Czech Geological Survey

Annual Review 2004

Geological research & mapping

Geochemistry & environmental studies

Mineral resources & mining impact

Applied geology & natural hazards

Management & delivery of geodata

Laboratory services & research

International activities & cooperation

Czech Geological Survey

since 1919

Mission

- collecting, assessment and dissemination of data on the geological composition, mineral resources and natural risks of the Czech Republic
- providing geoscience information and support to the authorities for the political, economical and environmental decision-making
- international cooperation and development aid
- education in geosciences and environmental protection

Main areas

- geological research and mapping
- environment and pollution
- mineral resources and mining impact
- prevention of natural risks
- management and delivery of geodata

Staff

317 employees (~276 load equivalent), including more than 175 research workers (December 31, 2004)

Budget

200 million CZ (~6.6 million EUR, in 2004)

Legal status

A state research institute supervised by the Ministry of Environment of the Czech Republic

Ministry of Environment of the Czech Republic

Contents

Short historic overview

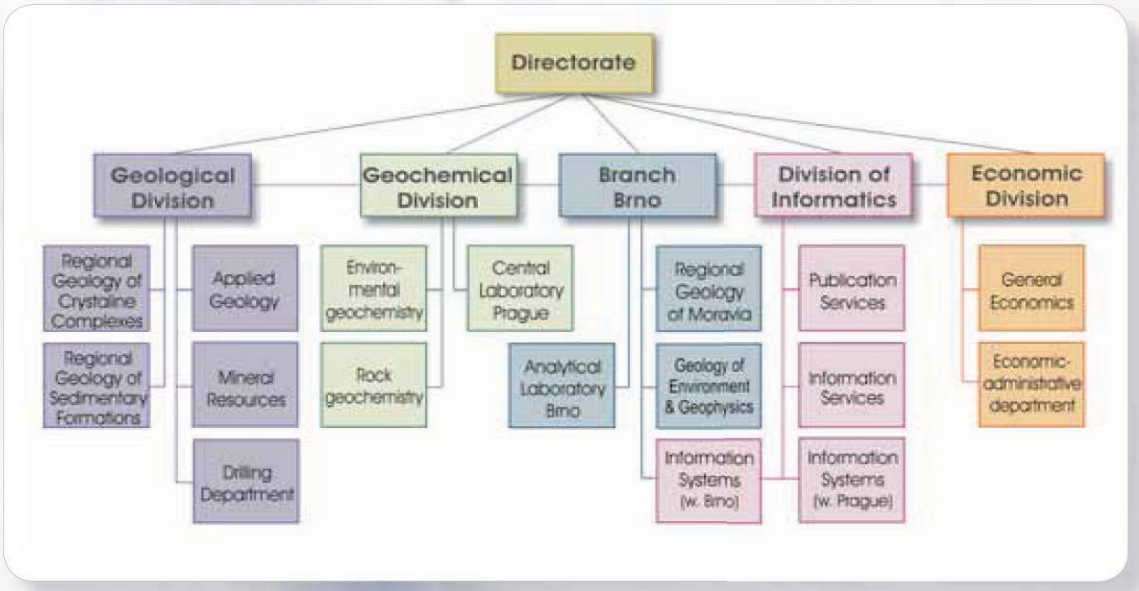
The Czech Geological Survey (CGS) was established in 1919, and became the successor of the Imperial and Royal Geological Institute of Vienna (founded in 1849). Its main tasks consisted of basic geological research and the geological mapping of Czechoslovakia. The Survey was an independent, objective state body, engaged in extensive assessment activity. This activity primarily concerned the exploitation of mineral and water sources, and the building of railways, dams, and other constructions.

At the time of Nazi occupation (1939–1945) the Survey became subject to German authorities, and its scope of activity was restricted to the so-called Protectorate of Bohemia and Moravia. After the liberation of the country in 1945, the Survey was incorporated into the Ministry of Industry, and retained its status as an independent body until 1958. Following the Soviet model, the Survey became subordinate to the administration of the Central Geological Office in 1958.

After the year 1989 the Geological Survey reclaimed its role as a state geological service. Currently, the CGS belongs to the Ministry of Environment. The statute of the institution as a state research institute is based on a Decree, updated and valid since January 1, 2001, and on the Constitution Instruments signed by the Minister of Environment of the Czech Republic on July 31, 2003.

www.geology.cz

Czech Geological Survey | Organizational Structure 2004



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- Joint Microprobe Laboratory of Masaryk University, Brno & the CGS

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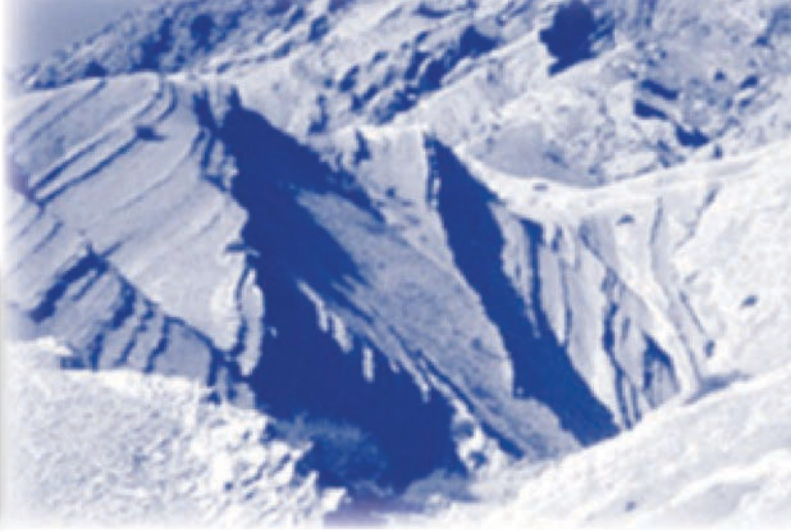


Foreword

The year of 2004 in the Czech Geological Survey had a very special personal meaning for me. As of January 1st, by decision of the Minister of the Environment, I was appointed as Director of the Czech Geological Survey. In this connection, I would like express my esteem and thanks to my predecessor, Dr. Miloš Růžička, for his dedicated work in our Survey and his leadership during the years 1997 to 2003.

Let me use this opportunity to explain briefly my vision for the Czech Geological Survey. The Survey has to have a twofold character. The first feature is world-class science, which in turn serves as a qualification for the other function: expert services to the public through interaction with the state, regional, and local administration. There is no way to continue providing high quality services to the public if they are disconnected from research in the Earth sciences.
The other part of this vision is oriented inside the Survey and concerns the general position of research and development in Czech society. Two of my goals in working for the CGS are to lead a modern research institution that will attract young scientists, not only from the Czech Republic, and to increase the income of our outstanding and hard-working researchers. As we cannot rely on any substantial growth based on the state budget, but only through our own efforts, I greatly value all projects funded from external resources, like the Czech Grant Agency, the Czech Development Assistance Program, or potentially the World Bank or EuropeAid. Thus I encourage all research initiatives, and collaboration with other national and foreign partners, which will contribute to income growth in the CGS.
This is one strategy that can elevate the generally poor economic conditions of researchers in the Czech Republic, and prevent the brain drain from the state geologic institutions to private consulting or employment abroad.

The most significant achievement in 2004 was the CGS Research Plan 2005–2010: Geosciences for the Society of the 21st Century. This plan encompasses everything from regional research to geological hazards and global changes, and was subsequently approved by the Research & Development Council of the Government. This document sets out the research objectives focused on i) Regional geology and geological mapping, ii) Applied geology, iii) Environmental geochemistry and biogeochemistry, iv) Global change, and v) Information systems, whilst the approval by R&D Council theoretically guarantees financing from the state budget for the next six years.

Another important success was our victory in the competition for establishing research centres sponsored by the Ministry of Education. Since 2004 we have been working jointly with specialists from the Technical University in Liberec and Aquatest plc. in the Advanced Remedial Technologies and Processes Research Centre, which has allocated funding until 2009. The main goal of the Centre is the development of an interdisciplinary study of natural processes combined with research into engineering systems for the thorough evaluation and remediation of the impact of industrial activities on the environment.

In the past year we have also begun preparing for a major transformation of the research institutions in the Czech Republic since the change of the political regime in 1989. This transformation, regulated by the Act on Public Research Institutions (expected to enter into force in 2006), should be launched in 2007, and will establish new economic mechanisms and principles of self-governance controlled by a supervisory board.

In 2004 I was also selected as a fellow of the H. H. Humphrey Program funded by the U.S. State Department through the Fulbright Commission. I applied for this fellowship in 2003 which happened, before I knew I would be appointed as the director of the CGS. Thanks to the capability and understanding of the Deputy Director, Petr Mixa, who served in my position for 10 months, I was able to take up this opportunity and benefit from studies at the University of California, Davis and a professional affiliation with the U.S. Geological Survey, Menlo Park, California and Reston, Virginia. I do hope to extend this benefit from my personal perspective to the scale of the whole Czech Geological Survey and its future prospects.

This brochure refers to the activities of the Czech Geological Survey in the years 1999–2004.

Zdeněk Venera
Director of the Czech Geological Survey

Geological Research & Mapping

Regional Geological Research | Geological & Thematic Mapping | Paleontologic and Biostratigraphic Studies | Geological Heritage

Regional geological research: Our detailed geological study of the Czech Republic (CR), which involves the compilation of geological and thematic maps of various scales and the collecting, assessing, and provision of data and material documentation, focuses on the following aspects:

- the deep structure of the Bohemian Massif and the Western Carpathians
- regional studies of the evolution, tectonic patterns and composition of particular geological units
- petrological, geochemical and mineralogical investigations of crystalline formations
- the genesis and paleogeography of sedimentary basins and their thermal histories
- global lithostratigraphic and biostratigraphic correlations
- crystal chemistry and isotopic research
- metallogenesis.

Geodynamic modeling of the contact between the Bohemian Massif & Western Carpathians: This project deals with the geology of the eastern margin of the Bohemian Massif and the adjacent Western Carpathians, and the potential for oil and gas accumulations in this area. The work included an update of the lithostratigraphy, a study of paleogeography and paleoenvironmental characteristics, and consideration of its structural evolution in space and time. The combined analysis of seismic and gravity data, the composition of density-balanced cross-sections along selected seismic profiles, and the examination of digital topographical models enabled the visualization of low- amplitude structural features.

Tectonosedimentary evolution of NW Bohemia: A digital elevation model of the crystalline basement and the Upper Paleozoic surface strata that underlie sedimentary and volcanic units in NW Bohemia resulted in a new view of the geological structures of this area. This model was constructed using the completely re-evaluated well log database of CGS – Geofond and other sources (approx. 23,000 well logs were processed).

The research on the crystalline complexes is connected to the geological mapping and to Czech- and EU-funded research projects, which also involve international cooperation. The research activities are focused on:

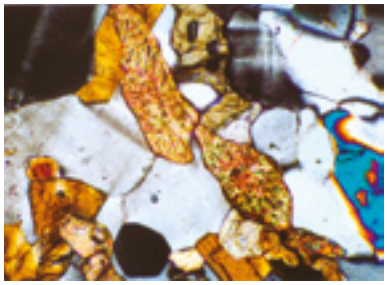
- petrology, geochemistry, structure
- metamorphism of the sedimentary and intrusive rocks, and reconstructing their evolution (applying analytical methods)
- modeling of metamorphic development using PT paths and/or geochronology
- magma genesis & emplacement
- the definition of regional geological units and main tectonic structures
- special mineralogical and crystal-chemical investigations (e.g. the thermomagnetic analysis of Fe-spinellides in young volcanics).

Geological and thematic maps:
Geological mapping has been among the main tasks of the CGS since its foundation. Following the production of a series to small scale maps (1 : 1,000,000 to 1 : 200,000) from the 1960s to the 1980s, the CGS has conducted further mapping at medium scales (i.e. 1 : 50,000 and 1 : 25,000). The geological and thematic mapping of crystalline complexes and their sedimentary cover in the Czech Republic and the digitization of these maps, has focused on:

Devonian basal quartz conglomerates in the Babí Quarry Natural Reserve, Lelekovice near Brno

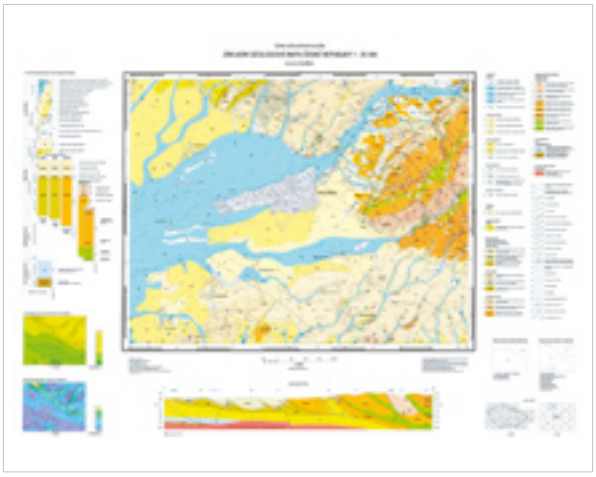
Schematic geological map of the western part of the Outer Western Carpathians

Titanite with younger titanite & plagioclase symplectite, from the Rešice skarn, Moldanubicum (transmitted light, XP)



Aulacopleura konincki, Motol Formation, Silurian, Wenlock, Testograptus testis Biozone, Loděnice

The transgression of Karpatian conglomerates over greywackes of the Culm facies of the Moravice Formation. Flooded quarry, Opatovice locality



Layout of geological map at the scale of 1 : 25,000 processed by digital cartographic methods (map sheet 25-312 Holešov)

- completing the 1 : 50,000 scale geological and thematic maps
- basic geological 1 : 25,000 mapping
- compilation of a synoptic 1 : 500,000 geological map of the Czech Republic
- participation in constructing a geological map of the Western Carpathians (published by the Slovak Geological Survey)
- collaboration on compiling a geological map of Europe and Northern Europe
- maps of protected areas in the Czech Republic
- map of the Quaternary sediments of the Czech Republic
- synoptic geophysical maps (1 : 500,000 radiometric and magnetic maps)
- constructing of geological and environmental maps for the Landscape Atlas of the Czech Republic at the scales 1 : 500,000 to 1 : 2,000,000.

Czech Republic covered by 1 : 50,000 geological maps: CGS has covered the entire Czech Republic in geological and other thematic maps at the 1 : 50,000 scale. The collection of 1,651 geological, hydrogeological and other maps (such as for mineral deposits, soils, surface water geochemistry, geochemical reactivity of rocks, environmental factors, and zoning for geological engineering) was published in the late 1990s.

Detailed geological mapping 1 : 25,000: Since 1996 the CGS has restarted geological mapping at the 1 : 25,000 scale, which had been interrupted in the interest of completing the 1 : 50,000 mapping program. The selection of mapped areas reflects the priorities of state and local authorities being related to environmental or development problems. New map sheets have been completed and the mapping continues in the areas of the Bohemian Forest, Giant Mts., NW Bohemia, Jeseníky Mts., Žďárské vrchy Mts., Vsetín area, Maleník-Poodří and elsewhere.

Regional geology of Lower Paleozoic sedimentary formations: During the past few years, Lower Paleozoic research has concentrated on detailed studies of the development of the Prague Basin's Silurian and Lower Devonian facies, systematic studies of the Bivalvia and Cephalopoda (including their paleocommunities), and the correlation of Bohemian Silurian and Lower Devonian with other North Gondwana regions. The study of the Wenlock migration of nautiloid cephalopods to the Prague Basin was completed in 2004. The protection and conservation of important geological sites in the Lower Paleozoic of Bohemia is also of high importance.

Mapping and studies of Upper Paleozoic: Geological mapping has improved our knowledge of the structure and distribution of Carboniferous and Permian sediments in the Plzeň and Kladno-Rakovník basins, and of the Krkonoše Piedmont Basin. Stratigraphic and paleontological investigations are currently being carried out in order to help correlate the Permian horizons in the northern part of the Boskovice Graben, as well as the paleobotanical evaluation of the plants from the tuffaceous horizons of the Central and Western Carboniferous. The Permian Trutnov Formation in the Intrasudetic Basin has also been studied by means of facial analysis and heavy mineral association.
Paleobotany and palynology: Cuticles of cordaites and seed-ferns were investigated as part of grant projects. The projects dealing with the investigation of spores of "in

The map published in cooperation with geological surveys of Germany and Poland

Porphyric variety of the durbachite of the Knížecí stolec type – detail of a zoned phenocryst of K-feldspar with inclusions of biotite, plagioclase, and accessory minerals (crossed polarizers)

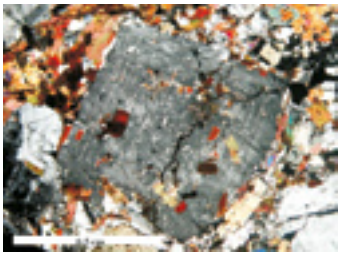
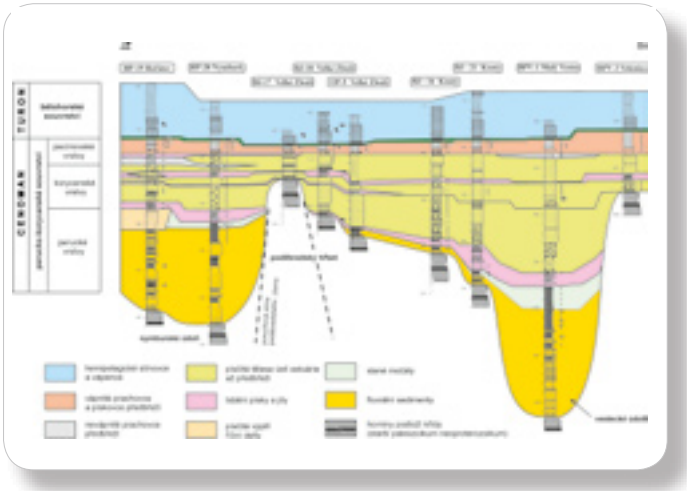


Image analysis by the "Lucia G" computer program developed at the Department of Crystalline Formations, Klárov

CGS drilling machine LUMESA 353 near Žulová



The cross section through the Poděbrady region, showing the correlation and facies relations of the Peruc-Korycany Formation, Bohemian Cretaceous Basin

situ" spore-plants entailed the conjunction of paleobotany and palynology. The Archaic group of Progymnosperm plants (*Noeggerathia*), which became extinct by the Upper Paleozoic, was carefully studied.
The revision of older materials in the archives of the CGS, such as boles, cones and fronds of the species *Noeggerathia foliosa*, enabled the reconstruction of an image of an entire plant with its cuticles and primitive stomas. Other spore-plants, such as seed-ferns and club-mosses, were also studied.

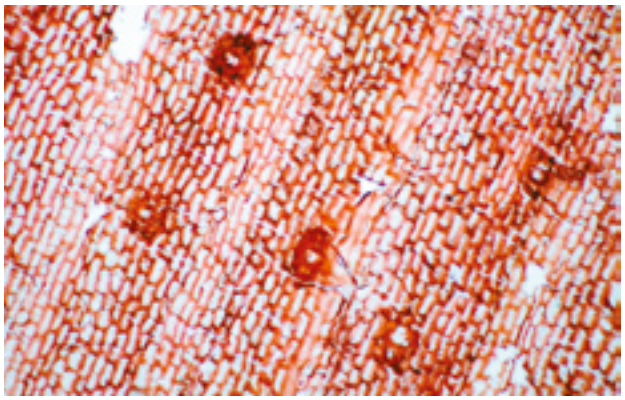
Research in the Upper Cretaceous sequences: Cretaceous sediments form the most extensive pre-Quaternary platform cover of the Bohemian Massif. The Bohemian Cretaceous Basin contains the largest sources of groundwater and some important mineral deposits, such as uranium, sand for glass making and foundries, building materials (lime, gravel, sand) and decorative stones.
Regional geology and geological mapping: One of the main objectives of our Cretaceous research is systematic regional geological investigation and mapping at different scales. Publications about the Bohemian Cretaceous Basin and the Police Basin present some of the main outcomes of these studies. Current geological mapping activity has given us an updated view of the stratigraphy and tectonic structure of the Cretaceous in Northern and Eastern Bohemia and Moravia.
Special studies: One of the important themes of our special research is the multiphase development of the Saxonian tectonics of the Bohemian Cretaceous Basin, which includes the reconstruction of movements along the Lužice fracture zone. In the years 2002–2004 the specialists of the Department of Sedimentary Formations participated in the project "Stratigraphic architecture of Cenomanian strata of the Bohemian Cretaceous Basin: relationship of depositional system and reactivation of basement fault zones" coordinated by the Geophysical Institute of the AS CR.
Biostratigraphy and paleontology: A general paleobotanical investigation of the Bohemian Cenomanian was undertaken. The past five years have also been dedicated to the study of Cretaceous bivalves, foraminifers, and calcareous nannoplankton.

Micropaleontological and biostratigraphic research:
The investigation of calcareous nannofossils was successfully applied to biostratigraphy during geological mapping and in large-scale joint projects with the International Correlation Programme, a bilateral cooperation with the Academy of Sciences of the Czech Republic. This research covered the following areas:

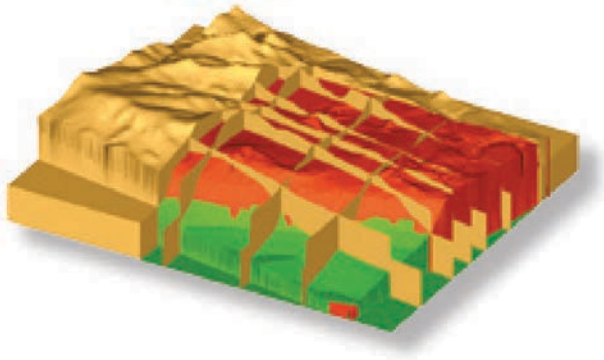
- Bohemian Cretaceous Basin: Attention was given to the *Braarudosphaera*-bloom during the Turonian, which can be explained by an increased input of terrigenous material and/or a complete sea-level standstill.
- Outer Western Carpathians: The joint occurrence of high- and low-latitude nannofossil taxa was found in the Cretaceous flysch. The degree of influence of the "boreal" province fluctuated during geological time and was affected by paleogeographic conditions. This phenomenon was used for the paleogeographic reconstructions of the N Tethys Sea.
- The Upper Cretaceous nannofossil assemblages from the Eastern Alps.
- The K/T boundary was identified in the distal flysch sediments of the Rača Unit, Magura Group of nappes.
- Carpathian Foredeep: studies were carried out especially in the Lower/Middle Miocene boundary sediments.

Gneiss fragment in the Žulová granite, Huttung quarry

Microphoto of the Carboniferous cordaitalean adaxial cuticle with stomata



The study of older material in the CGS collections enabled the reconstruction of the plant *Noeggerathia foliosa*



Elevation model of the crystalline basement (red) and the surface of the Upper Paleozoic sediments (green) with cross-sections through Tertiary volcanics (golden yellow), NE part of the Doupovské hory Mts., map sheet 11-222 Kadaň, view from SE

© Vladislav Hošek

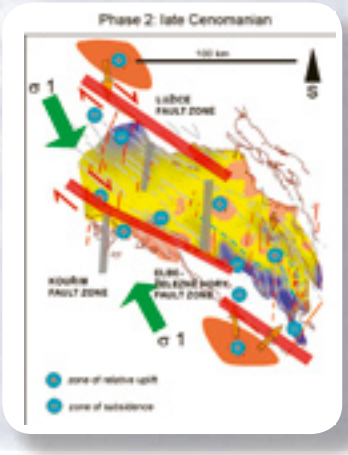
A block field at the top of the Lusen Hill (Luzný), Bohemian Forest, was formed by the action of climatic conditions in the glacial periods

Tertiary research: Besides the geological mapping and research of Tertiary volcanic and sedimentary rocks, issues concerning Tertiary fluvial relics and Carboniferous sedimentary basins were studied. This comprised the history of the sedimentary basins and relics, paleogeography with source areas, petrology of rocks, stratigraphy, paleontology and palynology, and tectonic history. Many old deep drill cores and geophysical data were used for constructing the basin relief.

Lithostratigraphy and paleogeography: The lithostratigraphic research of lower Miocene Karpathian stage in Europe, and paleogeographic studies of Miocene in the Carpathian Foredeep and Tertiary cover of the Bohemian Massif. Modern geophysical well-log methods were applied toward sedimentary analyses and studying the structure lithological architecture and development of the basins and relicts.

Quaternary research: Our Quaternary geologists have participated in the construction of more than 50 geological and thematic maps the explanatory notes of which contain significant stratigraphic, biostratigraphic, paleobotanical and malacozoological conclusions. Geological mapping in the scale 1 : 25,000 has started to cover the last large Quaternary accumulation region in the Bohemian Massif in the middle course of the Labe River, and to connect the well known areas of the eastern Polabí and the Vltava-Labe confluence near Mělník. The re-assessment of the stratigraphic classification and its correlation with the rest of Central Europe are the main scientific goals of the project.
The palynological investigation of organic sediments in the currently compiled geological maps helps with stratigraphic classification of Quaternary deposits, and with determining the past environments. Recent investigations concern the palynology of the lacustrine and oxbow sediments of the Morava (March) River. Important Quaternary outcrops, new exposures of flood deposits, and landslide areas were documented and evaluated.
The assessment of valuable objects from the Paleolithic up to the Middle Ages was accomplished with cooperation of archeologists. The investigation of Quaternary sediments in Europe, Asia, and Latin America was also carried out on an international scale. Some Quaternary localities were carefully documented and presented to the authorities for official protection measures.

Geological heritage: The Czech Geological Survey actively participates in the protection of sites and landscapes of geological interest (geotopes). The geodatabase of important geological localities in the Czech Republic, compiled by the CGS, consists of more than 2200 records of sites that are protected or have been recommended for protection, as well as other geological sites of scientific and natural interest.



Simplified kinematic interpretation of the complex system of the Labe fracture zone and Rodly-Blanice system. Constracted after isopachous contours on maps of genetic-stratigraphic units of the Middle and Upper Cenomanian

Sampling for magnetic susceptibility at the loess/paleosol section of Bistryanka, in the northern foothills of the Russian Altay Mts.

Carbonized wood and pipe in situ, dated at 440 years BP, on the bottom of an abandoned Upper Holocene meander of the Morava River, Bzenec-Přívoz

Example of paleoecologically significant assemblage with siphonodosarias and stillostomelas, Nosislav-3, 232.2 m

The sedimentary sequence of Early Pleistocene sediments in the highway cut near the town of Beroun

Geochemistry & Environmental Studies

Interactions between the Atmosphere – Biosphere – Hydrosphere – Geosphere | Monitoring of Element Budgets | Acidification of Forest Soils | Organic Pollutants | Radon Risk

Geochemical research related to environmental problems: The Czech Geological Survey leads and participates in many basic and interdisciplinary environmental research projects, including long-term monitoring and mapping. Some of the topics of this research are listed below:

- the geochemical interactions of the atmosphere, biosphere, hydrosphere, and geosphere
- the long-term monitoring of element cycling
- geochemical cycles of sulfur, nitrogen, and heavy metals
- the effects of bedrock composition on element cycling
- geochemical and biogeochemical assessment of critical loads
- long-term trends in the atmospheric deposition of sulfur, nitrogen, and basic cations
- changes in biogeochemical pathways in Central European forest soils
- acidification and eutrophication of waters and forest soils: nutritional degradation of forest soils (collecting data for new legislation)
- the geochemical aspects of forest decline: data synthesis and formulation of recommendations to forest managers
- interdisciplinary environmental sciences, such as biogeochemistry, medical geology, plant and soil ecology
- mapping and analysis of chemical records: studying the migration and accumulation of inorganic contamination and organic pollutants in terrestrial and aqueous environments
- behavior of trace elements in ecosystems and isotopes as tracers of dispersion of pollutants
- assessment of radon risk
- global change studies
- the effects of climatic changes on the mobility & transport of metals in ecosystems.

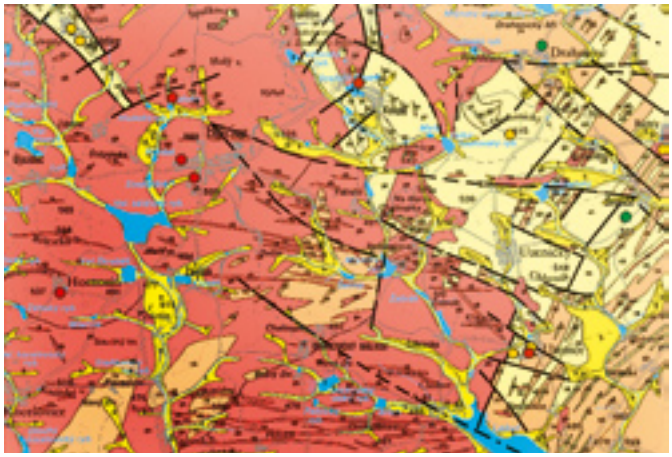
Hydrochemical and biogeochemical processes: We are studying hydrochemical and biogeochemical processes in relation to regional pollution and global change. The main methodological approach is that of monitoring water balances, element budgets, and element cycling in a national network of small forested basins. The data we obtain (fluxes of chemical compounds and critical loads) is used for modeling interactions between the bedrock, soil, hydrosphere, atmosphere, and biota. Time studies of inputs and outputs of acidifying and/or toxic compounds at the catchment level can also be used in assessing the health status of ecosystems.

Geomon: Hydrological and chemical data from the GEOMON network, which encompasses fourteen small forest catchments in the Czech Republic, has been collected. Unified field and laboratory methods have been used since 1994, but many catchments have been monitored much longer. Bulk deposition as well as throughfall deposition and runoff of ecologically important components have been measured on a monthly basis. A marked decrease in the atmospheric deposition of pollutants occurred as a result of the desulfurization program adopted in the Czech Republic between 1993 and 1998. However, the throughfall deposition of sulfur, which incorporates wet and dry portions, is still substantial, especially at higher elevations. The recent return to the use of coal heating in the residential sector may explain the increase of the sulfur deposition in some areas.

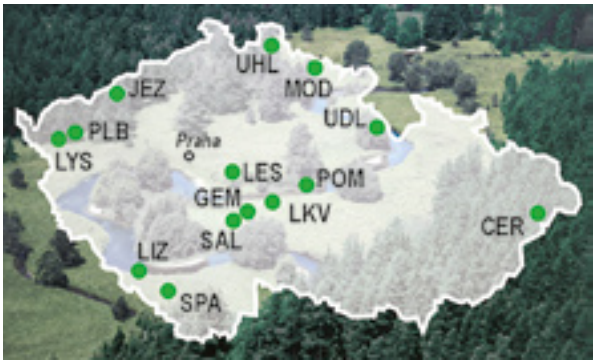
The burning of brown coal in power plants during the 1960s–1980s resulted in large-scale soil acidification and forest dieback in the Krušné hory Mts. Since the 1990s all power plants have been desulfurized, and emissions have declined by 90% compared to the 1980s

The influence of atmospheric deposition on the forest decline has been studied in the Orlické hory Mts.

Cover page of a study of the long-term acidification and nutrient degradation of forest soils, coordinated by CGS, and published in 2003 by the Ministry of Environment of the Czech Republic



Radon risk map at the scale of 1 : 50,000, sheet 22-14 B Blatná



Locations of the GEOMON network of small forest catchments, which have been monitored under unified methods since 1994

The proportion of dry deposition of sulfur measured under coniferous canopies represents 30–70% of the total deposition. Much less deposition was measured under canopies of deciduous trees. Atmospheric deposition data has shown that nitrogen compounds have become the most important source of acidification since 2000, caused by increased road traffic. The direct impact of air pollution (including ozone), an abundance of nitrogen, acidification and toxic metal mobilization are probably the primary causes of forest decline. Acute weathering changes, insect pests, or fungal infections act as secondary stressors.

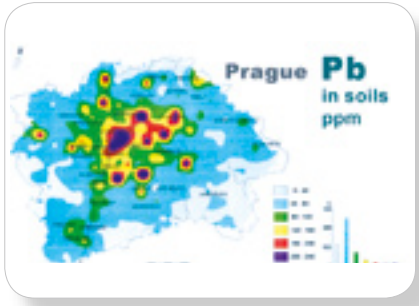
Biogeochemical studies of forest ecosystems: Stable isotopes of light elements (sulfur, nitrogen, carbon and oxygen) have been used in the biogeochemical studies of forest ecosystems, wetlands, and greenhouse gas emissions. Sulfur isotopes have shown that over 50% of the sulfate sulfur in streams draining spruce die-back affected catchments had been organically cycled. Consequently, the modeling of mere inorganic sulfate adsorption/desorption cannot give reliable predictions of the rates of an acidification reversals. All sulfur is cycled within the soil.
Lead isotope profiles in peat bogs suggest the predominance of lead derived from coal-burning in Central Europe, over lead derived from gasoline burning and ore-smelting.

MAGIC Project: The interest in using dynamic acidification models for predicting the response of soils and drainage waters in atmospheric deposition and land use leads to the application of MAGIC (Model of Acidification of Groundwater in Catchments).
This project was designed to reconstruct past and predict future drainage water and soil chemistries at two catchments in western Bohemia with contrasting vulnerability to acidification (granitic Lysina & serpentinitic Pluhův Bor).

The long-term acidification and nutrient degradation of forest soils has been identified in many areas of the Czech Republic as a major factor that can limit forestry in the near future. It is for the reason that in May 2000, the Czech Government commissioned the Ministry of Environment to develop the "Proposal of Complete and Systematic Measures for Mitigating Forest Soil Degradation due to the Effects of Air Pollution".

Radon risk research: The spatial research of ^{222}Rn (radon) in the geological bedrock of the Czech Republic is oriented toward confining the areas of enhanced radon concentration in lithological units. The 1 : 50,000 radon risk maps, accessible free of charge at www.geology.cz, help the efficient distribution of indoor radon track-etch detectors in municipalities with predicted high and medium radon index.
The research activities included testing the radon transfer model (ratio of indoor/soil gas radon) in six districts covering the area of the Central Bohemian Plutonic Complex.
The indoor relations between soil gas and radon were tested in four districts along the Czech border with Bavaria.
The results have shown the increase of radon in dwellings situated on lithological units with enhanced soil gas radon concentration. The spatial dependence of radon concentration on proximity to faults was determined by GIS methods. Further research study the radon concentration in water sampled from drill wells in the bedrock geology (in cooperation with National Radiation Protection Institute).

Lead content in soils, Geochemical Atlas of Prague



Maps of radon risk (index) of the bedrock at the scale of 1 : 50,000 (CD-ROM)

Long-term soil acidification as a result of acid rain was the reason for widespread spruce decline in high altitude forests (Giant Mts.)

The experimental polygon with removed leaf litter, investigated as part of a project sponsored by the Grant Agency of the Czech Republic. Lysina locality, Protected Landscape Area Slavkovský Forest

Sampling of subsurface waters from the Cenomanian rocks for radiometric dating, in cooperation with the University of Bern as a part of the BASELINE EU Project

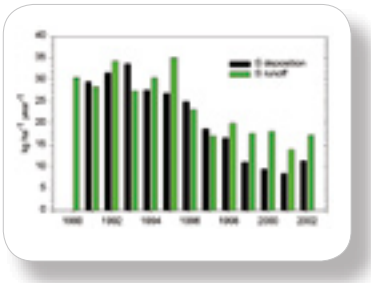
Research of ^{137}Cs marker horizons: This research is focused on monitoring the distribution of a wide range of contaminants in the region of the Jeseníky Mts. (Jeseníky–Ostrava). In addition to roughly monitored persistent organic compounds and heavy metals, the distribution of anthropogenic ^{137}Cs (half-life 30.1 years), ^{134}Cs (half-life 2.06 years) and other radionuclides (U, Th, K) in various soil types (woods, pastures, fields) is being examined. The ecological and radiological significance of the contamination is being analyzed with respect to soil utilization and potential transfer of ^{137}Cs and other monitored elements in the food chain.

Lake research: All five Czech lakes are located in spruce forested catchments in the Bohemian Forest along the border with Germany and Austria, in the largest woodland area of Central Europe. The chronology of metallic pollution, and the relative changes in the atmospheric input of pollutants into lake watersheds were studied in 0.3 to 1.3 m long sediment cores collected from the Černé, Čertovo, Plešné, and Prášilské Lakes.
The ^{210}Pb and ^{14}C dating methods provide a reliable chronology of cores extending back more than 6,500 BP (Prášilské Lake). The sediments have recorded both regional and local atmospheric pollution caused by the smelting of metals (for example since about 2,810 BP for Pb). Concentrations of Pb, Cu, Bi, and As increased during three periods of the 1st millennium AD (around 0 AD; 550 and 900 AD). The pollution produced by smelting was more pronounced in the 14th and 16th centuries AD, when concentrations of Pb exceeded the natural background by a factor of 7–8. These maxima of Pb, Bi, Sb, and As are result of pollution from metal smelting in the wider surroundings of the lakes, and are unlike any previously reported. After complex development during the Renaissance, the pollution peaked twice during the 20th century: between 1900 and 1910 and from 1956 to 1978. Only the last increase in metal concentrations in the lacustrine sediments was connected to emissions from coal combustion and mobile sources (automobiles).
A decrease in metal deposition to the lake watersheds started in the 1970s, which predates the decrease in the deposition of sulfur compounds (1986).

Risk assessment of sediments of dam reservoirs, ponds and lakes: The investigation of these sediments, coordinated by the CGS, was carried out on model objects. Samples are comprehensively characterized by a series of analyses, including grain size, silicate composition, XRD, content of humic compounds, TOC, TIC, extractable organic matter, organic contaminants, heavy metals, and the content of radiogenic elements. The fixation of selected contaminants in rocks and their leakage into the environment is studied under conditions of dynamic and static sorption and desorption, in column experiments and by sequential analysis. The results of the model solutions and the pilot risk assessment data enable the formulation of preliminary principles for treating the contaminated sediments of dam reservoirs, ponds and lakes. Methods of sampling of basin sediments from greater depths were improved. Older data on the contamination of sediments from the barrier reservoirs and fishponds (more than 600 examples) were summarized. New sampling was carried out and sediment cores from 11 barrier basins were analyzed. The results were compared with known limits for toxic organic matter and element contents. Catchments models of the erosion, transport, and deposition of sediments were compiled for Vrchlice, Vír, and Brno

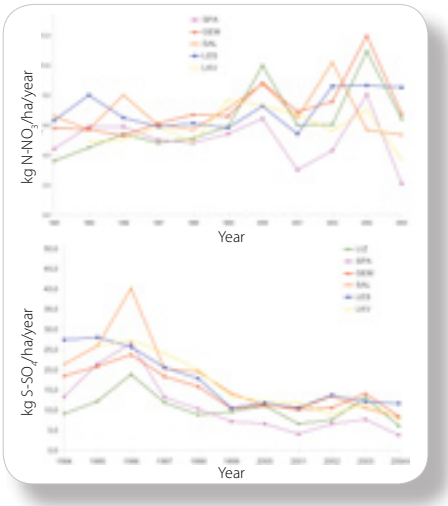
Geochemical & geochronological research reconstructed climatic oscillations during Atlantic & Sub--boreal in the upper section of Holocene freshwater travertines

Sulfur budgets (inputs vs. outputs) of the Lysina catchment (Slavkov Forest)



Lacustrine sediments from Černé Lake in the Bohemian Forest have been studied for their metal content

Gammaspectrometric measurement in the Hrubý Jeseník Mts., a part of the project of ^{137}Cs marker horizons



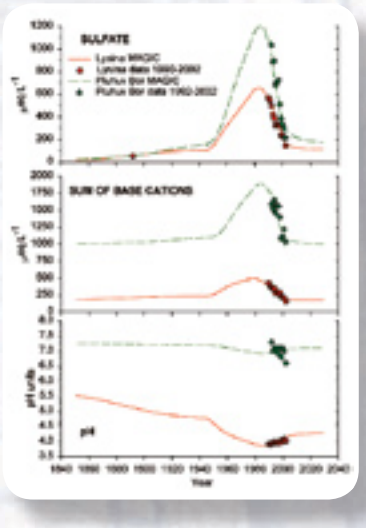
Time series of annual throughfall deposition of sulfur and nitrogen in selected catchments of the GEOMON network

Sampling of throughfall precipitation and trunk humidity in the beech wood at the Na lizu catchment in the Šumava Mts.

(for the first time in the Czech Republic). Such data are useful for estimating the rate at which reservoirs become filled with mud.
The problem of eutrofication was also solved, because the acceleration of this process affects the utilization of numerous reservoirs. The contamination of sediments in most fishponds and barrier reservoirs is relatively low.

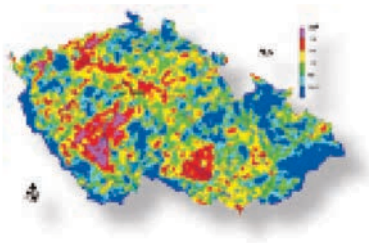
The migration of radionuclides and toxic compounds in the fractured matrix of a crystalline massif: The first version of this simulation system was designed to represent groundwater flow and the transport of dissolved chemical components in a fractured rock environment. The system of models and codes consists of a pre-processor part, proper models, and a post-processor part. The pre-processor transforms data from granitectonic measurements and hydrogeological tests into input data. These data structures are entered into the numerical models of physical and chemical processes (water flow and chemical transport). Experimental data were obtained from the deep drill holes in the granitic massif of the Krušné hory Mts. (Potůčky). The models developed for porous rock environments were applied to the flow and transport around a hypothetical radioactive waste repository. In this case, the fractures were represented by a rock environment with a double porosity of extremely small and extremely high permeability. The transport and decay of radionuclides was simulated using this model.

Paleoenvironmental studies – the karst record: Detailed studies of the geochemical record of paleoenvironmental changes in freshwater carbonates (calcareous tufa deposits and cave deposits), combined with sedimentological and biostratigraphic analysis, have significantly improved our understanding of the climate and its evolution during the Upper Pleistocene (and especially during Holocene). Most of these projects dealt with sedimentary profiles from the Bohemian Karst, and benefited from cooperation with the Geological Institute of the Czech Academy of Sciences and the Institute of Geology of Polish Academy of Sciences. The response of the karst environment to river system evolution during the Tertiary and Quaternary is the focus of an ongoing project. The behavior of the karst environment during Late Holocene flood events, including the 2002 flood, is an integral part of the study. The past two thousand years have been a period of especially intense erosion within the Holocene.

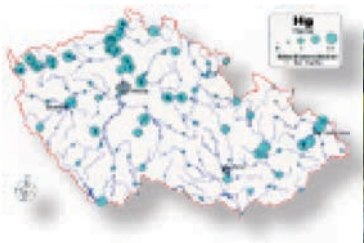


Long-term changes in streamwater chemistry, observed between 1989–2002 (dots) and modeled for 1850–2030 (lines), at the Lysina and Pluhův Bor catchments, two geologically contrasting environments

The schematic map of As content in the streams of the Czech Republic



The map of Hg content in river sediments of the Czech Republic



The fishpond Vizír – example of a decaying, reservoir that is becoming filled in without application of mitigation measures

© Photo J. Gergel

Mineral Resources & Mining Impact

Mineral Raw Materials | Identification and Assessment of Resources | Regional Raw Material Policies | Mineral Markets | Mitigation of Mining Impacts

Regional policies on raw material minerals: Fourteen analyses of regional policy on mineral raw materials, based on the requirements of the Ministry of the Industry & Trade of the Government of the Czech Republic, were completed during years 2001 to 2003. The purposes of these analyses is to help formulate and sustain activities through which the newly established local authorities manage the utilization of local mineral reserves and resources, and balance the deficits concerning aggregates. The regional mineral policies are based on an analysis of local sources and a prognosis of future demand for aggregates. These policy analyses also serve the purposes of land development documentation, which is based on the principle of sustainable development, and help to create conditions for balancing economic, social, and environmental factors.

Exploitation of mineral raw materials in protected landscape areas: The 24 protected landscape areas (PLA) of the Czech Republic comprise almost 15% of the state territory. The Environmental Protection Act (1992) strictly forbids any mineral exploitation within the first PLA zone, and does not allow mining activities in the second zone. The Ministry of Environment has aimed at analyzing and evaluating the various economic and environmental aspects that influence the exploitation of different deposits of various mineral raw materials. This project was coordinated by CGS during the years 2000–2003.

Re-evaluation of potential mineral resources in the Czech Republic: More than 3,000 potential sources of mineral raw materials (reconnaissance mineral resources – RMR) were digitalized and re-evaluated for the state authorities during the years 1997–2002. The RMRs of the Czech Republic were divided into 4 categories of varying importance. Updating the reconnaissance mineral resources database continues during the year 2005.
Feldspar-bearing deposits: An analysis carried out in the Syrovice–Iváň area (Southern Moravia) resulted in the designation of 16 new reconnaissance mineral resources of feldspar-bearing alluvial sand and gravels (totaling more than 21 mil. tons with an estimated feldspar content 6–8%). Based on these results, all feldspar resources were subjected to exploration, which resulted in six new deposits with measured feldspar resources.
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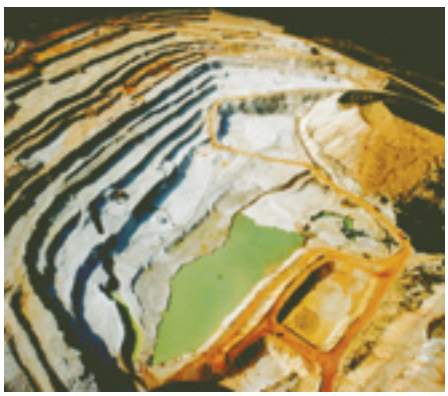
The assessment of the coal bed methane: After most of the exploratory work focused on the possibility of using gas sorption on coal beds in the Upper Silesian Basin was completed, the CGS was assigned to summarize and evaluate information acquired there from, to reconstruct the mechanisms of genesis, sorption, and desorption of CBM, and to evaluate the prospects of taking over CBM sources in this basin and in other parts of the Czech Republic.

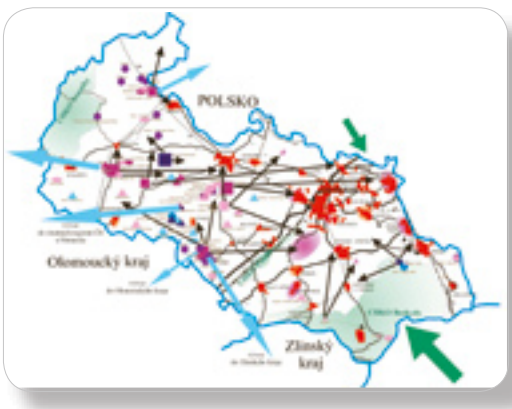
An aerial view of the Střeleč glass sands deposit in the Bohemian Cretaceous Basin



© Photo J. Gergel

An exhibition devoted to the Zlaté Hory ore district in the Jeseník Regional Museum

A scheme for using mineral raw materials for land use planning in the Morava-Silesian region



Re-evaluation of potential mineral resources in the Czech Republic

An aerial view of the Rožná uranium mine, Western Moravia

UNFC mineral reserve/resource classification: An analysis entitles "Possibilities of the Application of the UNFC Mineral Reserve/Resource Classification in Czech Mining Law" was compiled for the Ministry of Economy in 2004. The study discusses the incorporation of the existing Czech mineral reserve classification system (based on Russian classification) into a free market UNFC mineral reserve/resource classification. To fulfill this requirement, standard processes for the determination of economic viability must be adopted and assessed. Two case studies clearly show the absence of economic data during the evaluation of the deposit reserves (such as the hard coal deposit at Frenštát, and the bentonite deposit in Chomutov).

Evaluation of expected changes in the export and import of economic minerals after joining the EU: Data on the mining legislation of the European Union member countries, as well as main trends in exploitation, processing, and the international trade of economic minerals, were used for predicting changes in the exploitation, export, and import of economic minerals in the Czech Republic following its accession to the EU.

Environmental mining impacts: The Czech Republic has extensive remains from the mining and processing of mineral raw materials in the past. A significant proportion of the population lives in areas that have been highly affected by the mining and extraction of brown and black coal, uranium, and polymetallic ores. The long term project is mainly focused on assessing the entire impact of mining and mineral processing, and on collecting evidence of this impact.
The project covers methodological studies, analyses of potential risks, support for other projects (i.e. mineral policy) support for state and municipal authorities, and links and support for international cooperation.
The CGS leads and participates in projects focused on determining all possible mining and mineral processing impacts, and on collecting evidence of the impact of mining on the entire Czech Republic, particularly in areas of past and present mining activity:

- assessment of the environmental impact from the mining of coal and industrial minerals in Sokolov-Karlovy Vary area
- mining and ecological evaluation of the Zlaté Hory ore district after concluding the mining activity, and the future of its development
- a study entitled "Possible Variants for Exploiting Brown Coal Reserves in the Area of ČSA with regard to their Possible Environmental Impacts" was conducted during the year 2004.

The requirements of international cooperation and the full EU-membership of the Czech Republic in 2004 resulted in our participation in the following EU projects:

- PECOMINES (inventory, regulations, and environmental impact of toxic mining waste in pre-candidate countries; the CGS is the supervisor for the Czech Republic)
- MINEO (monitoring & assessing the environmental impact of mining in Europe using remote sensing techniques, and the study of new technologies)

Other science and research projects:

- The modeling of uranium mineralization in the Rožná deposit: The study of secondary minerals forms the basis for the prediction of the water-rock reactions during the future flooding of the mine
- Processes and Environments of rhythmic deposition in a coal-bearing foreland basin: sedimentology of the Upper part of the Petřkovice Member, Upper Silesian Basin.

The rim of a collapsed modern stope (recently proclaimed a cultural monument), at a Cu ore deposit in Zlaté Hory

A monograph on the Rožná Uranium Deposit: A Model of the Late Variscan and Post-Variscan Mineralization

Sand pit Hrušovany u Brna

The active quarry for high quality decorative Liberec granite, Ruprechtice

Applied Geology & Natural Hazards

Hydrogeological Mapping & Research | Geological Hazards | Radioactive Waste Deposition | Support of Development Planning

Hydrogeological research and mapping: The CGS Hydrogeology Group is a multidisciplinary group of hydrogeologists with a wide range of experience and skill in regional groundwater research in the Czech Republic. The main fields of expertise include:

- regional hydrogeological mapping, the compilation of different types of hydrogeological maps (e.g. basic hydrogeological and hydrochemical maps, groundwater dynamics maps, and vulnerability maps), and complementary explanatory notes or hydrogeological studies
- groundwater resources assessment and mapping
- estimation of regional groundwater dynamics and borehole hydraulics, development of new methods for pumping tests
- assessment of urban, industrial, and agricultural groundwater pollution
- estimating the aquifer properties of regional hydraulic parameters
- assessment of water quality, mineral water analysis
- research on groundwater quality and hydrochemical processes, the implementation of the EU groundwater protection policies and directives
- groundwater protection strategies (hydroecological mapping, different sorts of vulnerability maps).

Geothermal energy: Information on the thermal environment in the deep boreholes of the Naftové doly Hodonín, Corp. was assessed within the framework of the project "The possibilities of exploitation of the geothermal sources".

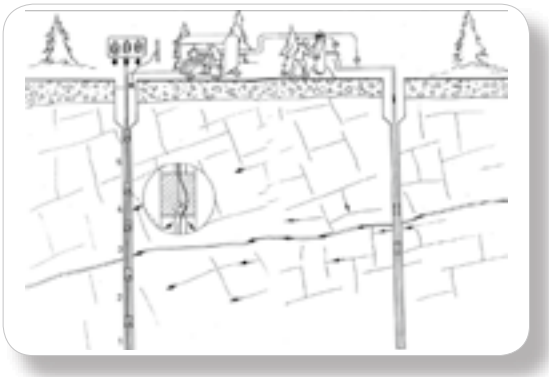
Engineering geology: The CGS engineering geologists and their associated staff play a fundamental role in the qualification of geological risks caused by exogenic dynamic processes. The problems of rock avalanches and landslides, triggered by different processes, comprise a major part of the activities of the engineering geology team. Their research activities have resulted in the recommendation of mitigation measures after the catastrophic flooding in Moravia in 1997 and Bohemia in 2002. Engineering geologists are also assessing the risks of catastrophic gravitational slope movements in the Labe River valley of the České středohoří Mts., and slope stability around the dams along the Vltava River valley.

In the Vltava River valley they estimate hazard risks to the City of Prague from possible flood waves triggered by landslides on unstable slopes. The long-time experience of the CGS engineering geologists is being successfully applied to aid projects in developing countries.

Geological hazards: The problems of rock avalanches and landslides, triggered by different processes, comprise a major part of the activities of the CGS engineering geologists. Their research resulted in the recommendation of mitigation measures after the flooding in the Czech Republic as well as in the risk assessments of volcanic and seismic hazards in Central America.

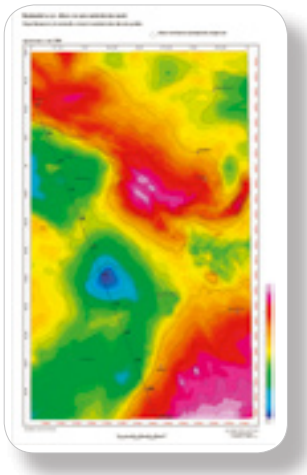
Slope deformation projects began in 1997, when the flood triggered many landslides in Moravia. The current subproject "Documentation and mapping of slope deformation in the Czech Republic" (ISPROFIN n. 215124–01) was established for years 2004–2007. This special research project strives to summarize and evaluate as much information as possible on the physiographic settings and mechanisms of landslide phenomena in the model areas

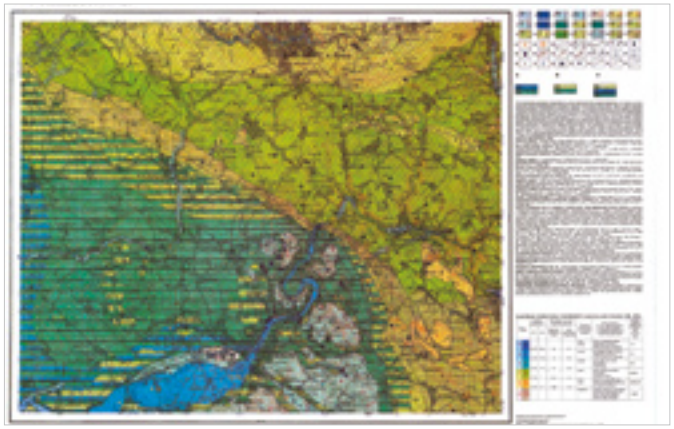
Measurement of pressure responses in two boreholes (300 and 350 m deep) during an injection test using a multipacker system in the granite massif of the Krušné hory Mts.



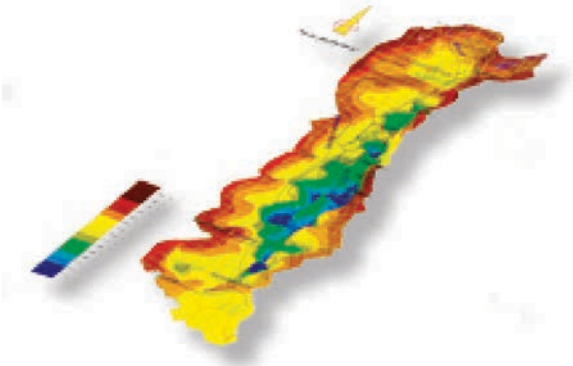
Borehole UH-61 drilled by the ND Hodonín Enterprise for studying the possible usage of geothermal resources

Bouguer gravity anomaly map of the Melechov massif area – the testing locality of the Czech Deep Geological Repository Development Program





A hydrogeological map of the Czech Republic at the scale 1 : 50,000, sheet 03-32 Jablonec nad Nisou



3D view of an impermeable bedrock surface underlying a gravel sand aquifer (Upper Moravian vale area) – model based on DC-resistivity soundings data from the national geophysical database

of Mladá Boleslav, Most, Teplice, Vsetín, and Zlín. Thousands of landslides have been documented, while special research, georadar profiles, and boreholes have been conducted. Special maps of stability conditions provide the primary basis for producing simple graphical prediction maps of landslide susceptibility (landslide hazard). The results of the program are used towards a project concerning mitigation measures, and a Geohazard Portal is being prepared for the Czech Republic.

High level waste deposition: Since 1991 the CGS has participated on the "National High Level Waste Repository Development Project" financed by the Czech Radioactive Waste Repository Authority (RAWRA). Following a series of pilot studies, which included the selection of twenty seven geological localities, the long-term research activities of the CGS have begun on a granitic massif in the Melechov test locality. The current stage of research encompasses detailed geological, geophysical, and geochemical research, including boreholes and related tests. This complex of detailed research is undertaken with the aim of the definitive test-polygon location.

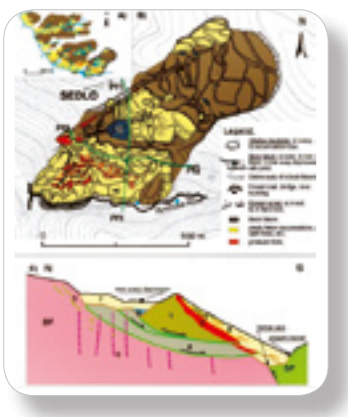
Applied geophysics: The Geophysical Section of the CGS is, together with its sister organisation CGS – Geofond, in charge of the Czech national geophysical database. This database consists of 5 data registries (seismic, gravity, airborne, petrophysical and DC-resistivity soundings) and involves geophysical data acquired in state-financed projects in the Czech Republic since the 1960s. The CGS geophysicists are also engaged in further projects in which the utilization, re-processing and interpretation of geophysical data contribute to solve geological problems.

Geological storage of CO_2: CGS has become a research pioneer in the field of geological storage of CO_2, not only within the Czech Republic but also among research institutions in the new EU member states of Central and Eastern Europe. It participates in two international projects – CASTOR and EU GeoCapacity – within the 6th EU Framework Programme for Research and Technological Development. In this field, the CGS is mainly focused on assessing the CO_2 geological storage potential of the country and on case studies for selected suitable geological structures.

A new research centre established: The Technical University of Liberec, Aquatest plc., and the Czech Geological Survey initiated the establishment of the Research Centre of "Advanced Remedial Technologies and Processes". Since the beginning of 2005, the main focus has been the study of natural processes toward creating engineering geological systems for the thorough assessment and subsequent reduction of environmental damage from industrial activity. The Czech Geological Survey is responsible for the rock environment session.

CGS participated in the compilation of the Atlas of Geothermal Resources in Europe (published by the EC, 2002)

Geological interpretation of the georadar profile at the locality Vaculov-Sedlo



Earth flow in Karolinka, Vsetín district, destroyed a large forest area (August 1997)

Data unit for data collected during the pressure test

District Geologists & Specialists

Geologists on the Spot | Expert Assessments | ISO 9001 | Support of Regional Authorities | Assessments of Remedia l Activities of Old Environmental Impacts

The Czech Geological Survey undertakes the surveying of the Czech Republic within the framework of its research and development activities, as formulated in the founder's deed and its amendments, and in accordance with Section 17 of Act No 66/2001 Coll. The system of district geologists and associated specialists assists in the acquisition of background data and in providing reliable information in accordance with the requirements of all levels of government authorities in the Czech Republic. These professional opinions serve various political, economic, and ecological decisions concerning land use planning, environmental protection, natural resource management, and other important environmental issues.

ISO 9001: Since 1999 the Czech Geological Survey has strictly enforced a System of Quality Assurance in accordance with the Standards of ČSN EN ISO 9001. This rule is being applied to the CGS's high priority tasks, which include providing expert opinions and technical reports supervised by the Administration of District Geologists, within the framework of the project CGS 3500 (Expert assessments). District geologists are specialists in environmental legislation with an emphasis on the geological environment, and in the methods of geological surveys.

Basic geological research: District geologists currently study the geological development of the territory in their charge. They participate in a basic geological research, including geological mapping and specific detailed investigations.

Geoinformation service: District geologists and associated specialists mainly provide the following types of information concerning the territory in their charge:

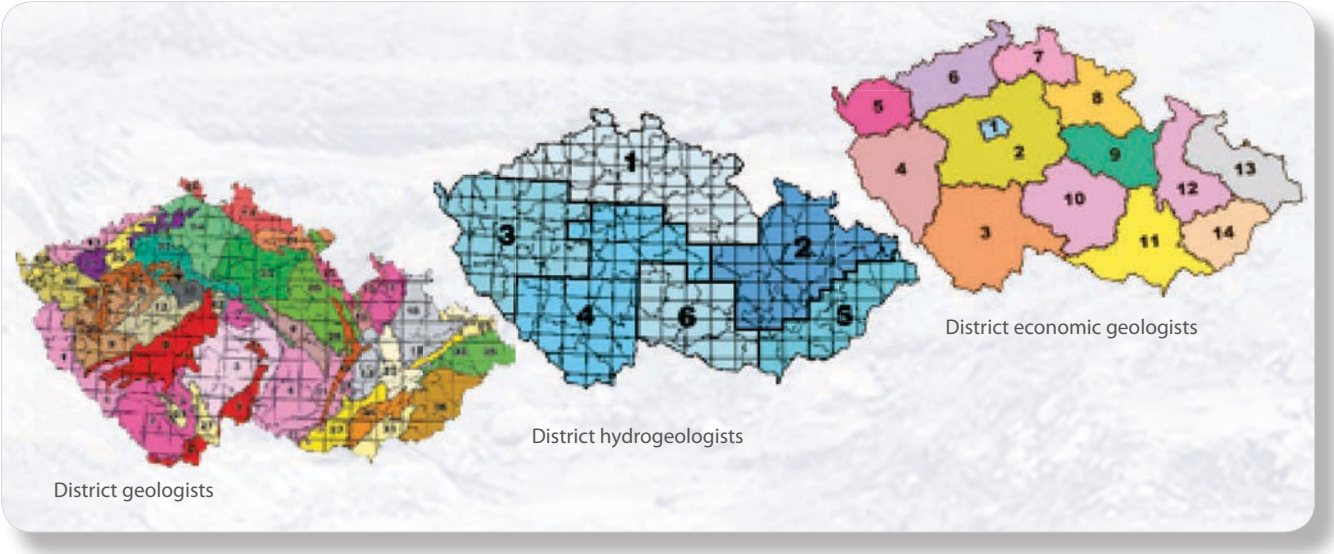
- geological mapping, and technical works, large-scale construction works and mining activities
- the occurrence of new temporary outcrops (e.g. exposed by the construction of highways, railroads, pipelines etc.)
- conditions concerning protected and important geological localities
- persistent or temporary contamination of the geological environment
- impacts on the geological environment from other spheres of the natural environment
- natural catastrophes related to the geological environment and their effects (inundations, landslides, rockslides etc.)
- geohazard factors, such as undermined and unstable areas
- protection of mineral deposits and groundwater resources.

Geologists in the districts: District geologists and associated specialists are required to cooperate officially with regional and local authorities and autonomous organs with respect to geological problems (e.g. with municipal and county authorities, the Administration of Protected Landscape Areas, regional branches of the Ministry of Regional Development, and respective sections of the Ministry of Environment).
District geologists suggest and, if need be, assure the geological activities necessary for a given sphere of activity by state authorities and autonomous organs. They offer professional consultations to these bodies.
District geologists and associated specialists express the views of the CGS concerning hazardous geofactors, conflicts of interest, land use planning documents, impact

The OSTRAMO lagoons – old ecological impact

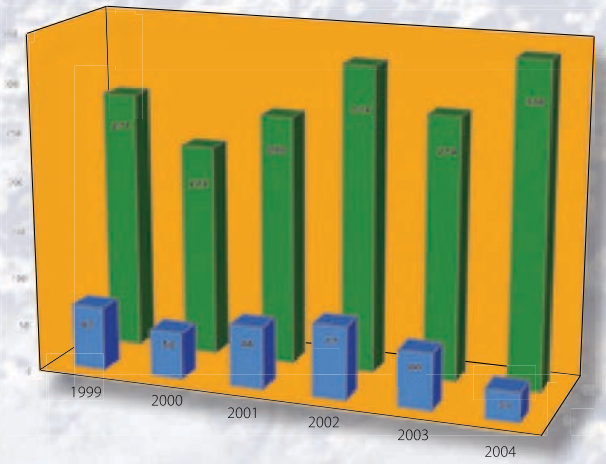
Remediation of a leakage from an oil pipeline punctured by thieves, contaminating loess and Cretaceous sediments, Polepy at Kolín

Contact of basal glauconitic Turonian sediments and Cenomanian sandstones, Praha-Kbely



of construction activities and technology on the natural environment, pursuant Act No. 100/2001 Coll. (E.I.A.), which also concerns procedures for construction planning and plans for the protection of the environment.
All of this based on the written requirements of state and autonomous authorities.

The role of CGS in the remediation of old environmental impacts: Fundamental political and social changes during the past ten years have launched the process of privatization. Thus the state, as the former owner of extensive assets, has been fully responsible for enormous ecological impacts on the geological and groundwater environment. Financial means allocated from the state budget for the remediation of such ecological burdens should be spent appropriately; and thus a thorough knowledge of the geological engineering and hydrogeological conditions of contaminated sites is essential, together with an understanding of the composition and behaviour of various pollutants in the geological and groundwater environment.
CGS specialists apply their knowledge of regional geology and geochemistry towards mastering the complicated situations posed by urbanized areas and industrial zones. Their experience in geochemical laboratory techniques allows them to produce professional technical reports concerning a broad spectrum of problems, such as risk assessments with their amendments, remediation and sanitation projects, and suggestions for proper monitoring methods. Such professional opinions can assist the Foundation of the National Property Organization of the Czech Republic with deciding on the allocation of financial means for the remediation of old ecological liabilities in the privatized assets. Complicated situations involving the remediation of old ecological impacts occur in the North Bohemian and Ostrava coal basins, and also involve the privatization of large industrial enterprises in Prague, Brno, Ústí nad Labem, and Olomouc.



The Czech Geological Survey's expert assessments:
- by the CGS district geologists & specialists
- of old ecological impacts' remedial works

Pecínov quarry

Sludge storing lagoon of the uranium ore processing plant, Dolní Rožínka

Amerika quarry

© Photo J. Rudolský

Management & Delivery of Geodata

Geological Information System | GIS | Central Data Warehouse | Metadata System | CGS Portal | Map Server | Support of Research Projects | Digital Map Production

Like most other public sector research organizations, the CGS has been responsible for acquiring, storing, and analyzing geoscience data and information since its foundation.
In response to the increasing public demand for relevant geoscience information, together with its statuary task of supporting government and local authorities in land-use planning, environmental protection, and sustainable resource development, the CGS had to develop a data management system for the effective delivery of geodata. In order to meet these requirements and to promote geoscience data to public, the CGS established the independent Division of Informatics in 2001 and started to build up a uniform geological information system. Additionally, an essential part of the Division's responsibility is the complete IT support for CGS employees involving technological training and consultation services.

Geological Information System: The CGS geoinformation system has been developed with the following long-term goals in mind:

- to unify the management and development of informatics in the CGS
- to apply unified procedures for collecting, storing, and delivering data
- the standardization of an effective information flow, based on uniform IT equipment
- the better utilization of human, technical, and financial resources
- to improve the presentation and marketing of the CGS and its activities
- to ensure its compatibility with the Uniform Environmental Information System of the Ministry of the Environment, its agency CENIA, and the EU directive INSPIRE.

The Central Data Warehouse serves as a repository for fifty-four CGS data sources with geoscientific themes.
The Central Data Warehouse (CDW) archives data gained from CGS research projects, unifies different data sources and formats, and defines and applies uniform geological lexicons. The storing of data in the CDW goes together with creation of database applications, enabling easy user access. There are two types of the database applications:

- non-graphic (using RDBMS Oracle)
- graphic (using Map Server services).

Metadata Information System (MIS): A new catalogue of CGS data sources, stored in the Central Data Warehouse, provides a complete description of individual data sources, including such information as availability, quality, and precision of geodata. The MIS is accessible via the CGS Portal as a database application and has become an efficient data discovery tool.

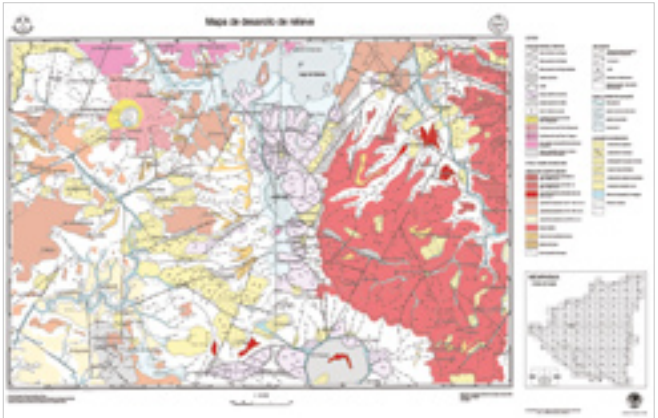
Information Portal: The www Information Portal, launched in 2001, provides access to geological data and information arising within the CGS activities. The Portal provides the following functions:

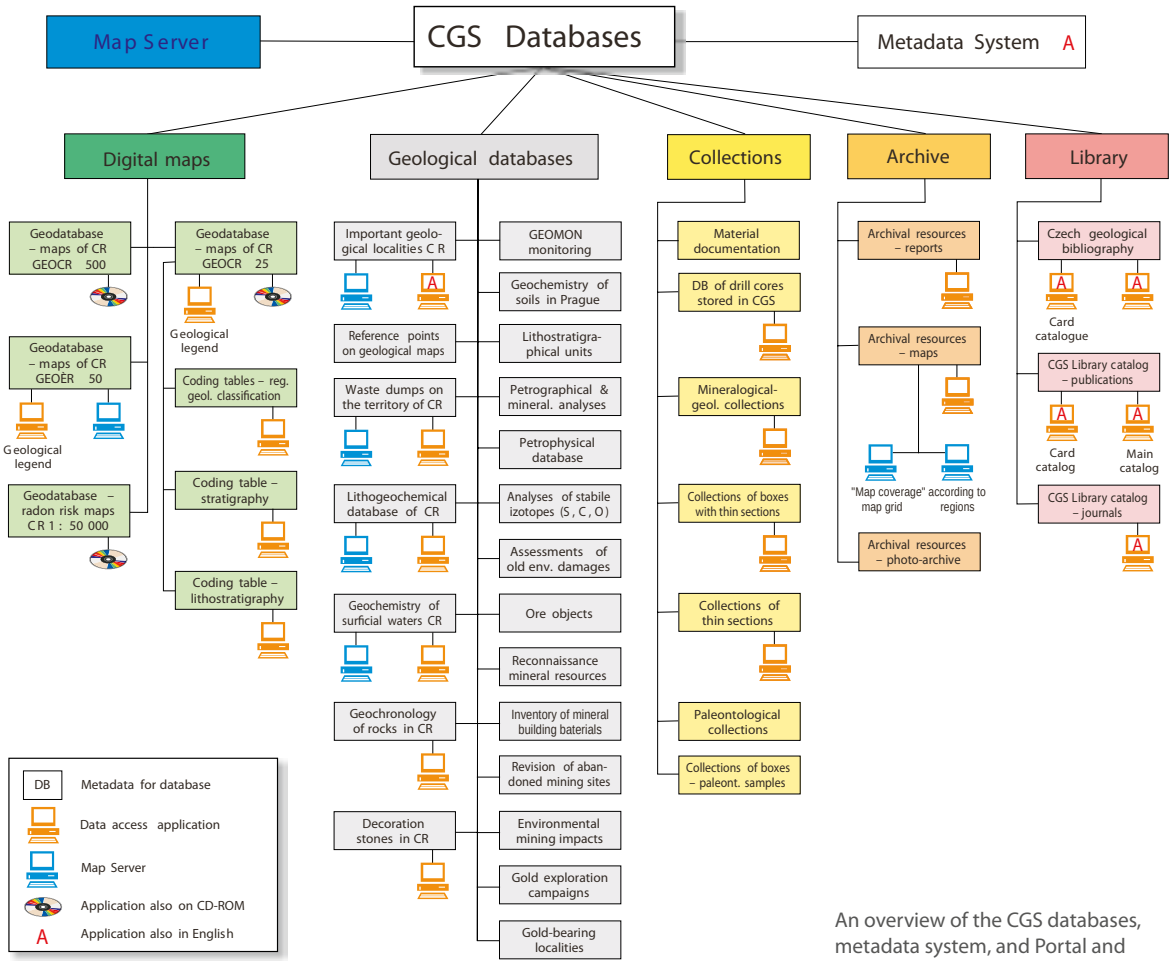
- internal (corporate) information system for authorized users
- external www presentation
- self-publishing of documents
- document management system.

The introduction of the CGS Intranet has significantly helped to increase general awareness of the scope of CGS activities

The CGS IT team received a prestigious Special Achievement in GIS Award at the 24th Annual ESRI User Conference, 2004, San Diego

The digital 1 : 50,000 map of the land relief development, Jinotega, Nicaragua





An overview of the CGS databases, metadata system, and Portal and Map Server applications for access to information stored in the Central Data Warehouse

among its employees. The Intranet provides such services (database applications) as economic agendas, a calendar of geoscience events, over 40 database applications allowing access to CGS data sources, metainformation system of all CGS projects (abstracts, final reports, etc.), library services, and E-mail service, including remote user access to mail boxes. The users get information depending on assigned user privileges.
The Portal is kept up to date by utilizing the self-publishing of documents by authorized users (content managers).

The promotion of geosciences is an integral part of our activities. Besides lecturing and producing publications and exhibitions for the general public, the Portal's World of Geology promotes the geosciences to the broader public. The CGS has also begun using standard marketing tools for spreading information about its activities, geodata, products, and services, and to build up its unified corporate image.

Geographical Information Systems (GIS): The majority of geological data is spatially oriented; the implementation of GIS technology therefore plays an important role in developing a complex geological information infrastructure for the CGS. GIS technology is applied in two major fields:

- the development and management of corporate GIS (digital geological maps and related data sources)
- the use of GIS within research projects. The use of GIS within the CGS is focused on the methods of spatial data

The CGS "IT Headquarters" in Prague (Klárov)

The entrance window to the Information Portal of the Czech Geological Survey

The Portal's Intranet supports the activities of the CGS and delivers information to its employees

The 1 : 100,000 geological map of the crystalline complexes of the Giant Mts. and Jizera Mts. produced by the methods of the digital cartography

A digitized geological sketch of the volcanoes in Ometepe Island, Nicaragua

processing, unification and dissemination. The digital processing of geological and applied maps, and the development of GIS follows standardized procedures utilizing common geological dictionaries and graphic elements.

The main objective in accordance with the latest trend in GIS is to create and implement the uniform geological data model (geodatabase), as well as to provide the public and the scientific community with easy access to geodata through the www GIS applications. Digital geological data are currently available in the CGS at three different scales:

- Full coverage of the area of the Czech Republic – 1 : 500,000 (GEOCR500), 1 : 50,000 (GEOCR50)
- Limited coverage of the area of the Czech Republic (63 map sheets) – 1 : 25,000 (GEOCR25).

GEOCR500: This geodatabase is a unique collection of 12 thematic layers (including topographical, satellite, geological, hydrogeological, metallogenic, radiometric, radon risk, etc.). This data resolution is suitable for government authorities and other specialists requiring general geological data.

GEOCR50: This unique geographical information system contains over 260,000 mapped geological objects from the entire Czech Republic. The essential part of this geodatabase is a unified national geological index (legend), that consists of four main types of information: chronostratigraphical units, regional units, lithological descriptions of rocks, and lithostratigraphical units. The revision of the geodatabase lead to a digital 'seamless' geological map of the Czech Republic.

GEOCR25: Under development since 1999, presently 63 map sheets are covered. This is a GIS project integrating extensive data sources related to geological mapping. Its core is comprised of databases of documentary points and unified geological legends.

Research project support: Modern information technologies are routinely used within the CGS to solve geological problems using such GIS methods such as 3D modeling, data querying, and spatial analyses. IT specialists are either fully responsible, or provide consultant services for, the digital processing and publishing of CGS research projects. Furthermore, the latest available technological advances allow geologists to utilize the output of advanced methods, as remote sensing, while geological mapping.

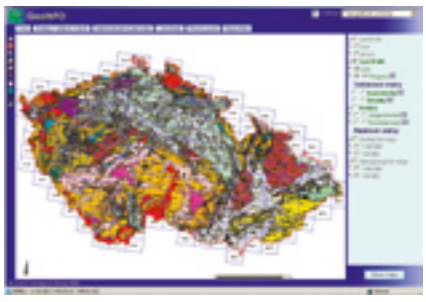
Map Server: The www Map Server, launched in 2003, is integrated into the CGS Portal and provides such services as:

- metadata catalogue of maps – map coverage applications
- www GIS – GIS applications of digital geological maps and related DB
- distributed GIS – sharing of map services.

The Map Server allows easy access to spatial data for end-users. These modern technologies are a significant contribution not only to the geodata dissemination, but also to the promotion of GIS functionality among geologists. Presently there are six www map server applications on the CGS Portal:

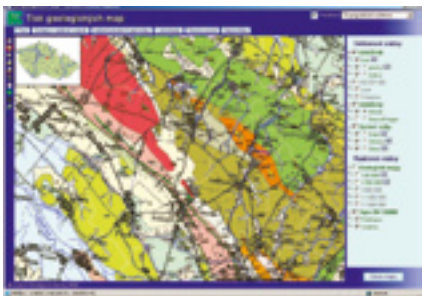
- "Map coverage I" – utilizing map grid systems to search data
- "Map coverage II" – utilizing administrative units & user defined areas (spatial querying)
- "GeoINFO" – based on the vector GEOCR50 and GEOCR500 geodatabase, allowing efficient data querying, the combining of themes (geological mapping and applied geology databases) and different data formats (raster and vector)

The CGS Map Server on-line aplication

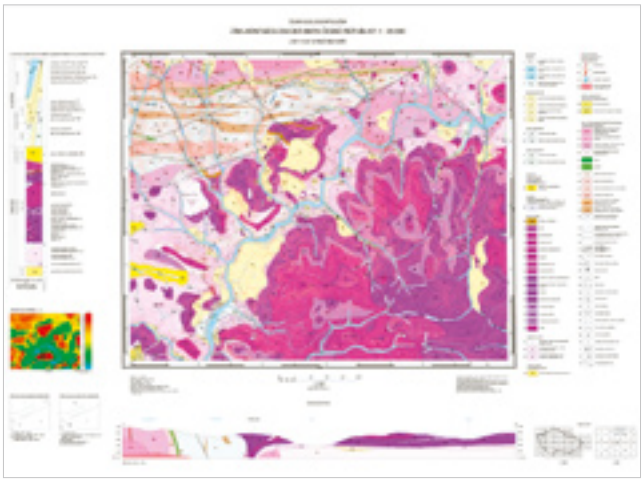


The "Map Coverage I" application of the CGS Map Server

A vector geological map in the GEOCR50 application of the Map Server



Landsat 7 ETM+ satelite image, the eastern termination of the Mongolian Altay, Mongolia



Layout of geological map at the scale of 1 : 25,000 processed by digital cartographic methods (map sheet 11-221 Stráž nad Ohří)

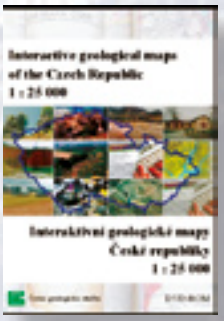
- "Geological map printing" – printing user defined areas with legends (raster and vector data)
- "Important geological localities of the Czech Republic" – the principal layer is geological localities in the Czech Republic, supplemented by the GEOCR50, GEOCR500, and thematically linked layers in the map server of the Ministry of the Environment (e.g. boundaries of protected areas, selected layers NATURA 2000)
- "Radon index maps of the Czech Republic" – this application presents these maps at a scale of 1 : 500,000 and 1 : 50,000, including the representation of the state of mapping and average radon concentration in places of extraction.

Remote sensing: The remote sensing center was established in 2003 in order to support geological activities by the expert interpretation of earth observation data. GIS and Remote Sensing have become integral components of numerous earth resource applications in the CGS for such activities as geological mapping, structural analysis, mineral exploration, geomorphology interpretation, and geohazards mapping. The specific, and often extreme, natural conditions in Mongolia, El Salvador, or Peru, such as lack of vegetation and rock exposure, even enhance the utilization of such advanced methods.

Digital map production: The map production using digital methods began in the CGS in the mid-1990s. Following the introduction of GIS methods into CGS map publishing, a Digital Map Production System was created. This system has been applied to the publishing of new editions of the 1 : 25,000 geological maps, and to others such as the 1 : 50,000 radon maps and geological maps of Nicaragua, Zambia, and El Salvador.

Technical support: High quality technical support is the backbone of a modern and fully-functional geological survey. Consequently, CGS has a separate unit of IT specialists who provide full technical support. Their daily work involves such activities as:

- gathering, maintaining, and auditing of the CGS hardware and software
- E-mail administration
- network administration and security management. In the interest of increasing system security and allowing data sharing among the service organizations administrated by the Ministry of the Environment, a massive improvement was made in the network architecture during 2002, and our organization became a member of the Local Area Network of the Ministry.



DVD-ROM with 940 geological maps at the 1 : 25,000 scale is the best digital product of the CGS

An example of print out--put from the GEOCR50

CGS on-line shop with publications and maps

A lecture on the development and management of GIS for the employees of the Geological Information Center, MRAM, Ulaanbaatar

Library, Archive & Collections

Over 80 Years of Support to Geological Community | On-line Services | Digitizing Maps in the CGS Archive | Paleontological Collections | Virtual Museum

The CGS Geological Library: The Library of the Czech Geological Survey was established in 1924 as a National Geosciences Information Service. During the past ten years the Library has been transformed into a modern Internet library providing information services to the general public and the worldwide geologic community, including free on-line access to the library databases. Published documents from the Library's collection are made available for study.
The Library has gathered and preserved a repository of all publications released by the CGS since 1919. It likewise preserves archive copies of Czech literary publications.
The archive is complemented by a backlog of publications up to 1900. It gathers publications of Czech authors, and geological literature related to the Czech Republic.
Acquisitions: International geoscientific literature in the most widely-used languages is acquired by purchase and by large-scale international exchange. Containing over 160,000 books and journals, the funds of the Library represent the largest collection of geoscience-related books in the Czech Republic.
Geological bibliography services: The deposit fund has provided data for the Geological Bibliography of the Czech Republic, which the Library has produced since 1928. On-line computer catalogues (since 1990) enable an expanded and combined search of all bibliographic data.
The CGS Library is recently working on the following programs of the Department of Information Services:

- Establishment of a common database of users from all sections of the Department of Information Services
- Adoption of common index cards
- Establishment of a common study room for the Archive and Library of the Czech Geological Survey (up to the end of 2005).

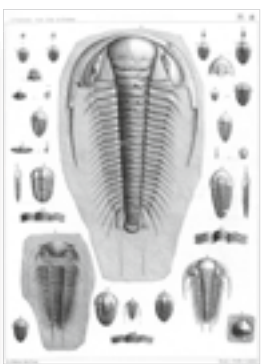
CGS Archive: The Archive preserves the results of the scientific activity, especially the mapping activities, of the Czech Geological Survey. At present, the Archive owns about 9,500 printed maps of geoscience interest from the Czech Republic, and more than 28,500 maps from 118 other countries, all of which are often accompanied by explanatory notes. The Archives also possess over 27,867 unprinted maps (manuscripts, fair copies), their manuscript supplements (legends, geological sections, stratigraphic columns), and about 15,600 unpublished reports.
Digital Map Archive Project of the Czech Geological Survey: The chief objective of this project, financed by the Ministry of the Environment of the Czech Republic and completed in 2004, was the secure, long-term preservation of valuable map documentation, and easy access to information stored in the CGS Archive for both the scientific and lay community. The undertaking of this task included four principal steps:

- Digitization of maps and accompanying documents stored in the CGS Archive and partly in the CGS – Geofond site (totaling 66,000 map sheets and accompanying documents)
- Complete revision of all documents (with the use of EAN barcodes) and logical data model structures, and the improvement of the Archive's metadata system
- Integration of digitized data into the unified Information Systems of the CGS
- Production of front-end www database applications for easy access to the Archive's on-line data sources via the CGS Portal or in the Digital Study Room where the

The study room of the Library at the CGS headquarters in Prague (Klárov)

Geological Bibliography of the Czech Republic from the years 1928–1929, and 2002–2003

An Illustrations from the Systême Silurien du Centre de la Bohême by Joachim Barrande (1852)



An exhibit focused on the geological history of the Czech Republic at the CGS Headquarters in Prague (Klárov)

Geognostic map of central and western Europe, including the British Islands, France, Germany, and neighbouring countries (1844)

documents are available and printable in high resolution formats.

One such front-end application, the Interactive DVD-ROM of 1 : 25,000 Geological Maps of the Czech Republic, has become a very successful publication. The DVD-ROM contains a unique collection of 940 printed and/or manuscript geological maps owned by the CGS Archive, supplemented by explanatory notes and/or other documents.

A second interactive DVD-ROM, produced jointly with the State Geological Survey of Dionýz Štúr, contains 498 historical geological maps of Central Europe from the years 1778–1918, including map supplements, accompanying texts, explanatory notes, illustrations, and biographies of renowned authors.

The Collections and Material Documentation Centre:

The Collections of the Czech Geological Survey store geologic materials acquired by the staff of CGS or other organizations. These funds are stored, registered, and made accessible to scientists for study. The CGS collections contain about 300,000 specimens pertaining to life and geology throughout the history of the Earth. The paleontological collections are especially beautiful. They are among the most extensive in the Czech Republic, with more than 10,000 type and original specimens of worldwide paleontological importance. Mineralogical and geological collections document the regional geology of the Czech Republic. In 2004, almost 5000 new paleontological samples were gathered and submitted into the "Central Register of Collections (CES)" of the Czech Ministry of the Culture. In addition to processing the new acquisitions, our work toward revising and submitting the older material into the CES database was intensified. Furthermore, the data on 710 paleontological and 500 mineralogical samples were revised during our periodic inventory activities. Access to the collections is possible for both domestic and foreign researchers.

The Collection Administration manages the paleontological, geological, and mineralogical collections, drillcore samples, map sheet-related samples and a large thin-section database in the repositories in Prague, Lužná, Brno, and Jeseník.

In the interest of popularization and education, the CGS **Virtual Museum** was launched in 2003 and subsequently supplemented in 2004. The on-line application enables free access to photographs of the most important paleontological, mineralogical, and geological samples, and to the collection databases at www.geology.cz. An exhibit focused on the geological history of the Czech Republic was installed in the CGS Headquarters in Prague (Klárov), and has been supplemented by temporary exhibitions focused on the international activities of the CGS.

The study room of the CGS Archive in Prague (Klárov)

Newly re-furnished repository of the CGS collections

New repository of Material Documentation, Library & Archive in Lužná at Rakovník

DVD-ROM Geological Maps of Europe (1780–1918)

The Virtual Museum launched on the CGS Portal enables the public to view the best specimens of the CGS collections on-line

Laboratory Services & Research

Inorganic Analyses of Rocks | Soils and Waters | Analyses of Gases | Crude Oil & Organic Matter | Special Methods For Geology and Environment

The CGS Central Laboratory has long standing experience in the inorganic analysis of rocks, soils, sediments, mineral raw materials and surface and rain water. The accredited laboratory at Prague-Barrandov supplies the chemical analyses of **solid samples** performed by:

- Perkin-Elmer flame AA spectrometers 3100, AAnalyst 100 and 4000 with hydride generation unit
- Iris Advantage Thermo Jarell Ash emission spectrometer with inductively coupled plasma
- Perkin-Elmer Hitachi 200 and Lambda 10 spectrophotometers
- AMA 254 mercury analyzer
- Eltra CS 500 analyzer for C and S
- Strohlein CO_2 analyzer
- Advant XP 9400 RL wave dispersed X-ray spectrometer
- automatic volumetric apparatus pX-meter (Radiometer)
- modern unit for preparing deionized water.

Water analyses are performed by:

- AMA 254 mercury analyzer, pX meter, conductometer
- Perkin-Elmer Hitachi 200 and Lambda 10 absorption photometers
- Shimadzu liquid chromatograph with UV detection
- Perkin-Elmer 3100 and AAnalyst 100 flame AA spectrometers
- Perkin-Elmer 4100AA spectrometer with electrothermic atomization
- IRIS Advantage Thermo Jarell Ash emission spectrometer with inductively coupled plasma.

The Laboratory of Organic Geochemistry at the Brno Branch Office performs chemical analyses of organic matter in rocks, crude oils, gases, and organic pollutants in sediments, soils, water, and wastes. Our analytical results are applied to organic geochemistry, environmental organic chemistry, and in monitoring environmental pollution.

Analytical methods and instrumentation:

- elemental analysis of carbon, sulphur, and chlorine (TC, TOC, TIC, DOC, AOX, EOX) by Eltra (Metalyt CS), Stroehlein (7020Cl) & ThermoEuroglas (TOC 1200)
- gas chromatographs Agilent Technologies (AT) 6890 and 5890 with FID, ECD, NPD, and TCD detectors for analysis of gases, hydrocarbons, and organic pollutants
- headspace analyzer Tekmar Dohrmann 7050HT and Purge and Trap Concentrator Tekmar for determination of volatile organic compounds
- gas chromatography / mass spectrometry AT 6890 GC / AT 5973 MSD for analysis of biomarkers in rocks and oils and organic pollutants in environmental samples
- high-performance liquid chromatography with UV/VIS and fluorescence detection AT 1100 for determination of polycyclic aromatic compounds & other pollutants
- infrared spectrometry (Perkin-Elmer 783) for qualitative analysis and determination of non-polar extractable compounds
- isolation and preparation for organic analysis by Dionex (ASE), Foss (Tecator Soxtec) and Zymark (TurboVap)
- optical analysis of organic matter in rocks.

The CGS Central Laboratory, Prague and the Laboratory of Organic Geochemistry, Brno have **Certificates of Accreditation**, issued by the Czech Accreditation Institute, as testing laboratories in accordance with standard EN ISO/IEC 17025.

IRIS Advantage Thermo Jarell Ash emission spectrometer: main and trace elements in waters, REE in solid samples

Trace elements in solid materials are measured by the wave dispersed X-ray spectrometer 9400 Advant XP (ARL)

The Perkin-Elmer AAnalyst 100 flame AA spectrometer analyses cations in waters and solid samples

Gas chromatograph with autosampler Tekmar, enables the quick determination of volatile compounds in water and solid samples

The mass spectrometer MAT 251 Finningan in the Stable Isotope Laboratory

The X-ray Microanalysis Laboratory has performed over 100,000 quantitative chemical analyses

Laboratories of the geochemistry departments

The research activities of these departments encompass a wide spectrum within the earth sciences, from mineralogy and petrochemistry, to the geochemistry of the atmosphere, hydrosphere, and terrasphere, and even interdisciplinary environmental sciences such as biogeochemistry, plant and soil ecology, and global change.

Laboratory of Mineralogy and Special Methods

- **X-ray Diffraction Facility**. This laboratory, equipped with a Philips X'pert System powder diffractometer, has participated in mineralogical, geochemical, and environmental projects. Our work has included qualitative and quantitative phase analysis, crystal structure refinement, description of new natural phases, and the study of extraterrestrial minerals.
- **Mineral Separation Facility**
- **Thin Section Facility**
- **Optical Microscope Facility**
- **Fluid Inclusion Facility**
- **X-ray Microanalysis Facility (LAREM)**. LAREM is equipped with two independent analytical systems: a LINK ISIS 300 energy-dispersion (ED) system with an ultra-thin window, and a Microspec wave-dispersive system. The laboratory has performed over 100,000 quantitative chemical analyses.
- **The Laboratory of Experimental Petrology** studies phase relationships and synthesizes mineral phases.
- **The Micropaleontological Facility** prepares microfossils for examination under the CS 3200 scanning electron microscope.
- **The Laboratory of Stable Isotopes** is equipped with two mass spectrometers, a Finnigan MAT 251 and a Geo 20-20. Routinely available analyses include: the determination of ^{13}C, and ^{18}O in carbonates; ^{2}H and ^{18}O in waters; ^{13}C in solid, liquid and gaseous organic materials; ^{15}N in organic materials and solutions; ^{18}O in sulfates; and ^{34}S in sulfides and sulfates. The laboratory has participated in several international calibration exercises (sulfur and carbon standards).
- **The Laboratory of Radiogenic Isotopes** studies the distribution of radiogenic isotopes, principally of Sr and Nd, in natural environments. The chemical separations are carried out by ion-exchange techniques in the Ultra Clean Lab. LARIZ is equipped with a Finnigan MAT 262 thermal ionization mass spectrometer (TIMS).

The CAMECA SX-100 electron microprobe, at the joint laboratory of Masaryk University, Brno & the CGS, allows the detection and quantification of elements from B to U, acquisition of SE & BSE images, and the collection of X-ray distribution maps

Inspection of the liquid chromatograph HP 1100

Gas chromatographs: AT 6890 (left), equipped with FID and ECD detectors, and AT 6890 with MSD 5973

The Laboratory of Radiogenic Isotopes is equipped with a Finnigan MAT 262 mass spectrometer

International Activities & Cooperation

Foreign Development Aid | Bilateral & Multilateral Cooperation | International Scientific Projects | Education

Foreign development aid: Within the Czech Official Development Assistance Program the Czech Geological Survey has carried out projects in Nicaragua (since 1997); Zambia, Namibia, Burkina Faso, Mongolia, El Salvador, and Peru (since 2003), and the postgraduate course GEOCHIM (since 2001). The main aims of the projects are as follows:

- geological mapping, evaluation and risk assessment of geodynamic processes (seismicity, volcanic activity, landslides, and floods) in Central and South America
- research on mineral resources, including assessing the economic potential of selected areas in Africa (Zambia, Namibia, Burkina Faso) and Asia (Mongolia)
- impact of anthropogenic activities on the environment (Zambia, Mongolia).

Bilateral cooperation: CGS participates in bi- and multilateral research projects, including the compiling and publishing of maps. CGS continues to expand its broad, long-term activities with the Geological Surveys of Poland, Slovak Republic, Austria, Germany, France, UK, USA, Chile, Nicaragua, Zambia, and newly with Iran.

International scientific projects: CGS geologists, geochemists, and other specialists have received several important scholarships for participating in research abroad. Many have also conducted research within international projects financed by foreign grant agencies. These include:

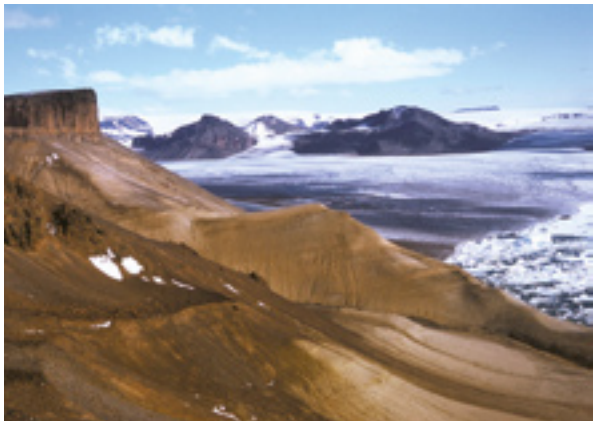
- the RECOVER 2010 grant from the EU, for assessing the current and future anthropogenic impact on sensitive European freshwater ecosystems
- the joint project on"The Dynamics of the Biogeochemistry of Beryllium" (NSF Washington & AV CR)
- the International Cooperative Program on Assessment and Monitoring of Acidification of Rivers and Lakes (ICP Waters)
- work on the Geochemical Atlas of Europe (FOREGS)
- participation in the DACH International Group (concerning Rn problems in the EU); in the RAPHAILE project proposal; and in co-founding the "Centrum Radonowe" in Poland
- the TEM experimental study of the behavior of experimentally shock-loaded dolomite (V-X/2002 NATO-CNR), and a TEM & EELS spectroscopic study of shock-loaded quartz
- NATO Linkage Grant DISRM.LG 931421, dealing with ^{135}Cs immobilization in micas
- the project for researching and describing new minerals, conducted by CGS in co-operation with the Universities of Siena, Italy, and Adelaide, Australia
- the projects "The Changing Role of Organic Acids in Surface Water Acidification" and "Prediction Episodic Acidification in the Future" at the Swedish University of Agricultural Sciences
- participation in the Swedish MISTRA project, entitled "New Concepts and Methods For Effect-based Strategies on Transboundary Air Pollution"
- the EU CANIF project, concerning carbon and nitrogen cycling in forest ecosystems
- the EU FORCAST project, concerning forest carbon and nitrogen trajectories
- studying the differences in the soil chemistry and isotopic profiles of organic carbon and nitrogen
- the EU project LIMPIT (Lead isotopes and heavy metal pollution), which is an integrated study of the threat to groundwater resources.

Extraction of gold using a primitive sluice, northern Burkina Faso, 2004

Soil sampling during the geochemical mapping campaign in the Zambian Copperbelt, 2003

The President of Nicaragua, Eng Enrique Bolaños Géyer, greeted the CGS group in Somoto at a public meeting during the state program for development of the Madriz Province, Somoto, 2004

Camp site at the place of the future Czech base on James Ross Island, Antarctica, 2005



Whisky Bay, Neogene James Ross Island Volcanic Group overlying the Upper Cretaceous marine sediments

Additionally, CGS researchers are active in the IGCP Projects:

- IGCP 408 – Rocks and minerals at great depth and on the surface
- IGCP 421 – North Gondwanan Mid-Paleozoic bioevent/ biogeography
- IGCP 449 – Global correlation of Late Cenozoic fluvial sequences
- IGCP 463 – Upper Cretaceous oceanic red beds: response to ocean/climate global change
- IGCP 469 – Late Variscan terrestrial biota and palaeoenvironments
- IGCP 479 – Sustainable use of the platinum group elements
- IGCP 486 – Au-Ag-telluride-selenide deposits
- IGCP 499 – Evolution of ecosystems and climate in the Devonian
- IGCP 502 – Global comparison of the volcanic-hosted massive sulphide districts: the controls on distribution and timing of VMS deposits
- IGCP 503 – Ordovician palaeogeography and palaeoclimate
- IGCP 518 – Fluvial sequences as evidence for landscape and climatic evolution in the Late Cenozoic.

International memberships: CGS is a member of EuroGeoSurveys, FOREGS, ENeRG, CO2NET, CGMW, and GIC. Its employees are active in many other international societies, associations, editorial boards, and WGs (IUGS /IAGS, GAGE, AEGS, ProGeo, IAGOD, SGA, EAGE, INQUA, DIMAS, KBGA, CEI, V4).

GEOCHIM: Each year, CGS organizes a certified postgraduate UNESCO course aimed at providing knowledge about the widely used geochemical methods for ore deposit prospecting and the solution of environmental problems.

The geological research in Antarctica has continued during the 2004/2005 season with the following topics:

- geological and geomorphological mapping of the northern part of the James Ross Island
- geological and geomorphological record of Cenozoic glaciation in relation to global climatic changes
- structural-metamorphic profile across the magmatic arc of the Antarctic Peninsula
- sedimentary provenance study of Jurassic–Lower Tertiary marine sediments of the James Ross Basin
- concentration, behavior and degradation of organic industrial pollutants in Antarctic ice and water.

Scientific cooperation with the Instituto Antartico Argentino and Instituto Antartico Chileno has been established.

Strongly deformed slopes of the upper Piura River catchment area above the Chanchaque, with a typical dormant landslide, Peru, 2003

Shortly after the eruption of the Masaya volcano, Nicaragua, 2001

A landslide damaged this church in the village of San Simón de Palsila near Matagalpa, Nicaragua, 2002

Field research: Salvadorian and Czech geologists on the Juan Pancha volcano, eastern El Salvador, 2003

Conferences & Education

Conferences | Workshops & Excursions

International symposia: CGS has been the organizer and co-organizer of many international symposia and workshops since 1999:

- 8th Meeting of the National Representatives of the Central European Initiative, Section A – Geology (2001)
- AAPG European Region Conference with GSA (Prague 2004)
- Acid Rain 2005 – the 7th International Conference on Acid Rain Deposition (2005)
- AIG–6 – the 6th International Symposium on Applied Isotope Geochemistry (2005)
- BIOGEOMON – Biogeochemistry of Small Catchments (2002, at Reading, UK)
- Dimension Stone 2004
- FOREGS Annual Meeting (2003)
- GEOCHIM (1999–2005)
- Geology Without Frontiers: Magmatic and Metamorphic Evolution of Central European Variscides (2003)
- GIC-18 – Annual Meeting of the Geoscience Information Consortium (2003)
- International Association of Hydrogeologists Conference "Groundwater in Fractured Rocks" (excursion, 2003)
- International Workshop on Petrogenesis of Granulites and Related Rocks (2004)
- IWAF – the 6th International Workshop on Agglutinated Foraminifera (2001)
- IX. International Conference on Moldavites, Tektites and Impact Glasses (2002)
- LERM – Light Elements in Rock-forming Minerals (2003)
- Meeting of International Union for Quaternary Research – Commission for the Study of the Holocene (2000)
- PROGEO – The European Association for the Conservation of Gelogical Heritage – Annual Meeting (2000)
- RADON – international workshops on the Geological Aspects of Radon Risk Mapping (2000, 2002, 2004)
- Uranium Deposits: From Their Genesis to Their Environmental Aspects (2002)
- World Championship in Gold Washing, Kocába River (1999).

FOREGS meeting organized by the CGS in Prague, 2003

AAPG European Region Conference with GSA in Prague, 2004

A geological excursion for the students of the Mongolian University of Science & Technology, Ulaanbaatar, in Mongolian Altay, 2004

Lectures in economic geology, petrology, and regional geology given at the Geological Department, MUST, Ulaanbaatar

Lectures

Jiří Babůrek: *Metamorphic reactions and their application in petrology,* MU
Jan Čurda: *Regional hydrogeology of Moravia,* MU
Milan Drábek: *Experimental ore petrology,* UK
Josef Adámek: *Correlation methods applied to oil geology,* MU
Juraj Franců: *Basin analysis,* MU
Juraj & Eva Franců: *Mineralogy and geology of clays,* MU
Pavel Hanžl & Kristina Buriánková: *Selected problems of granite geology,* MU
Jana Hladíková: *Stable isotope geochemistry,* MU
Vojtěch Janoušek: *Geochemistry of granitoids | Graphic presentation and numerical modeling of geochemical processes – a short course of the "R" language | Isotope geochemistry & geochronology,* UK, MU, US
Oldřich Krejčí: *Regional geology of the Flysch Belt of W Carpathians,* MU
Zuzana Krejčí: *GIS in geosciences,* MU
Zdeněk Kukal: *The ABC's of marine geology,* UK
Vladimír Lysenko: *Remote sensing,* UK
Karel Martínek: *Sedimentary petrology | GIS and Remote Sensing in Geosciences,* UK
Pavel Müller: *Organic geochemistry, KU | Petrology of organic compounds and organic geochemistry,* MU
Martin Novák: *Isotopes in the environment | Methods of isotope research of the Quarternary,* UK
Jiří Otava: *Basics of karstology & speleology | Heavy minerals, provenance and genesis of Quaternary sediments,* MU
Tomáš Pačes: *Kinetics in environmental sciences,* UK
Jaroslava Pertoldová: *Examples of landscape recultivation following the mining and processing of ores,* UK
Jan Šikula: *Interpretation of logging methods,* MU
Zdeněk Táborský: *Heavy minerals, UK | Optical microscopy,* VSCHT
Jaroslav Tyráček: *Quaternary geology,* UK
Karel Žák: *Stable isotope geochemistry,* UK

UK – Charles University Prague
MU – Masaryk University Brno
VSCHT – Institute of Chemical Technology Prague
KU – Komensky University, Bratislava, Slovakia
US – University of Salzburg

GEOCHIM underground visit of the Rožná uranium mine

The participants of the UNESCO GEOCHIM training course organized by the CGS

GEOCHIM training activities of 2002

GEOCHIM training activities of 2004

Publications

Geological Monographs | Journals | Proceedings | Geological & Thematic Maps | Posters | Postcards | CD- & DVD-ROMs | On-line Bookstore

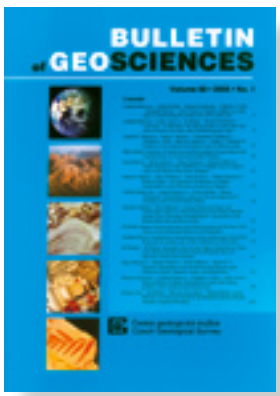
Since its establishment, the Czech Geological Survey has been publishing geological studies and maps. The CGS Publishing Department assures the editorial handling, DTP and printing of:

- geological and applied maps at both small and large scales
- explanatory texts to these maps
- individual regional/geological publications, monographs, and methodological handbooks
- a series of thematically oriented publications (CGS Special Papers, Transactions of CGS, Library of CGS)
- geoscience periodicals (Bulletin of Geosciences, Journal of Geological Sciences, Reports on Geological Research, Geological Bibliography of the Czech Republic)
- publications dealing with the protection of the geological environment
- popular publications, posters, postcards, geological hiking maps
- the proceedings of national and international conferences
- specialized maps on CD-ROM and DVD (GEOCR 500, Radon Risk, Interactive Geological Maps 1 : 25, 000).

Selected monographs published from 1998 to the beginning of 2005:

- Herčík F., Herrmann Z., Valečka J., 2003: Hydrogeology of the Bohemian Cretaceous Basin
- Krásný J. et al., 2002: Hydrogeology of the Police Basin, utilisation and protection of ground waters (in Czech)
- Krentz O., Kozdrój W., Opletal M. (eds), 2005: Geological Map Lausitz-Jizera-Karkonosze 1 : 100, 000
- Kříž J., 1999: Geological Monuments of Prague
- Kukal Z., Reichmann F., 2000: Geological Environment of the Czech Republic
- Mikuláš R., 2000: Trace fossils from the Middle Cambrian of the Barrandian area (Central Bohemia, Czech Republic)

The Bulletin of Geosciences provides free on-line access to abstracts & full papers



Geology of the Protected Landscape Areas and National Parks in the Czech Republic

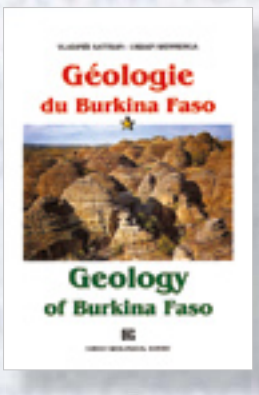
Geological thematic maps (prints and CD/DVD-ROM)

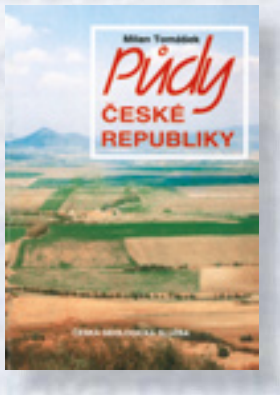
- Müller P., Novák Z. et al., 2000: Geology of the Brno City and its surroundings (in Czech)
- Pešek J. et al., 1998: Paleogeographic Atlas – Late Paleozoic and Triassic Formations
- Pešek J., Skoček V., 1999: Alluvial-lacustrine red beds in Upper Paleozoic continental basins (Bohemian Massif, Czech Republic)
- Růžičková E., Růžička M., Zeman A., Kadlec J., 2000: Quaternary Clastic Sediments of the Czech Republic
- Šalanský K., 2005: Neovolcanics of the Czech Republic and their geophysical evidence (in Czech with English abstract)
- Šalanský K., Gnojek I., 2002: Geomagnetické anomálie v České republice
- Tomášek M., 2000, 2003: The soils of the Czech Republic (in Czech)
- Žák K. et al., 2000: Holocene calcareous tufa accumulation and karstic spring in Svatý Jan pod Skalou (Bohemian Karst)
- Atlas of maps of the Czech Republic GEOČR 500 (CD-ROM)
- Geology of National Parks in the Czech Republic (Bohemian Forest, Podyjí, Bohemian Switzerland, Giant Mts.)
- Geological maps of Europe (1780–1918) – DVD-ROM
- Geology of the Protected Landscape Areas in the Czech Republic (Bohemian Karst, Moravian Karst, Blanský Forest Mts., Slavkov Forest, Jizerské hory Mts., Železné hory Mts., Křivoklátsko)
- Interactive Geological Maps of the Czech Republic 1 : 25, 000 – DVD-ROM.

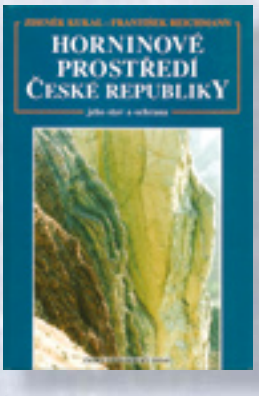
Since 2003 CGS has been publishing GEO ENeRGY, the newsletter of ENeRG.

Popular geology: The publishing of maps, folders, postcards, and other publications, in addition to the Czech Geological Survey web portal pages, promotes the geosciences and protection of nature with the general public.

A monograph compiled within the CGS Development Assistance Project in Burkina Faso







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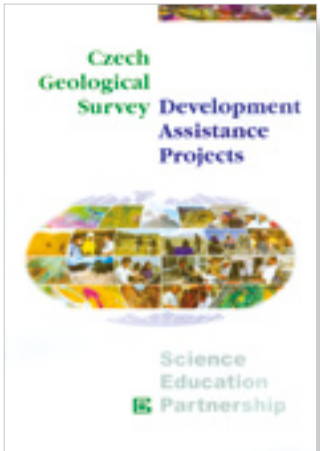

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Scientific Articles

A selection of scientific papers published in international geoscientific journals from 1999 to early 2005.

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Budget & Staff

In the past few years the Czech Geological Survey has been funded mainly by the Government Council for Research and Development. The annual budget has also been supplemented by funds for projects financed from various sources (grant agencies, the Ministry of Environment, other ministries of the Czech Republic, state & public organizations etc.) and by our own tenancy and production.

Finance (thousands of Czech Crowns)

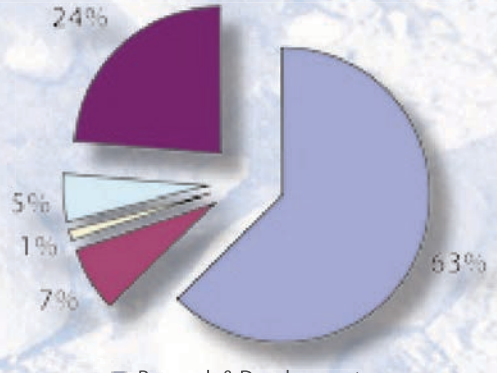
	2001	2002	2003	2004
Income				
Research & Development Core Funding	99,084	95,528	107,567	124,885
Commissioned by Ministry of Environmen	12,259	11,209	11,136	14,582
International Grants	1,222	554	261	1,879
Czech Grants	7,563	7,956	9,582	10,852
Revenue from sales and services	*34,204*	*28,775*	*34,651*	*47,667*
Total Income	**154,332**	**144,022**	**163,197**	**199,865**
Operating costs				
Energy	15,941	14,839	20,408	21,592
Services	46,276	31,256	36,642	54,868
Wages	71,001	72,187	80,974	92,927
Depreciation	12,759	12,768	11,694	14,000
Cooperation	14,130	10,147	11,974	14,200
Total Operating Costs	**160,107**	**141,197**	**161,692**	**197,587**
Surplus/Deficit	*-7,346*	*554*	*1,165*	*2,278*

Exchange rate: 1 Euro = 30 Czech Crowns (August 2005)

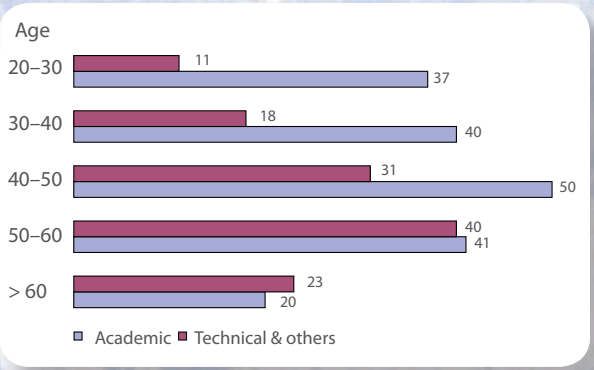
CGS Staff

The number of CGS staff has decreased from 350 in 1992 to 276 in 2004 (calculated in terms of full-time positions), and has been quite stable since. The current structure and age pyramid is shown on attached graph.

Income (2004)



Age pyramid in January 2005



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