldanubian Zone, eastern part of the Bohemian Massif* was published. The guest

editors J. Pertoldová and S. Vrána, together with a large number of collaborators presented the results of three years of research carried out under the terms of Project No. 6352 *Reconnaissance of lithologically contrasting rocks in crystalline units along the NE margin of the Moldanubian Unit* (Pertoldová J. et al. 2007) jointly carried out by the Department of Conservation of the Geological and Soil Environment of the Ministry of the Environment and the CGS. During the years 2005–2007, an extensive, varied and unique collection of field and laboratory data was acquired and many of the most important results are summarized in the seven papers included in this thematic issue.

August



● 10–21 August

A palaeobotanical and palynological investigation of a famous Carboniferous site at Ovčín near Radnice was carried out. The main organizer was the West-Bohemian Museum in Plzeň, other participants were: the Czech Geological Survey, the Geological Institute of the Academy of Sciences of the Czech Republic (ASCR), the Faculty of Science of Charles University and the National Museum. Some Chinese colleagues, who visited under the terms of a bilateral cooperation agreement with the ASCR, also took part in the field excavation. The Ovčín site is unique because, during the Upper Carboniferous, an ash layer covered a coal bed and preserved the coal-forming vegetation *in situ* in much the same way as the eruption of Mt Vesuvius preserved Pompeii. This enables the contemporary relationships within this fossil plant community to be studied in remarkable detail.

● 14 August

Effects of acid rain on the forest and water ecosystem. This paper by the researchers RNDr. Jakub Hruška et al., from the Division

of Environmental Geochemistry and Biogeochemistry of CGS was published in Issues 2–4 of the oldest Czech scientific journal *Živa*, in 2009. This paper was compiled thanks to Project CZ0051 supported by a grant from Iceland, Lichtenstein and Norway through the Financial Mechanism of the EEC and the Financial Mechanism of Norway.

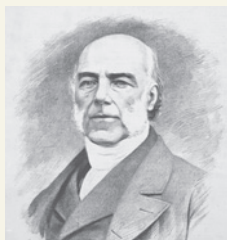
September

After more than 50 years, **new discoveries of fossil marine fish were made at Krumvíř** during fieldwork carried out by the Czech Geological Survey and the Moravian Museum. At this locality, the remains of marine pipefish and luminous deep-sea fish are preserved. A suction disc belonging to one of the *Echineidae*, suckerfish that attach themselves to the skin of large marine vertebrates such as sharks, whales and dolphins, was found. Fossil records are very rare, they have been found only in the Tertiary of Europe (including Moravia) and the Caucasus.



8 September

The new building of the Brno Branch was inaugurated in the presence of Zdeněk Venera, Director of CGS, representatives from the Ministry of the Environment of the Czech Republic, representatives from related institutions and employees. The architect for the building project was Atelier AS from Brno and it was constructed by the firm REKO.



15 September

On the occasion of **the 210th anniversary of the birth of the French palaeontologist Joachim Barrande**, the French Institute, together

with Palaea (the Society for Paleontology) organized an exhibition in Prague, and an all-day colloquium devoted to lectures concerning Barrande's life and work. A speech at the opening ceremony of the colloquium was given by Pavel Bém, the Mayor of Prague, and one of the descendants of Joachim Barrande who travelled to the Czech Republic specially for this occasion. The Czech Geological Survey also contributed to this prestigious event through lectures given by the specialists Dr. J. Kříž and Dr. P. Budil and by presentation of publications of the Publishing House of CGS relating to Joachim Barrande. In addition, an exhibition of original graphic work by Radek Šarič devoted to artistic depictions of trilobites must also be mentioned.

30 September – 4 October

A Joint geological congress of the Czech and Slovak Geological Societies was held in the building of ŠGÚDŠ (Štátný geologický ústav Dionýza Štúra – State Geological Institute of Dionýz Štúr) in Bratislava. On this occasion, official representatives of The Czech Geological Survey and the Czech Geological Society were presented with the prestigious Ján Slávik Medal. This is the highest award of the Slovak Geological Society and one of the most prestigious geological honours in Slovakia.

October



22 October

The 3rd year of the painting contest *My Piece of Earth* for children and young people, which is organized by the Czech Geological Survey and the Ministry of the Environment, ended with the ceremony at which prizes were awarded to the winners. The winners of each of the three categories had to compete against more than 1300 artistic works from 140 kindergartens, junior schools and high schools from all over the CR. The prizes were awarded by Zdeněk Venera, the Director of CGS, Barbora Pečová representing the Ministry of the Environment, Blanka Šreinová



representing the National Museum and Tomáš Černý from the publishers Mladá fronta. After the ceremony an excursion to some of the departments of CGS was organized. The independent educational website for this contest concerned with geology and ecology was visited by over 16,000 individual users in 2009. The contest is organized in cooperation with the Ministry of the Environment and was initiated in 2008 in relation to the International Year of Planet Earth. The aim of the contest is to highlight the importance of Earth sciences in sustainable development worldwide, to reduce the impact of natural hazards, to rationalize construction work and optimize the use of natural resources.

28 October

Václav Klaus, the President of the Czech Republic, awarded **the State Medal of Merit in the Field of Science** to Prof. RNDr. PhDr. **Jiří Krupička** who is a legendary figure in Czech geology, a political prisoner and co-founder of KAN (Club of those Committed to Independence) and K 231. Currently he is a Professor Emeritus of Geology at the University of Alberta in Edmonton, who at 96 years of age is indeed a worthy recipient of this award. After being imprisoned for ten years and working in the uranium mines, he started to work in the Central Geological Institute in 1965 and took part in preparations for the 23rd International Geological Congress in 1968. After the occupation by the Soviet army in August 1968 he went into exile, first to the Netherlands, and then to Canada where he has lived in Edmonton, in the Province of Alberta, ever since. The Czech Geological Institute awarded him the Purkyně Medal in 1990 for merit in geology and outstanding ideological principles. Later, Jiří Krupička was also awarded the PEN Club Prize.

November



● 2–8 November

This year, the **Week of Science and Technology (TVT)** was co-organized for the first time by the Czech Geological Survey. TVT has been organized every year for the last nine years by the Academy of Sciences of the Czech Republic and its aim is to introduce the work of the scientific institutes to the public and present their results, as well as to encourage talented students to take up careers in science. The exhibitions, *Planet Earth: Mighty and Vulnerable*, and *Fossil secrets of Antarctica*, at which unique photographs from the polar station and mapped localities accompanied by video reports, together with an exhibition of fossils, were presented, were hosted by the Czech Geological Survey under the auspices of TVT 2009. The historical first **Open day** at the Czech Geological Survey took place on Wednesday 4 November. On this occasion, specialists from the CGS gave lectures and volunteers took visitors on guided tours to some departments. Mgr. Zdeněk Venera, Ph.D, the Director of CGS, gave a lecture about the *Czech Geological Survey in Antarctica* in the lecture hall of the ASCR. On the 5th November, lectures on the theme *From Bohemia to the Horn of Africa* took place in the City Library. These lectures, placing the AEGOS project in perspective, were given by RNDr. Dana Čápková, Deputy Director for Informatics of the CGS with her colleagues Dr. Ing. P. Konečný from the Institute of Geonics ASCR and Mgr. J. Jiroušková, CSc., from the Náprstek Museum.

● 10–12 November

The Czech Geological Survey was a partner in **Geographical Information Systems Days (GIS)** at Liberec, organized by the Technical University in Liberec, the County Council of Liberec Region, the Fire Brigade and Rescue Service of the Liberec Region, Sadská School, Children's Television Liberec and the F.X. Šalda

Grammar School. The Czech Geological Survey presented their geological map of the Liberec Region with samples of rocks from the area and also demonstrated how ArcGIS is used to create a GIS so that visitors could learn about the use of GIS in geology. For eleven years, all over the world, such events provide an opportunity for the public to meet with scientists and learn about activities that affect the daily lives of all of us. In Liberec these Days have been taking place since 2000.



● 19 November

A festive reception was held at the Kaiserštejn Palace to celebrate the 90th Anniversary of the foundation of the CGS.

This was the finale of a year long sequence of events marking this grand jubilee. After the opening, introductory speeches were given by Mgr. Zdeněk Venera, Ph.D, the Director of CGS, and RNDr. Ladislav Miko, Ph.D., the Minister of the Environment. Words of encouragement were added by former directors of CGS: RNDr. Ing. Vladimír Sattran, CSc., RNDr. Miloš Růžička, CSc. and doc. RNDr. Zdeněk Kukal, DrSc. The festive atmosphere of the occasion was enhanced by the award of the Prof. Dr. h. c. Cyril Purkyně Medal to three outstanding specialists from the Czech Geological Survey – RNDr. Zdeněk Stráník, DrSc., RNDr. Arnošt Dudek, DrSc., and RNDr. Miloš Růžička, CSc. The medals were presented by the Director of the CGS, Zdeněk Venera.

The jubilee was also celebrated by the publication of a special Annual Report for the year 2008. This includes sections describing the history of the CGS and its various divisions.

Attention is also drawn to the milestones that mark the development of the international scientific reputation of the CGS supported by some interesting personal reminiscences and comments from distinguished Czech and foreign geologists.

December

● 4 December

On the occasion of the opening the new building of the Brno Branch, an **exhibition of paintings by František Hubatka** took place. Hubatka, who is a famous painter from Brno, and also an excellent geophysicist, was invited to express the genius loci of the building and its surroundings below Petrov Cathedral in the Old Town of Brno through his painting. He created one large canvas named *A Whale under Petrov* and also paintings called *Erosion* and *Sedimentation*. Another ten impressive pieces of his work were loaned for this exhibition.



● 7 December 2009

The Town Museum at Nové Město nad Metují held an exhibition assembled by Václav Pavel called **Josef Sekyra, the first Czech at the South Pole**. This is dedicated to the life and work of the important Czech scientist and geologist, doc. RNDr. Josef Sekyra, CSc. Zdeněk Sekyra, the son of Josef Sekyra, who was also his student and a close colleague, together with Jiří Šebesta, a specialist from the CGS, gave speeches at the opening of this exhibition.

●

The book ***On the meaning of science*** written by Zdeňka Petáková was published, together with other popular scientific titles such as *Trilobites – stony crayfish*, *Memories from Café Barrande* and a selection of postcards from Antarctica. These are all intended to promote the interest of the wider public in the Earth sciences and the work of the CGS.

A new office building for the Brno Branch of the Czech Geological Survey



In September 2009 a milestone in the history of the CGS took a place, a new office building for the Brno Branch was inaugurated. A brief history of the events that led to this is given below.

In 1850, the foundation of the Werner Geological Society (Wernerverein zur geologischen Durchforschung von Mähren und Schlesien) marked the beginning of formal geological investigations in Silesia and Moravia more than 150 years ago. Although this society existed for only 15 years, the contribution it made to the geology of Moravia and Silesia was of great importance and the Brno Branch of CGS continues in the tradition established by the Werner Geological Society and its members. In the same way that the Werner Society was made responsible by the Imperial Geological Institute in Vienna for the geological mapping of Moravia and Silesia, the Czech Geological Survey (at that time led by Dr. Ladislav Čeppek) was subsequently appointed by the Central Geological Institute to provide the same regional geological services.

In 1945, the Regional Geological Institute was established in Brno under the direction of Dr. Karel Zapletal. However, it remained in existence for only four years. In 1949, together with the regional government, it was closed down and replaced by a county administration. The number and the areas of the counties established then have remained the same to the present day.

The institute as it is now was founded by state decree on the 7th July, 1950. RNDr. Jan Kalášek was appointed as the director and, for the first year of operation, there were only 14 employees. The main task of the organization was the geological mapping of the crystalline basement and the Palaeozoic, Cretaceous and Tertiary cover rocks. In 1963, the institute was closed for a short period but reopened again two years later when the staff from the Oil Research Institute were transferred to the existing institute. The director at that time was RNDr. Mikuláš Dlabáč, CSc., replaced later by the very able hydrogeochemist Ing. Miroslav Michalíček, CSc.

In 1970 the Brno Branch office was fully staffed with 42 employees. Most of them were university graduates and there were also one or two technicians working with them. The scope of the scientific work covered the area of Moravia including the Moldanubian, the Moravian Palaeozoic, the Carpathian Flysch, petroleum geology and later also the ore geology of the Jeseníky Mts. During the period from 1950 to 1970 a total of 265 scientific papers on these various topics were published.

From the early to mid 1970s the geological staff had to put up with a lack of space and being dispersed in different places. The situation improved in 1977 when the new building for the CGS in Brno was built in Leitnerova Street and also another close by in Jircháře Street. Some of the laboratory operations, facilities for rock cutting, preparation and storage remain in these two old buildings on the same street. In 1977 the Brno Branch office had 44 employees, all working in the new building.

Following Ing. Michalíček, the other geologists who became directors of the Czech Geological Survey were RNDr. Lubomír Maštera, CSc., RNDr. Zdeněk Stráník, DrSc., doc. RNDr. Pavel Müller, CSc., and RNDr. Oldřich Krejčí, Ph.D.

In 2009 the Brno Branch office employed 62 specialists (apart from the microprobe laboratory and the CGS office in Jeseník, altogether 8 employees). This increase in the number of employees over the years led to a discussion with the Ministry of the Environment about the construction of a new office building to replace the old laboratory and storage buildings where the sister institute Geofond will be housed. The planning and administrative work for this project took 6 years, including the demolition of the old buildings and construction of the new ones.

On 8th September 2009, the opening ceremony took place at 4a Jircháře Street, attended by Dr. Zdeněk Venera, Director



of the Czech Geological Survey, together with representatives from the Ministry of the Environment, other institutions and guests. The architect for the project was Ing. Jiří Zaplatil of Atelier AS Ltd., Brno, and the building was constructed by REKO, a.s., Brno. The economic management of the project was supervised by Ing. Milan Blažej.

By invitation of Dr. Krejčí, the Director of the Brno Branch office, an exhibition of paintings by František Hubatka was hung in the new building at the opening ceremony. František Hubatka is not only a talented artist but also a geophysicist whose vision has enabled him to capture the genius loci of the new building sited in the old quarter of the city of Brno below the Cathedral of St Peter and St Paul. The painting called *A Whale under Petrov* and two paintings *Erosion* and *Sedimentation*, side by side, are on exhibition together with ten other canvases in the main hall of the new building.

- 1/ The new building of the Brno Branch of CGS (photo by P. Neubert).
- 2/ The Director of CGS Zdeněk Venera at the opening ceremony of the new Brno Branch building (photo by A. Havlín).
- 3/ The building site before the initiation of construction work on the old building of the Brno Branch of CGS at Leitnerova Street in 1975.
- 4/ The Brno Branch building before the completion of construction work at the turn of year 1976–1977.
- 5/ The old estate at the site of the new building during the site investigation in 2008 (photo by O. Krejčí).
- 6/ *Erosion* and *Sedimentation* by the painter František Hubatka on display inside the new Brno Branch building (photo by P. Neubert).
- 7/ *A Whale under Petrov* by František Hubatka.

List of projects of CGS in 2009

Legend of Czech abbreviations: **AV ČR** – Academy of Sciences of the Czech Republic; **CGS** – Czech Geological Survey; **CR** – the Czech Republic; **MU** – Masaryk University; **MŽP** – the Ministry of the Environment; **PfF** – Faculty of Sciences; **UK** – Charles University; **MPO** – Ministry of Industry and Trade; **TU** – Technical University

number	name	leader
Research and development		
221600	VaV SP/2E1/153/07 – Principles governing interaction in the system “water/rock/landscape” and their application to groundwater protection in the Czech Republic, 2007–2011	RNDr. Renata Kadlecová
221700	VaV SP/1a6/151/07 – Evaluation of the effects of climate change on hydrological balance and a proposal for practical procedures to reduce their impact, 2007–2011	RNDr. Daniela Fottová
221800	VaV SP/1c5/157/07 – Creation of an interactive map of slope and rock failure hazards in the Czech Republic, 2007–2011	RNDr. Zuzana Krejčí, CSc.
221900	VaV SP/1b7/156/07 – Model for transport of sediments and organic pollutants attached to suspended material in the Dyje drainage area, 2007–2011	Mgr. Eva Franců, Ph.D.
222000	VaV SP/2e7/229/07 – Effects of anthropogenic load on the state of soils, water resources and water ecosystems in the Bohemian part of the international Elbe River drainage, in cooperation with VUV, 2007–2011	Ing. František Bůzek, CSc.
222100	VaV SP II 1a9/23/07 – Contribution of the CR to stabilization of the state of the ozone layer of Earth and solar UV radiation in Antarctica, palaeoclimatological and palaeogeographical reconstruction of a selected part of Antarctica and related geological study and mapping, 2007–2011	RNDr. Petr Mixa
222200	VaV SP II 4h3/22/07 – National geoscientific bibliography, 2007–2011	RNDr. Hana Breiterová
222300	VaV DE08P04OMG002 – Building of the Information System of the Czech Geological Survey – revision and palaeontological investigation of selected older funds from the CGS collections, 2008–2011	RNDr. Petr Budil, Ph.D.
222400	VaV SP/2E6/97/08 – UNESCO European Geopark Český ráj – the creation of a geo-information system for the development of the region and the protection of its geological heritage, 2008–2010	RNDr. Lilian Švábenická, CSc.
222500	VaV Q191C118 – 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., 2009–2013	Mgr. Magdaléna Koubová, Ph.D.
222600	FR-T11/367 – Research on the influence of intergranular porosity on disposal into deep geological formations and the methodology for developing measuring apparatus, 2009–2013, in cooperation with Stavební Geologie-Geotechnika, a.s. (provider MPO, Programme TIP)	Mgr. Lenka Rukavičková
222700	Research and development of the methods and technologies for capture of CO ₂ from fossil fuelled power plants and CO ₂ storage in geological formations in the Czech Republic, in cooperation with ÚJV, Řež (provider MPO, Programme TIP), 2009–2013	RNDr. Vladimír Kolečka
Internal projects – the research plan of CGS		
322000	Preparation of methods for mapping directive, 2009–2010	RNDr. Pavel Hanžl, Dr.
322700	Database of decorative stones	RNDr. Barbora Dudíková Schulmannová
323000	Special studies, methods of research, Ph.D. theses and dissertations	RNDr. Lenka Hradecká, CSc.
325100	Geological base mapping of CR 1 : 25,000, sheet 13-324 Kutná Hora, using the results for local development, 2006–2009	RNDr. Veronika Štědrá, Ph.D.
325500	International Year of Planet Earth in the CR, 2007–2009	RNDr. Veronika Štědrá, Ph.D.
325700	Processes of sedimentation and resedimentation of volcanic material in unmetamorphosed formations of the Bohemian Massif, 2007–2009	Mgr. Michal Rajchl, Ph.D., Mgr. Vladislav Rappich
325800	Geodynamic aspects of emplacement of post-collision granitoids: multidisciplinary approach to the study of granitoid bodies, 2007–2009	Mgr. Jiří Žák, Ph.D.
325900	Dating of selected tectonic events in the Bohemian Massif, 2007–2009	Mgr. Jiří Konopásek, Ph.D., Mgr. Lucie Tajčmanová, Ph.D.

number	name	leader
326100	English-Czech Hydrogeological Dictionary, 2007–2009	RNDr. Renata Kadlecová
326300	Database of rock-forming minerals, 2007–2009	RNDr. Zdeněk Táborský
326500	Polabí: palaeoenvironmental evidence from sediments in oxbow lakes and its importance for geological mapping and revitalization of rivers, 2008–2010	RNDr. Eva Břízová, CSc.
326700	Structural and tectonic interpretation of the south-west part of the Bohemium in relation to the record from neighbouring units, 2008–2009	Mgr. Jan Franěk, Ph.D.
326800	Evidence in Cambrian and Devonian sediments for the exhumation of the Brunovistulicum, 2008–2009	Mgr. Helena Gilíková
326900	Conditions of crystallization of the Jihlava syenite, 2008–2010	doc. RNDr. Jana Kotková, CSc.
327000	Geological evolution of units on the NE margin of the Moldanubicum, 2008–2009	RNDr. Jaroslava Pertoldová, CSc.
327100	Comprehensive research on clastic sediments from the Middle Miocene of the Moravian Gate, 2008–2009	Mgr. Pavla Tomanová Petrová, Ph.D.
327300	Volcanism in the Prague Basin during the Silurian and Devonian, 2008–2010	Mgr. Zuzana Tasáryová
327400	Development of methods for field x-ray-fluorescence spectrometry for the purpose of geological and environmental investigations, 2008–2009	Ing. Petr Lukeš
327500	Chemistry and alteration of ilmenites, their use in interpretation of the palaeogeography of Tertiary relics, 2008–2009	RNDr. Tamara Sidorinová
327900	Correlation between the fractionation of platinum metals and the geochemistry of rocks in the Svitavy anomaly and Letovice metaophiolite complex, 2008–2009	Ing. Ilja Knésl
327800	Automatic processing of hydrogeological data for basic regional hydrogeological characterization of the rock environment, 2008–2009	Mgr. Tomáš Ondovčín
328200	Preparation of geological base maps at 1 : 25,000 scale and legends for printing, 2009	RNDr. Zuzana Krejčí, CSc.
328300	Creation of a digital information system and final entry of geological data for the area of Jeseníky, 2009–2010	RNDr. Vratislav Pecina, Ing. Lucie Kondrová
331800	Contribution of the CGS to the "International Network of Small Forest Drainages: International Cooperative Programme – Integrated Monitoring", 2006–2009	RNDr. Pavel Krám, Ph.D.
332300	Contributions to specific parts of the research plan of CGS by the Department of the Geochemistry of the Rock Environment, 2007–2009	Mgr. Jakub Haloda
332500	Studying mechanisms of the reaction of the biosphere to global crisis events in the geological past, 2007–2009	doc. RNDr. Jiří Frýda, Dr.
332600	Carbon balance in freshwater peat bogs – comparison of sites in middle latitudes with those in subarctic areas, 2007–2009	Mgr. Leona Zemanová
332800	Determination of Sr isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$) in soil leachates from sites at Načetín and Lysina, 2008–2009	Mgr. Filip Oulehle, Ph.D.
333000	Research on radon hazards, 2009–2010	RNDr. Ivan Barnet, CSc.
333100	Development of the procedure for Os isotope analysis using N-TIMS, 2009	Mgr. Vít Erban
340300	Development of the www Information Portal of CGS, 2009–2010	Ing. Radek Svítal
340500	Data sources and metainformation system of the Czech Geological Survey, 2007–2010	RNDr. Dana Čápková

number	name	leader
341600	Procedures for the protection of geological sites, 2006–2010	RNDr. Pavla Gürtlerová
341700	Creation of an interactive atlas "The atlas of plutonic rocks and orthogneisses in the Bohemian Massif", 2008–2009	Ing. Martina Klímová
341800	Combined general geological map of the CR and the SR using the OGC/CGI/IWG standard in the internet environment, 2009–2010	Mgr. Petr Čoupek
390000	Geological base mapping of the Czech Republic at a scale of 1 : 25,000, 2008–2014	RNDr. Jaroslava Pertoldová, CSc.
390001	Krkonoše	Mgr. Jiří Konopásek, Ph.D.
390002	Šumava	RNDr. Vladislav Žáček
390003	Brněnsko	RNDr. Jiří Otava
390004	Beskydy	Mgr. Roman Novotný
390005	Jeseníky	RNDr. Vratislav Pecina
390006	Doupovské hory	RNDr. Bedřich Mlčoch
390007	Křivoklátsko	RNDr. Tomáš Vorel
390008	Central pluton	RNDr. Kryštof Verner, Ph.D.

Provision of the State Geological Service

350000	Geological composition as a factor determining usage and development of the territory of CR: continuing investigations	RNDr. Jan Čurda
360000	Providing the state geological service outside approved projects	RNDr. Petr Mixa

Grant Agency of the Czech Republic

618100	GA526/07/1187 – Soil acidification in less-polluted natural forests: Evaluation of present situation and prediction of future development, 2007–2011 (in cooperation with MLZU, Brno)	RNDr. Jakub Hruška, CSc.
618200	GP526/07/P349 – Influence of liming on the availability of base cations and the transformation of organic matter in the forest ecosystem, 2007–2009	RNDr. Filip Oulehle, Ph.D.
618300	GA205/07/0992 – Application of non-traditional isotopes to the petrogenesis of granitic rocks, 2007–2009 (in cooperation with Charles University, Prague – Dr. Holub; MU, Brno – Prof. Novák)	RNDr. Vojtěch Janoušek, Ph.D.
618400	GA205/07/1409 – Tectonic control of repeated magmatic activity during formation of orogenic belts – the example of the Kaoko belt in NW Namibia, 2007–2009 (in cooperation with Charles University, Prague – Dr. Ulrich)	RNDr. Jiří Konopásek, Ph.D.
618500	GC205/07/J061 – Methane and carbon dioxide sorption on coals: Effects of pressure, temperature and bacterial activity, 2007–30/06/2009 (in cooperation with Deutsche Forschungsgemeinschaft)	RNDr. Juraj Franců, CSc.
618600	GACR 205/08/0122 – The Fe-Mo-Nb-S system, determining the stability of synthetic phases and clarifying their structure, 2008–30/06/2010 (in cooperation with VŠB – TU, Ostrava; Institute of Physics of AV ČR)	RNDr. Milan Drábek, CSc.
618700	GA205/08/0062 – Evolution of molluscan nacre: a study of microstructures and crystallographic textures using diffraction techniques, 2008–2010 (in cooperation with VŠB – TU, Ostrava)	doc. RNDr. Jiří Frýda, Dr.
618800	GA205/08/0321 – Impact of ore mining and processing on the environment in the Copperbelt Province, Zambia: A model for heavy metal and sulphur cycles in soils, sediments and water, 2008–2010 (in cooperation with PřF UK; PřF MU; Ochrana podzemních vod, s.r.o.)	doc. RNDr. Bohdan Kříbek, DrSc.

number	name	leader
618900	GP205/08/P474 – Stability and alteration mechanisms of monazite as a function of temperature from 150 to 300 °C and the chemical composition of hydrothermal fluids, 2008–2010	Mgr. Renata Čopjaková
619000	GETOP/08/E014 – Quantification and timing of uplift and erosion in the West Carpathians and adjacent Bohemian Massif in relationship to mass transfer to active basins, 2008–2011	RNDr. Juraj Franců, CSc.
619100	GA205/09/1989 – Assessment of Mining Related Impacts Based on the application of the ARES Airborne Hyperspectral Sensor, 2009–2012	Mgr. Veronika Kopačková

Projects for the Ministry of the Environment of the Czech Republic

635900	The National Centre for Effects – Commitment of the CR to an International Treaty on Distant Transport of Pollutants, OOH MŽP, 2006–2008	RNDr. Irena Skořepová, CSc.
636800	Research on the distribution of ¹³⁷ Cs and other selected radionuclides in the near-surface layer of rocks in the Říčany-Přelouč-Pelhřimov-Bechyně-Milevsko polygon, 2007–2009, OOHPP MŽP	RNDr. Pavel Müller, CSc.
637200	Effects of exploitation, modification and processing of mineral resources on the environment, 2007–2009, OOHPP MŽP	RNDr. Petr Rambousek
637300	Assessment of risks stemming from the presence of undetonated charges of TNT in boreholes for geophysical exploration in the land register of Halenkovice and proposals for remedial measures, 2007–2009, OOHPP MŽP	RNDr. František Konečný
637500	Identification of anthropogenic contaminants attached to sediments and washings from the lower part of the Morava drainage area (cooperative project between Slovakia and the CR), 2008–2010, OOHPP MŽP	RNDr. Pavel Müller, CSc.
637800	Monitoring of geodynamic effects in the NE part of the Beskydy Mountains, 2008–2010, OOHPP MŽP	RNDr. Oldřich Krejčí, Ph.D.
638000	Creating the technology to provide access to data for mapping projects, 2008–2009, co-contractor CGS – Geofond, OOHPP MŽP	RNDr. Dana Čápková
638100	Organic pollutants and their natural analogues in suspended matter from the Bílina River and in sediments from its drainage area, 2008–2009, OOHPP MŽP	Mgr. Eva Franců, Ph.D.
638200	Geochemistry and dynamics of leakage of carbon dioxide and methane from the rock environment in the area of the West Carpathians, 2008–2010, OOHPP MŽP	RNDr. Juraj Franců, CSc.
638300	Geochemistry of dust from urban areas, 2008–2009, OOHPP MŽP	Ing. Miloslav Ďuriš, CSc.
638500	Creation of GEOČR25 – geological GIS of geoscientific data and information acquired during base geological mapping of CR, 2008–2009, OOHPP MŽP	RNDr. Zuzana Krejčí, CSc.
638600	Geological factors affecting the environment on the southern foot of the Krkonoše Mountains, 2008–2011, OOHPP MŽP	RNDr. Jiří Konopásek, Ph.D.
638700	Geological composition and geofactors in the environment of the Beskydy Mountains, 2008–2011, OOHPP MŽP	Mgr. Roman Novotný
638800	Review of the current state of safety of old mine workings, 2008–2011, OOHPP MŽP	RNDr. Michal Poňavič
639300	Classification of forests in the CR based on the geochemical impacts caused by mining in relation to the use of forest remnants for energy purposes, 2009, Department of Landscape Protection of the MŽP	RNDr. Jakub Hruška, CSc.
639400	Assessment of the significance of the inanimate components of nature – creation of a descriptive register of important geological localities in nature reserves and natural monuments in the Bohemia-north region, 2009, Department of Specially Protected Areas MŽP	RNDr. Pavla Gürtlerová
639500	Research and evaluation of the distribution of caesium and radionuclides in south Bohemia, 2009–2011, OOHPP MŽP	RNDr. Pavel Müller, CSc.
639600	Regional documentation of hazardous geodynamic phenomena in the area of Džbán, Central Bohemia, and in the urban areas of Brno and around Zlín, 2009–2011, OOHPP MŽP	Ing. Petr Kýcl
639800	Evaluation of effects of floods on the landscape and environment. Assessment and evaluation of slope failures and connected geodynamic features generated after rain storms on 26–27 June 2009 at the foot of Rychlebské Mountains and Hrubý Jeseník, Department of Water Protection MŽP, 2009	Mgr. Daniel Nývlt

number	name	leader
Cooperating on projects for the Grant Agency of the Czech Republic		
644600	GA205/07/0691 – Geothermal resources, their limits and sustainable development: Benešov-Ústí aquifer system; in cooperation with Charles University, Prague, 2007–2009	RNDr. Jaroslav Valečka, CSc.
644700	GA105/07/1358 – Research into the long-term possibilities for the elimination of mining hazards in the Horní Benešov and Horní Město mining districts; in cooperation with VŠB – TU, Ostrava, 2007–09	RNDr. Petr Rambousek
644800	GA205/09/1876 – Recent deglaciation of the northern part of James Ross Island, Antarctica; in cooperation with MU, Brno, 2009–2012	Mgr. Daniel Nývlt, Ph.D.
644900	GA205/09/0703 – Integrated late Silurian (Ludlow-Přídolí) stratigraphy of the Prague Synform; in cooperation with the Institute of Geology AV ČR, 2009–2013	RNDr. Štěpán Manda
645000	GA205/09/0619 – The Silurian Sedgwickii Event: Carbon isotope excursion, graptolite mass extinction, sedimentary record; in cooperation with the Institute of Geology AV ČR, 2009–2011	doc. RNDr. Jiří Frýda, Dr.
645100	GA205/09/1521 – Feeding strategy from the Cambrian until the mid-Ordovician in the Teplá-Barrandien Unit; in cooperation with Přf UK, Prague – Dr. Fatka, 2009	RNDr. Petr Budil, Ph.D.
645200	GA205/09/1162 – Lacustrine and coal deposits of the Sokolov Basin, Eger Graben, as an archive of Miocene continental palaeoenvironments, palaeoclimate and tectonics; in cooperation with Přf UK, Prague – K. Martinek, 2009–2011	RNDr. Juraj Francú, CSc.
645300	GA205/09/0540 – Origin of topaz-bearing granites of the Krudum granite body; in cooperation with the ÚSMH AV ČR, 2009–2011	Mgr. Vojtěch Janoušek, Ph.D.
645400	GA206/09/1642 – Pattern of occurrence and community composition of deep subsurface microflora in Miocene clay and claystones of the Sokolov coal mining district; in cooperation with the Biological centre of AV ČR, v.v.i., 2009–2012	doc. RNDr. Bohdan Kříbek, DrSc.
Grant agency of the Academy of Sciences of the Czech Republic		
651700	A300460602 – Upper-crustal model of the Ohře Rift and its vicinity, 2006–2010	RNDr. Zuzana Skácelová
651900	IAA300130703 – Palaeoecology, palaeogeography, stratigraphy and climatic changes during the Upper Stephanian (Gzhelian) of the Central and Western Bohemian basins; in cooperation with the Institute of Geology AV ČR; UK, Prague 2007–2010	RNDr. Zbyněk Šimůnek, CSc.
652000	KJB300130701 – Zircon growth and its modification during polyphase granulite-facies metamorphism – a case study of the Moldanubian Zone of the southern Bohemian Massif; in cooperation with the Institute of Geology AV ČR, 2007–2009	Mgr. Jakub Haloda
652100	IAA300130801 – Study of the chemical evolution of contrasting types of highly fractionated granitic melts using melt inclusions; in cooperation with the Institute of Geology AV ČR, 2008–2011	RNDr. Milan Drábek, CSc.
652200	IAA30111098 – Faunal dynamics in communities at the climactic stage of the Upper-Ordovician before the global crisis caused by climatic changes: evidence from the Královodvorské Formation in the Barrandien; in cooperation with the Institute of Geology AV ČR, 2009–2011	RNDr. Petr Budil, Ph.D.
652300	KJB300130903 – Low temperature magnetic properties of sulphides present in meteoritic material; in cooperation with the Institute of Geology AV ČR, 2009–2011	Mgr. Patricie Týcová-Halodová
International grants and projects for the Ministry of Education, Youth and Sports of the Czech Republic		
664800	GOCE-CT-2003-50554: EUROLIMPACS – Integrated project for the evaluation of the impact of global changes on European freshwater ecosystems; 6 th Framework Programme of the EU, 2004–2009 (III/2009)	RNDr. Jakub Hruška, CSc.
666000	EU CO2NET EAST: CO ₂ capture and storage: extension of network to include new member states, 2006–2009	RNDr. Vít Hladík, MBA
666200	Fractionation of platinoids in different types of geological environment based on examples from selected ore deposits in the Polar Urals, 2007–2009	RNDr. Jan Pašava, CSc.
666300	Sources, transport and fractionation of platinoids in selected giant gold and copper deposits of Uzbekistan, 2007–2009	RNDr. Jan Pašava, CSc.

number	name	leader
666400	Assessing the impact of the Gothenburg protocol on acidified waters and soils in the Czech Republic – proposal for further investigations; Norwegian project, CZ0051; 2007–2011	RNDr. Jakub Hruška, CSc.
666500	Soil Crit Zone; 6 th Framework Programme, EU; 2007–2009	RNDr. Martin Novák, CSc.
666600	ME 08011: Middle Palaeozoic climatic and sea-level changes and their influence on marine community evolution: a comparison of models from the Perunica microcontinent and Laurussia continent, 2008–2012	doc. RNDr. Jiří Frýda, Dr.
666700	OneGeology-Europe; EU, 2008–2010	RNDr. Robert Tomas, Ph.D.
666800	Towards geological storage of CO ₂ in the Czech Republic; FM EHP/Norway, 2009–2010	RNDr. Vít Hladík, MBA
666900	Monitoring of trans-border air pollution by isotope fingerprinting of sources; EU, 2008–2011	RNDr. Martin Novák, CSc.
667000	African-European Georesources Observation System (AEGOS), EU, 2009–2011	RNDr. Dana Čápková
667100	LA-09022: Activities within the SGA; programme INGO, MŠMT, 2009–2012	RNDr. Jan Pašava, CSc.
667200	Activities within the American Association of Petroleum Geologists, AAPG, 2009–2010	RNDr. Vlastimila Dvořáková
667300	Educational project, Brno, 2009–2011	RNDr. Vlastimila Dvořáková
667400	LA-09046: Membership of the European Polar Board and European Polar Consortium (EPB, EPC) and fulfilling the duties of membership; programme of MŠMT, in cooperation with MU, Brno, 2009–2012	Mgr. Zdeněk Venera, Ph.D.
667500	Soil Transformations in European Catchments – Soil TrEC (FP7-ENV-2009-1, grant agreement number 244118), 2009–2014	RNDr. Martin Novák, CSc.
667600	Transfer of know-how to assist efficient usage of the results of geological research for the prediction of natural hazards under the terms of international development cooperation projects between state administrative bodies and municipalities in the recipient country, EČ 031-3V (Norwegian mechanisms), 2009–2010	Ing. Petr Kýcl

International development cooperation

681500	Regional geological research for definition and prediction of natural hazards in the central part of Mesoamerica, 2007–2009	RNDr. Petr Hradecký
681600	Research and exploration of geomorphological and hydrogeological conditions in the Piura drainage area in order to identify and minimize environmental factors limiting social and economical development of the region, Peru, 2007–2010	Mgr. Michal Rajchl, Ph.D.

Research centres

690100	Research centre – Advanced remediation technologies and processes (leader: TU Liberec), 2005–2009	doc. RNDr. Tomáš Pačes, DrSc.
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Important external requests of a research character

528001	Research into factors governing the field of distant interactions of HÚ spent nuclear fuel and highly active waste (SÚRAO), 2007–2009	doc. RNDr. Tomáš Pačes, DrSc.
548001	Geological mapping in Iran, 2006–2009	RNDr. Jiří Babůrek, Ph.D.
548013	Assessing the impact of exploitation and processing of ores on the environment and human health in selected areas of the Central Province and Copperbelt in Zambia, project ZRS, 2008–2010	doc. RNDr. Bohdan Kříbek, DrSc.

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Czech Geological Survey Annual Report 2009

Edited by Šárka Doležalová and Petr Maděra

English language editors: Chris Halls and Lucie Čápová

Graphic design: Helena Neubertová

Printing: Reprographic centre of the Czech Geological Survey

Published by the Czech Geological Survey, Prague 2009

446-414-10

ISBN 978-80-7075-753-6

ISSN 1804-4832

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ISBN 978-80-7075-753-6



ISSN 1804-4832

