

# **Evaluation of the Research and Professional Activity of the Institutes of the Czech Academy of Sciences (CAS) for the period 2010–2014**

## **Final Report on the Evaluation of the Institute**

**Name of the Institute:** Institute of Geology of the CAS, v. v. i.

**Fields, in which the Institute registered its teams:**

Earth and related environmental sciences

Observer representing the Academy Council of the CAS: Josef Lazar

Observer representing the Institute: Petr Štorch, substitute observer Karel Žák

**Commission No. 5: Earth and related environmental sciences**

Chair: Prof. Dr. Franz Fiedler

Date(s) of the visit of the Institute: October 29 - November 4, 2015

Programme of the visit of the Institute: see attached Minutes from the visit

Evaluated research teams:

*No. 1 - Department of Geological Processes; No. 2 - Department of Paleobiology and Paleoeecology; No. 3 - Department of Environmental Geology and Geochemistry; No. 4 - Department of Analytical Methods, Geotechnics and Paleomagnetism*

## **A. Evaluation of the Institute as a whole**

### **Summary Report on the individual departments of the Institute of Geology, CAS**

#### **1. Introduction.**

The four departments, a) Analytical Methods, Geotechnics and Paleomagnetism, b) Environmental Geology and Geochemistry, c) Geological Processes, and d) Paleobiology and Paleocology were visited by the evaluation commission on 3 November, 2015. The consensus among the evaluation team was that this institute has excellent energy, vitality and sense of purpose. Inasmuch as the Institute covers many topics within the broad field of geological sciences, we felt that the coverage by individuals is quite ambitious. Further, the focus of Institute members and its director, Pavel Bosák, is on excellence and research outputs that are competitive with peer institutes within the Czech Republic, as well as internationally. With new facilities and more international exposure, the Institute has fared well. It matured from a group of dedicated field geologists and palaeontologists (with international recognition in the 1980s) to a group with continued biostratigraphic expertise and now involvement in broader in allied fields (i.e., paleomagnetism).

#### **2. Strengths and Opportunities.**

Historically, the Institute has been deeply involved in geologic issues in both Czechoslovakia and Czech Republic. The work of the group has international recognition. Many work with international colleagues, have visitors from a broad spectrum of countries (European and elsewhere). Given the rather complex geologic history of central Europe, the group has an excellent record of working with, and publishing on tectonic, stratigraphic, biostratigraphic, paleomagnetic, and allied “baseline” topics. The Institute is very aware of global science trends and has complemented its staff with stable isotope geochemists and appropriate equipment for these scientists. There is no question that individuals within the Institute will continue its work and merit commendation from abroad.

#### **3. Weaknesses and Threats.**

There have been several retirements (or assignment to emerita/us status) in the Institute. It is unclear if there will be replacements, as well as what field(s) they will represent. This, of course, is an issue everywhere on the planet: groups within an organization lobby for more personnel in their particular field(s). The director and others are urged to continue the balance of expertise currently in the Institute. Further, the personal experience of one Commission member shows that some newer geoscientists consider some of the more “classic fields” of geology are antediluvian. Places that have followed this model have suffered for a lack of fundamental, basic research. For applied geology, it is essential to replace “fundamental” geologist retirees. It is noted that there is an under-representation of women in the Institute. We urge more gender-conscious hiring. There are other geologists in other Institutes, but the Suchdol group is the true flagship of geologic science. There are some good geologists in Prague, as well as in Brno and České Budějovice, and in the evaluation commission is unanimous in urging better communication between institutes across the country.

#### 4. **Recommendations.**

As mentioned above, we urge a) more gender equality among the research scientists, b) maintenance of a balance of expertise within the Institute, c) and more interaction with institutes in Prague and elsewhere in Czech Republic. Further, we suggest that the director look at and consider as a model the excellent promotional flyer-brochure published by the Biology Centre in České Budějovice. It impressed everyone and will certainly enhance the reputation and recognition of the science performed there. Further, it underscores basic and fundamental research being conducted there, as well as the positive impacts the work has on improving the environment and quality of life for Czech citizens. This publication is on a par with any country's scientific institute's promotional material.

#### 5. **Detailed evaluations.**

a) Quality of results: The outputs by journals ranking are good to very good. We recommend submission of research results in high-profile international journals.

b) Involvement of students: There is a reasonably effective outreach and involvement with students.

c) Societal relevance: It is suggested that the Institute promotes its work through a well-designed brochure (see above).

d) International and national context: The Institute of Geology has a long history of involvement with international scientists, and this momentum continues.

e) Vitality and sustainability: At present the vitality of the Department appears to be high. The core research topics remain important in future. Although the present age structure is not critical, attention must be paid to attract young and women scientists for longer term sustainability.

f) Plans for the future: The Institute's energetic director and its researchers are very cognizant of future geologic trends and developments. The Institute will remain competitive.

#### 6. **Director and Board.**

Director Bosák (as discussed above) has tremendous energy, sense of direction for the Institute, as well as a sensitivity for maintaining an *esprit de corps*. Further, as with some other institutes, his leadership has assured good quality results and maintenance of the institute's recognition by the Academy and national government. The Board, like that at some other institutes, was largely composed of Institute personnel. Because of this, the commission questioned whether the Board did much more than advocate for their own niches in the Institute. We recommend more outside members, possibly with some representation from the private sector.

## **B. Evaluation of the individual teams**

### **Evaluation of the Team No. 1: Department of Geological Processes**

#### **Report on the Research Team of Department of Geological Processes, Institute of Geology of the CAS**

1. **Introduction:** Scientific activities of this team includes seven topics (identified as research areas). The first three topics relate to petrology and geochemistry of igneous rocks and dating of mantle and crustal basement rocks. Two topics cover a wide range of activities, as do like Geoarchaeology, Quaternary Processes, Paleoclimatology, Sedimentology and Stratigraphy. the last two topics which include transport and deposition of dust and Neotectonics and Sandstone Landscapes. There are several outputs that were obtained by cooperation with other institutes or they are as byproduct of the above mentioned activities.
2. **Strengths and Opportunities.** The team is well equipped (with ICP-MS, Mineral Separator, Gamma ray spectrometer, Zeiss fission-track imager scope, and a clean lab) and has several motivated members (e.g., Breiter, Ackerman) who will carry out successful research in petrology and geochemistry. The main focus of team is to understand magmatic and metamorphic processes in the upper mantle and crust. In the next year, the team is expecting to hire two more young scientists, who will be returning from abroad after several years of experience in geochronology and applied science. There are also well experienced members in this team, who are working on the rest research topics. There has been excellent cooperation with several overseas colleagues and universities (e.g., Argentina, Japan, Poland, USA).
3. **Weaknesses and Threats.** The team is dealing with wide range of activities that are different in research methods and scope. In addition some activities of the team members overlap with the research performed by other teams of this institute as well as by some departments in other institutes of CAS. This makes difficult to define the main goal or vision of the team as whole for the future research.
4. **Recommendations.** The team has achieved very good results in investigation of igneous petrology, geochemistry and geochronology of both mantle and crustal rocks. This, together with their excellent facilities, makes the team stronger and unique in the Czech Republic. The international cooperation along with hiring new and experienced co-workers will strengthen research activities of this team.
5. **Detailed evaluations.**
  - a) Publication record of the team is very good. Seventeen papers were submitted for the evaluation; one was judged to be in category 1 and eleven in category 2. The quality of the science is phenomenally good. The research on granitic rocks as well as isotope geochemistry along with Re-Os geochronology is very promising.

- b) Several of the team members lead Master's degree and PhD students. Further, they deliver lectures at Charles University that facilitate them to select the best students, some of whom then join the team.
- c) The topics on alkaline and carbonate-rich melt metasomatism and trace element composition of quartz are among the best outputs of the research team that were published in highly-ranked petrological journals. There are several high quality outputs on sedimentology that were published in international journals. However, as stated above this research has an overlap with other teams in the CAS.
- d) International cooperation of the team is outstanding and this can be seen from the publication list of the team members. It is appreciated that the team is open to attract young and well educated researcher from abroad.
- e) Age structure of the team is very good with many young members under 35, which guarantee sustainable research for long period. The team has success to obtain significant amount of non-institutional fund.
- f) The strategy and future research plan is to develop Lu-Hf isotopic system, building and establishment of methods of U-Pb dating and to set up a very precise ID-TIMS dating technique. The team will continue to bring prestige to the Czech Republic. The research team as whole wish to continue also in all other research topics (sedimentology, tectonic, environment protection, geoarcheology), which does not make straightforward the main focus of the team.

## **Evaluation of the Team No. 2: Department of Paleobiology and Paleoecology**

### **Report on the Research Team of the Department of Paleobiology and Paleoecology, Geology Institute of the CAS**

1. **Introduction.** In this evaluation, we shall use paleontology as an inclusive term for both paleobiology and paleoecology. The former includes taxonomic, biostratigraphic and phylogenetic (*sensu lato*) work, while paleoecology incorporates organismic and various sedimentological and geochemical data in paleo-environmental interpretations. Considered to be the department within the Geology Institute with the longest tradition of paleontologic service for the country and adjacent regions, the department has evolved to follow current international trends in paleontologic science. This stemmed from the exquisite recoveries of invertebrate fossils in the general Bohemian and Moravian areas. The department had specialists in various fossil groups as specimens and materials were recovered in the process of establishing the famous Barrandian and Bohemian Devonian and Silurian type sections to which sedimentary geologists elsewhere on the globe would necessarily correlate their age equivalent rocks. Following modern trends in the general science of paleontology, the department has continued its taxonomic (including assemblages and phylogeny) work but has expanded its research into interpretation of marine paleo-environments (from shoreline to abyssal settings) and non-marine systems as well. Current team members are accomplishing very significant goals, including (but not limited to) recovering fructifications AND their pollen and spores together, and conodonts (fundamental biostratigraphic microfossils) from the type Devonian rocks. Given that paleontology covers all of geologic time, the department has done an admirable job of representing four fascinating research areas: Paleozoic stratigraphy and marine paleoenvironments, Carboniferous plants, vertebrate paleontology and Cretaceous systems. This includes body fossils and their assemblages, trace fossils, and microfossils. Further, the graptolite extinction is important and being addressed within the group. Mass extinctions in geological history are actually strongly debated (e.g., hypothesis of extensive volcanism, see end Permian and end Triassic mass extinctions), also with respect to threatening ongoing or forthcoming mass extinction, and refinement of Cretaceous stratigraphy and environmental change, in particular in the extra-alpine European Cretaceous basin. In (central) Europe intensive research has developed in the past one to two decades into the upper Cretaceous-Lower Tertiary “basin inversion” starting during the Upper Santonian to Lower Campanian (e.g., von Eynatten et al. 2008).
2. **Strengths and opportunities.** Main strength is the synergistic approach to sedimentary rock problems and interpretations of the team. While each member works independently with international collaborators, the product of the team is to be commended. The overall geographic coverage and areas of expertise shown by colleagues from Europe, North America, South America, Asia and Australia are

testament to the team members' reputations and desire to expand their skill sets. There is no question that present and new team members will continue their international collaborations. This follows the excellent reputation the department has had for many decades.

3. **Weaknesses and threats.** Given the evolution within paleontological research and applications, a temptation to modernize and abandon more traditional paleontologic principles could arise. That is, there remains a need for paleontology to be applied to biostratigraphic resolution, especially as global sea level histories are established through sequence stratigraphy. The Bohemian type sections are ripe for this work. The team cannot be everything for everyone, and decisions for upcoming replacements of retirees will need careful evaluation. Further more diversity in the team would better reflect demographics (i.e. more women should be considered; one woman, M. Svobodová is near retirement).

4. **Recommendations.** Some earth scientists think that paleontological science is anachronistic. To the contrary, as stated above, biostratigraphy is *exceedingly* important in not only refining the relative geologic time scale, but it is one of the two fundamental inputs to sequence stratigraphic analysis. Therefore, the Institute should maintain the strengths of the team and replace retirements forthwith. It should be noted that there is no redundancy of expertise and research topics by the group in the country.

5. **Detailed evaluations.**

a) Publications by the team are impressive, in content, quality, impact factor and numbers of citations. Inasmuch as taxonomic work rarely finds a high profile journal outlet, the team has nevertheless produced some collaborative papers that found their way to international journals. There are research articles in Geological Society of America Bulletin (USA), Geological Magazine and Palaeontology (UK), and others of reputable impact. It should be noted that, of the entire Geology Institute, paleontologic publications lead the pack.

b) The team has advised students, but the output is not impressive. This may reflect a lack of recruitment, although interactions within national (Charles and Masaryk) universities are quite good. More outstanding are visits and collaborations with foreign universities on several continents. However, this may not necessarily have involved undergraduate or graduate students at these institutions. Finally, the interaction with the world-famous Drumheller vertebrate paleontology group (Canada), probably the most famous site in the New World, is very impressive.

c) Paleontology remains one of the disciplines within the geological sciences that attracts and impacts public perceptions. The vertebrate team has the potential to expand its presentations to the public through exhibits, seminars and public presentations.

d) The most significant accomplishment of the team has been its work in international venues. As with all science, geology and paleontology required interaction with global colleagues and experts.

e) The age structure of the group is quite uniform across all age brackets. The number of women in the team is low, and this must be improved. The Commission members hope that the Academy of Sciences will approve requests for new hires as retirements occur.

f) Plans for the future are realistic. More student involvement is encouraged.



## **Evaluation of the Team No. 3: Department of Environmental Geology and Geochemistry**

### **Report on Department of Environmental Geology and Geochemistry, Institute of Geology**

1. **Introduction.** The department covers relatively wide areas of geosciences, although the FTE slightly decreased 2010-2014. Research areas are within the CR but also in other countries and continents based on a wide network of collaborations. Besides a considerable number of articles in journals with and without IF the department has been extremely active in publishing professional books and chapters in professional books as well as in popularization of science. Highlights of research areas include sandstone weathering and landforms, Karst research, environmental geochemistry, fluxes in the environment, and radioactive waste disposal (applied science in cooperation with private companies). Furthermore, development and innovation of analytical methods is worth mentioning.
2. **Strengths and Opportunities.** The first results on cryogenic cave carbonates, magnetism of cave sediments, on salt karst, and on sandstone landscapes admirably demonstrate the capability of the Department to execute research at the leading edge. Potentially toxic elements, fluxes (including dust), and geological work for nuclear safety and safe nuclear waste disposal are of outstanding importance for understanding and managing our environment but require ongoing intense research in future. The knowledge of past and present-day environments is the key to mitigate future environmental threats. Research abroad not only widens the horizon but also increases international visibility. The Department conducts collaboration not only with other departments of the Geology Institute but also with other institutes of the CAS, universities in the CR and abroad, and research institutes abroad. Efforts into popularisation of science are exceptional.
3. **Weaknesses and Threats.** The age structure is somewhat mixed. Young scientists are underrepresented, as well as more experienced scientists between 45 and 55 years old which may cause problems to replace experienced scientists in the next decade. As the team with actually 8.15 FTE (2014) is not just weak but also not strong dispersion of resources may be threatening. Teaching activities at universities and mentoring of students have declined during the evaluation period, apparently due to retirement of team members.
4. **Recommendations.** Despite an impressive list of popularization activities, the department needs to target its efforts towards recruitment of students, in particular PhD students, in order to improve its age structure. The good analytical facilities and exciting research topics are helpful preconditions. The team should take care to focus on its core expertise which is already internationally recognized. Although the department already cultivates collaboration within the Institute of Geology and with other institutes synergies may be improved (e.g., radioactive waste, climate and weather extremes); it may be also considered to move some activities to other

institutes (e.g., Geomycology to Microbiology; Pedology to Soil Service) and inversely strengthen the own department by incorporating suited teams from other institutes. Research abroad should be continued to expand international collaboration.

**5. Detailed evaluations.**

a) Quality of results: According to the results of Phase I the quality profile is satisfactory to good, the outputs by journals ranking, however, are good to very good. The outstanding publication is, of course, the contribution in Nature Geosciences. Several other papers, e.g., on cryogenic cave carbonates, will yield a great impact on the international paleoenvironment community.

b) Involvement of students: After a decline of defended theses (see above) increased efforts to attract students are advisable.

c) Societal relevance: The outputs of the Department are of immense societal relevance, not only with respect to urgent environmental problems but also to education, culture and landscape protection.

d) International and national context: In the national context the visibility of the Department is very high because of its great efforts in popularization (e.g., many professional books etc.) and the societal relevance of research topics. In the international context the visibility has clearly improved but may be enhanced by more targeted international publication strategies and collaboration in large international projects.

e) Vitality and sustainability: At present the vitality of the Department appears to be high. The core research topics remain important in future and the new instrumentation of the Department allows for high quality research in the next years. Although the present age structure is not critical attention must be paid to attract young scientists for longer term sustainability (as is already addressed in the Research Plan).

f) Plans for the future: The Research Plan highlights both, basic and applied research. If synergies will be utilized fully and the vitality can be maintained the objectives of the Research Plan can be achieved.

## **Evaluation of the Team No. 4: Department of Analytical Methods, Geotechnics and Paleomagnetism**

### **Report on the Research Team of Department of Analytical Methods, Geotechnics and Paleomagnetism, Institute of Geology of the CAS**

1. **Introduction:** The scientific activities of this team include 14 “research areas” that can be classified into 3 broad groups. The first group covers research on palaeomagnetism in sedimentary rocks, or magnetostratigraphy, and the magnetic properties of minerals. The second groups on mineralogy relates to crystal chemistry, deformation in quartz, radiation effects on minerals, the crystallography of synthetic phases and the chemistry of tactites. The magmatic history of an intrusive complex is also included in this group’s studies. The third group is dealing with the elastic and mechanical properties of rocks.
2. **Strengths and Opportunities.** The team with three well experienced leaders (Pruner, Skála, and Lokajiček) is well equipped (with magnetometers, scanning electron microscope and electron probe microanalyser) which guarantees that successful research in the three above mentioned research directions can be carried out. The main focus of the team members is on the paleomagnetism of interesting volcanic rocks, sediments, and meteorites, and the crystal chemistry of minerals. The group investigating elastic and mechanical rock properties has wider international cooperation with colleagues active in this research area; the capabilities of the triaxial cell equipment complements those of similar new equipment at the Institute of Geonics.
3. **Weaknesses and Threats.** As the team activities cover different research topics, there is little cooperation between the team members or different groups. In addition, some activities of the team members overlap with research performed by other teams of this institute as well as by some other institutes of CAS. This makes it difficult to define the main goal or vision of the team as a whole for the future.
4. **Recommendations.** The team has achieved very good results in the investigation of paleomagnetism, and in the assessment of elastic properties and velocity anisotropy in rocks. The research topic of the mineralogy group is specific for the investigation of crystal chemistry, but some research activities of this group are close to those performed by the Department of Geological Processes in the same institute. Research on the elastic and mechanical properties and the assessment of rocks fits rather better in the Institute of Rock Structure and Mechanics or the Institute of Geonics of the CAS. More national and international cooperation involving all three groups will be helpful.
5. **Detailed evaluations.**
  - a) The publication record of the team is very good. In total 89 papers were published in international journals. Nine papers were submitted for the evaluation and 2 were judged to be in category 1 and four in category 2, with two in category 3 and one in category 4. The quality of the science is very good.

b) Several of the team members supervise master degree and PhD students. Further, they deliver lectures at Charles and Masaryk universities that facilitate them to select the best students, some of whom then join the team.

c) The research on alkaline and carbonate-rich melt metasomatism and trace element composition of quartz are among the best outputs of the research team that were published in high-rank mineralogical and petrological journals. There are several high quality outputs on sedimentology and elastic properties and thermal conductivity of rocks published in international journals, where members of the team are the first or corresponding author. However, as stated above this research overlaps with the research of other teams in the CAS. Research in relation to the disposal of nuclear waste materials is relevant to society.

d) International cooperation of the team is good, but could be further improved by using exchange programs for young scientists and joint publications with colleagues in other countries. It is much appreciated that the experienced team leaders supervise and engage MS and PhD students in their research projects.

e) The age structure of the team is very good with many young members under 35, which guarantees sustainable research for a long period into the future. The team has successes in obtaining significant amounts of non-institutional funds.

f) The strategy and future research plan is to upgrade the equipment in all three laboratories and to continue in research on magnetostratigraphy, seismic anisotropy or thermal and mechanical properties of the rocks and investigation of tektites and crustal chemistry of meteoritic phosphides and sulphides. The definition of a more focused research strategy of the department and closer cooperation among different teams in the department as well as with other institutes will be required.

**Date:** December 28, 2015

**Commission Chair:** Prof. Dr. Franz Fiedler