Academy of Sciences of the Czech Republic

Institute of Geology
Annual Report 2000

CONTENTS

Editorial Note: This report is based on contributions of the individual authors; contents and scientific quality of the contributions lies within the responsibility of the respective author(s).
The report was compiled and finally edited by L. Slavík and P. Bosák. English version was kindly revised by J. Adamovič.

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1. Preface

The year 2000 was dedicated to a complicated bureaucratic procedure – the Institute evaluation for the period of 1995 to 1999. All of us spent about two man/years to prepare an 11 cm thick box full of lists, documents, projects and other necessary papers. As a part of this procedure, the Institute was visited by a number of foreign scientists who supported us by abundant comments and recommendations. We are grateful to them.
The year 2000 was exceptional also from the technical point of view. We ordered a new electron microprobe system CAMECA SX 100 (France) to be delivered in early 2002. The system will replace our old microprobe dating to 1972. We also obtained financial resources to reconstruct roofs of our 3 buildings at the Suchdol headquarters.
To conclude, the year 2000, the last year in the Second Millennium, was successful for the development of our multidisciplinary Institute. The willing co-operation of all employees is highly acknowledged.

Pavel Bosák, DSc.
Director of the Institute

2. General Information

The Institute of Geology of the Academy of Sciences of the Czech Republic (abbr. GLI AS CR) was founded in 1961. It concentrates on research activities in the principal branches of geological sciences. Major research areas especially developed in the Institute are as follows:

- Petrology and geochemistry of igneous and metamorphic rocks
- Lithostratigraphy of crystalline complexes
- Volcanology and volcanostratigraphy
- Structural geology and tectonics
- Paleogeography
- Terrane identification
- Taxonomy and phylogeny of fossil organisms
- Paleobiogeography of Variscan Europe
- Paleoecology (incl. population dynamics, bioevents)
- Paleoclimatology as evidenced by fossil organisms and communities
- Biostratigraphy and high-resolution stratigraphy
- Basin analysis and sequence stratigraphy
- Exogenic geochemistry
- Quaternary geology and landscape evolution
- Paleomagnetism
- Magnetostratigraphy
- Petromagnetism

The research potential of the Institute is divided into 6 units:

Scientific departments

1. Endogenic Geology and Geochemistry
2. Stratigraphy and Paleontology
3. Exogenic Geology and Geochemistry
4. Paleomagnetism

Service units

1. Service Laboratory of Physical Methods
2. Information Centre (Library and Computer Network)

The following specialized laboratories have been set up:

Specialized laboratories

1. Paleomagnetic laboratory (head Ing. Petr Pruner, CSc.)
2. Micropaleontological laboratory (heads RNDr. Jiří Bek, CSc. and RNDr. Ladislav Slavík)
3. X-ray and DTA/TG laboratory (head RNDr. Karel Melka, CSc.)
4. Electron scanning and microprobe laboratory (head Ing. Anna Langrová)
6. Laboratory of rock processing and mineral separation (head Václav Sedláček)
7. Laboratory for thin and polished sections (head Ing. Anna Langrová)
8. Microscopic laboratory (head Mgr. Monika Němečková)
9. Sedimentary laboratory (head RNDr. Anna Žigová, CSc.)
10. Fission track laboratory (head Mgr. Jiří Filip)

The scientific concept of the Institute of Geology and the evaluation of its results lie within the responsibility of the Scientific Council that includes both the internal and external members. Besides research, staff members of the Institute are involved in lecturing at universities and in the postgraduate education system. Special attention is also paid to popularization of the most important scientific results in the public media.

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3. Connections

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4. Staff (as of December 31,2000)

Management

RNDr. dr hab. Pavel Bosák, DrSc.	Director of the Institute
Ing. Ottomar Gottstein, CSc	Vice-Director (finances)
Doc. RNDr. Jaromír Ulrych, CSc.	Vice-Director (research)
RNDr. Petr Štorch, CSc.	Chairman of the Scientific Council

Head Office:

Josef Brožek (photographer)
Radim Blažek (civil military duty)
Marcela Nováková (assistant to the Director)
Ing. Miroslav Fridrich (computer specialist)
Martin Chadima (civil military duty)
Václav Javůrek (computer specialist)
Karel Jeřábek (garage attendant, driver)
Jaroslav Kratochvíl (technical service)
Michal Krůta (civil military duty)
Petr Vachalovský (technical service)
Martin Mráček (boiler operator)
Antonín Čejka (technical service)
Božena Trenzeluková (phone operator)

Scientific departments

Department of Endogenic Geology and Geochemistry

Scientific Staff:

RNDr. František Patočka, CSc. – Head of the Department (petrology, geochemistry)
Mgr. Martin Svojtka – Deputy Head of the Department (geochronology, geochemistry)
Mgr. Jiří Adamovič (basin analysis, tectonics)
RNDr. Miroslav Fajst, CSc. (petrology)
RNDr. Vladimír Cajz (volcanology)
RNDr. Miroslav Coubal, CSc. (structural geology)
Ing. Jiří Fiala, CSc. (structural geology, metamorphic petrology)
Mgr. Monika Němečková (structural geology, tectonics and metamorphic petrology)
Mgr. Petra Vítková (petrology)
prom. geol. Jiří Novák (petrology)
RNDr. Edvín Pivec, CSc. (igneous petrology and mineralogy)
Mgr. Jana Svobodová (igneous and metamorphic petrology, geochemistry)
Doc. RNDr. Jaromír Ulrych, CSc. (igneous petrology, geochemistry)
RNDr. Zdeněk Vejnar, DrSc. (structural geology, metamorphic petrology)
RNDr. Vladimír Bouška DrSc. (mineralogy)

Technical Staff:

Josef Forman (technician)
Ing. Jaroslava Pavková (secretary of the Department, technician)
Jana Rajlichová (technician)
Václav Sedláček (technician)
Jaroslava Tejčková (chores)

Department of Stratigraphy and Paleontology

Scientific Staff:

RNDr. Radek Mikuláš, CSc. – Head of the Department (ichnofossils)
RNDr. Marcela Svobodová, CSc. – Deputy Head of the Department (Cretaceous palynology)
RNDr. Jiří Bek, CSc. (Devonian and Carboniferous spores)
RNDr. Petr Čejchan (paleoecology)
prom. geol. Arnošt Galle, CSc. (Devonian corals)
Doc. RNDr. Jindřich Hladil, CSc. (Devonian stratigraphy and reefs)
RNDr. Václav Houša, CSc. (Jurassic and Cretaceous stratigraphy, calpionellids and ammonoids)
RNDr. Magda Konzalová, CSc. (Proterozoic, Early Paleozoic, Jurassic, Cretaceous and Tertiary palynology)
Doc. RNDr. Luftulla H. Peza, DrSc. (Mesozoic molluscs)
Doc. RNDr. Zbyněk Roček, DrSc. (origin and evolution of the Amphibia, Tertiary Anura and Sauria)
RNDr. Miloš Siblík, CSc. (Mesozoic brachiopods)
RNDr. Ladislav Slavík (conodont biostratigraphy)
RNDr. Petr Štorch, CSc. (Ordovician and Silurian stratigraphy, graptolites)
RNDr. Milada Vavrdová, CSc. (Proterozoic, Paleozoic and Mesozoic palynology and plankton)
RNDr. Jaroslav Zajíc, CSc. (Carboniferous and Permian vertebrates and stratigraphy, acanthodians)
RNDr. Jiří Žítt, CSc. (Cretaceous and Tertiary paleoecology and sedimentology, echinoids and crinoids)

Technical Staff:

Marcela Šmídová (secretary of the Department, technician)

Department of Exogenic Geology and Geochemistry

Scientific Staff:

RNDr. Václav Cílek, CSc. – Head of the Department (Quaternary geology)
RNDr. Anna Žigová, CSc. – Deputy Head of the Department (pedology, paleosoils)
Ing. Irena Dobešová (geochemistry)
Ing. Ottomar Gottstein, CSc. (geochemistry of magmatic and metamorphic rocks)
Mgr. Jaroslav Hlaváč (Quaternary geology, malacozoology)
RNDr. Jaroslav Kadlec, Dr. (Quaternary geology)
Ing. Olga Kvídová, CSc. (exogenic and environmental geochemistry)
RNDr. Vojen Ložek, DrSc. (Quaternary geology, malacozoology)
Ing. Luděk Minařík, CSc. (geochemistry)
Mgr. Tomáš Navrátil (aquatic and environmental geochemistry)
RNDr. Eliška Růžičková (petrology, Quaternary geology)
Doc. Ing. Petr Skřivan, CSc. (exogenic and environmental geochemistry)
Ing. Václav Suchý, CSc. (sedimentology and basin analysis)
Mgr. Michal Filippi (geochemistry)

Technical Staff:

Jaroslava Bednářová (editorial services – maternal leave)
RNDr. Miloš Burian (chemical analyst)
Magdaléna Čejková (chores)
Miroslav Karlík (technician)
Jana Macháčková (secretary of the Department, technician)

Department of Paleomagnetism

Scientific Staff:

Ing. Petr Pruner, CSc. – Head of the Department (geophysics, paleomagnetism)

prom. fyz. Otakar Man, CSc. (geophysics)
Mgr. Jana Štěpánková (geophysics – maternal leave)
RNDr. Daniela Venhodová (petrophysics)

Technical Staff:
Martin Blažíček (technician)
Tomáš Kohout (technician)
Jana Drahotová (technician)
Věra Havlíková (technician)
Jiří Petráček (technician)

Service Units

Service Laboratory of Physical Methods

Ing. Anna Langrová – Head of the Laboratory (microprobe and scanning microscope analyst)
Jiří Dobrovolný (X-ray and thermic analyses)
Jaroslava Jabůrková (preparation of thin/polished sections)
Ivana Konopáčová (preparation of thin/polished sections)
RNDr. Zuzana Korbelová (microprobe and scanning microscope operator)
RNDr. Karel Melka, CSc. (X-ray and thermal analyses)
Mgr. Jiří Filip (fission track dating)

Information Centre and Library

RNDr. Helena Purkyňová – Head of the Department (librarian)
PhDr. Liliana Peza (librarian)
Mgr. Václava Škvorová (librarian)

Economic Department

Ing. Ottomar Gottstein, CSc. – Head of the Department
Jana Klímová (accountant)
Alena Sokolová (accountant, human resources)

Scientific Council

RNDr. Petr Štorch, CSc. (Institute of Geology AS CR) - Head of the council
Prof. RNDr. Petr Čepek, CSc. (Faculty of Science, Charles University)
Prof. RNDr. Zlatko Kvaček, DrSc. (Faculty of Science, Charles University)
RNDr. Václav Cílek, CSc. (Institute of Geology AS CR)
prom. geol. Arnošt Galle, CSc. (Institute of Geology AS CR)
Doc. RNDr. Jindřich Hladil, CSc. (Institute of Geology AS CR)
Doc. RNDr. Zdeněk Kukal, DrSc. (Czech Geological Institute, Governmental Council for Research and Science)
RNDr. František Patočka, CSc. (Institute of Geology AS CR)
Ing. Petr Pruner, CSc. (Institute of Geology AS CR)
RNDr. Vladimír Rudajev, DrSc. (Institute of Rock Structure and Mechanics AS CR)
RNDr. Jan Šílený, CSc. (Institute of Geophysics AS CR)
RNDr. Lilian Švábenická, CSc. (Czech Geological Institute)
Doc. RNDr. Jaromír Ulrych, CSc. (Institute of Geology AS CR)

Foreign consultants

Prof. György Buda (Department of Mineralogy, L. Eötvös University, Budapest, Hungary)
Dr. Pavel Čepek (Ackerrain 18, Burgwedel, Germany)
Prof. Petr Černý (Department of Earth Sciences, University of Manitoba, Winnipeg, Canada)
Prof. Jaroslav Dostal (Department of Geology, Saint Mary's University, Halifax, Canada)
Prof. Peter E. Isaacson (Department of Geology, College of Mines and Earth Resources, University of Idaho, Moscow, USA)
Dr. Horst Kämpf (GeoForschungsZentrum, Postdam, Germany)
Prof. Dr hab. Ryszard Kryza (Institute of Geological Sciences, Wroclaw University, Poland)
Prof. Henri Maluski (Université Montpelier II, Montpelier, France)
Prof. Ronald Parsley (Department of Geology, Tulane University, New Orleans, USA)
Prof. Dr. Franz Pertlik (Institut für Mineralogie und Kristallografie, Universität Wien, Geozentrum, Austria)
Prof. Henning Sørensen (Geological Institute, University of Kobenhagen, Denmark)
Prof. John A. Winchester (Department of Geology, University of Keele, Great Britain)

Note: Czech scientific and pedagogical degrees are equivalents of:

Czech degree	**Equivalent**
prom.geol., prom. fyz., Ing., Mgr.	MSc
RNDr., PhDr.	no equiv.
CSc.	Ph.D.
DrSc.	DSc
Doc.	Assoc. Prof.
Ing.	Dipl.-Ing.

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5. Staff News

January

1.1.2000	Mgr. Dana Otrubová (paleomagnetism) joined the Institute
3.1.2000	RNDr. Miroslav Fajst, CSc. (petrology) joined the Institute
3.1.2000	Mgr. Petra Vítková (petrology) joined the Institute
31.1.2000	RNDr. Miloš Lang, CSc. (petrology) left the Institute
31.1.2000	RNDr. Jarmila Waldhausrová, CSc. (petrology) left the Institute

February

29.2.2000	Ing. Jaroslav Martínek (geochemistry) left the Institute
9.2.2000	Radek Jireš (accomplished the civil military duty)

March

1.3.2000	Jana Krejčová (technician) joined the Institute
14.3.2000	Radim Blažek (civil military duty) joined the Institute

April

3.4.2000	Jiří Petráček (technician) joined the Institute

May
31.5.2000 Zuzana Kratinová (technician)
left the Institute
June
1.6.2000 Martin Blažíček (technician)
joined the Institute
July
24.7.2000 Prof. RNDr. Vladimír Bouška, DrSc. (geochemistry)
died
September
1.9.2000 Mgr. Michal Filippi (Quaternary geology)
joined the Institute
7.9.2000 Martin Blažíček (technician)
left the Institute
October
9.10.2000 Mgr. Dana Otrubová (paleomagnetism)
left the Institute

November
1.11.2000 Tomáš Kohout (technician)
joined the Institute

December
18.12.2000 Mgr. Martin Chadima (civil military duty)
joined the Institute
31.12.2000 Jaroslava Břízová (phone operator)
left the Institute
31.12.2000 Svatava Jandeková (administration, human resources)
left the Institute
31.12.2000 Jana Krejčová (technician)
left the Institute
31.12. 2000 Ing. Miroslav Krs, CSc. (paleomagnetism)
left the Institute
31.12.2000 Mgr. Marie Lachmanová (Quaternary geology)
left the Institute

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6. Undergraduate and Graduate Education

Undergraduate and Graduate Courses at Universities Given by Staff Members of the Institute of Geology AS CR:

Bek J.: Evolution of Paleozoic spores. Graduate course, Faculty of Science, Charles University, Prague.
Bosák P.: Karstology and Paleokarstology. Graduate Course, Faculty of Science, Charles University, Prague.
Cílek V.: *Cultural geology.* Undergraduate and Graduate course, Faculty of the Humanistic Studies, Charles University, Prague.
Cílek V.: *Field archaeological course – Mesolithic of northern Bohemia* (together with J. Svoboda, Institute of Archaeology ASCR, Brno), one-month field course, Institute of the fundamentals of learning, Charles University, Prague.
Cílek V.: *Field Course: History and landscape development* (B. Brown). George Mason University. Virginia, USA.
Cílek V.: *Landscape, environment and urbanism*. Simon Fraser University, Vancouver, Canada. Part of the course: Cultural memory (J. Zaslove). Summer studies abroad.
Fajst M.: *Environmental regional geology of the Czech Republic*. Undergraduate course, Faculty of Science, Charles University, Prague.

Fajst M.: *Geological problems of crystalline formations*. Undergraduate course, Faculty of Science, Charles University, Prague.
Hladil J.: *Field course on carbonate facies in the Moravian Karst.* Open Graduate course, Faculty of Science, Masaryk University, Brno.
Houša V.: *Zoological and paleontological nomenclature.* Undergraduate course, Faculty of Science, Charles University, Prague.
Kadlec J.: *Causes and consequences of Quaternary climatic changes*. Undergraduate course, Faculty of Science, Charles University, Prague.
Lachmanová M.: *A review of geology for teachers.* Undergraduate course, Faculty of Paedagogy, Charles University, Prague.
Ložek V.: *Quaternary development and protection of the Czech landscape*. Undergraduate course, Faculty of Philosophy (Archaeology), Faculty of Science, Charles University, Prague.
Nehyba, S. & **Hladil, J.**: *Sedimentology*. Undergraduate course, Faculty of Science, Masaryk University, Brno.
Němečková M.: *Course of geological survey*. Undergraduate course (practice), Faculty of Science, Masaryk University, Brno.
Němečková M.: *Petrography of magmatic rocks*. Undergraduate course (practice), Faculty of Science, Masaryk University, Brno.
Němečková M.: *Petrography of metamorphic rocks*. Undergraduate course (practice), Faculty of Science, Masaryk University, Brno.
Němečková M.: *Petrography of sedimentary rocks*. Undergraduate course (practice), Faculty of Science, Masaryk University, Brno.
Roček Z. & Švátora, M.: *Comparative anatomy of vertebrates.* Undergraduate course (practice), Faculty of Science, Charles University, Prague.
Roček Z. & Švátora, M.: *Morphology of animals*. Undergraduate course (practice), Faculty of Science, Charles University, Prague.
Roček Z.: *Comparative anatomy of vertebrates.* Undergraduate course, Faculty of Science, Charles University, Prague.
Roček Z.: *Evolution of vertebrates*. Undergraduate course, Faculty of Science, Charles University, Prague.
Roček Z.: *Excursion to the Upper Jurassic of the Solnhofen Region, Germany*. Undergraduate course (practice), Faculty of Science, Charles University, Prague.
Roček Z.: *Morphology of animals*. Undergraduate course, Faculty of Science, Charles University, Prague.
Roček Z.: *Review of fossil vertebrates*. Undergraduate course, Faculty of Science, Charles University, Prague.
Štorch P.: Principles and methods of stratigraphy. Undergraduate and graduate course, Faculty of Science, Charles University, Prague.
Ulrych J.: *Special mineralogy*. Graduate course, Technological Faculty VŠCHT, Prague.
Ulrych J.: *Interpretations of mineralogical data*. Undergraduate course, Faculty of Science, Charles University, Prague.
Ulrych J.: *The České středohoří Mts.- a significant Neoidic structure of the Central Europe*. Invited university and public lecture, Palacký University, Olomouc.
Vítková P.: *Geology for teachers*. Undergraduate course (practice), Faculty of Science, Charles University, Prague.
Žigová A.: *Geography of soils and protection of soil resources*. Undergraduate course, Faculty of Science, Charles University, Prague.

Supervision in Undergraduate Studies

Brůna J. (MSc. thesis), Faculty of Science, Masaryk University, Brno (*supervisor **Z. Roček***)
Čápová M. (MSc. thesis), Faculty of Humanistic Studies, Charles University, Prague (*supervisor **V. Cílek***).
Dašková J. (MSc. thesis), Faculty of Science, Charles University, Prague (*supervisor O. Fatka and **M. Konzalová***)
Fialová B. (MSc. thesis), Faculty of Forestry, Czech Agricultural University, Prague (*supervisor **O.***

Kvídová *and* ***P. Skřivan***)
Hubačík M. (MSc. thesis), Faculty of Science, Masaryk University, Brno (*supervisor R. Melichar and* ***J. Hladil***)
Kettnerová L. (MSc. thesis), Faculty of Forestry, Czech Agricultural University, Prague (*supervisor* ***P. Skřivan***)
Kordová L. (MSc. thesis), Faculty of Forestry, Czech Agricultural University, Prague (*supervisor* ***P. Skřivan***)
Královec K. (MSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Lehotský T. (Msc. thesis), Faculty of Science, Palacký University, Olomouc *(supervisor O. Bábek, co-supervisor* ***R. Mikuláš****)*
Majorová H. (BSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Mládková L. (MSc. thesis), Faculty of Forestry, Czech Agricultural University, Prague (*co-supervisors* ***L. Minařík*** *and* ***P. Skřivan***)
Ročková H. (BSc. thesis), Faculty of Science, Charles University, Prague (*supervisors I. Horáček and* ***Z. Roček****)*
Rudolfová J. (BSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Sedláčková L. (MSc. thesis), Faculty of Science, Masaryk University, Brno (*supervisor* ***Z.. Roček***)
Slavík O. (BSc. thesis), Faculty of Humanistic Studies, Charles University, Prague (*supervisor* ***V. Cílek***).
Suchá K. (MSc. thesis), Faculty of Science, Institute of Ecology, Charles University, Prague (*supervisor* ***P. Skřivan***)
Šandera M. (MSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Zahradníček O. (BSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)

Supervision in Graduate Studies

Adamovič J. (CSc. - Ph.D. thesis), Institute of Geology, AS CR, Prague (*supervisor* ***P. Bosák****)*
Baroň I. (Ph.D. thesis), Faculty of Science, Masaryk Univeristy, Brno (*supervisor* ***V. Cílek***).
Beran L. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***V. Ložek***)
Cajz V. (CSc. - Ph.D. thesis), Institute of Geology, AS CR, Prague (*supervisor* ***J. Ulrych***)
Čejchan P. (CSc. - Ph.D. thesis), Institute of Geology AS CR, Prague (*supervisor* ***J. Žítt***)
Černý R. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Dašková J. (RNDr. thesis), Faculty of Science, Charles University, Prague (*supervisor O. Fatka and* ***M. Konzalová***)
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Gilíková H. (Ph.D. thesis), Faculty of Science, Masaryk University, Brno (*supervisor J. Leichmann and* ***J. Hladil***)
Hlaváč J. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***V. Ložek***)
Juřičková L. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***V. Ložek***)
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Lachmanová M. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*co-supervisor* ***V. Cílek***)
Novák J.K. (CSc. - Ph.D. thesis), Institute of Geology, AS CR, Prague (*supervisor* ***E. Pivec****)*
Slavík L. (CSc. - Ph.D. thesis), Institute of Geology, AS CR, Prague (*supervisor* ***J. Hladil***)
Slepičková-Štěpánková J. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*co-supervisor* ***P. Pruner***)
Štorc R. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*co-supervisor* ***J. Žítt***)
Trbušek J. (Ph.D. thesis), Faculty of Science, Palacký University, Olomouc (*supervisor* ***Z. Roček***)
Vach M. (Ph.D. thesis), Faculty of Forestry, Czech Agricultural University, Prague (*supervisor* ***P. Skřivan***)
Vater M. (Ph.D. thesis), Institute of Zoology, Slovak Academy of Sciences, Bratislava (*supervisor* ***Z. Roček***)
Vlačiha J. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*co-supervisor* ***J. Žítt***)

RNDr. Pavel Bosák, DrSc. – Member of the Scientific Board, Faculty of Science, Masaryk University, Prague. Member of the Committee for Interdisciplinary Study of Quaternary, Faculty of Science, Masaryk University, Brno.
RNDr. Václav Cílek, CSc. - Member of the Scientific Board, Faculty of Humanistic studies, Charles University, Prague.
Doc. RNDr. Jindřich Hladil, DrSc. - Member of the Board of Graduate Studies in Geology, Faculty of Science, Charles University, Prague and Faculty of Science, Masaryk University, Brno, Member of the Committee for Finals of Undergraduate Students in Geology, Faculty of Science, Charles University, Prague.
RNDr. Jaroslav Kadlec, Dr. - Member of the Board of Undergraduate and Graduate Studies in Geology, Faculty of Science, Charles University, Prague.
RNDr. František Patočka, CSc. - Member of the Board of Graduate Studies in Geology, Faculty of Science, Charles University, Prague and Faculty of Science, Masaryk University, Brno.
Doc. RNDr. Zbyněk Roček, DrSc. - Member of the Board of Graduate Studies in Zoology, Faculty of Science, Charles University, Prague and Member of the Committee of the Ministry of Education of the Czech Republic for Doctoral Dissertations (DrSc) in Geology.
Doc. Ing. Petr Skřivan, CSc. - Member of the Scientific Board (Section of Geology) of the Faculty of Science, Charles University, Prague.
Doc. RNDr. Jaromír Ulrych, CSc. - Member of the State Examination Comitee for Mineralogy and Geochemistry, Faculty of Science, Charles University, Prague.
RNDr. Anna Žigová, CSc. - Member of the Board of Graduate Studies in Physical Geography, Charles University, Prague.

Degrees obtained by the staff of the Institute of Geology AS CR

DrSc.

Doc. RNDr. Jindřich Hladil, CSc.: *Cyclic sedimentation of the Devonian limestones in Moravia and Silesia, with emphasis on the Macocha Formation in the Moravian Karst and on the SE borders of the Bohemian Massif.* Institute of Geology, AS CR, Prague (Febr. 8, 2000).

CSc.

p.g. Jiří K. Novák: *Rock-forming minerals as products of the late- and post-magmatic processes in granites of the Krušné hory Mts. batholith.* Institute of Geology AS CR, Prague (Nov. 14, 2000)

Ph.D.

Mgr. Jana Svobodová: *Origin and evolution of the Kdyně massif*. Faculty of Science, Charles University, Prague (March 3, 2000)

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7. Positions in International Organizations and Editorial Boards

Bosák P.: Secretary General, International Union of Speleology (UIS), elected in 1993, re-elected in 1997
Cílek V.: National representative, Past Global Changes: Pole-Equator-Pole III profile. UN project, since 1993
Hladil J.: Appointed Committee Member in Working Group for Subdivision of the Frasnian Stage at the SDS, Subcommission on Devonian Stratigraphy, since 1999.
Hladil J.: Voted Council Member and Representative of Europe-III Group of Countries, IASFCP, the International Association for Study of Fossil Cnidaria and Porifera, since 1995.

Hladil J.: Voted Secretary of the CzNC IGCP, International Geological Correlation Programme, since 1994.
Krs M.: Honorary Member, Geological Society of London, since 1992
Ložek V.: Foreign Member, Polish Academy of Arts and Sciences, election approved by the Polish President on July 20, 1999
Melka K.: Czech/Slovak Representative, ECGA, the European Clay Groups Association, since 1991
Roček Z.: Executive Council Candidate, Society of Vertebrate Morphology, since 2000
Roček Z.: Member of the Scientific Programme Committee, Fourth World Congress of Herpetology, since 1997
Roček Z.: Vice-President, Societas Europaea Herpetologica, since 1995
Siblík M.: Correspondent Member, Geological Survey in Vienna, Austria, since 1999

Editorial Boards

Bosák P.: *Český kras*, Beroun, Member of Editorial Board, since 1976 and Editor, since 1998
Bosák P.: *Theoretical and Applied Karstology*, Bucuresti, Member of Editorial Board, since 2000
Bosák P.: *Geologos*, Poznań, Member of Editorial Board, since 2000)
Bosák P.: *Speleo (Praha)*, Prague, member of Editorial Board, since 1990
Bosák P.: *International Journal of Speleology*, L´Aquilla, Member of Advisory Board, since 1994
Bosák P.: *UIS Bulletin*, Editor-in-Chief, since 1993
Cílek V.: *Encyclopedia of Life Support Systems*, Honorary Theme Editor, UNESCO
Kadlec J.: *Geolines*, Member of Editorial Board
Ložek V.: *Studia Quarternaria*, Kraków, Poland, since 1999
Melka K.: *Clay Minerals*, Journal of the European Clay Groups, since 1999
Mikuláš R.: *Geolines*, Member of Editorial Board
Patočka F.: *Geologia Sudetica*, Member of Editorial Board, since 1997
Patočka F.: *Geolines*, Member of Editorial Board
Pruner P.: *Geolines*, Member of Editorial Board
Roček Z.: *Bulletin de la Société Herpétologique de France*, since 1992
Roček Z.: *Živa*, since 1995
Svojtka M.: *Acta Universitas Carolinae, Geologica*, Member of Editorial Board
Svojtka M.: *Geolines*, Editor-in-Chief
Štorch P.: *Geological Journal*, Liverpool, Manchester, Member of Editorial Board since 1993
Štorch P.: *Newsletters on Stratigraphy*, Berlin, Stuttgart, Member of Editorial Board, since 1999
Štorch P.: *Geolines*, Member of Editorial Board

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8. Department of Endogenic Geology and Geochemistry

Foreign Grants and Joint Projects

4th Framework Programme of the European Commission

Europrobe-PACE (Paleozoic Amalgamation of Central Europe) TMR Research Network (*Project leaders J.A. Winchester, Keele University, United Kingdom & T. Pharaoh, British Geological Survey, United Kingdom*)

Subproject: Late Devonian to Early Carboniferous bimodal volcanics of the westernmost part of the West Sudetic orogenic wedge - the Ještěd Range Unit (*V. Kachlik, Faculty of Science, Charles University, Prague &* ***F. Patočka***)

Late Paleozoic volcanic activity is a specific feature of the Ještěd Range Unit (JRU) situated on the westernmost margin of the Krkonoše-Jizera terrane (KJT) where it occupies the lowermost position in the W- to NW-directed orogenic wedge.
The Late Paleozoic metavolcanics of the JRU Middle/Late Devonian to Early Carboniferous sequence are represented by metarhyolites, submarine basic lavas and doleritic basalts. The latter often show relics of ophitic textures and of mafic minerals such as pyroxenes and kaersutitic amphiboles. The rocks are strictly bimodal, in volatile-free SiO_2 concentrations distributed within narrow ranges - 48 to 52 wt. % and 74 to 76 wt. %, respectively. The greenschists and metadiabases usually display moderate light-to-heavy REE fractionation. Chondrite-normalized lanthanide distribution patterns of these rocks have tholeiitic WPB-like $(Ce/Yb)_N$ ratios. Trace element abundances in the metabasites resemble those of modern basalts of both E-MORB and tholeiitic to transitional WPB compositions. The felsic metavolcanics are significantly enriched in LILE, HFSE and REE. They show pronounced negative anomalies of Ba and Eu in ORG- and chondrite-normalized trace element and lanthanide distributions, respectively. Regarding these features, the porphyroids may be compared with within-plate acid igneous rocks. The Late Paleozoic metavolcanic assemblage of the JRU may be compared to modern bimodal suite related to lithospheric extension.
The volcanic activity of the JRU Late Paleozoic sequence started in the latest Middle Devonian according to the associated fossil record, and was protracted: the Tournaisian flysch is intruded by subvolcanic diabases. The time span of the Ar-Ar ages on the Variscan metamorphic events related to the waning of subduction and subsequent exhumation and thrusting E and S of the KJT (365-340 Ma) is late Famennian to latest Tournaisian, thus being set within the duration of the JRU Late Paleozoic volcanism. Tectonic setting of the lithospheric extension-related Late Paleozoic bimodal volcanism of the JRU is essentially antagonistic, albeit contemporaneous, in relation to tectonic regime of the W-propagating orogenic wedge of the KJT. This contrast supports an idea that juxtaposition of the KJT complexes is a result of Variscan large-scale nappe stacking from the Late Devonian to the Early/Late Carboniferous boundary.

Subproject: The Ar-Ar ages from the West Sudetes (NE Bohemian Massif): constraints on the Variscan polyphase tectonothermal development *(D. Marheine, ISTEEM–CNRS, Univ. Montpellier 2, France, V. Kachlik, Faculty of Science, Charles University, Prague,* ***F. Patočka****, H. Maluski, ISTEEM–CNRS, Univ. Montpellier 2, France & A. Żelaźniewicz Inst. Geology, PAN, Wroclaw, Poland)*

The West Sudetes are a complex mosaic of crustal fragments or terranes evolved through rather comparable pre-Variscan and Variscan sequences of events. The studied terranes are characterized by a widespread and quite voluminous intracontinental rift-related magmatism as the most important Early Paleozoic episode. The Cambro-Ordovician magmatic activity was associated with lithospheric extension and rifting of the Cadomian basement of the West Sudetes. Magmatism similar in

age and tectonic setting was ubiquitous in realms of the Recent Western and Central Europe, and heralded large-scale fragmentation of the Gondwana northern margin, which was followed by limited generation of oceanic lithosphere forming the floors of narrow basins (seaways) among the individual fragments. As the result of the supercontinent break-up, a loose assemblage of peri-Gondwanan fragments (together with the major part of the Bohemian Massif principal units, including the West Sudetes), drifted northwards to the peri-equatorial latitudes. There the members of the recently termed Armorican Terrane Assemblage (ATA) were welded together due to a series of mutual collisions as well as collisions with Baltica (± East Avalonia) culminating in the Variscan orogeny. The closure of the intervening seaways by oceanic lithosphere subduction was associated with HP metamorphism.
The distribution of Ar-Ar ages in the West Sudetes reflects the complexity of the Variscan polyphase deformation and metamorphism ranging from very low-grade to eclogite facies. The Famennian subduction-related eclogite/blueschist metamorphism may be interpreted as a closure of narrow seaway(s) between fragments of the ATA. This would imply an amalgamation of members of the ATA prior to their final collision with East Avalonia and Baltica, respectively, which commenced in the Tournaisian. The interpretation is supported by the presence of widespread Famennian subduction-related HP-LT metamorphism along the Armorican Terranes from Malpica-Tuy in the northwestern Iberian Massif through Ile de Groix and Champtoceaux in the Armorican Massif to the East Krkonoše Complex in the Bohemian Massif. All these parts of the ATA subsequently underwent broadly synchronous deformation and thrusting during the Visean exhumation processes provoked by joint accretion and the docking with East Avalonia and Baltica.

Grant Agency of the CR

No. 205/98/1551 Analysis of deep slope violation development in neovolocanics of the České středohoří Mts. (*J. Rybář, Institute of Rock Structure and Mechanics AS CR, **V. Cílek**, **V. Cajz** & et al.)*

Subproject: Geological evaluation of the Jedlka locality (***V. Cajz***)

Another important locality of deep-seated slope movement near the Jedlka village is located within the superficial volcanic products of the České středohoří Mts. volcanosedimentary complex. These products are subdivided into three formations by their lithology, but only two lower ones are affected by slope movement activities. This movement begins with multiple block-sliding along subvertical planes and all the rest of the slope is covered by debris accumulation down to the Ploučnice River flow. The volcanics are represented by solid and argillized basanitic lavas and clayey volcaniclastics of hyaloclastic origin. These rocks form the lower Ústí Fm., together with the underlaying coarse-grained products of volcanic debris flows in the western part of this area. This unit is overlain by pyroclastics of trachybasalts intercalated with thin subaerial lava flows and sheets in the upper part – the Děčín Fm. These pyroclastics were redeposited by lahars (volcanic mudflows) and washed in a shallow lake environment in the marginal part of a composite volcano.
The presence of clay material in the rocks of the Ústí Fm. is essential for the slope movement with the more solid rocks of the Děčín Fm. representing mere passive elements in this process.

No. 205/99/0907 Recent geodynamics of the western Bohemia in relation to the Earth's crust architecture (unique natural laboratory) *(J. Horálek, Institute of Geophysics, AS CR, **J. Ulrych, V. Cajz, E. Pivec, J.K. Novák** & Č. Nekovařík, Czech Geological Institute, Prague*)

Subproject: Cenozoic intraplate alkaline volcanism of the Teplá Highland (***J. Ulrych, V. Cajz, E. Pivec, J.K. Novák,** Č. Nekovařík, Czech Geological Institute, Prague & K. Balogh*, *Institut of Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary)*

Two contrasting weakly (trachybasalt–trachyandesite–trachyte–rhyolite; 13-11 Ma) and strongly alkaline series (melilite-bearing/ olivine nephelinite–basanite–tephrite; 12-8 Ma) in the Teplá Highland were

characterized volcanologically and petrologically. Magmas of both series are mantle-derived, associated with AFC (assimilation-fractionation crystallisation). Mantle and crustal xenoliths occur in different host rocks. Trachybasaltic rocks are locally rich in inclusions of (i) granitic and syenitic rocks (Okrouhlé Hradiště and Polom Hills), (ii) disaggregated serpenitinized dunite (Okruhlé Hradiště Hill), (iii) zeolitized ijolitic? rock (Pekelský vrch Hill near Nečtiny), and (iv) disaggregated clinopyroxenite (Okrouhlé Hradiště and Pekelský vrch Hills). Typical mantle xenoliths were identified in basaltic rocks at Horní Rotava, Hutnický vrch Hill and Thierstein, represented by weakly cataclastic peridotite inclusions. High-pressure megacrysts containing clinopyroxene and kaersutite in parental basanites (quarry at Stráž nad Ohří) are probably of cumulate origin.

Subproject: Ijolitic segregations in melilite nephelinite of Podhorni vrch volcano, Western Bohemia (***J. Ulrych, E. Pivec, M. Lang*** *& F. E. Lloyd, Univ. of Reading, United Kingdom*)

Miocene Podhorní vrch volcano (15-12 Ma), situated near Mariánské Lázně in western Bohemia, is associated with a tectonic zone striking NNW-SSE and pertaining to the Neogene Cheb-Domažlice Graben. The volcanic products represent undifferentiated melts of mantle origin of olivine nephelinite composition: Mg # (70-72); Cr (410-570 ppm), Ni (240-380), Co (50-55), Sc (24-29); the presence of harzburgite xenoliths. The $^{87}Sr/^{86}Sr$ (0.7035) and $^{143}Nd/^{144}Nd$ (0.51286) isotope ratios correspond to HIMU OIB from a sublithospheric source. Enhanced contents of incompatible elements such as U, Th, Nb, Ta, (REE) with high $(La/Yb)_N$ are characteristic. Coarse- to medium- and fine-grained segregations of ijolite to turjaite composition in the parental olivine nephelinite show the following mineral paragenesis: nepheline + diopside (with fassaite-aegirine rims) + melilite/(leucite, sanidine), titanian magnetite, hydroxylapatite, olivine, sodalite. Pegmatoid segregations are characterized by low contents of Si, Al and K and higher concentrations of Na and Ca compared to those from classical localities (Meiches and Löbauer Berge Hills in Germany). This difference in chemistry is reflected in the crystallisation of nepheline + melilite instead of, more commonly, nepheline + leucite and sanidine. The origin of the pegmatoid segregations is associated with post-eruptive, low-pressure fractional crystallisation, which resulted in the formation of segregations of restricted volume. However, independently(?) sourced late-magmatic fluids may have introduced Na and selected trace (REE, U, Th, Nb, Ta, P) and volatile elements (F, Cl, SO_3) that contributed to pegmatoid crystallisation.

Grant Agency of the Academy of Sciences CR

No. A301203903 Tectonomagmatic position and evolution of the Permo–Carboniferous volcanism in the Variscan Belt of Europe (***J. Ulrych, V. Cajz, J.K. Novák, J. Svobodová, V. Bouška, M. Lang, E. Pivec*** *& J. Pešek, Charles University, Prague*)

Subproject: Paleotectonic setting of Permo-Carboniferous volcanism of the Bohemian Massif: geochemical constraints (***J. Ulrych & J. Svobodová***)

One-hundred and five major and trace element analyses, including both new and published data, were used for establishing the source and genesis of the Permo-Carboniferous basin-related volcanism in the Bohemian Massif. Based on SiO_2 frequency distribution the rocks can be divided into two groups – basaltic and rhyolitic. Rocks with medium SiO_2 contents (55-70 wt. %) are very rare, and the rhyolitic members cannot be simply derived from the basaltic ones by fractionation crystallization. Zr/Nb, Y/Nb and Zr/Y ratios of basaltic and rhyolitic rocks vary considerably; therefore, different source materials can be supposed for the two rock groups. Mafic rocks of all studied basins (Central and Western Bohemian, Česká Kamenice, Mnichovo Hradiště, Krkonoše Piedmont and Intra-Sudetic basins) show very similar MORB-normalized trace-element pat-

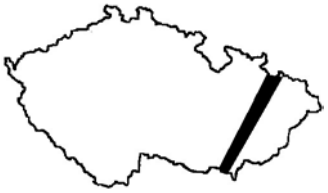
tern with pronounced Sr-anomaly indicating plagioclase fractionation prior to the extrusion, and Ti and Nb negative anomalies, which can be explained by crustal contamination of source magma. Crustal contamination of mafic rocks is also implied from the following diagrams: Th/Yb, K_2O-P_2O_5-TiO_2, Hf/3-Th-Ta and Hf/3-Th-Nb/16, 2Nb-Zr/4-Y and Ti/100-Zr-Y*3. Significant crustal contamination is clear also from new Nd isotope data from the Krkonoše Piedmont Basin. However, not all trace-element variations can be explained by upper crustal contamination of N-MORB, and the origin of source magma from a mantle plume or anomalous mantle segment is probable.
Rhyolitic rocks are geochemically close to peraluminous S-type granitoids, however, the presence of I-component is probable in some of them. Sr, P and Ti anomalies are characteristic for the MORB-normalized trace-element pattern. These anomalies can be explained by fractional crystallization of feldspars, apatite and Fe-Ti oxides or their presence in the source material. Y, Yb, Nb, Ta and Rb contents in the rhyolites tend to the composition of within-plate granitoids. Most of the late Paleozoic granitoids of the Bohemian Massif differ geochemically from the rhyolites with the exception of the granitoids of the Krušné hory-Erzgebirge Mts.
Mineralogy and geochemistry of rare andesites and trachydacites point to the mixing of acid and mafic magmas. Geochemical characteristics of the Permo-Carboniferous volcanics summarized above indicate that the source magma of mafic rocks was derived from an anomalous mantle segment or a mantle plume. The magma was deposited in the crustal chamber where it evolved by the assimilation-fractionation crystallization process before its extrusion. Extrusions of the rhyolites were driven by extensive melting of the surrounding crystalline rocks as a result of thermal input from the depth. A substantial part of the acid magma cooled in the depth and formed subvolcanic granitic equivalents of rhyolites. In some places, mafic and acid magmas were mixed and parental magma of andesites and trachydacites were formed. The Permo-Carboniferous volcanism is associated with a late Variscan to post-Variscan rifting episode in central Europe.

Subproject: Tectonomagmatic position and evolution of the Teplice Rhyolite Complex (***J.K. Novák,*** *K. Breiter, Czech Geological Institute & M. Chlupáčová, PETRAMAG, Prague)*

The volcanic suite of the Altenberg-Teplice Caldera (ATC) was documented in its entire volcanic pile, 924 m thick, at the pilot borehole of Mi-4 (Mikulov in the Krušné Hory Mts.) using lithogeochemical data, petrological methods and magnetic susceptibility measurements. Besides post-caldera felsic rhyolite dyke swarms and syenogranitic porphyry bodies (lying outside the borehole), five successive volcanic events were recognized as:
-1st volcanic phase represented by Basal Silicic Rhyolite (BC, Mi-4, 870.1-924.3 m) that has its equivalent in the NW part of the ATC at Sayda,
-2nd volcanic phase composed of dacitic tuffs and ignimbrites (Dc, borehole Mi-4, 604.3-868.3 m) that refers to the Schönfeld dacite in Germany,
-3rd volcanic phase (TR 1, Mi-4, 493.0-601.6 m) formed by rhyolitic tuff and/or ignimbrite.
-4th volcanic phase (TR 2)
TR 2a comprising air-fallen rhyolitic tuffs with green-coloured lava clots at a depth of 412.9-490.6 m
TR 2b - ignimbrites (191.4-412.9 m),
-5th volcanic phase (TR 3) representing ignimbrite of the Pramenáč type (at a depth of 0.5-192.0 m), Vlčí Kámen type (ignimbrite), Přední Cínovec type (probably subvolcanic intrusion into older tuffs and ignimbrites)
Two older units (BR and DC) are calc-alkaline in composition, while three younger units, traditionally termed as the Teplice rhyolite (TR1-TR3), have high-K calc-alkaline to A-type trend. Vertical compositional zoning was recognized within those phases showing a significant enrichment in Rb, (Th, HREE) and negative Eu anomaly with respect to the starting liquid at the floor of each unit. In contrast, the higher concentrations of Sr (LREE) predominate at the top of each unit. Some horizons markedly rich in Zr were found at the top of units TR1 and TR2. This reverse chemical zoning can be explained by stepwise exhaustion of a stratified magma chamber. The BC unit shows depletion in compatible elements (Mg, Sr, P, Zr, total REE) and relative enrichment in Rb toward the top. In dacitic rock types, the relatively homogenous Rb and Zr concentrations contrast with highly variable Sr contents. Rapid ignimbritic eruptions resulting in major caldera subsidence were followed by emplacement of post-

caldera syenogranite porphyry dykes and granites of the Younger Intrusive Complex. With the exception of dacitic tuffs (k = 1 x 10^{-3} to 22 x 10^{-2} SI), all rhyolitic rocks show very low values of magnetic susceptibility.

No. A3408902 Tremolite-bearing marbles as a specific lithotype for correlation of metacarbonate-bearing variegated units in the eastern part of the Bohemian Massif (*M. Novák, Faculty of Science, Masaryk University, Brno,* ***M. Němečková*** *& S. Houzar, Moravian Museum*, *Brno*)

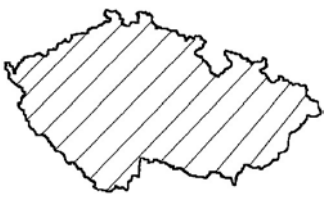


Tremolite marbles represent a specific lithotype of marbles in some crystalline complexes situated particularly along the eastern margin of the Bohemian Massif: Velké Vrbno Unit, Olešnice Group, Vranov Group, Vratěnín Group, Český Krumlov Varied Group and Waldviertel. They are typically present in the rock sequences situated along principal tectonic boundaries: Moldanubicum/Moravicum or Lugicum/Silesicum. The host rock complexes consist of dominant metapelites (mica schists, gneisses) with locally common intercalations of quartzites, calcite and dolomite marbles, minor metabasites and graphite-rich rocks closely associated with metacarbonate rocks.
Tremolite marbles form relatively thin layers within large metacarbonate bodies or small individual lenses located in mica schists. Two distinct compositional types were recognized: calcite- and less abundant dolomite-dominant marbles. The typical mineral assemblages Cal + Tr $\pm$ Phl and Dol + Cal + Tr $\pm$ Phl mostly exhibit Tr >> Phl, but locally Tr < Phl. Higher-grade minerals such as forsterite and spinel, known from dolomite marbles in the adjacent part of the Moldanubicum, occur only exceptionally in the Český Krumlov Varied Group and the Moldanubicum of Waldviertel.
Tremolite occurs in several texturally and paragenetically distinct generations. Preliminary chemical data indicate that the early tremolite porphyroblasts (Tr I) range from tremolite to magnesiohornblende. Younger generations of commonly fibrous tremolite are of metasomatic and retrograde origin and their specific mineral reactions and chemical composition have not been studied in detail yet.
Marbles from the Olešnice Group are good examples for the study of metamorphic reactions producing tremolite. Using transmitted light and CL, several mineral reactions producing early tremolite I (Tr I) were found:

(1) 5 Tlc + 6 Cal + 4 Qtz $\rightarrow$ 3 Tr + 6 CO_2 + 2 H_2O
(2) 2 Tlc + 3 Cal $\rightarrow$ Tr + Dol + CO_2 + H_2O
(3) 5 Dol + 8 Qtz + H_2O $\rightarrow$ Tr + 3 Cal + 7 CO_2.

Participation of the reaction (1) is supported by the textural relations of early calcite (Cal I), with characteristic deep orange colour in CL image, associated with relics of quartz Qtz (blue CL) and grains of Tr I. Both Cal I and Tr I underwent brittle deformation and their angular grains are rimmed and healed by younger Cal II (bright orange CL). Formation of Cal II is very likely not related to reaction (1), but rather represents a recrystallization of Cal I. Rare equilibrium assemblage Tr I + Dol (red CL) suggests mineral reaction (2). Rare relics of Dol (dark red CL) and Qtz (blue CL) found in large porphyroblasts of Tr I also indicate a participation of mineral reaction (3) (e.g., Olešnice and Jobova Lhota). Rare diopside (green CL) in rims around Tr I was observed in marbles near the contact with the higher-grade Moldanubian Zone. It was formed by the reaction: Tr + 3 Cal + 2 Qtz = 5 Di + 3 CO_2 + H_2O. The latest Cal III (pale yellow CL) commonly fills cracks in some silicates, e.g., in retrograde Tlc, and originated during the latest metamorphic stage or in the zone of weathering.

No. A3013006/00 New feldspar cooling-rate speedometer based on experimental data and its implication for selected rocks of the Bohemian Massif (***J. Svobodová****, M. Drábek, Faculty of Science, Charles University, Prague &* ***M. Svojtka***)



The first year of the project was devoted to collection of feldspar samples and their preparation for experimental works, and to the early stages of experiments orientated on the determination of diffusion coefficients and elaboration of the theoretical background for the geospeedometer.

The principal results lie in the derivation of equations defining geospeedometer and preparing the computer algorithm for processing of the measured data. Border diffusion and inter-diffusion were chosen from the existing types of diffusion as suitable for defining the geospeedometer. Several advantages make inter-diffusion suitable for defining cooling-rate geospeedometer in alkali feldspars: (a) most of the alkali feldspars are perthitic, which allows the exchange of major elements between individual lamellae, (b) the starting temperature at the beginning of diffusion during cooling is given by the time of separating individual phases and can be easily estimated from the feldspar composition, and (c) the perthites commonly follow one crystallographic orientation, which eliminates the differences in the diffusion coefficient in different directions given by crystallography of the feldspars. The inter-diffusion is relatively slow and suitable for estimation of cooling rates during late magmatic stage. Incapability of inter-diffusion to continue to lower temperatures was the reason why the border diffusion, which is relatively rapid and acts at lower temperatures, was chosen for the definition of the second type of geospeedometer. The application of this second geospeedometer is more difficult as it requires thermometric data and knowledge of crystallographic orientation.
The theoretical background for the geospeedometer entails equations describing the dependence between the shape of the diffusion profile, starting and ending temperature of profile formation and cooling rate. Previously used equations defined for constant temperatures were extended to the cases of lowering temperature. The ending temperature of profile formation is given by closure temperature calculated from the Dodson's equation. The procedure of calculation made use of the MAPLE software, for which the algorithm was prepared. New results from experimental works will complete the procedure by precise constants, which will allow a common use of the geospeedometer for the reconstruction of thermal history of magmatic and metamorphic rocks.

No. A3013910 Young volcanism-related ferruginization of sedimentary rocks, Bohemian Cretaceous Basin (***J. Adamovič, J. Ulrych, M. Coubal & K. Melka***)

The project is aimed at the determination of spatial and genetic relations between magmatic/hydrothermal activity and individual types of Fe-mineralization in sediments of the Bohemian Cretaceous Basin. It was found that products of secondary Fe-mineralization in shallow marine quartzose sandstones of the Bohemian Cretaceous Basin (94-85 Ma) are spatially associated with late Cretaceous to Cenozoic intrusive bodies. Subhorizontal bodies of ferruginous sandstone and conglomerate (type 3) concentrate in the Middle to Upper Turonian sandstones between Mělník and the Lusatian Fault while the other morphological types of Fe-mineralization such as joint fillings and dyke contacts (type 1) or undulating Fe-crusts and concretions (type 2) pose a widespread phenomenon in all psammitic facies of the basin.
Field mapping, tectonic study and surface geomagnetic survey were conducted at a number of localities in the N and NE part of the basin. Classical localities in the Lužické hory Mts. were re-described: Pískové návrší, Kohout and Janovický les near Rynoltice and Vraní skály near Horní Sedlo. Clasts of ferruginous siltstones were found to be widely distributed in conglomerates along the northern basin margin. Numerous examples of ferruginization were newly described from the Upper Turonian to Coniacian sandstones E of the Jizera River: Klokočské skály, Borecké skály, Valdštejn, Nouzov, Sokolka and Příhrazy, Podlažany and Prachovské skály.
As indicated by preliminary mineral phase analyses (X-ray diffraction), the iron mineral is goethite, α-FeOOH. The first set of bulk analyses consisting of 25 samples showed that Fe oxide contents range between 21-52 % in quartz-poor Fe-crusts and 12-30 % in ferruginous sandstones, with average Fe_2O_3/FeO ratio of 103.7. Although some spherical concretions are probably derived from iron sulphides, especially in the Cenomanian and Coniacian, most types are clearly associated with occurrences of young basaltic rocks.

Grants of the state departments

No. RK99P030MG035 Minerals of the České středohoří Mts. (*T. Wiesner, Municipial Museum in Ústí nad Labem,* ***J. Ulrych, V. Cajz*** *&* ***J. Adamovič***)

Subproject: Dobranka Creek near Děčín: geological, petrological and mineralogical characteristics (***J.K. Novák, J. Ulrych, V. Cajz, A. Langrová, J. Adamovič****, M. Chvátal, Charles University, Prague, R. Rychlý, Purkyně Military Medical Academy, Hradec Králové & T. Wiesner, Municipial Museum in Ústí nad Labem*)

*Trachyandesite of Dobranka near Děčín: petrology, geochemistry and amygdale mineralogy (****J.K. Novák****, J. Ulrych, A. Langrová, V. Cajz, J. Adamovič, M. Chvátal, Charles University, Prague, T. Wiesner, Municipal Museum in Ústí nad Labem & R. Rychlý, Purkyně Military Medical Academy, Hradec Králové)*

New petrological-geochemical data as well as a detailed compilation of earlier mineralogical studies allow to present the mineralogy at the locality of the Dobranka Creek valley. Amygdale minerals are hosted in vesicular and analcimized facies of a trachyandesite lava flow embedded in the volcaniclastics of the Děčín Fm. (i.e., remnant of a Miocene composite volcano). Five principal mineral assemblages were distinguished: (illite) – analcime I – analcime II; (illite) – analcime I – (thomsonite) – natrolite – (calcite); gismondine – thomsonite; Ba-bearing phillipsite-Ca – analcime II.; analcime I – gmelinite-Ca – hyalite. To some extent, monomineralic gmelinite-Ca crusts were observed in sporadic amygdules.
The relatively fresh trachyandesitic rock represents a more fractionated product of the strongly alkaline series (SAS), which is exceptional in the České středohoří Mts. It is characterized by DI = 67-70, Mg # = 37-38, Na/K ratio in the range of 0.47-0.66, lower contents of compatible elements, such as Ni (5-6 ppm), Cr (8.9-9.2 ppm), Co (9.9-10.1 ppm), and Sc (3.9 ppm). In contrast, incompatible elements, such as Sr (1 195-2 004 ppm), Ba (1 421-1 651 ppm), Zr (487-495 ppm), U (4.5-5.0 ppm), Th (16.5-17 ppm), Nb (53-55 ppm), Ta (2.7 ppm) show characteristic enrichment. The content of Rb is likely lowered due to autohydrothermal leaching (50-64 ppm) causing high K/Rb ratios (467-553). The chondrite-normalized REE pattern (with Eu/Eu* = 0.94 and Gd/Gd* = 0.20-0.21) resembles that for phonolitic rocks of the České středohoří Mts. The trachyandesite body belongs among the erosional relicts of the composite volcano which is developed in the upper volcanosedimentary complex of the České středohoří Mts. (the Děčín Fm.). These lavas form tabular bodies within the prevailing redeposited pyroclastic material. Small-scale brittle tectonic measurements show some influence of the recent slope movements.

Subproject: Celadonite and saponite nodules from Tertiary volcanic breccia of Račí vrch Hill in Ústí n.L. (***K. Melka, J.K. Novák, J. Ulrych*** *& T. Wiesner, Municipial Museum in Ústí nad Labem*)

Clay minerals such as celadonite and Fe-saponite were found as infills in green nodules 1-7 cm in size, hosted by basanitic volcanic breccia at Račí vrch Hill (Krebsberg) near Krásné Březno in Ústí n.L. The massive intrusion of basanitic composition (26 Ma in age) is emplaced into the brecciated facies. The textural as well as compositional evidence suggests that both the spongy celadonite and the Fe-rich saponite with subordinate mixed-layer celadonite/smectite originated by interaction of the decomposed ultramafic xenoliths with autohydrothermal solutions. The Al-bearing celadonite, previously interpreted as dellesite, plots to the boundary between celadonite and glauconite in the classification diagram. According to X-ray diffraction data, celadonite was identified as a well-ordered one. In contrast to volcanic breccia, the individual vesicles in the dominant massive basanite rock are rarely filled with zeolite species such as analcime, natrolite, thomsonite as well as apophyllite and calcite.

No. OG MŽP 13/99 Slope movement hazards in the Labe River valley, Děčín county (*O. Moravcová, Czech Geological Institute, Prague &* ***V. Cajz***)

Subproject: Study of neovolcanic rocks and their evaluation for the thematic study of susceptibility for slope movements in the selected area (***V. Cajz***)

Rockfall and landslides are natural hazards that control regional development of the area near Labe, Ploučnice and Kamenice rivers. The Ministry of the Environment CR commissioned a purpose-made study of slope-movement hazards as the continuation of the analogous study of the Ústí nad Labem county.
The studies were concentrated in the northern part of the area. The territory occupies the central and northern parts of the České středohoří Mts. volcanic range. Volcanic rocks participate in the slope-movement hazards by rockfall and by landslides due to their cohesion. Solid volcanics, esp. those with irregular and columnar jointing, are predisposed to rockfall if exposed on steep slopes. Volcaniclastic rocks, which are mostly incoherent and argillized, are very convenient materials for landslides. This situation is common at the base of the volcanic complex, esp. where underlain by Cretaceous marlstones. Due to intensive erosion in river valleys, the base of the volcanic complex is frequently exposed in steep slopes, thereby creating favourable geological conditions for both types of slope movements. Based on field investigation, a thematic map of these natural hazards was constructed to help the state authorities in making competent and correct decisions.

No. 165/1998/Bgeo/PřF Lamprophyres associated with the Krušné hory (Erzgebirge) batholith and their petrogenetic significance (*M. Štemprok, Charles University, Prague,* ***E. Pivec & J.K. Novák***)

Subproject: Lamprophyre dykes and their main rock-forming minerals (***E. Pivec & J.K. Novák***)

The study of Paleozoic lamprophyres (kersantites, spessartites and minettes) and cognate dykes (e.g. porphyrites, microdiorites etc.) focused on the chemical and optical properties of rock-forming minerals continued. The study concentrated on dark minerals with the primary purpose of estimating the origin of these rocks. Multiphase origin of these rocks is evidenced by the chemical composition of multiple generations of micas, which range from phlogopite (almost one-half of the studied micas from lamprophyres of the western part of the Krušné hory Mts.) to biotite (mostly from the eastern part). Compositions corresponding to actinolite and actinolitic hornblende prevail among amphiboles, but edenitic hornblende and ferroan pargasite were also identified in kersantites from Krupka. Pyroxene (augite) is rare in most rocks and, much like olivine, was altered and replaced by a mixture of secondary amphibole and chlorite (pseudothurigite and corundophyllite) $\pm$ carbonates. In addition to calc-alkali feldspars up to An_{70} (kersantites from Jáchymov area), albite occurs as a product of younger postmagmatic processes (especially in the western part of the Krušné hory Mts. area). In the eastern Krušné hory Mts., the field of the chemical composition of feldspars is relatively narrow, ranging between An_{30} and An_{50}. Ternary alkali feldspars were found in the studied dyke rocks in the western part only.
All the studied rocks are altered, as indicated by the $\delta^{18}O$ values from 1.4 to 7.8 $^{o}/_{oo}$ in the Jáchymov area; the relatively unaltered rock is diorite porphyrite near Mariánské Lázně, which forms xenoliths in a granodiorite porphyrite dyke ($\delta^{18}O$ = 10.5 $^{o}/_{oo}$).

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9. Department of Stratigraphy and Paleontology

Foreign Grants and Joint Projects

Grant projects with international cooperation

Bilateral cooperation between the Czech Geological Institute, Prague and Geological Institute, Vienna (Geologische Bundesanstalt – GBA, Wien):
"Study of the Upper Cretaceous foraminifers and palynomorph assemblages from the Gosau Group – Northern Calcareous Alps (Dachstein area) *(L. Hradecká, L. Švábenická, Czech Geological Institute, H. Lobitzer, GBA, Vienna &* ***M. Svobodová****)*

Subproject: Study of the Upper Cretaceous palynomorph assemblages from the Huehnerkogel (Northern Calcareous Alps – Dachstein area) (***M. Svobodová***)

Eight samples were studied from the Huehnerkogel locality and only 4 samples contained palynomorphs.
HK4: Only few specimens of ceratioid dinocyst species of *Odontochitina* sp. A were found in this sample. This type of *Odontochitina* was described by Kirsch, 1991 from lower-middle Campanian from Oberbayern, Rohrdorf locality, Pinswanger Schichten.
HK5 and HK6: Both samples contain similar palynomorphs, only HK6 is more diverse and more rich in the number of specimens. Terrestrial flora, especially angiosperm pollen, prevails in Huehnerkogel samples (HK5 - 37 %, HK6 - 49 %, HK7 - 38 % of palynospectra). Sample HK6 yielded a mixed assemblage of a few non-marine algal forms, pollen grains of gymnosperms (mainly halophyte pollen grains of *Classopollis/Corollina* – family Cheirolepidiaceae which inhabited coastal regions), and a miospore assemblage that is dominated by angiosperm pollen.
Among angiosperms, triporate pollen of the *Normapolles* are the most abundant and diverse. Most common are *Trudopollis-Plicapollis-Pseudoplicapollis-Interporopollenites* species. No *Papilopollis* pollen grains were found. This assemblage is consistent with the Late Campanian age. Biostratigraphically more important are the finds of *Dinogymnium euclaense* (occurrence from the Late Campanian-Maastrichtian) and *Xenascus* cf. *sarjeantii* (occurrence from the Early Campanian). This means that samples HK5 and HK6 are most probably of Late Campanian age.
Marine influence is indicated by the presence of dinoflagellate cysts, acritarchs and chitinous linings of microforaminifers. Marine microplankton forms up to 20 % of the palynospectra, with prevailing chorate cysts, e.g., *Florentinia, Spiniferites*, a.o.. Noteworthy is the presence of green algae (*Chlorophyta*) of the family Zygnemataceae (1 %) - *Lecaniella* sp. and *Ovoidites parvus* in sample HK6. Species of *Lecaniella* inhabited shallow, short-lived sandy pools of the "wet heatland". The species of *Ovoidites* represents probably zygospores or aplanospores of zygnemataceous algae, probably pertaining to *Spirogyra* and related filamentous forms. They appear to reflect deposition in shallow, open water in which oxygen levels may occasionally have been reduced at the sediment-water interface but were never lowered sufficiently to create stagnant conditions. HK6 association most likely does not represent open marine depositional environment with a higher proportion of pollen and spores. Depositional environment indicates marine conditions with strong terrestrial supply. The palynofacies of samples HK6 is dominated in general by light brown to brownish-red wood detritus, tracheids of the family Pinaceae and terrestrial palynomorphs.

American Chemical Society, The Petroleum Research Fund: Re-evaluation of mid-Paleozoic strata in southern Peru in context of Late Devonian Gondwanan glaciation (*P. E. Isaacson, Geological Department, University of Idaho, Moscow, E. Díaz Martínez, Departmento de Estratigrafia, Facultad de Ciencias Geologicas, Universidad complutense de Madrid, Madrid*, ***M. Vavrdová*** & ***J. Bek***)

Subproject: Palynology of selected sections in Western Gondwana (***M. Vavrdová*** & ***J. Bek***)

Plant microfossils such as dispersed miospores and unicellular marine microplankton were used for the assessment of glacially influenced sediments in subsurface sequences and selected sections in southern Peru, Altiplano and northern Bolivia (Madre de Díos Basin). Palynomorphs of marine origin predominate in sequences of presumed Early and Late Silurian age, such as San Gabán Formation and Ananea Formation in southern Peru. Age-diagnostic miospores appear in the Tequeje Formation of Lower Devonian age and predominate in the Middle Devonian Tomachi Formation. Late Devonian diamictites studied mainly in the Altiplano region, Bolivia, yielded *Retispora lepidophyta* and *Umbellasphaeridium saharicum*.
Hinchaka, Isla del Sol and Mina Matilda sections were studied. Mature, organic-rich Upper Devonian oil-source rocks in Madre de Díos basin show potential for large accumulations of oil reserves. Marine microplankton associations of Silurian, Early Devonian and Famennian age reveal affinities to assemblages known from the eastern part of North America (Ohio, Ontario, Tennessee and Michigan in the Famennian, and the Lower Devonian Haragan Formation of Oklahoma).

Other established international research groups

Grant project of University College of Cape Breton, Sydney, Canada: In situ pecopterid microspores from near the Westphalian D-Cantabrian boundary in Sydney Coalfield, Nova Scotia, Canada (*leader: E. L. Zodrow, Centre for Natural History, University College of Cape Breton, Sydney, Canada,* ***J. Bek****, J.Pšenička, West-Bohemian Museum, Pilsen, Ch. Cleal, National Museums and Galleries of Wales, Department of Biodiversity, Cathays Park, Cardiff, UK & A.R. Hemsley, Laboratory for experimental Palynology, Department of Earth Sciences, Cardiff University, UK*)

Subproject: Tree ferns at Point Aconi, Sydney Coalfield: Evidence from variability of microspores (***J. Bek***)

The study is a comprehensive investigation of microspores and the *in situ* fructifications from which they were isolated, using all the fertile material in the Paleobotanical Collection at the University College of Cape Breton (150 specimens). They originated for the most part from narrow stratigraphic interval around the Westphalian D-basal Cantabrian boundary near Point Aconi in the Sydney Coalfield, Nova Scotia. Descriptions of dimensional and morphological variability in the sample microspore populations were made and correlated with sterile pecopterid foliage. This fills a gap in the study of *in situ* pecopterid microspores for the Euroamerican floral province. In effect, the present data allow to establish taxonomic boundaries for a number of biostratigraphically important pecopterid microspores that occur close to the Carboniferous-Permian boundary in the Carboniferous Maritimes Basin.
The studied *in situ* microspores can be divided into five groups according to their morphology. The first group is represented by relatively large (about 60 μm in diameter) microverrucate to microgranulate trilete microspores of the *Cyclogranisporites* type. The second group consists of larger (about 30 μm in diameter) monolete to triletoid microspores of the *Punctatosporites* type. Microspores of the third group (about 20 μm in diameter) have finely microspinate to microverrucate sculpture and are of the *Punctatosporites pygmaeus* type. The fourth group is characterized by scabrate to microspinate microspores

of the *Punctatosporites minutus* type. The fifth group consists of the smallest (about 20 μm in diameter) laevigate to scabrate microspores of the *Laevigatosporites-Latosporites* type.
In the process of study, unusual sporangia were noticed resembling *Radstockia, Crossotheca,* or even *Whittleseya*-type for taxonomy. The sporangia originated from a ca. 40 by 25 cm large fragmentary frond that is entirely fertile and without sterile foliage. The extremely well-preserved claviform "synangia" contain two types of palynomorphs: the monolete laevigate microspores corresponding to dispersed species *Latosporites minutus* (smallest, circular form: 27.3 μm on average), *Laevigatosporites minimus* (oval, intermediate size of 20 to 34 μm), and monolete to triletoid microverrucate "microspores" corresponding to dispersed species *Punctatosporites oculus* (oval to circular, largest: 29.6 μm on average).
The problem is that the recovered palynomorphs can be interpreted either as microspores (implying pteridophyte tree-fern affinity), or pre-pollen (implying gymnosperm seed-fern affinity), because the size difference between microspores and pre-pollen can be very small. The pre-pollen hypothesis is based on the fact that the fragmentary fertile frond is found in exclusive physical association with medullosan fronds of the alethopteroid and linopterid types. A weak, third possibility is the assignment to a so far unknown Carboniferous plant sporangium! This hypothesis is based on the observation that the fructification is very unusual, and not known from the Sydney Coalfield in Nova Scotia, or for that matter from other Carboniferous coalfields. It is assumed that ultrastructural stratifications of wall components in microspores and pre-pollen differ from each other, based on the reproductive biologies that govern pteridophytes and gymnosperms! However, this is a risky assumption, as differentiation could be dependent on whether or not medullosan pollen grains have unusual ultrastructural wall stratification. So, the objective of the study of the sections will focus on demonstrating male functionality, and this includes studying sections of laesurae.

International Joint Project "NECLIME" (Neogene Climate) (*Project coordinator V. Mosbrugger, Tuebingen, Germany)*
Subproject: Tertiary fresh-water and wetland ecosystems of the North Bohemian Lignite Basin *(Z. Kvaček, Faculty of Science, Charles University, Prague,* ***M. Konzalová****, J. Sakala, J. Dašková & J. Prokop, Faculty of Science, Charles University, Prague)*

The results from the studies of plant and animal assemblages from the southern part of the North Bohemian Basin are involved in the Project. Systematically collected and investigated micro- and macroremains of all the preserved biological groups, their autoecology and environment can well contribute to the mosaic of European basin vegetation and paleobiology, in more accurate interpretation of the local environment and climatic impact on their biotas. Special attention is given to the development of the aquatic micro- and macrophytes, to algae, aquatic ferns and plants.

International Research Programme "EEDEN" – Environments and Ecosystem Dynamics of the Eurasian Neogene *(Chairman J.E. Meulenkamp, Inst. Earth Sci., Utrecht Univ., The Netherlands).*
Subproject: To be defined in the year 2001 *(Z. Kvaček, Faculty of Science, Charles University, Prague,* ***M. Konzalová,*** *J. Eder, Museum of Natural History, Wien & L. Hably, Museum of Natural History, Budapest)*

The data on high-resolution taxa, which were obtained within a systematic study of terrestrial plant ecosystems of the Bohemian Neogene, are integrated in the project. Many taxa of herbaceous plants, shrubs and evergreen/deciduous trees are comparable in the context of Eurasian flora. New data from paleogeography and paleoenvironment can be applied. Special attention is given to the environment of wet ecosystems and lowland forests, their diversity and linkage with the Oligocene ecosystems.

Joint Project of the Czech and Polish Acad. of Sciences: Studies of Tertiary deposits at the periphery of the Bohemian Massif – comparison of the vegetational development in Czech and Polish parts of the Zittawa Basin *(**M. Konzalová** & M. Ziembińska-Tworzydlo, Geol. Instit., Warsaw University, Poland, coordinator E. Turnau, Geol. Inst., Polish Academy of Sciences, Krakow, Poland)*

Sporopollen associations were examined from complete borehole sections of both parts of the basin. *Selaginellaceae, Osmunda, Lygodium, Histiopteris* and numerous *Polypodiaceae* can be mentioned among coal-forming ferns distributed in both parts of the basin. Swamp forests of *Taxodiaceae* and *Cupressaceae* belong to dominant conifer communities besides the common *Pinaceae* and *Pinus* species. Among *Pinaceae*, the Chinese narrow endemic conifer of *Cathaya* was recognized. Another Chinese conifer, *Sciadopitys,* abundant in some horizons of the Miocene coal basins in Germany, was recorded as a rare element only. Deciduous trees predominated in lowland and riparian forests, with an admixture of paleosubtropical representatives of the North American Atlantic province, *Nyssa* and *Liquidambar.* They are prominent but rather rarely recorded taxa in pollen. Very common are *Carya* and *Castanea,* characteristic for both parts. Worth mentioning is the abundant occurrence of *Clethraceae – Cyrillaceae* (*Tricolporopoll. bruehlensis* (R.Pot.)Th. et Pf.) in the Polish part, contrary to the *Sapotaceae* in the Czech part. The differences can be interpreted ecologically and by edaphic factors. Palms *(Araceae*), *Calamoideae* and uncertain monocots are common in basal inlets and the lowermost clays. Their pollen display fine differences in size and tectum arrangement and were therefore examined parallel in the LM and SEM. Besides climbing palms (*Calamoideae)* and palms of *Sabal* and *Trachycarpus* types, *Liliaceae and Araceae* could be distinguished. Representatives of these families, often growing at pond edges and in wet habitats of bogs and fens, were studied more thoroughly. More than four morphological groups were established among monocots linked with the mentioned families.

Spanish project with Czech participation, Consejo Superior De Investigaciones Científicas (*collaboration with J.C. Gutiérrez-Marco, CSIC and D.K. Loydell, University of Portsmouth)* Project: Research on graptolite biostratigraphy, paleobiogeography and paleoecology of NW Gondwana (***P. Štorch***)

Densely sampled section at El Pintado Dam near Cazalla de la Sierra (Ossa Morena Zone) ranges from the base of the Silurian to the Early Ludlow. In 2000 the section yielded richly fossiliferous *Coronograptus cyphus* Biozone, *Demirastrites triangulatus* Biozone, *Pribylograptus leptotheca* Biozone and *Lituigraptus convolutus* Biozone (first records) as well as entirely complete and fossiliferous *Stimulograptus sedgwickii* Biozone. Rather condensed but complete sequence containing mid-Llandovery biozones was recorded for the first time in the Ossa Morena Zone. Several graptolite extinctions and subsequent recoveries were recorded including the post-extinction faunal assemblage of the lowermost *sedgwickii* Biozone. The latter assemblage was identified as a lateral correlative of the so far tentatively dated graptolite-shelly fauna from Hýskov in the Barrandian area.

Grant Agency of the CR

No. 205/98/0454 Evolution of the Devonian sedimentary environments in the Barrandian basins using isotopic compositions of carbon, oxygen and strontium in brachiopod shells (***J. Hladil**, J. Hladíková, V. Janoušek, J. Frýda, Czech Geological Institute, J. Košler, Charles University, **A. Galle** & **L. Slavík***)

The project documents an anomalous composition of calcite in brachiopods N of the Koněprusy reef. During the Pragian and Emsian times, the water mass in these extinct seas differed from their oceanic neighbourhood by surplus of ^{18}O isotope. The anomalous change in the composition of oxygen isotopes is accompanied by a moderate depression in $\delta^{13}C$ values (both in micrite and low-magnesium calcite of secondary brachiopod layers). Anomalous contents of trapped metals in LMC of brachiopods developed with similar timing as observed in C and O isotopes. Such change in seawater composition was possible in deep and cold water reservoirs where metal-rich exhalations must have spread on the seafloor (similarly to the present-day depressions in seafloor relief of the Indian Ocean). The anomalous composition of water in the depths of this former marine basin also corresponds to the scarcity of brachiopods in relevant sediments. Separation of this basin (or several interconnected basins) was incomplete, and the barriers involved shallow passages but also large islands, as documented by the dispersal of lateritic weathering products and geochemical influences of emerged siliciclastic basement (change in $^{87}Sr/^{86}Sr$). A complete separation of the basin(s) by continuous continental coasts of Silurian and Early Devonian times was practically impossible because a perfect exchange of surface water with planktonic faunas (such as graptolites, conodonts or dacryoconarids) connected the Barrandian basin(s) with the neighbouring ocean. The sites in Spain, Morocco and many other areas within an originally huge periphery of the Gondwanan region have the same planktonic-nectonic faunas. This exchange worked smoothly even during the lowest sea levels of late Pragian and early Emsian. General implications: The eustatic emergence of zonal barriers with islands suggests that the search for an extinct volcanic island arc is correct; this type of imperfect barrier separation must have disappeared during the Early Devonian movement of lithospheric plates. This suggestion corresponds with the latest geochemical evidence for the presence of volcanic arc-related rocks submitted by both German and Czech colleagues. This further implies that the mid-Devonian closure of the Rheic-ocean relict passage between the juxtaposed crustal segments of Gondwana and Laurussia was connected with subduction of a passive margin of a hypothetical Perunican crustal segment (within the Armorican family of terrane precursors). This also implies that the tectonic settings during the early Devonian Variscan stages were completely different than the paleogeography of the late Variscan orogenic stages in the Carboniferous, when a rule of the passive margin had to be ascribed to already cratonized and thinned early-Paleozoic amalgamates on margins of Laurussia. Subduction developed in other areas (in closing Rhenish basins) and the direction of subduction was incomparable with the Early Devonian settings, which were roughly 80 Ma older than the late Variscan collisions.

Subproject: Evaluation of stratigraphical completeness in reef-related facies near Koněprusy, SW Barrandian (*V. Janoušek, J. Frýda, Czech Geological Institute, Prague, **J. Hladil** & **L. Slavík***)

Suggestions made on the basis of conodont stratigraphy were tested in light of strontium chemostratigraphy. Generally, the strontium chemostratigraphy is a promising tool for the determination of age and duration of reef sediments, where the number of correlable biostratigraphical levels based on pelagic faunas is usually limited by facies. The Pragian crinoidal-bryozoan biodetrital sediments are no exception in connection with the typical scarcity of reliable biostratigraphical markers. In studying the Barrandian sediments of Pragian age, geologists face a considerable weakness of Pragian stratigraphical zonation, because the subdivision to sulcatus, kindlei and pireneae conodont zones has both fuzzy evidence and boundaries, and dacryoconarid zones acuaria and strangulata have no better resolution within the Pragian times (duration of ca. 4 m.y. is assumed in the present literature). Sedimentological evidence (unconformities

and missing facies) agrees with the paleontological evidence (missing of zone-defining index species), and both approches suggest missing parts of sedimentary record in the early but mainly in the late Pragian. As the study of fossils has so far failed to produce convincing evidence concerning the detailed timing and total duration of sedimentation at Koněprusy in the Pragian, an alternative method has been sought. The steep gradient on the sea water Sr isotope curve observed in the Pragian (databases produced by J. Veizer and collective) indicates that strontium chemostratigraphy may have such a potential to determine the missing parts with sufficient accuracy. In order to date the uppermost part of the preserved Pragian sequence, the well-preserved brachiopod secondary layers were analysed in samples 10 and 30 metres below the top of a 150-m thick complex in the Čertovy schody Quarry East. In addition, a short interval of beds approximately 25 m below the top of a 80-m thick complex in the Plesivec quarry was sampled. The samples for Sr study were subjected to selection on the basis of the CL-methods, minor- and trace-element compositions as well as O isotopic ratios. If only presumably little altered brachiopod shells (Sr/Mn = 2.3-4.7) are used, the $^{87}Sr/^{86}Sr$ ratios fall into a restricted range of 0.70840 to 0.70842 (n = 4). When compared with the last up-dates on Veizer's database, these newly obtained values indicate mid-Pragian ages, i.e., equivalents of kindlei zone in partly obsolete standard conodont zonal concept. The strontium results fit with the hypothesis that the uppermost Pragian sedimentation in the Koněprusy reef was either originally absent or is (largely?) not preserved, considering the possibility of Pragian/Emsian erosional events on this part of emerged seafloor. The Pragian sedimentation here was relatively short-lived and the main volumes of the preserved biodetrital sediments originated during mid-Pragian high sea-level episodes.

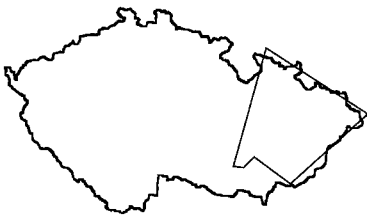
No. 205/98/1347 Paleobiogeography of the mid-Paleozoic with emphasis on the Bohemian Massif (***A. Galle, J. Hladil, P. Čejchan*** & ***L. Slavík***)

Subproject: Migration routes of Hyostragulidae and evolution of mid-Paleozoic basins (***A. Galle***)

The described species of *Hyostragulum* (with septum) occur in central Bohemia, Kellerwald and in Morocco. On the other hand, the described species of *Marekostragulum* (without septum) are known from Moravia, the Armorican Massif, and from Algeria. Probable *Marekostragulum* is known from Unterharz, Germany. Representatives of another probable *Marekostragulum* and a new genus of hyostragulid occur in Ossa Morena (Portugal) and in the Eastern part of the Rhenish Mountains.

The known occurrences of hyostragulids are mainly restricted to a relatively small region of peri-Gondwanan terranes and their respective adjacent mainlands. The occurrences of *Hyostragulum* sp.n.? in Kellerwald and *Marekostragulum*? in Lower Harz are situated in the Giessen-Harz nappe. This, together with sedimentological, tectonic and faunal evidence, supports a Gondwanan origin for the Giessen-Harz nappe. Nevertheless, there are at least two occurrences of hyostragulids north of the Rheic Ocean, i.e., South Laurussia: new genus in the Lahn Syncline and *Marekostragulum adam* in Moravia. This last area is considered Laurussia but the position of Stínava in Moravia is strange and could be exotic. The small area in which hyostragulids occur indicates a rather short planktonic stage of their supposed planulae particularly if one accepts a narrow Rheic Ocean in the Emsian times.

Subproject: History of Devonian rocks within the easternmost part of the Variscan Orogen (***J. Hladil***)



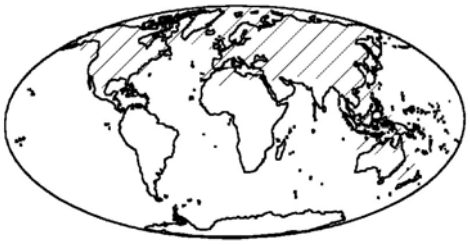
A holistic analysis of the Devonian rocks of Moravia is based on facies, tectonic information, paleomagnetic data, and faunal biodynamics in the easternmost part of the Variscan Orogen. Sediments and metasediments of the Moravian Karst, Němčice-Konice, Horní Benešov, Rýmařov-Vrbno and Tišnov facies were formerly parts of a large Rhenish-type basin developed on attenuated crust undergoing dextral transtension during the Emsian to Early

Carboniferous times. It communicated with other Rhenish-type basins along the southern Laurussian margin and, during the Devonian, may have been several hundred kilometres in length. Most of the diastrophic sediments are Late Visean in age. Basin eversion, reflected in the cessation of diastrophic sedimentation in deep marine basins, occurred during the Viséan/Namurian. Formerly remote facies-tracts were subsequently juxtaposed. Facies in various areas of western Moravia-Silesia suggest other basins but additional data are needed to prove or disprove their former existence. The Givetian Městečko Trnávka shale with its cover of diastrophic sediments may reflect the entry of the Late Devonian collision occurring mainly in the Sudetic region in the northern part of the Bohemian Massif. The Velké Vrbno facies is suggested as representing a Barrandian-like sequence accreted to a volcanic arc during Early Devonian times. Major palinspastic breaks of tens to hundreds of kilometres are explained by strike-slip wedging and reworking of terranes controlled by clockwise rotation and bending of the orogen. Large crustal blocks were uplifted, dissected and ultimately completely erased from the structure. An extensive nappe structures affect the Devonian also in eastern Moravia, as exemplified by facies, geophysical and biostratigraphical documents from revised log of the Raškovice Ja-7 borehole.

Subproject: Middle Devonian faunal list database progress (***P. Čejchan***)

A new algorithm for paleobiogeographic reconstruction has been repeatedly applied to occurrences of lower to middle Devonian rugose corals of the Perigondwana. The database of occurrences was completed in co-operation with A. Galle, who carried out a systematic revision. Pragian faunas of the Barrandian are similar to those of Thuringia but they differ from those of Iberia: this result supports the idea of a peri-Gondwanan ancestry of the Saxo-Thuringia, at least their connection without distinct paleobiogeographic barries. A lesser similarity of Barrandian and Iberian faunas are herein explained by different bathymetry and by the possibility of small-scale isolation of Iberian terranes, presumably in the Prototethys area. Another main result is the migration of the Givetian faunas out of Gondwana. Moravian faunas are closely related to those of Laurussian terranes: this contrasts with the (once) presumed peri-Gondwanan ancestry of the Cadomian basement, and supports the idea of close relationship to the Northern Continent.
Due to the recent paleogeographic reconstructions, a system of subparallel ridges and valleys developed in the central European Variscides, represented by the Devonian and Carboniferous precursors of the units, which were later, during the Variscan Orogeny, incorporated into the Rheno-Hercynian, and Bohemian Units, and to the Moravosilesian and Moravian Units that surrounded the southern margin of Laurussia. Faunal and floral assemblages of the individual ridges differ from one another and, moreover, they are influenced by the migration from the Barrandian terrane of North Gondwanan origin. Comparison of the assemblages with the PAUP program helped to asses the faunal similarity between the individual ridges of the central European Variscides.
In parallel, programming of another part of published similarity and distance coefficients used in quantitative paleobiogeographic reconstruction, and investigation of their performance in the main models of paleobiogeographic evolution (vicariance vs. amalgamation, formation and ceasing of barriers, or migration pathways) were done. The published version 2.22 is programmed as a C. It is accessible anonymously at ftp://ftp.uchicago.edu.

Subproject: Critical review of worldwide distribution and abundance of Lower Devonian conodont index taxa *(**L. Slavík**)*



An extensive review of worldwide Lower Devonian conodont distribution provided evidence for strong conodont endemism during these times, which considerably affected also the distribution of zone-diagnostic species. The significance of index taxa that substantiate appropriate conodont zonal scales in individual Lower Devonian stages is well known. Accordingly, the endemism, substantial differences between

conodont assemblages in major world areas and evolutionary stasis in many lineages represent serious problems with regard to correlation. These facts have also strong impact on the validity of the individual standard conodont biozones, which are practically used worldwide for basic relative dating of marine carbonate sediments. Difficulties in correlation potential of already accepted index conodonts occur within the whole Lower Devonian, unlike in its middle and upper parts. These problems are very typical for the Lochkovian and Pragian stages.

Previous Lochkovian conodont zonal scale was composed of the *hesperius*, *eurekaensis*, *delta* and *pesavis* zones and was only recently substituted by a new zonation involving five newly introduced units. The previous zonal concept of the Lochkovian bears many imperfections regarding big differences in the presence of indexes between Europe and North America, especially Nevada, where majority of Lochkovian zones have been defined. On the other hand there exist many similarities in the composition of conodont assemblages between Nevada and Spain but this cannot be stated elsewhere. Although the current zonation, involving *omus alpha*, *eleanorae*, *trigonicus pandora beta* and *gilberti* zones, established on the basis of comparative studies between western North America, Alaska, Carnic Alps and Spain, provides better possibilities for comparison, it still has numerous unresolved parts. An example is the lowermost Lochkovian where introduction of new standard zones is still very difficult, and problematic occurrences of the name-bearers in Australia, Morocco, Podolia, Zeravshan Range and Barrandian make this zonation in these areas practically inapplicable.

The situation with Pragian distribution of zone-diagnostic species is very similar. Almost non-problematic character has the first Pragian index – *Eognathodus sulcatus*, which is widely referred throughout the world. The only problem seems to be the low number of platform elements in conodont associations and the rare occurrence of this form in Moroccan and European sections, including the stratotype area of Pragian stage. Somewhat bigger difficulties concern the second Pragian conodont zone. It was established on the basis of the occurrence of younger descendant of *E. sulcatus* – *E. sulcatus kindlei* within the *Eognathodus* lineage. This concept undoubtedly represents a correct approach to this problem, when the *kindlei* Zone is underpinned by ancestral control. Although this unit has been largely accepted as a standard middle Pragian zone, the occurrence of the index subspecies *E. s. kindlei* is very limited worldwide. We have only a few references from North America and these correspond probably to randomly dispersed finds (Alaska, Nevada, Canadian Arctic Archipelago, Canadian Eastern Cordillera), Victoria (Australia) and only one questionable reference comes from the whole Europe (Sardinia). Thus, if ever referred, this zone was determined indirectly for the most part of the world. Moreover, the base of this rather functionless zone should also serve as the upper limitation of the *sulcatus* Zone, because the definition of late Pragian is even more difficult. Very doubtful and unsatisfactory *pireneae* Zone cannot be, at the present stage of knowledge, regarded a standard stratigraphic unit due to both uncertain origin and unclear or extremely fluctuating stratigraphic range. Due to culmination of endemism and profound global eustatic sea-level drop during the late Pragian, any substitution for this former zone has not been devised yet.

The above given examples, in spite of still increasing number of conodont data, clearly illustrate that the establishment of new, really useful and globally applicable Lower Devonian standard conodont zonation will be difficult also in future, especially due to strongly endemic and rather environmentally stressed than blooming character of these faunas.

No. 205/00/1000 A multidisciplinary research of the Dětaň locality (Tertiary of the Doupov Mts.): the integration of paleontology and pedology (***R. Mikuláš, A. Žigová, E. Kadlecová,*** *O. Fejfar & J. Sakala, Charles University, Prague*)

Beds several centimetres to tens of centimetres thick, recognizable in the volcanosedimentary sequence at Dětaň represent either individual ash layers or results of their subsequent alteration by exogenic processes. Purely subaerial sediments occur in the upper part of the sequence, showing signs of early pedogenesis in some distinctive beds. These layers contain an unusual, kettle-shaped body, 1 m in diameter, formed by mineralized pet-like mass with rich fossils, rootlets and

ichnofossils. The paleontological content of the “kettle” shows an unusual concentration of life activities in such a small space. In the upper part of the section, which consists of ca. 60 distinctive layers, features of subaquatic sedimentation become more common.

No. 205/00/0118 Facies architecture of the Moravice Formation turbidite system, Nízký Jeseník Culm Basin, based on sedimentology and ichnofacies analysis (*O. Bábek, J. Zapletal, Palacký University, Olomouc* & ***R. Mikuláš***)

Previous determination of some ichnofossils, considered to be important for ichnofacies analysis of the Nízký Jeseník Culm Basin, needs a revision. Not only principally vertical U-shaped traces but also subhorizontal ones were identified as *Arenicolies* by previous authors; the subhorizontal ones, however, belong to the ichnogenus *Furculosus* Radwanski and Roniewicz, 1977. Traces previously determined as *Crossopodia,* and partly also those placed to *Nereites*, represent various taphonomical varieties of the trace *Dictyodora*. New interpretations of original full morphologies of the traces are to be taken in consideration, both for ichnofacies analysis, and for the knowledge on sedimentation/erosion regime on the sea floor.

No 206/99/1321 Phylogeny of discoglossid anurans in Europe: Reconstruction based on developmental and paleontological data (***Z. Roček***)

The frontoparietal complex is among the characteristic features of the Anura. Histological investigation of the early development in *Bombina variegata* (Discoglossidae) revealed that the frontal develops from three pairs of ossification centres arising on dorsal surface of the orbital cartilages, accompanied with the fourth pair adjoining the antero-dorsal part of the otic capsules. All are recognizable as early as in pre-calcified, not-yet-stainable stages. Later, these centres fuse with each other and this process may be observed in the cleared and alizarin red-S stained larvae as gradual expansion in the posterior-anterior direction. This principally corresponds to the development of the frontal and parietal bones in the Osteichthyes in which, however, the separate pairs of the ossification centres within the future frontal persist till later development when the osteoid becomes to calcify. The chronological difference probably reflects some developmental shift that could have occurred at the transition from water- to land-dwelling vertebrates.
The development of the skeleton in two European species of the genus *Bombina* (*B. bombina* and *B. variegata*), including the sequence of ossification, is the same till the end of metamorphosis. The skeletal differences in the two species arise only after their external metamorphosis is completed, and occur only in the skull, while the postcranial skeleton remains uniform. The diagnostic characters on the skeleton of adults include the morphology of the proocitooccipital and pterygoid bones, anterior part of the parasphenoid and the structure of the teeth which are non-pedicellate in *B. variegata*. Since pedicellate teeth develop only in adult anurans from non-pedicellate ones, the presence of the latter in *B. variegata* suggests its paedomorphic character. This corresponds to comparatively late appearance of *B. variegata* in the fossil record, compared with *B. bombina*.

No. 205/99/1322 Lower Silurian graptolite biostratigraphy and correlation of the northwestern Gondwana, biogeography and faunal links with the peri-Gondwanan Europe (***P. Štorch***)

In the northern Saharan basins of Libya and neighbouring countries, low- to moderate-diversity inner- and mid-shelf graptoloid faunas are widely distributed. Monospecific and/or oligospecific assemblages of usually long-ranging taxa and, in several cases, endemic taxa barely allowed correlation with internationally recognized zonal schemes with a precision better than a few biozones. North African faunas

of the early Llandovery age are composed of biserial, often endemic species. A progressive influx of world-wide distributed monograptoid taxa (*Coronograptus, Neolagarograptus, Pristiograptus, Campograptus, Rastrites, Lituigraptus*) can be observed in the mid-Llandovery strata. A number of the mid-Llandovery species *(Rastrites peregrinus, Lituigraptus convolutus, Torquigraptus decipiens, Campograptus obtusus, Camp. lobiferus, Neolagarograptus tenuis, Petalolithus clandestinus*, a.o.) collected during a field trip to northern part of the Murzuq Basin (Gargaf Arch area, November 2000) were recorded for the first time in the Saharan Platform and considerably improve the correlation. The precise position of the Ordovician-Silurian boundary, however, remains unknown in the northern Sahara due to the lack of correlatable faunas from the *persculptus* and *ascensus-acuminatus* biozones. The succeeding *vesiculosus* Biozone has already been recorded in the Ghadamis Basin. Due to distinct endemicity of the Lower Llandovery faunas in the N Saharan basins, a local biozonation has been erected in Algeria. Some of the local zones (*africanus-tariti*, *fezzanensis* and *libycus-gregarius* biozones) can be employed in biostratigraphical correlation across the region including Libya, Niger, Algeria and Tunisia. Along with the recent discoveries of the world-wide distributed mid-Aeronian graptolites, the biostratigraphic correlation of the Lower Silurian of N Sahara has been further enhanced by the discovery of several Upper Llandovery taxa, formerly known only from northern Africa, in Europe (*Nd. fezzanensis*, *Metacl. flamandi*, *Metacl. asejradi* and *Parapet*. *meridionalis*). Wenlock shales with low to moderately diverse graptolites are preserved in central and NW Libya and SE Tunisia (Ghadamis Basin). They largely comprise long-ranging monograptids of the *M. priodon* Group, pristiograptids and infrequent *Ret. geinitzianus*. Age-diagnostic species are *M. riccartonensis*, *Colonograptus ludensis*, *Goth. nassa*, uncommon cyrtograptids including *Cyrt. lundgreni* and *Cyrt*. *perneri*, and mediograptids. Early Wenlock faunas are still of rather low diversity if compared with coeval assemblages of peri-Gondwanan Europe, Avalonia and Baltica. Late Wenlock faunas, however, closely resemble their counterparts known from elsewhere. The relative increase in graptolite diversity during the Wenlock is in clear contradiction to the widely described progradation of the Acacus sandstones in the N Saharan region and suggests that increasing paleotemperatures may have influenced graptolite distribution.

No. 206/00/0942 Permian acanthodians of the Czech Republic (***J. Zajíc***)

Acanthodes gracilis is in all probability the only Permian acanthodian species of the Bohemian Massif area. This species was originally described from the locality Wolbromów (the old German name is Klein Neudorf) in Polish Silesia (the North Sudetic Basin). Finds in the Czech Republic come from the Krkonoše Piedmont Basin, the Blanice Graben, and the Boskovice Graben. The occurrence in the Saale Basin (Germany) is presumptive. The other Permian species were described from the Saar-Nahe Basin (Germany; *Acanthodes bronni, Acanthodes boyi, Acanthodes tholeyi*), the Massif Central (France; *Acanthodes bourbonensis*), and Lueders Formation (Texas; *Acanthodes luedersensis*). The remaining Permian finds determined as *Acanthodes* sp. come from Greenland, Oklahoma, Texas, New Mexico, and Kansas. Comparison of *Acanthodes gracilis* with other Carboniferous and Permian acanthodian taxa necessitated biometric measurements and comparative osteological studies of the rich acanthodian material in the British Museum of Natural History, London. For a detailed investigation of some osteological structures (fins and fin spines, pectoral girdles, jaws, circumorbital rings, gill arches, scales, and sensory lines system) and biometric measurements (distances between individual fin spines, diameter of circumorbital ring, mandibular bone length, prepectoral distance, standard and total specimen length, number of scales per millimetre in a row) of the Czech and Moravian material, specimens from Prague collections were used (for the time being). The biometric measurements form a basis for the calculation of 17 ratios of various significance (taxonomic, ontogenetic, and functional-morphologic).

No. 205/99/1315 Nearshore taphocoenoses across the Cenomanian-Turonian boundary (Bohemian Cretaceous Basin) (***J. Žítt, L. Peza*** *& B. Záruba, National Museum, Prague*)

Sampling in the rocky-coast facies at most of the key localities of the project (e.g., Karlov, Velim, Nová Ves, Starkoč) was finished. A study of hardgrounds, their correlated horizons and overlying beds (i.e., pre- and post-omission) continued regarding the taphonomy of macrofauna (crinoids, echinoids, thecidean brachiopods, rudists and oysters) and micropaleontology (foraminifera, palynomorphs). New exposures at the Plaňany quarry supplied a particularly rich set of important data on the distribution of macrofaunal remains and their taphonomic features, and highly varying pattern in time averaging. The rudist horizon was recovered here and compared with the Radim and Kuchyňka new rudist finds of comparable age. A new oyster species with special taphonomic characters was identified in the episodic coprolite deposit at the base of the Bílá Hora Formation found at Plaňany, together with a giant worm tubes. The data were markedly enriched due to the excavations for a gas pipe-line constructed north of Prague, especially in the area of the Korycany limestones (Netřeba, Korycany, Horňátky) and at the Kojetice High (early and late Upper Cenomanian). New detailed information on the geology and sedimentary environments of the sandstone-limestone shallow-water deposition are being presently evaluated together with the taphonomic data derived from rich macroinvertebrate taphocoenoses, especially regarding taphonomic categories of univalve, bivalve and massive skeletons (e.g., corals) and encrustation of lydite substrates.

No. 205/00/0944 Middle Liassic brachiopod fauna and the development of brachiopod assemblages in the Liassic of the Northern Calcareous Alps (***M. Siblík***)

The study was focused on Schafberg, Hierlatz and Adnet areas. Rich brachiopod fauna of the Schafberg environs was monographed already by Böse in 1897. Characteristic Pliensbachian species *Securithyris adnethensis* was ascertained during the new sampling in relatively numerous specimens in the red micrites at the localities of Mittersee, Suiśsensee, and then ENE Meislalm.

In the Hierlatz area, several generations of the fissure fillings were studied on Feuerkogel containing rich brachiopod fauna with prevailing rhynchonellid species of the "*variabilis*" type and of Sinemurian age (Neptunian dykes with so-called "Hierlatz-type" brachiopod fauna). The age of the Neptunian dykes filled with red micrites was, on the other hand, stated as Pliensbachian on the basis of occurrences of terebratulid *Phymatothyris cerasulum.* Similar dykes were ascertained on the Hoher Trog Mt. and on the Keferfeld path towards the Nieder Ochsenkogel top. *Lobothyris punctata* and strongly ribbed rhynchonellids were characteristic of the biosparitic fillings of these fissures. It is of particular interest that *Rhaetina gregaria,*which was mentioned from the Hierlatz Limestone of Feuerkogel by Geyer in 1898, was not found during the new sampling.

The Adnet Limestone in Adnet quarries is relatively poor in brachiopod fauna. Determinable specimens found in 2000 in the quarry XXXVIII-XXXIX included *Linguithyris aspasia, Bakonyithyris apenninica, Apringia paolii, Pisirhynchia ex gr. retroplicata and Calcirhynchia (?) laevicosta.* Upper Sinemurian age of this fauna was confirmed by the ammonites, studied in the last years by Dommerque, Meister and Böhm. Pliensbachian index terebratulid *Securithyris adnethensis*, which came from Adnet quarries and which was found in numerous specimens during quarring in the past decades, was not confirmed by the present sampling.

Grant Agency of the Academy of Sciences CR

No. A301-3-906 Early Paleozoic extension in the Central European realm: sedimentary, volcanic, fossil and paleomagnetic record of the Barrandian (Bohemian Massif) (***P. Štorch, F. Patočka, P. Pruner & J. Svobodová***)

Geochemical data on siliciclastic sediments of both Cambrian and Early Ordovician to Middle Devonian sequences of the Barrandian area provided significant implications on the provenance of detrital material and paleotectonic setting of the area of deposition. Middle Cambrian siliciclastics were essentially derived from intermediate to acid rocks of a Cadomian island arc evolved on oceanic lithosphere. Inversion of relief (Bohemian phase) interrupted the sedimentation and uplifted the Cambrian Příbram-Jince Basin; the successory Prague Basin subsided since the Tremadocian. Shallow-water siliclastic sedimentation prevailed in the Ordovician and Early Silurian, and was replaced by the deposition of carbonate rocks in the Late Silurian and Early Devonian. In the early Givetian, short-lived accumulation of flysch-like siliciclastics (heralding the onset of Variscan orogeny) completed the sedimentation in the Barrandian area. In the Early Ordovician to Early Silurian, and possibly also in the Middle Devonian, clastic sediments of the Prague Basin were derived from mature upper continental crust dominated by intermediate to acid igneous rocks. The supply of recycled sedimentary component was increasing through time. Synsedimentary basic volcanism conspicuously contributed to the clastic material during the Ordovician and Silurian. The Early Paleozoic siliciclastics of the Barrandian area were deposited at intracontinental extensional tectonic setting, which may be related to a large-scale extension and fragmentation of the northern margin of the Gondwana supercontinent.

A graptolite assemblage comprising 13 species and assigned to the lowermost part of the *S. sedgwickii* Biozone (late Aeronian, Llandovery) was described from a tectonic block of unique volcanic-carbonate facies preserved along the Prague Fault at Hýskov near Beroun. The assemblage is considered to be a low-diversity relic fauna surviving the late *convolutus* (and/or early *sedgwickii*) extinction event. The graptolites are associated with highly diverse, brachiopod- and trilobite-dominated benthic fauna (*Aegironetes-Aulacopleura* Community). Biostratigraphic correlation suggests that the sudden appearance of shallow-water limestones (grainstones, packstones and lime mudstones) and bottom dwelling fauna in the otherwise anoxic, black-shale dominated Lower Silurian of northern Gondwanan margin may be explained by rapid growth of local submarine volcano, simultaneous with eustatic sea-level fall. This setting developed in the sub-normally to normally oxygenated part of the middle-higher photic zone, influenced by both wave and current activity, in presumably subtropical conditions, similar to those that existed during the late Wenlock and early Ludlow in the Svatý Jan volcanic centre, as documented by the similar biodetrital microfacies and faunal communities.

No. A301-3-801 Brachiopod fauna of the Kössen “Beds” (uppermost Triassic) (***M. Siblík***)

The present study was focused on the uppermost parts of the section of the classical locality of Kössen “Beds” in Loferbach Valley near Kössen and its brachiopod fauna. The studied level yielded mostly large specimens of *Oxycolpella oxycolpos*, which represented about 80 % of the total brachiopod fauna. *Fissirhynchia fissicostata, Rhaetina pyriformis* and *Zeilleria norica* were other species occurring sporadically at this level. The faunal assemblage corresponds well with the “*Oxycolpella* facies” (uppermost Triassic, Eiberg Member). On the Dachstein Plateau S and SW of Wiesberghaus, two new localities of variegated micrites with *Triadithyris gregariaeformis* were ascertained, well documenting the occurrence of this species near the Triassic/Jurassic boundary. No other macrofauna was found in these micrites, which documents a temporary marine influence during the sedimentation of the huge masses of the Dachstein Limestone. Study of the brachiopod fauna of the Dachstein Limestone at Hochschwab, which contains some Kössen-type brachiopod species, continued in the domain of reefal facies of the Dachstein Limestone near Fölzalm. In comparison to lagoonal facies studied at Karlhochkogel in the last years, the brachiopod fauna near Fölzalm was poor in species and was prevailingly characterized by specimens of *Halorella amphitoma* only.

No. A301-3-807 Hyolith-epibiont relationships: Taxonomy, nature of symbiosis, and spatial/temporal distribution (***A. Galle***)

New family Hyostragulidae has been established, with genera *Hyostragulum* Marek and Galle, 1976 and *Marekostragulum* gen. nov., and a new genus currently under study. The known species of Hyostragulidae are listed in the table below:

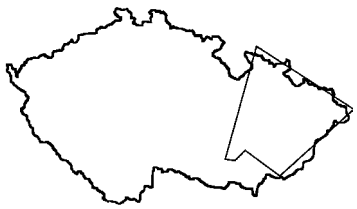
Species	Basal outline	CW	CL	Age	Locality	Host
Hyostragulum mobile	long, elongated, hexagonal	1.4	1.7	Pragian, Dvorce-Prokop and Loděnice Lst.	CB, St. Prokop Quarry, Konvářka	*Pterygotheca barrandei, "Cycloceras"* sp.
H. anna	short, elongated hexagonal	1.1	1.3	Zlíchovian-Dalejan, Suchomasty Lst.	CB, Koněprusy	*Ottomarites discors, ?Pterygotheca barrandei*
H. barbora	short, rhomboidal	0.7	1.4	Dalejan, Trebotov Lst.	CB, Praha-Holyně	*"Hyolithes"* sp. A
Hyostragulum sp. A	short, squamose	1.3	1.6	Zlíchovian, Zlíchov Lst.	CB, Chýnice	*Pterygotheca* sp.
Hyostragulum sp. B	short, elongated hexagonal	1.3	1.4	Pragian, Koneprusy Lst.	CB, Koněprusy	*"Hyolithes"* sp. B
Hyostragulum n.sp. ?	short, squamose	1.6	1.9	L. Emsian, Erbsloch-grauwacke	Germany, Kellerwald	?
H. ometanum	elongated hexagonal and squamose	1.3	2.0	L. Emsian, Ain El Beida Fm.	Morocco, Kandar	*?Pterygotheca*
Marekostragulum adam	slightly elongated hexagonal	1.3	1.7	U. Pragian or L. Emsian, Stínava Mbr.	Moravia, Stínava	*?Pterygotheca*
M. simplex	long, all types	1.2	1.5	U. Emsian, Kerdreolet Fm.	Armorican Massif, Rade de Brest	*?Pterygotheca*
?*M.* cf. *simplex*				U. Emsian, Teferguenit Fm.	Algeria, W. Sahara, Ougarta	?

CW = corallite width, CL = corallite length, CB = Central Bohemia

Tabulate corals are classified as primary tierers. Hyostragulidae, considered Tabulata, maintain the position above the sediment-water interface utilizing hyolithid conchs as support structures. Therefore, they can be classified as secondary tierers.
It was stated that 50-70 % of *Pterygotheca barrandei* was covered with *Hyostragulum*. Other benthic fauna from the localities yielding *Hyostragulum* (and an undescribed epibiont, which is currently under study), does not bear epibionts, or bears far fewer epibionts than do hyolithids. Also, Ordovician hyolithids from Wisconsin, Scandinavia, and the Baltic States were commonly overgrown by bryozoans throughout their life. This seems to indicate that hyolithids did not merely serve as hard substratum for epibionts, but were otherwise attractive to them. It was proposed that increased current velocity (explained by Bernoulli's principle) caused by the protruding shape of the hyolithid operculum (hence a longer hydrofoil surface across the top of the animal) might have brought more food particles to the epibionts.
Our attention was directed to the fact that the coral colony growing from the hyolithid's apex toward its aperture lengthened the hydrofoil so that the flow over the corals would have been both increased and turbulent. This would have further lengthened the path of a food particle passing over the colony thus increasing the chances of its capture. Current velocities near the coral/water interface would not usually permit destabilization of the shell.
The hyolithid shell itself may have other, not observed properties that would attract and support the growth and/or preservation of epibionts.

No. A301-3-809 Assessment of regional and eustatic sea-level changes at the Devonian carbonate platform bordering southeastern edge of the Bohemian Massif (***P. Bosák, J. Hladil, A. Galle, P. Čejchan & L.Slavík***)

Subproject: Defining the major Frasnian cyclicity of eustatic sea-level change (***J. Hladil & P. Bosák***)



Two modern methods were technically developed to a sufficient stage of their applicability to thick sequences of carbonate platform limestones. The first of these two concepts concerns the reciprocal lowstand clastic and highstand carbonate sedimentation on platforms and uses the anomalous gamma-ray counts with additional spectral information for detection of low sea-level stages in the sediment. The second concept is based on the experience that high magnetosusceptibility values usually correspond to weathering products deposited in condensed carbonate beds of lowstand systems tracts, including closely preceding and following intervals (terminal falling stage systems tract and flooding surface). Numerous total gamma-ray logs from drillholes, gamma spectrometric measurements and magnetosusceptibility measurements on samples from outcrops provided an extremely large information basis, which allowed to calculate the mean fluctuation of values and definition of six major Frasnian cycles. An up-dated Moravian biostratigraphic chart suggests that duration of these six cycles is roughly comparable, assumedly 1 m.y. Cycles 1, 3, 5 and 6 are symmetrical, but the shape of the cycles 2 and 3 signals a considerable structural heterogeneity. The extant biostratigraphical markers, although very scattered laterally and vertically, suggest that the big six Frasnian cycles may correspond to the following ranges expressed in terms of standard biozones: FrC-1 – *Pa. falsiovalis*, FrC-2 – *Pa. transitans*, FrC-3 – *Pa. punctata*, FrC-4 – *Pa. hassi* + *Pa. jamiae*, FrC-5 – *Early Pa. rhenana*, and FrC-6 – *Late Pa. rhenana* + *Pa. linguiformis*. The main transgression-regression reversal in the entire Middle-Upper Devonian carbonate sequence is connected with the boundary between the FrC-4 and FrC-5. According to previous 'Moravian terminology' from 1980s, this stratigraphic level corresponds to the parasequence boundary MC-III/MC-IV (a concept introduced by J. Hladil) and/or start of the Upper Frasnian Division IV (a concept introduced by V. Zukalova). There is a trend of a general increase in gamma-ray values from early to late Frasnian beds. This is caused by increased amount of radiogenic potassium ^{40}K (recalculated to K at whole). The potassium and thorium records at the beginning of the Frasnian strongly fluctuate and the calculable elevations are visually expressed mainly due to narrow dividing peaks. The three lower cycles are defined both in magnitudes and patterns. The LST/FS levels became to be strongly developed within the upper half of the Frasnian. The MS-maxima at the bound-

ary between 4th/5th cycles are accompanied by specifically low contents of uranium, which contrast with the high contents of thorium by only sluggish subsidy of potassium. This special configuration is explained by the amounts of aeolian dust as a result of a 'desert-climate sea-level lowstand event'. Completely different is the $5^{th}/6^{th}$ cycle boundary, where considerably high gamma-ray counts are jointly generated by corresponding changes of K, U and Th contents. Especially, a long-term surplus of terrigenous uranium wash-out (continuing to FS with organic-matter binding), together with FS-related amounts of microbial magnetite, indicates a 'humid lowstand event'. This conclusion corresponds to the presence of 'micro-pebbles' of crystalline rocks from distant areas, lateritic alterations and/or shallow-water ferruginous coatings on other particles, which all are related to riverine drainage of low-relief coast, karstification on emerged limestone surfaces and low-salinity coastal swamps.

Subproject: Devonian environmental cycle database (***P. Čejchan***)

Archiving of all accessible geophysical and geological data on electronic media has been done. Assessment of data from boreholes from the margins of the Bohemian Massif was made with the attempt of cycle detection.
Assessment of benthic faunas continued. It became clear that richly structured ecosystems with high evolutionary rates are characteristic for the intervals immediately preceding and following the maximum sea-level rise. These are the times of the Lochkovian, Eifelian, and the Frasnian. Benthic associations of macrofauna from the Pragian, Zlichovian, and Early Eifelian are much more endemic compared to those of the Givetian-Frasnian. This is presumably caused by the sea-level oscillation in the middle to upper Givetian and lower Frasnian. The presumed amplitude was up to 150 - 200 metres. In the Middle Devonian, the sea level was generally higher than in the Pragian-Zlichovian and Famennian-Tournaisian. Ecosystem improvement during the Devonian clearly demonstrates the Givetian-Frasnian episode of shelf submergence and the warming of climate. Diversification of reef assemblages of this interval is recognized and is the direct result of the above mentioned changes of conditions. The proper eustatic and temperature maximum is then characterized by the relatively unified, common but less diversified biota.

Subproject: Gamma spectrometric analysis of Pragian sediments with implications for eustasy of Early Devonian times (***L. Slavík, J. Hladil*** & ***R. Blažek***)

High-resolution sedimentary records with implication for short-lived sea-level fluctuations are very rare among the Pragian sections because all Early Devonian times are connected with reflection of relatively low sea-level stages. The typical Pragian marine sediments on continents, if preserved, contain many hiatuses or zones affected by sediment starvation. Viewed from this point, the Section "Under the Barrandov Bridge" (alongside the Old Zbraslav Road, between the Barrande Rock and the Chapel) is a significant site that involves an unusually continuous succession of calciturbidite/hemipelagite beds in total thickness of 170 m. The extant documents based on macropaleontology and basic lithological indicators allow an assumption of full continuation in this segment with only small corrections for shifts on several normal faults (consulted by I. Chlupáč). The dominating rock type corresponds to the Dvorce-Prokop Limestone. This section was subject to new gamma spectrometric measurements with a step of 0.5 m. The basal bed of the Slivenec Limestone is characterized by low gamma-ray counts. Potassium contents (clay) increase steeper than thorium contents (negative shift in Th/K ratio at the base). Generally decreasing uranium contents turn to short-lived extraordinary positive shift (at 9-m point of the section). This extremely developed U-spike was named as the "Uranium Event", because of the poor correlation with shifts in potassium values. A broad sinusoidal elevation on total gamma-ray counts was measured between this uranium spike and the "First Shale Event", which lies at 86 m. In general, this "wave" (as well as two subsequent waves above) corresponds to an increase in K and Th contents (clay, silt). Uranium contents vary independently, even with slight negative correlation with the values of K, Th. Four "Silt Anomalies" are reported at 22, 27, 38 and 58 m. These partial anomalies are characterized by a strong increase in Th, whereas sub-parallel elevations of U, K

are slight and shaped with a delay. A specifically low-oscillating zone within the late phase of the first "wave" (0 to 86 m) involves a "U/Th Inversion", where U contents become equal to, or slightly higher than, the Th contents (at 66 m). This is the first time since the "Uranium Event" (at 9 m) that such inversion occurs. The evolution of the Th/U ratios markedly copy the shape of the total gamma-ray curve, and also details of this relationship within the "First, Second and Third Wave" seem to be repeated. Also the setting and distribution of the silt-related anomalies within the "Second and Third Wave" resemble the situation in the "First Wave". Due to the sharp offsets at 86 and 141 m (associated with very narrow total gamma-ray spikes), the section would also be suspected of tectonical repetition (hypothetical bedding-parallel faults). However, these sharp offsets and spikes occur also in minor patterns. They can be considered normal stratigraphic features connected with this type and age of sediments. Strong offsets at the boundary of waves at 86 and 141 m are interpreted as major episodes of sedimentary starvation in this section. The end-peak on K, U and Th curves at 172 m lies close above the H.-P. Schoenlaub's finds of *Po. dehiscens*, the entry of which is used as an indicator of the Pragian-Emsian stage boundary. However, the structure of this end-peak cannot possibly be a good equivalent of the "Dark-coloured Graptolitic Event", which is known from the facies in the northern limb of the Barrandian synform (from Na Pozarech near Prague in the east to Stydle vody near Sv. Jan in the west). It can be only suggested, in this connection, that another interesting, highly oscillating pattern occurs within the segment of 161-166 m in this section. As for the general interpretation of this section, we can suggest that this deep-water facies reflected a sea-level rise with increased amount of non-carbonate material. This is the main difference from platform carbonates. An evidence for this statement can be seen at least in the rise of total gamma-ray counts at the transition from the Slivenec to the Dvorce-Prokop facies. Downshift asymmetry observed on the "First and Second Wave" is a typical characteristic of deep turbiditic sediments. The three waves in the section (slowly increasing gamma-ray counts followed by subsequent decrease) are regarded as three eustatic cycles, which can potentially serve as physical-stratigraphic basis for a subdivision of the Pragian into three parts.

No. A3013902: Fructifications and spore populations of plants of groups *Lycopodiophyta, Equisetophyta* and *Polypodiophyta* from Carboniferous limnic basins of the Czech Republic (***J. Bek**, S. Opluštil, Faculty of Science, Charles University, Prague, J. Drábková, Czech Geological Institute, Prague & J. Pšenička, West Bohemian Museum, Plzeň*)

Several Carboniferous fructifications were studied including *Oligocarpia, Senftenbergia* and *Noeggerathiostrobus.Senftenbergia plumosa* is an abundant Carboniferous fern in the central and western Bohemian Carboniferous basins of the Czech Republic. Its epidermal structures in detail were described for the first time. The adaxial epidermis is relatively thickly cutinised. There are differences in the cell structure between the costal and intercostal fields. The intercostal cells are isodiametric, random, pentagonal or hexagonal in shape. The costal cells are rather elongate, random, pentagonal or hexagonal in shape. Abaxial cuticles are very thin. The cells are isodiametric, random, pentagonal or hexagonal in shape. Stomata occur only on the abaxial side of the pinnules. They are irregularly scattered and more or less orientated in one direction; stomatal density is ca. 200 per mm². Stomata are of cyclocytic or sepolocytic type, flush with the epidermal cells. The abaxial and adaxial surfaces contain small trichome bases. Sporangia are of the *Senftenbergia*-type with *Raistrickia*-type spores. They are different from all previously described fertile specimens of *Senftenbergia plumosa* from Bohemia, suggesting a large morphological variability of microspores in this species.
Emendation of *Oligocarpia lindsaeoides* was suggested on the basis of the study of a specimen from the Kladno-Rakovník Basin, Bolsovian age. Measurements for the sorus or sporangia are given for the first time. The sori created 2 rows (1 on each side of midvein) on abaxial side of each pinnule and they are 0.47 mm in diameter. The sporangia of *Oligocarpia lindsaeoides* are the smallest of all of the species of the genus *Oligocarpia.* The most frequently encountered number of sporangia per sorus is 5. Sporangia are 0.22-0.3 mm in diameter, pyriform or rounded, free, short stalked, and annulate. Annulus equatorial, composed from one to two rows of 18-22 oblong thick-walled cells, is interrupted by a stomium composed of several (probably 4-6) thin-walled isodiametric, elongated cells. Trilete, laevigate, scabrate to microgranulate *in situ* microspores 20 to 39 μm in size are correlable with the dis-

persed species *Leiotriletes subadnatoides.* A review of Carboniferous fructifications yielded microspores of the *Leiotriletes*-type. Only two species of *Noeggerathia* have been described from the Carboniferous of the Czech Republic. The most complete information (fronds, cones and trunks) concerns *Noeggerathia foliosa* (Sternberg) Šimůnek and Bek. Measurements come from sporangia of 54 cones. The length of cones exceeds 200 mm, their width is 18-22 mm. Sporangia are oval, 3-4.4 mm long and 2-3.2 mm wide. A reconstruction of the whole plant was suggested. Cuticles are of amphistomatic type with long four-sided cells. Microspores of the *Verrucosisporites* type and megaspores of the *Calamospora laevigata* type were isolated. Species *Noeggerathia intermedia* K. Feistmantel is known from only 20 fragments of fronds. Cones of *Noeggerthiostrobus vicinalis* Weiss are associated with this plant species. They yielded mico- and megaspores of the *Calamospora* type, which evidences that these cones are of *Discinites* affinity

Grants of the Charles University, Prague

GAUK 145/1998 B GEO Paleoecology of swamps of the Upper Radnice Group of Coals of the Kladno–Rakovník Basin (*S. Opluštil, Faculty of Science, Charles University, Prague,* ***J. Bek*** *& I. Sýkorová, ÚSMCH ASCR*)

The ancient mire of the Upper Radnice Seam in the southeastern part of the Kladno-Rakovník Basin (Kladno Coalfield) was characterised by dominance of two different floral assemblages: (a) the assemblage of tree-like lycopsids of genera *Lepidodendron* and *Lepidofloyos* and (b) the assemblage of sub-tree lycopsids of the genus *Omphalophloios*. These assemblages colonised different environments depending on the level of groundwater table in the mire. Assemblage of tree-like lycopsids favoured permanently high level of water table of frequently inundated mire with clastic input (clay suspension). On the opposite, *Omphalophloios* lycopsids preferred drier conditions with groundwater table temporarily lowered below the mire surface. The mire was characterised by alternation of the above mentioned floral assemblages which is interpreted as the response to relative water table changes due to base-level oscillations.

The onset of peat deposition in the mire was characterised by high ground water table up to the level between the "velká opuka" and "malá opuka" tonsteins. The mire at this level was colonised by a *Lycospora*-producing assemblage (*Lepidodendron, Lepidofloyos*). Frequently occurrig thin sedimentary partings and generally increased ash content indicate the existence of occasional flooding events introducing the clay suspension into the mire. The mire was eutrophic, with planar morphology. Approximately between the "velká opuka" and "modrošedá opuka" the decelerated base-level rise increased the drainage and the mire became relatively drier. Consequently *Lycospora* producing assemblage of tree lycopsids was replaced by densospores producing an assemblage of sub-tree lycopsids of the genus *Omphalophloios*. Increasing rate of base-level rise led to final change of the assemblages to *Lycospora*-producing lycopsids at the end of the mire existence. These changes are correlable over the whole mire of the Upper Radnice Coal in the Kladno Coalfield.

Lateral changes in the floral assemblages studied show a pattern similar to the vertical succession of assemblages.

Industrial grants

Bohemian-Moravian Cement Co. (Lime and Cement Works of Mokrá Co.) No. 7004 Mineral composition of the Vilémovice Limestone and geophysical testing of their possible continuation within the Frasnian-Famennian boundary interval (***J. Hladil, L. Slavík****, P. Špaček, Dept. of Geology and Paleontology at Faculty of Sciences, Masaryk University, M. Chadima, Agico, Ltd. & B.B. Ellwood, Lousiana State University, Baton Rouge*)

The detailed documentation was based on gamma spectrometric and magnetosusceptibility tools, studies of insoluble residues and a revision of biostratigraphic and facies data in the field. The present knowledge implies a strong refutation of Frasnian-Famennian survival of reefbanks at Mokrá. The whole story originated during 1970s, when a conflict between two extreme schools was growing in intensity, i.e., between the 'horizontal concept' of Fr-Fa event boundaries (V. Zukalová, V. Skoček) vs. 'consistently oblique stratigraphic boundaries' (J. Dvořák, O. Friáková). Especially the mid-Frasnian termination of reef limestones at Hranice with continuation of light grey-coloured grainstone banks up to Tournaisian at Hnojnik were the key arguments against 'horizontalists'. However, this antithesis was based on exceptional localities, where reefs were drowned due to sliding, truncation or transgressive backstepping of reef margins, and also on very shallow areas, where emerged Frasnian reef-banks were covered by thin, light-coloured grainstones to breccias with scattered stromatoporoids and corals in the Famennian-Tournaisian litho- and bioclastic debris. A large (0.5 km across), bedding-parallel contact between the Frasnian reef-banks and Famennian cephalopod limestones in the Mokrá Quarry West attracted the interest of geologists and gave rise to speculations about short-lived Famennian survival of reef-related marine paleoenvironment. These speculations were seemingly supported by the following arguments: a) presence of a strong coral-killing crisis several meters below the end of reef-bank formation, b) findings of rare populations of *Pa. crepida* and other conodonts, morphologically variant in comparison with conodonts from the overlying beds, c) absence of neptunian dykes in the Mokrá Quarry West, d) changed and impoverished benthonic communities with emergence of several Famennian-related endemics (such as rugose corals *Tabulophyllum*, stromatoporoids *Labechia* or tabulate corals *Syringopora*). Although several alternatives have been considered, many papers exaggerated this possibility of reef-banks survival. Practically, all local publications from the last two decades were partly biased by considerations of this 'possible continuity concept at Mokrá'. The present gamma spectrometric and magnetosusceptibility measurements documents normal presence of all six Frasnian cycles. The geophysical logs plotted from Mokrá are very similar to those obtained from many drillholes in platform limestones of Moravia and involve all necessary attributes of a complete section. A really high level of correlation exists between Mokrá and the Slavkov-2 borehole. Gamma-ray counts in beds relevant to terminating Frasnian are undoubtedly fitted with general patterns at the end of the Frasnian stratigraphical column. Only the proper 'Upper Kellwasser Horizon' (or its part) is not geophysically recorded at this site. A perfectly developed sharp uranium spike with slow but also strong increase in potassium(clay) curve are very solid arguments for a hiatus, which is correlated with several eustatically emerged areas in Moravia (such as Rataje or Uhřice). Therefore, the ideas on areas where several Frasnian shallow-water coral and stromatoporoid taxa survived the Fr-Fa extinction get even more puzzling than they were before this exact testing of stratigraphical correlations.

Subproject: Revision of the Famennian conodont fauna and zonation in the Mokrá Quarry West *(**L. Slavík**)*.

Famennian conodont assemblages obtained from samples from the Frasnian-Famennian boundary interval in the Mokrá Quarry West were revised. The studied section "Behind a Transformer" displays a bedding-parallel contact of two main facies members – coral-stromatoporoid reef banks (Vilémovice Limestone) and tempestites-calciturbidites with larger amount of recycled particles and clay ("lenticular limestone" or Křtiny Limestone). The re-investigated conodont material extracted by O. Friáková in the early 1980s is related to two different types of occurrences. Samples M1 and M3 corre-

spond to rare conodont-bearing spots within the reefbanks. The samples with higher numbers come from cephalopod and lenticular limestones in the overlying formation. The composition of fauna from all studied samples is generally uniform, consisting exclusively from the platform elements of the genus *Palmatolepis* Ulrich et Basler. No representatives of other genera were recognized around the contact of these two stratigraphical members. All elements are well preserved, with no signs of abrasion or weathering. The colour alteration of the elements suggests comparable values approximatelly CAI 3.5, which correspond to maximum temperatures of 150-250 °C. However, the number of the Pa elements significantly differs in the material from limestones of the Vilémovice and Křtiny members. The abundance of conodonts in undoubted beds of Křtiny Limestone is much higher than in the uderlying beds. Samples M1 and M3 provided associations containing, besides others, *Palmatolepis* cf. *regularis* Cooper, *Palmatolepis quadrantinodosolobata* Sannemann and *Palmatolepis wolskajae* Ovnatanova. The recognized taxa belong to lower crepida and middle crepida Zones. Exactly the same associations were assumed by O. Friáková and Z. Krejčí as ranging rather within the upper crepida Zone. The first sample from true cephalopod limestone facies yielded a very rich association of 38 palmatolepid elements with *Palmatolepis termini* Sannemann, *Pa. quadrantinodosolobata* and *Pa. wolskajae* showing the same age as the previous impoverished samples. The conodont fauna from samples M11 and M12 (taken in 0,5m intervals) already contains younger palmatolepids such as *Palmatolepis quadrantinodosa quadrantinodosa* Branson et Mehl, *Palmatolepis quadrantinodosa inflexoidea* Ziegler, *Palmatolepis glabra lepta* Ziegler et Huddle and *Palmatolepis marginifera marginifera* Helms. In detail, conodont fauna from sample M11 can be assigned to lower marginifera Zone, which is also documented from sample M12 together with the present upper marginifera and uppermost marginifera Zones. The present revision of the conodont collection of Friáková suggests several corrections: 1) The open-sea and partly also relatively deep-water conodont biofacies are incomparable with the depositional environment of reefbanks, and the conodont-bearing patches are most probably results of infiltration to porous parts of sediment. 2) These possible infiltrates and first beds of the overlying formation belong to the lower – middle crepida Zs. (not exclusively upper crepida Z. as mentioned by relevant papers from 1980s). 3) The study confirms missing evidence for rhomboidea Z., which is associated with an evident erosional surface within the Křtiny Limestone.

Bohemian-Moravian Cement Co. (Čertovy schody Quarries Co.) No. 7001 Studies on composition, age, structures and rock-mechanics properties in the Pragian as well as adjacent sedimentary units (***P. Bosák, J. Hladil, L. Slavík, A. Galle, J. Adamovič & M. Coubal***)

Subproject: Petrological, geochemical and geological reinvestigation of dark-grey coloured rock types within the Pragian and younger sediments of the Čertovy schody Quarry West (***P. Bosák, J. Hladil****, E. Franců, J. Franců, Z. Boháček, Czech Geological Institute, Brno & P. Kořínek, Ekosoft Ltd. Brno*)

Three different types of dark-grey coloured rocks originated within the coarse-grained Pragian limestones, which have major sedimentary substituents in crinoidal and bryozoan debris. Composition of organic matter was analyzed in samples from the lowermost bench No. 7 in the Čertovy schody Quarry West. These samples were collected from one large block, where contacts among rock types were displayed without any disturbance. This block (and slabs preserved in our laboratories) document a succession from evidently synsedimentary impregnations with bitumen (Sample 1), through metasomatic replacements of minerals after partial cementation of the sediment (Sample 2), to hydrothermal crystallization in veins (Sample 3), which are older than the Middle Devonian Kačák fills in fissures and speleothems (also blackish-grey colour hue, but very fine-grained sediment). In all these samples together, at least a part of amorphous kerogen corresponds to residual precipitates from migrated hydrocarbons. Composition of this kerogen suggests that these three types of impregnation are connected with one process, where the common primary source was the sedimentary organic matter of Early Paleozoic planktonic origin (Ordovician to Devonian age). The prevalence of phytane over pristane by increased contents of gammacerane implies a reduction and hypersaline character of water, at least above the relevant part of the Devonian sea floor and in upper layers of porous sediment with incipient cementation. Thermal alteration of organic matter corresponds

to terminal stages in the main phase of the oil window, and the uppermost temperatures related to rock-fluid migration, based on the data obtained by pyrolitic tools, correspond to 90-120 °C. According to CPI on n-alkanes, the lowest stage of maturation was found in Sample 1. The vitrinite reflectance values are also slightly lower in this sample than in the hydrothermal sequence. Isomerization stage inferred from the data measured on biomarkers, steranes and hopanes was characterized as terminated. The depletion of fluid hydrocarbons in bitumens by components up to C15 is considered as a secondary effect because the pristane/n-C17 and phytane/n-C18 ratios close to 1 suggest distillation of light n-alkanes in bitumen by migrated gas. The analyses of organic matter correspond well with the conclusions based on anorganic mineralogy-geochemistry in that especially the hydrothermal submarine vents on fault feeders affected this site. A chain of these feeders originated alongside an extinct dextral transpressional fault zone. Rapid cooling of hydrothermal plumes on the seafloor led to the origin of disoxic smudges at the toe of the Koněprusy high. These smudged fields were episodically covered with coarse crinoidal debris from chutes on the early/middle Pragian Koněprusy slope (a stage immediately preceding the late middle Pragian formation of the Koněprusy reef). The redeposited material was mixed with local sediment and hydrocarbon-rich hydrothermal venting continued also during the first stages of cementation and burial (metasomatism and hydrothermal veins). Later products of submarine hydrothermal venting in rocks are typical of higher contents of Mg, S, P, Mn and Fe compared to the early stages. According to evidence from organic matter, at least some of the migrated substances originated from compaction of Ordovician to Early Devonian rocks in the Koněprusy basement of these times (prior to the Frasnian deformation of the Barrandian).

Subproject: Lochkovian conodont fauna from the Čertovy schody quarry and its relation to other Early Devonian sections of the Prague Basin *(**L. Slavík**)*

Conodont fauna of the uppermost Lochkovian beds was studied on flanks of the Koněprusy skeletal accumulation in the Čertovy schody quarries by reason of better recognition of the Lochkovian/Pragian boundary. The investigation of late Lochkovian conodonts was made in association with the complex biostratigraphical research of Early Devonian sedimentary record of the Koněprusy area. Seven conodont samples taken from the Lochkovian breccia with clasts of the Kotýs Member yielded several stratigraphically significant taxa including *A. trigonicus* Bischoff et Sannemann, *A. kutscheri* Bischoff et Sannemann and *A. transitans* (Bischoff et Sannemann). These representatives of the genus *Ancyrodelloides* Bischoff et Sannemann allowed reliable delimitation of the conodont delta Biozone. No other zone-diagnostic species were recognized within the conodont assemblages, such as for example *Pedavis pesavis* (Bischoff et Sannemann) indicating the earliest Lochkovian conodont biozone - pesavis. Samples from the delta Zone also yielded *Ozarkodina remscheidensis* (Ziegler) whose stratigraphic range is also related to this zone. Sedimentation of the Pragian Koněprusy Limestone already begins just above the beds of the *delta* Zone. Accordingly, the Lochkovian/Pragian stratigraphic lacunae in the Čertovy schody quarry span at least across the entire *pesavis* Zone. The question was whether this hiatus has only a local character or is extended also to other Early Devonian sections within the Prague Basin. Therefore, the investigation was extended to several neighbouring localities (e.g., Homolák, Bacín) and to more distant sections (Na Branžovech, Na Požárech, Karlík Valley and Praha-Hlubočepy). About 15 samples taken from the uppermost beds of the Lochkovian in these sections provided about 250 conodont elements. The earliest Lochkovian zone – pesavis was recognized surprisingly only in two sections more distant from the key locality of Čertovy schody. The Na Branžovech section situated in the northwestern part of the Prague Basin, about 10 km from the Čertovy schody section, yielded only one incomplete element of *Pedavis pesavis*. The occurrence of this relevant taxon was formerly recorded by Weddige also about 10 meters below the Lochkovian/Pragian boundary in the northeastern part of the Prague Basin (Na Požárech section). Unfortunately, this occurrence was not confirmed by the present studies at this locality. To conclude, scarcity of the *Pedavis pesavis* as an index taxon defining the latest Lochkovian *pesavis* Zone, which is missing in the Koněprusy area and adjacent areas, is possibly caused by a significant global eustatic sea-level drop at the stratigraphic level of Lochkovian/Pragian boundary.

Subproject: Čertovy schody Quarry: analysis of brittle structures (***M. Coubal & J. Adamovič***)

The studies of brittle structures concentrated on the eastern part of the Čertovy schody Quarry (Devonian limestones, Prague Basin), the foreland of the Očkov Thrust Fault. This area was found to be dislocated by a number of smaller-scale thrust planes dipping gently north (locally south) and associated with prominent striated planes. This fabric results in the multiple juxtaposition of limestones of the Koněprusy and Kotýs members.

Severočeské doly Ltd.: Microscopic analyses of the upper coal seam, Bílina open-cast mine (***M. Konzalová***)

Analyses of coal microcomponents were carried out and observed in transmitted light. They were isolated by chemical maceration and evaluated in their origin, character of preservation and taxonomy. More than fifty groups of different particles and taxa of lower and higher plants were established. Besides resistant components – resins, pollen, spores, different fungi, wood tissues – also highly humified soft particles of plants and lower organisms were obtained and identified as components which contributed to the coal-forming mass. Plants and other biological components assigned to the living taxa or their groups were arranged in plates expressing their absolute and relative frequencies in the composition of coal samples. The slight differences demonstrate microenvironmental changes in the forming peat-mass and limnic delta environment.

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10. Department of Exogenic Geology and Geochemistry

Foreign Grants and Joint Projects

Grant No. 6330-98 of the National Geographic Society, Washington D.C., USA (1999-2001) The last foragers of northern Bohemia (*principal investigator: J. Svoboda, Institute of Archaeology ASCR, Brno, co-investigators:* ***V. Cílek*** *&* *I. Horáček, Charles University, contributions: P. Pokorný, Institute of Botany ASCR, Třeboň;* ***V. Ložek*** *&* ***R. Mikuláš***)

The field archaeological research took place under the sandstone rockshelters of Kummergebirge close to Doksy and on the slopes of Bezděz. No previous archaelogical research hes ever been carried out in Kummergebirge. We unearthed six rockshelters where five prehistoric cultures were found (Aeneolithic – Řivnáč and unspecified culture, Lusatian culture of Late Bronze Age, Halstatt, Silesian culture of Early Iron Age, medieval 13-15th centuries, New Age 16-20th centuries). The most important site was located at the foot of Bezděz Hill where well developed Mesolithic layer at the bottom of the section is followed by Neolithic Punctuated Bowl culture and some later cultures. Many sections are fossiliferous. They contain charcoals, vertebraete bones, molluscs, thereby permitting a reconstruction of paleoenvironmental conditions in the Mesolithic. The area was more humid, covered by numerous marshes. The open oak forest was the most common forest type while hazelnut and pine forests were located in rocky gorges and on sandstone plateaus. From the viewpoint of geomorphology, the most important find is a loess layer blown into one of the rockshelters. It provides evidence for the origin of abris and some sandstone caves as periglacial phenomena that probably developed by microgelivation of more humid parts of sandstone massif during glacial periods.

Project of UNESCO Encyclopedia of Life Support Systems (EOLSS) (*Honorary theme editor* ***V. Cílek****, 1999-2000)*
UNESCO has worked on the “Encyclopedia of life support systems” for several last years, as a source for sustainable development and global security. EOLSS is a comprehensive, authoritative and integrated body of knowledge. It is designated as a global guide to professional practise, education and heightened social awareness. It consists of theme topic and articles (about 15-25 pages each). V. Cílek was nominated the honorary theme editor of the opening part of EOLSS – Theme 1.1. “Earth system: history and natural variability”. Among some 70 contributors from different countries of the world, several experts come from the Institute of Geology AS CR, namely **J. Ulrych, V. Cajz, J. Adamovič, P. Štorch, R. Mikuláš, J. Hladil, L. Minařík** and **T. Navrátil**. The EOLSS will be inaugurated in 2001 and distributed as a CD set to all UN countries.

Czech - American (USA) Joint Programme "KONTAKT" (ministry of Education, Youth and Sports CR)
No. ME 147 The dynamics of the biogeochemistry of beryllium (*Principal investigator: J. Veselý, Czech Geological Institute, Prague, co-investigator:* ***P. Skřivan,*** *contributions:* ***M. Burian, I. Dobešová, O. Kvídová, T. Navrátil, L. Minařík & A. Žigová***)

Biogeochemistry of beryllium (concentration, speciation and fluxes) has been studied in the catchment area of the Lesní potok (Černokostelecko area, central Bohemia) and its surroundings. Results include the concentration and forms of Be (and other related minor and trace elements) in the individual compartments of the system:
The underlying bedrock, monzogranite of the Říčany type and two-mica Jevany syenogranite, is enriched in Be (with 12.7 mg.kg^{-1}, and 11.5 mg.kg^{-1}, respectively).

In the individual soil horizons, the total Be concentration increases from 3,75 mg.kg^{-1} in A-, to 7,38 mg.kg^{-1} in Gr_4 horizon, as a result of the Be leaching by acid precipitation. The acid- and ammonium nitrate-leachable forms of Be in soil have similar patterns.
Springs and acidified streams draining the forested area with bedrock of the Říčany granite (including the Lesní potok catchment) have considerably increased Be concentration (>1 to 10 μg.L^{-1}), dependent on the pH-value of water. On the other hand, stagnant waters of the Vyžlovský pond, which receives the Lesní potok stream water, show a high pH and low (<0,5 μg.L^{-1}) Be concentration.
Mean concentration of beech- (*Fagus sylvatica* L.) and spruce- (*Picea abies* L. Karst) tissues (the dominant tree species of the forest) are13.8 and 20.5 μgBe.kg^{-1} in stem wood, and 78.3 and 68.2 μgBe.kg^{-1} in bark, respectively. Concentrations of Be in beech leaves are 65 to 348 μgBe.kg^{-1} d.wt., increasing in the course of growing season, and 310 μgBe.kg^{-1} d.wt. in the litter of spruce needles.
Be fluxes in bulk atmospheric precipitation are usually considerably lower than 0.05 μg.m^{-2}.day^{-1} (mean annual atmospheric input in 2000 equals to 2.7 – 3.3 μgBe.m^{-2}.year^{-1}), whereas the fluxes in spruce- and beech throughfall are up to two times higher. Mean Be output from the catchment markedly exceeds the atmospheric input, reaching 477 μgBe.m^{-2}.year^{-1} in 2000. Moderately decreasing trends were observed since 1985 till 1998 both in the Be- atmospheric input and in surface discharge, as a result of decreasing acidity of the precipitation

Joint Project of the Institute of Geophysics, Chinese Academy of Sciences and the Institute of Geology, AS CR, Prague

Petrophysical and geochemical characteristics of loess deposits from selected localities of Eastern Asia and Western Europe (investigator: ***V. Suchý,*** *contributions: A. Zeman, Prague; Zhu Rixiang, Pan Yongxin & Guo Bin, Institute of Geophysics, Chinese Academy of Sciences, Beijing, People's Republic of China*)

An investigation of the rock magnetic properties using stepwise isothermal remanence (IRM) acquisition, thermomagnetic analysis and temperature-dependent susceptibility history, identified magnetite as the carrier of the main fraction of remanence, associated with maghemite and hematite in Malan loess (L1), Holocene soil (S0) and last-glacial paleosol (S1) at Lingtai section, north-central China. The presence of short-lived direction fluctuations indicates that no significant smoothing occurs in L1 when its remanence is locked, and thus L1 is capable of recording the geomagnetic secular variation (PSV), while the PSV has been severely smoothed or wiped out by pedogenic processes during S1 formation. It has also been suggested that the Mono Lake and Laschamp excursions are two independent geomagnetic events based on this study.

Grant Agency of the CR

No. 205/98/1551 The analysis of deep-seated slope movements in neovolcanic rocks of the České středohoří Mts. (*J. Rybář, Institute of Rock Structure and Mechanics AS CR, Prague, co-investigator* ***V. Cílek****, contributions:* ***V. Cajz*** *&* ***J. Hlaváč***)

The geological part of the project concentrated on Čeřeniště and Jedlka landslides where several interconnected topics were studied as follows:
1. Geological position (***V. Cajz***)
Detailed geological maps 1:10,000 were produced for each area including petrographic descriptions and tectonic study as the basis for the complex study of recent slope movements on both sites.
2. Sedimentary intercalations (***V. Cílek***)

Most of the landslides in the České středohoří Mts. are caused by sliding on semi-plastic soft Upper Cretaceous marls and claystones. However, the deep-seated landslides of Čeřeniště nad Jedlka Mts. are triggered by the presence of several sedimentary intercalations. These thin, 1-4 m thick layers represent tuffitic sediments of perennial marshes and small watery ponds embedded between individual lava flows. Diatom muds and even coal sedimentation are common. The prevailing mineral of sedimentary intercalations is montmorillonite. The impenetrable, slippery horizons represent the most important single factor of landslide development.

3. Mollusc assemblages (***J. Hlaváč***)

No fossiliferous sediments with fossil malacocoenoses which would help to reconstruct paleoenvironmental changes during the Quaternary were found in the Jedlka area. Research had to be aimed at the study of modern molluscan assemblages. Molluscan malacocoenoses detected in the Jedlka landslide area are strongly influenced by mixed woodland species with some sensitive species, such as *Macrogastra plicatula* and *Daudebardia rufa*. In comparison with malacocoenoses investigated in Čeřeniště area, the Jedlka site has poorly developed forest coenoses due to different exposition on the southern slope.

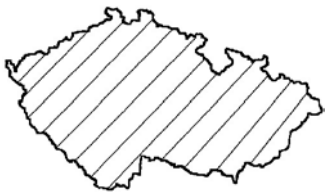
No. 205/99/1307 Biogeographical exploration of frozen scree fields of central Europe (*M. Zacharda, Institute of Landscape Ecology AS CR, co-investigator* ***V. Cílek***)

The research was conducted at these important sites: Studenec (Lužické hory Mts.), Kamenec near Merboltice, Plešivec near Litoměřice, Holý vrch near Jílové, Bobří soutěska, sections along modernised railway between Ústí nad Labem and Prackovice (all České středohoří Mts.), Křivoklátsko protected area, Žďár near Rokycany (western Bohemia), Řivnáč near Roztoky (Prague region). The most important results can be summarised as follows:

Talus, scree and block formation are common phenomena in the area of the Czech Republic, particularly in hilly and mountaneous regions. The most typical and spectacular formations are associated with granites (southern Bohemia), quartzose conglomerates of Cambrian age (central Brdy Mts.) and neovolcanics of the České středohoří Mts. The Tertiary screes (diamictons) often hidden beneath younger soil cover, may reach the thickness up to 20-30 m in central Bohemia but more than 50-60 m at the foot of neotectonicaly active slopes, e.g., the Krušné hory (Erzgebirge) Mts. Other scree accumulations are known from the Lower Pleistocene and from other glacial cycles. Loess sediments often form yellow to brown or rusty matrix of glacial screes. The Late Glacial geomorphic unrest seems to be one of the principal periods of enhanced slope movement, rockfalls, retreats of slopes and cave entrances. The cold pleniglacial is characterised by low scree productivity. The scree formation is a continuous process throughout the whole Holocene but continental climates of Epiatlantic and Subboreal favour major relief changes. The most important factor of scree formation is the melt-and-thaw cycle. It is often associated with other factors such as exfoliation, downcutting, undercutting, biological activities, lithological factors, earthquake and climate triggering.

Grant Agency of the Academy of Sciences CR

No. A3013005 Holocene evolution of the soil cover of the protected landscape areas of the Czech Republic (***A. Žigová****, co-investigator: V. Šrein, Institute of Rock Structure and Mechanics AS CR, Prague, contributions:* ***V. Cílek, V. Ložek*** *& M. Šťastný, Institute of Rock Structure and Mechanics AS CR, Prague*)



The soil cover reflects the conditions of its formation and therefore offers a possibility for the reconstruction of climatic and environmental impacts and weathering mechanisms in the Holocene.

Selected soil sections should furthermore serve the purpose of lasting standards for a long-term comparison with analogous soil units in agricultural landscape. The detailed soil research concentrates on the analysis of soil evolution within paleoenvironmental framework carried in

several time slices.
The evolution of soil cover has been studied in the Voděradské bučiny Nature Reserve, Blanský les Protected Landscape Area and Český kras Protected Landscape Area this year.
Very simple is the of soil cover of the Voděradské bučiny Nature Reserve. Dystric Cambisol is the most wide-spread soil unit. The studied area is covered by the Holocene soils.
A detailed soil research was started in the Blanský les Protected Landscape Area. Rendzic Leptosol is one of the soils which cover this area.
The structure of soil cover of the Český kras Protected Landscape Area is very complicated. This area is covered partly by Holocene soils (Eutric Cambisol, Rendzic Leptosol, Eutric Leptosol) and partly by non-buried paleosols (terra fusca). The oldest stage of pedogenesis of the terra fusca must be, therefore, of the Last Interglacial (R/W) age or older, but the upper part of these soils is influenced by the present soil-forming conditions.

No. A3012703 Thermal history of sedimentary basins of the Czech Republic and its relationship to tectonic processes *(J. Šafanda, Geophysical Institute AS CR, Prague; co-investigator **V. Suchý,** contributions **J. Filip**, I. Sýkorová, Institute of Rock Structure and Mechanics AS CR, Prague & M. Stejskal, Institute of Chemical Technology, Prague)*

A pilot study of the tectonothermal history of the Barrandian area has been undertaken by analysing apatite fission track (AFTA) data from twenty rock samples collected from principal lithostratigraphic units of the area.
Based on AFTA data, the lower Paleozoic sediments experienced maximum heating during middle-late Devonian to early Carboniferous time (380-340 Ma). Independent sedimentological evidence suggests that the heating was associated with substantial (2-3 km) post-middle Devonian burial rather than elevated heat flows. The AFTA t-T paths further document that over much of the Carboniferous period, lower Paleozoic sequences experienced significant cooling that is interpreted in terms of intense erosion of Variscan orogenic pile. This feature also provides indirect evidence that the Carboniferous sedimentary cover over the lower Paleozoic strata that has been inferred in some previous studies was probably of a negligible thickness, if any. Since 200-250 Ma, all lower Paleozoic samples exhibit a prolonged period of thermal stability during which the sediments enjoyed relatively low temperatures ranging from 50 to 70 °C. This thermal pattern can be readily interpreted in terms of non-deposition and/or moderate erosion in the area through Permian to upper Cretaceous time. The period of final accelerated cooling that is obvious in all the samples from 40-20 Ma onward, may reflect an extensive uplift of the Bohemian Massif that occurred since Paleogene-Neogene transition.
The AFTA t-T paths of slightly metamorphosed rocks of upper Proterozoic basement, though substantially annealed before 400-350 Ma, essentially parallel thermal evolution characteristic for those of overlying lower Paleozoic sequence. There are two fundamental implications for geological evolution of the Barrandian area stemming from the above findings. First, during all the geological past, the Proterozoic basement was probably covered by a considerable thickness of lower Paleozoic stratigraphic overburden. This fact would probably represent a hard nut for recently proposed concepts of geologically young, tectonically imposed contact of both complexes. Second, the AFTA data imply that substantial lower Paleozoic sedimentary cover originally extended far outside the present-day erosional margin of the basin. This, in turn, makes the early interpretation of the Barrandian (Prague) Basin as a narrow rift depression very unlikely.

Grants of the state departments

Project No. 4240/99 Salvage research of cave deposits in the Šošůvka Cave (Moravian Karst) (*Ministry of the Environment - AOPK CR, **J. Kadlec***)

Collaborative study was conducted together with the Moravian Museum and Masaryk University. Thirty orientated samples for paleomagnetic measurements were collected from five sections in the Šošůvka Cave in total. Reverse paleomagnetic sediments (older than 780 ka) were detected in two sections. Other sections reveal normal magnetic orientation. This means that the sediments are probably younger than 780 ka. $^{230}Th/^{234}U$ datings of five speleothem samples (conducted in Uranium-Series Laboratory at Institute of Geological Sciences of the Polish Academy of Sciences) from the same sections verified the paleomagnetic data. However, the speleothems were contaminated by detrital ^{232}Th. Therefore, an age correction was necessary and the dating errors are bigger. Based on $^{234}U/^{238}U$ ratio all dated speleothems are younger than 1.2 Ma. Speleothems were deposited during the Last Interglacial and between 350 and 350 ka. A reconstruction of Quaternary sedimentary history of the Šošůvka Cave was completed on the basis of data from both clastic and chemogenic cave deposits.

Industrial Grants

Bohemian-Moravian Cement Co. (Čertovy schody Quarries Co.) No. 7002 Complex research of the mining area of the Čertovy schody–East limestone quarry (***V. Cílek***, *contributions: **J. Hlaváč** – malacozoology, **A.Žigová** – pedology, the team of Faculty of Forestry of Agricultural University, Prague: F. Fér, J. Mőlllerová, J. Viewegh & M. Anděra – biology, National Museum Prague*)

The principal aim of the project is to determine the most valuable parts of the mining area near Koněprusy in Bohemian Karst and to protect them as the nature reserves. The environmental negotiation is the necessary part of the project because the reserves are likely to block several tens of millions tons of high-quality limestone. Multi-disciplinary approach was selected for the evaluation of the mining area. A team of experts from different fields of science - botany, forestry, zoology, geomorphology, geology, pedology etc. works together to find a suitable compromise between the mining company and nature protection. The Kobyla reserve was enlarged in the last year on the basis of multi-disciplinary research. The next year, another area centred around Voskop Hill may form a new reserve with outstanding features of karst morphology and steppe vegetation on the western slope of Voskop Hill. One of the most important scientific results deals with the Tertiary fauna found in the Red Quarry. The rich micro-mammalian fauna which was found in sediments of karst fissures of the Devonian limestone quarry of the Red Quarry in the Koněprusy area (near Suchomasty) is an assemblage of the Vallesian zone MN10 (Late Miocene, Pannonian). The composition of this assemblage indicates humid, subtropical, forested landscape with shrub-open grassland patches and sufficient water sources. Karst cavities were filled in the Late Miocene, and the caves became fossilised by terra rossa-like sediment.

Bohemian-Moravian Cement Co. (Čertovy schody Quarries Co.) No. 7003 Study of the Cenozoic sediments in the caves in southern part of Moravian Karst (***J. Kadlec***)

A 4 m deep test-hole in fluvial sediments of the Ochozská Cave was excavated. 17 oriented samples for paleomagnetic measurements were collected from basal part of the exposed section. All samples show normal remanent magnetization. This means that these sediments were most probably deposited in the Middle or Late Pleistocene.

The set of data of speleothem ages from the Ochozská Cave was completed. The age of flowstone horizons deposited at the banks of the flood channel is 28-22 ka and the flowstone layer covering infiltration sediments in section "U zkamenělé řeky" is 1.1 ka old based on $^{230}Th/^{234}U$ dating made in Uranium-Series Laboratory in the Institute of Geology of the Polish Academy of Sciences. Pollen analyses from the last mentioned sedimentary section were made at Masaryk University, Brno.
Malacozoological study from the excavated section (spanning Late Glacial and Holocene), which was exposed last year in a 6.7 m deep test-hole in front of the Ochozská Cave entrance was completed by pollen and charcoal analyses from these deposits made in the the Botanical Institute AS CR and Charles University, respectively.

Bohemian-Moravian Cement Co. (Čertovy schody Quarries Co.) No. 7814 Čertovy schody Quarry: Biogeochemical monitoring (***I. Dobešová**, contributions: **P. Skřivan, O. Kvídová & M. Burian***)

Atmospheric deposition fluxes of selected chemical elements were monitored in a broader region of the Bohemian Karst in 1997-2000, with special reference to the activities in the Čertovy schody Quarry. Results obtained in the Karst region are compared with monitored fluxes in a reference rural region in central Bohemia, approx. 30 km SE from Prague. Values of annual fluxes (expressed in $\mu g/mg.m^{-2}.year^{-1}$) of the elements are presented in Table 1, 2 and 3. The principal results are:

- Deposition fluxes of elements in the monitored region of the Bohemian Karst (with the exception of some localities) generally agree with the corresponding fluxes of the reference rural region.
- Deposition fluxes of Cu, Zn, Be, As, Cd, F^- and SO_4^{2-} mainly originate in major distant emission sources (coal-burning power plants), main source of Pb is the combustion of leaded gasoline.
- Deposition fluxes of elements with significant contribution of emissions from coal-burning power plants (Cu, Zn, Be, As, Cd, F^- and SO_4^{2-}) show temporal decrease resulting from the flue gases desulfurication.
- Local emission sources (mainly from the industrial and urban agglomeration of Beroun) affect the deposition fluxes of Cu, Zn, Pb, (Cd, SO_4^{2-}).
- Terrigenous dust containing soil and rock particles enriches the deposition fluxes of Mn, Sr, Mg, Ca, Al and Fe especially on the exposed localities inside and around the quarry.
- The sequestering effect of forest trees for solid atmospheric aerosol, which affects the composition of the precipitation below tree canopies (the throughfall), was demonstrated in Cu, Zn, Na, Mg, Ca, Al and Fe.
- Surface of the tree crowns also adsorbs acid gaseous compounds of F, Cl, S, and N, which is reflected in the chemistry of the throughfall.
- Essential elements and their homologues Cu, Mn, Zn, K, Mg, Ca, (Sr) and N affect the composition of throughfall by metabolic products of the vegetation, which are washed out and leached from the surface of its assimilation organs by acid precipitation.
- Annual fluxes of the mostly toxic trace elements Cu, Zn, Pb, As and Cd surprisingly show an increase in 2000, which is difficult to explain and therefore needs further data collection.
- Interpretation of the deposition fluxes of Be and Cr was embarrassed by the insufficient detection limit of their analytical determination.

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11. Department of Paleomagnetism

Foreign Grants and Joint Projects

Czech-Slovenian Joint Programme "KONTAKT" (Ministry of Education, Youth and Sports CR)

No. ME 251. Magnetostratigraphy and paleomagnetism of cave sediments in the Classical Karst (Slovenia) (***P. Pruner, P. Bosák, O. Man, D. Venhodová,*** *N. Zupan Hajna & A. Mihevc, Karst Research Institute, SAZU, Postojna, Slovenia*)

Two magnetostratigraphic sections were measured in the Černotiče Quarry and samples CR 1 – 54 were acquired. Measured part of the left section ranged between 0.07-7.03 m and of the right section between 5.05-7.70 m. Samples are characterized by low magnetic values of J_n = 930 ±1016 pT, k_n= 98 ±53.10^{-6} SI. Laboratory procedures were based on progressive demagnetisation by alternating field (totally 52 samples) and by thermal field (totally 6 samples). The magnetic susceptibility was also measured in the field using kappameter KT-5. It was found that high values well correspond with beds of Fe- and Mn- conglomerates. Magnetostratigraphic investigations defined normal polarity, only one sample from top part of the right section indicated reverse polarity of the Earth´s magnetic field.

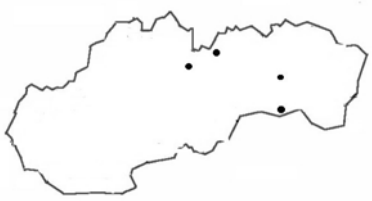
Czech-Italian Joint Programme. Agreement of scientific co-operation between Museo Civco di Storia Naturale, Trieste and Institute of Geology AS CR

Paleomagnetism and magnetostratigraphy of boreholes in caves (Trieste area, Italy) (***P. Pruner, P. Bosák, O. Man, D. Venhodová****, R. Calligaris & A. Tremul, Museo Civico di Storia Naturale, Trieste, Italy*)

Preliminary report “Paleomagnetic analysis of the core from the Grotta Pocala, Trieste area, Italy” was submitted. Totally 46 samples of sediments were taken from clays of the S1 borehole in Grotta Pocala, Trieste area, Italy. Samples were subjected to demagnetisation by alterning field. According to values of moduli J_n and k_n the samples and the section itself can be divided into two parts. The mean values of moduli of natural remanent magnetization J_n and of magnetic susceptibility k_n from 34 samples of the upper part (0.10-7.61 m) are J_n = 63.659 ± 37.567 [pT] and k_n = 2.798 ± 1.599 x 10^{-6} [SI]. This group of samples is characterised by intermediate magnetic values of J_n and k_n. The mean values of moduli of J_n and k_n from 12 samples of the lower part (7.80-9.94 m) are J_n = 617 ± 393 [pT] and k_n = 108 ± 17 x 10^{-6} [SI]. The samples from the lower part are characterised by low magnetic values of J_n and k_n. The directions of remanent magnetisation inferred by the above given procedures were tested using a multi-component analysis. Generally, the samples showed three components of remanence: A, B and C. A-components are mostly of viscous or chemoremanent (weathering) origin. They can be removed by an alternating field with the intensity of 10 to 30 Oe. Distinct reverse polarised magnetozone appeared at 0.51-1.89 m. Another two reverse incursions were detected at 2.50 and 9.19 m on one sample each. A detailed localization of the boundaries of reverse polarised magnetozones will be possible only after additional sampling.

Czech-Slovak Joint Programme. Agreement of scientific co-operation between Administration of Slovak Caves, Liptovský Mikuláš and Institute of Geology, AS CR

Paleomagnetism and magnetostratigraphy of cave sediments in selected caves of Slovakia (***P. Pruner, J. Kadlec, P. Bosák, O. Man, D. Venhodová*** *& P. Bella, Administration of Slovak Caves, Liptovský Mikuláš, Slovakia*)



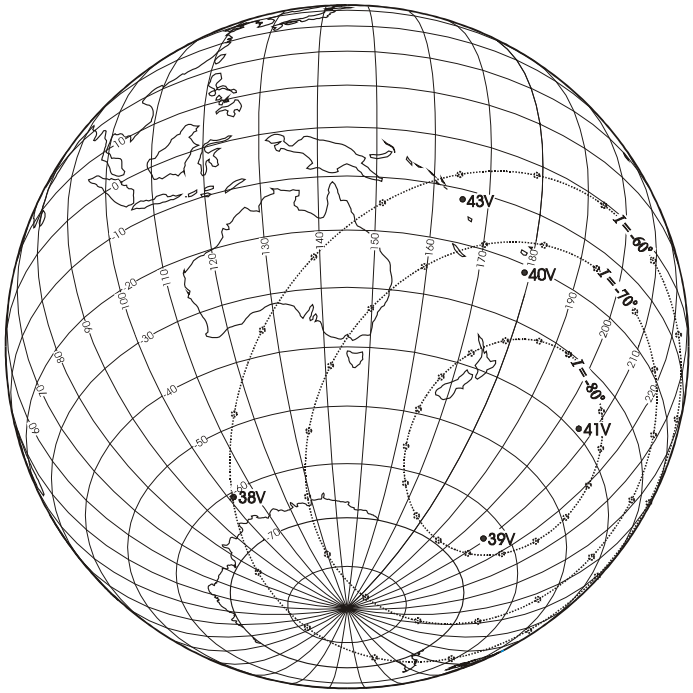
Paleomagnetic and magnetostratigraphic investigation in selected Slovak caves continued by a new stage. The present stage contributed substantially to the dating of speleogenetic process and evolution of cave systems in Slovakia. In the *Demänovská jaskyňa Slobody Cave*, sediments in the Žulová chodba Passage are normally polarised, i.e., they are younger than the Brunhes/Matuyama boundary. Sediments in the Medvedia chodba Passage and Hviezdoslavov Dome are reversely polarised, i.e., older than the Brunhes/Matuyama boundary. Data from the *Demänovská jaskyňa Mieru Cave* indicate normal polarity of sediments belonging to the IV^{th} and V^{th} evolutionary levels. Paleomagnetic data correlate well with the uranium series dating od speleothems. Sediments in the *Belianská jaskyňa Cave* showed complex magnetostratigraphy, with normal and reverse polarity of chrons. It seems that sediments are older than 1.77 Ma and most probably belong to Gauss or Gilbert epochs (ca. 2.58-3.58 Ma and ca. 4.18-6.15 Ma). Sediments are therefore Lower Pliocene in age or older, and the speleogenetical process must be much older. Sediments in the Suchá chodba Passage of the *Domica Cave* are normally polarised with one very short reverse excursion older than 131 ka (U series dating of flowstones). Sediments in the *Ochtinská aragonitová Cave* contain Brunhes/Matuyama boundary (0.78 Ma) in their topmost part. The overlying flowstone was dated at 164 ka.

Grant Agency of the CR

No. 205/99/0594 Paleomagnetic studies and paleogeographic interpretation of the Barrandian Lower Paleozoic with respect to the Bohemian Massif and peri-Gondwanan Europe (***P. Pruner, M. Krs, D. Venhodová, O. Man, P. Štorch & V. Suchý***)

The project is focused on yet unresolved problems in paleomagnetic characterization and paleogeographic interpretation of the Lower Paleozoic of the Barrandian terrane. The central part of the Bohemian Massif is formed by the Barrandian area with a complex of Cambrian to Devonian rocks. The Barrandian area is widely considered a peri-Gondwanan terrane with paleogeographic affinities to Armorica, amalgamated to the stable European lithospheric plate during the Variscan orogeny. In addition to specific interpretations of deformations in the European Variscan orogenic belt, the results of paleomagnetic studies also demonstrate - for the Barrandian example - problems that appear in the study of terranes subsequently amalgamated into stable lithospheric plates. Strongly deviated paleomagnetic declinations were also recorded for Silurian, Ordovician and Cambrian rocks from the Barrandian area. With respect to deformational effects of the Variscan orogeny on Devonian to Cambrian rocks and to the paleogeographic affinity of the studied formations, these values cannot be related to the values of paleorotation of either the Barrandian area as a whole or even the whole Bohemian Massif. The markedly low paleolatitudes result from subsequent remagnetization of the Early Ordovician silicites. Peri-polar paleolatitude values of 76°S for Early Ordovician rocks are in agreement with paleoclimatic indicators for Early Ordovician rocks but imply an anomalously fast drift for this period. Paleolatitudes inferred for Middle Cambrian sediments with normal and reverse paleomagnetic directions and for Late Cambrian volcanics, also showing normal and reverse paleomagnetic directions, are in agreement with paleolatitudes if recalculated for Armorica. It is, however, obvious that the Late Cambrian and Ordovician rocks should be subjected to additional paleomagnetic investigations also because the paleolatitudes were inferred from paleomagnetic directions of a single polarity only. Low paleolatitude values derived from the Early Ordovician silicites most probably result from

post-Early Ordovician fossilization of physically stable but probably non-syngenetic components of remanence showing a single polarity only. The peri-polar latitudes derived by some authors are in good agreement with the cold climate indicators for the Ordovician (Late Ordovician glaciation of N Africa) but, in case of the paleogeographic affinity of the Barrandian to Armorica, they imply an anomalously rapid drift of Armorica and Gondwana as well. The Ordovician rocks undoubtedly call for additional paleomagnetic and paleoclimatological studies. Consequently, additional rock samples for paleomagnetic and paleoclimatological studies have been collected from several outcrops of rocks of different origin (sedimentary and volcanic). The samples collected represent the Arenigian, Llanvirnian, Llandeilian and Caradocian and are subjected to laboratory study now. A large set of new paleomagnetic data will be acquired particulary from the Upper Ordovician and Silurian strata, and compared with the present knowledge on their lithofacies, biofacies and paleobiogeographical links.



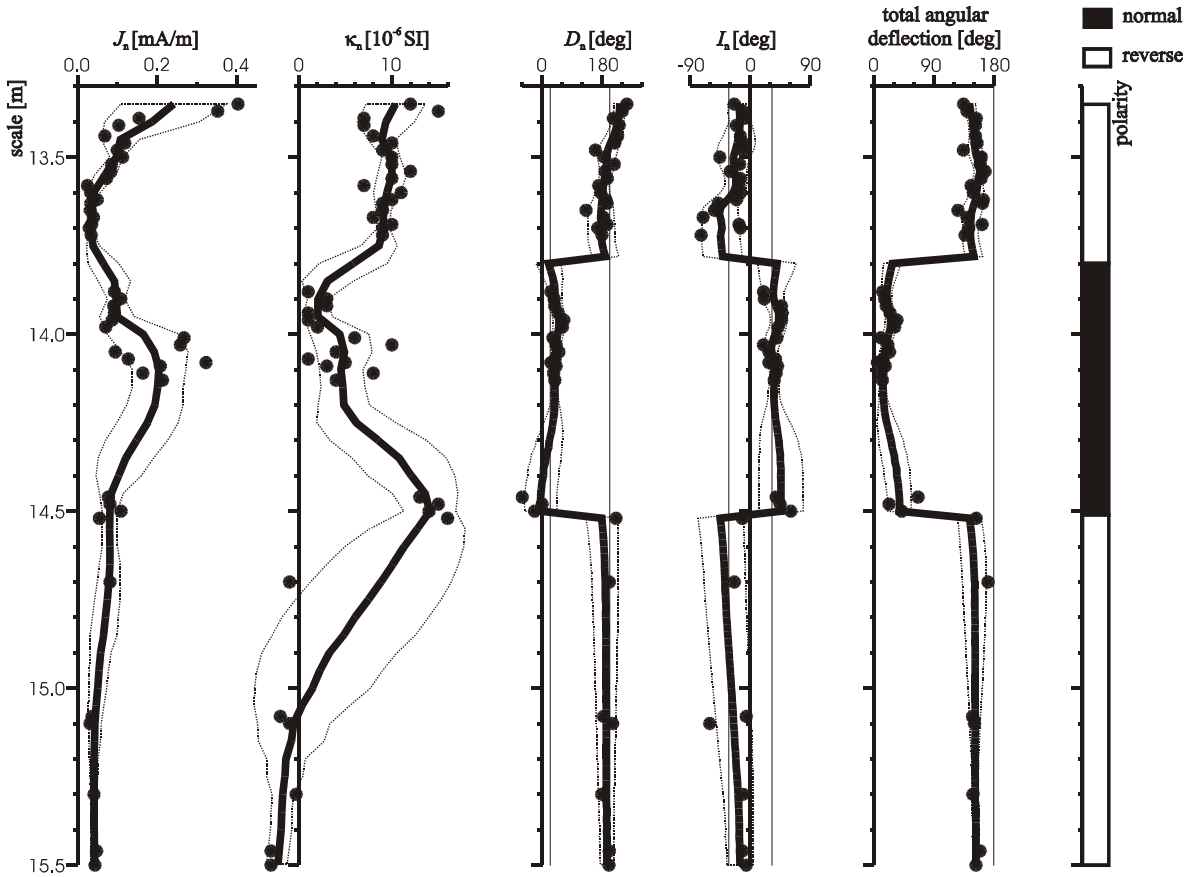
Barrandian Area – Llanvirnian to Arenigian virtual pole positions. Legend: 38V Žebrák - Točník, Llanvirnian or Llandeilian pillow lava. 39V Mýto, Top Arenigian basalt. 40V Volduchy - Borek, Arenigian red beds. 41V Medový Újezd, Arenigian shales with hematite. 43V Točník, Arenigian mineralized beds. (P. Pruner et al.)

Grant Agency of the Academy of Sciences CR

No. A301-3-802 Mineralogy, geochemistry and paleomagnetism of Variscan diastrophic sediments in the Bohemian Massif: provenance and paleotectonic interpretation (***P. Pruner, F. Patočka, J. Hladil, O. Man, D. Venhodová, J. Slepičková, M. Burian, J. Kadlec, P. Štorch,*** *J. Otava & L. Maštera, Czech Geological Institute, Brno)*

The effects of the Variscan Orogeny are even more evident from the mostly clockwise deviated paleomagnetic declinations inferred for the Devonian rocks from both the Moravian Zone and the Barrandian area. As shown above, these strongly deviated paleomagnetic declinations result from horizontal paleorotation of the individual tectonic slices and segments rather than whole uniform blocks. The described rotations result from effects on a local or regional scale. The paleomagnetic declinations found in the Barrandian were considered so anomalous that it was necessary to extend these studies also to areas SW of the TESZ. Clockwise rotations were es-

tablished nearly in all neighbouring areas. The highest values of paleorotation were documented at three sites in the Moravian Karst and adjacent areas. In this respect the paleomagnetically documented clokwise rotation in the Barrandian area similar but of much higher value. The key site of this study are the limestone outcrops at Seven Brothers´ Oak near Karlštejn (Eifelian/Givetian), the roadcut S of Hostim (middle/upper Eifelian), Prastav Quarry near Holyne (upper Emsian) and the Braník Rock in Prague (Pragian). The agreement between experimentally inferred pole positions and theoretically derived polar paths due to horizontal paleotectonic rotation proves that this rotation is of Variscan age.

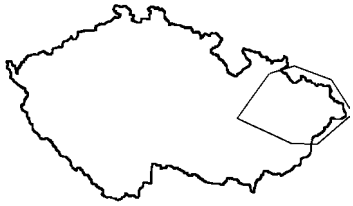


Magnetostratigraphic profile. Vertical scale: depth below the lower Kačák-event boundary. Thick lines: moving average. Dotted lines: moving standard deviations (P. Pruner et al.)

At least one reverse zone interleaves the upper Eifelian beds of the Choteč Limestone. The upper part of this sedimentary formation in a roadcut S of Hostim represents upward coarsening and thickening sediments of carbonate slope environment. The distal calciturbidites embedded in thin-bedded spiculites and radiolarian mudstones (mid-Eifelian age) gradually pass into to swelling and alternating beds of calcisiltites, grainstones and rare breccias (channelized debris flows). The carbonate rocks contain various sedimentary particles from shallow- to deep-water environments. Laminated micrite, beachrock and coral chips, foraminifers, peloids, crinoid ossicles, styliolinids, as well as resedimented slope sands to radiolarian ooze of a distant basin seafloor exemplify the variability of resedimented material. Sedimentation from gravity flows also corresponds to slight truncations on bedding surfaces, imbrication of bioclasts, floating orphan biomorphs, grading, and progressively developed top-down bioturbation. However, broad truncation of beds is known only from the terminal part of the sequence. The terminal type-1 sequence boundary at the base of the Kačák Member expanded to basins from early-Kačák highs, which were subaerially exposed during the lowest sea levels of the late *kockelianus* and late *ensensis* times. The entry of Kačák bituminous shales in the section corresponds to a flooding surface. Early lithification of sediment was connected with microbial precipitation of intersticial micrite (micropeloids and flakes). The sampled part of the sequence starts 13.3 m below the Kačák-related se-

quence boundary and ends at 15.5 m, possible age correlation is approximately *T. k. australis* to *T. k. kockelianus* zones. Progressive thermal demagnetization experiments in 11-13 thermal fields and to subsequent multi-component analysis of remanence were carried out for 44 samples. The C-component, as the carrier of paleomagnetic directions, was determined in the temperature interval of 400° to 560 °C, with observed northeast-southwest declinations and shallow inclinations. A normal polarity zone (0.7 m) was detected within the reverse magnetozone.

Subproject: Variscan tectonic structures with their Carpathian-related overprint in eastern part of Moravia (***J. Hladil*** *& L.F. Jansa, Geological Survey of Canada - Atlantic, Dartmouth*)



The theme of the present case study is a new stratigraphical evidence of a thrust fault in the Raškovice Ja-7 well (ESE of Frýdek-Místek). This was one of the pilot wells with full-cored section that penetrated the Carpathian nappes and continued through the entire thickness of the (para)autochthonous Paleozoic to the Brunovistulian crystalline basement. The carbonate rocks in this well (687 m) are 3 to 6 times thicker than in neighboring wells Morávka NP-828 (182 m), Krásná KS-9 (101 m), Ostravice NP-824 (151 m), Guty NT-5 (146 m), Kozlovice SV-4 (300 m) or Kozlovice SV-1 (236 m). Biostratigraphy of the early 1980s indicated normal superposition of faunas in two levels, at the very base and top of the limestones, in the Middle Givetian and Upper Frasnian, respectively. However, the fuzzy and alternating pattern between these two biomarker levels remained unanswered. An unlikely "Givetian-Frasnian transition" of hundreds of meters contrasted with the situation in all other Moravian sections, where sedimentary condensation and hiatuses are connected to short-lived but strong sea-level fall at the Givetian-Frasnian transition. Geophysical revision of this problem was based on digitized, corrected and normalized well-logs. It revealed the presence of two thick packages of Devonian limestones – approx. 1 250-1 440 m and approx. 1 470-1 690 m, which display identical geophysical sequence patterns and must be of the same age. Subsequently, the merge of three biostratigraphic databases provided an evidence about the real position of sequentially grouped biomarker patterns (such as maxima of *Amphipora angusta* with stepwise occurrences of *Amph. pinguis* and *Alveolites mailleuxi*) that stratigraphically repeat in the same way as shown in the gamma-ray record or other logs. In addition, the upper termination of the lower group of segments (at depths at 1 450 m and below) is marked with *Amph. moravica*, which is an index fossil of the upper Frasnian. The main interface of these tectonically repeated units is the thrust fault at 1 450 m. The surface of this fault involves stretched remnants of Namurian sandstones with mud-supported structure of this sediment. Shear dissolution of carbonate is associated with this structure. Thrust kinematics is also expressed by strong folding in the upper part of the Paleozoic at Ja-7. Relatively slight partial bedding-parallel movements accompany the main fault. The allochthonous part of the upper Givetian to middle/upper Frasnian sediments shows reduced diversity and abundance of fauna, with dominance of sponges, which all largely correspond to depositional environments in the northwest. Conversely, the Upper Frasnian sediments of the allochthonous part are much thicker compared with the (para)autochthonous part. Comparable beds are completely absent south and east of Ja-7 but they were documented in the west and modelled in the north, because of the latest Frasnian sea-level drop and progradation of carbonate shore. This considerable facies difference between the (para)autochthonous and allochthonous parts allows a translation along the Variscan thrust fault up to several kilometers from the northwest to the southeast. Subsequent evaluation of reflection seismic profiles confirmed that the above mentioned Variscan thrust is a relict within the Tertiary deformation structures (new thin-skin slicing and folding). Remark: Geophysical part of this study was supported from the grant No. 301-3-809 but the geological tasks were contributed by this grant.

Grants of the Charles University, Prague

GA UK No. 169/1998/B GEO Magnetostratigraphy of the Jurassic/Cretaceous boundary in the Tethyan Realm (Cuba) (*M. Kobr, Faculty of Science, Charles University, Prague,* ***V. Houša, P. Pruner, D. Venhodová,*** *J.R. Sanchéz, CEINPET, Habana, J. Pérez, Universidad de Habana & M. Fundora, IGA Habana*)

Magnetostratigraphic investigations of Jurassic/Cretaceous (J/K) boundary limestone strata carried out in detail at several localities in the Tethyan realm resulted in the determination of normal and reverse magnetozones and subzones well correlable with the M-sequence of marine magnetic anomalies. The globally-based events of the reversals of the Earth´s paleomagnetic field are applicable to correlation with biozones determined paleontologically. The aim is to prepare the background for the correlation of Late Tithonian and Early Berriasian boundary (J/K) limestones at the locality at Majagua in area Cinco Pesos – Cirro Redondo in Sierra del Rosario, western Cuba with the Earth´s global magnetoevents between the Tethyan realm and other regions on the Earth. However, the methodology of investigations had to be considerably modified according to varying physical properties of rocks. Laboratory studies in the early stages of the magnetostratigraphic investigation also included a magnetomineralogical study to determine mineral-carriers of remanent magnetization. The analysis of microcoercitive spectra showed that the tested limestone samples display medium to high magnetic hardness. Results of these diagrams show phase changes of magnetically active (mostly Fe-oxides) minerals occur during laboratory thermal processing, especially at low (300-400 °C) temperature intervals.

Such laboratory procedures were selected which allowed separation of the respective remanence components and the determination of their geological-historical origin. The samples generally showed three remanence components: the A-components are of viscous or chemoremanent origin and were inferred after the progressive thermal demagnetization procedure in the temperature interval below 100 ^{o}C, the B-components were mostly derived in the temperature interval of 60 to (200) 240 °C; C-component is the most stable one, demagnetizable in temperature range of ca. 280 to 400 (450) °C. The C-component indicates reverse directions in 99 % of investigated samples. From the whole set of samples, 89 were found totally remagnetized, few samples were found weathered, and the remaining samples from the whole Majagua section indicated syn-tectonic remagnetization. The total remagnetization of some limestone strata occurred during the Neogene, after termination of tectonic movements, while the most intense remagnetization was imprinted in the limestones during the reverse polarity of paleomagnetic field. In this presentation, we would like to draw attention to the Neogene remagnetization, which was also found by some researchers in other parts of the Tethyan realm.

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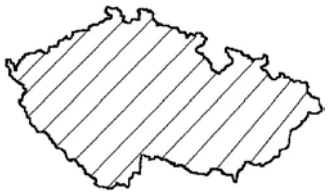
12. Programme of Advancements in Scientific Research in Key Directions

(12a) K1-012-601 Project No. 5: Geophysical processes and structure of the Earth (with special reference to the Bohemian Massif) (*co-ordinator A. Špičák, Institute of Geophysics, Academy of Sciences, Prague*)

Subproject: Paleozoic evolution of the Bohemian Massif terranes integrated into the history of the European Variscides (***F. Patočka, J. Adamovič, M. Fajst, J. Fiala, J. Filip, J. Hladil, M. Krs, M. Konzalová,O. Man, M. Němečková, J.K. Novák, P. Pruner, L. Slavík, M. Svojtka, M. Vavrdová, Z. Vejnar, D. Venhodová & P. Vítková***)



Introduction (***F. Patočka***)

The Bohemian Massif is one of the largest exposed parts of the Variscan orogen of Europe. In central European realm it occupies a unique position as it is – among Variscan massifs – the closest one to the Trans-European Suture Zone (TESZ). The Trans-European Suture Zone separating the Variscan Belt from the Precambrian of Fennosarmatia is considered the most important geological boundary in the European continent. According to the modern concept of architecture and evolution of continental lithosphere, the Bohemian Massif is interpreted as a complex terrane mosaic providing an outstanding basis for studies orientated on both pre-Variscan stage of develompent and succession of Variscan orogenic events. These studies are associated with at least one decade-lasting effort to define the individual terranes of the Bohemian Massif, and characterize their evolutions and mutual relations prior to the Variscan orogeny as well as during this cycle. Development of the pre-Variscan and Variscan terrane mosaic of western and central Europe comprised: (1) Cambrian and Ordovician extension and rifting of Cadomian continental lithosphere of Gondwana supercontinent northern maring which were followed by opening of narrow seaways (floored by oceanic or semioceanic lithosphere) among the peri-Gondwanan fragments (microcontinents), (2) Silurian to Early Carboniferous closure of the seaways, collisons and amalgamations of the microcontinents as well as polyphase accretion of the microplates to Baltica and Eastern Avalonia, and the Variscan orogeny.

The purpose of this project was to summarize results and conclusions obtained by a variety of methods and to evaluate them with the aim of shaping the concept of the terrane architecture of the Bohemian Massif and determining the succession of principal events during its evolution in the context of the central European Variscides.

INDIVIDUAL RESULTS:

Age constraints on the Cadomian evolution of the Teplá–Barrandian Unit (Bohemian Massif) through electron microprobe dating of metamorphic monazite *(G.Zulauf, F. Schitter, G. Riegler, F. Finger,* ***J. Fiala*** *&* ***Z. Vejnar*** *– joint research with the Institut für Geowissenschaften und Lithosphärenforschung and Geologisch-Paläontologisches Institut)*

The Teplá–Barrandian Unit forms a major constituent of the Gondwana-derived Armorican terrane assemblage where the impact of the Cadomian orogeny can be studied in great detail and at different structural levels. Electron microprobe dating of monazites from paragneisses of the Domažlice crystalline complex, situated in the southwestern part of the Teplá–Barrandian Unit, helps to constrain the age of Cadomian high-grade metamorphism of this area. Monazites in three samples from different localities were analysed and yielded weighted average Th-U-Pb model ages of 540±16, 542±23 and 551±19 Ma, respectively. On the basis of the new monazite ages and pre-existing stratigraphic, structural, metamorphic and radiometric age data, a geodynamic model for the Cadomian evolution of the Teplá–Barrandian Unit is suggested. This model includes the following stages of orogenic activity: (1) southward subduction of oceanic lithosphere along the northern, Andean-type margin of the supercontinent Gondwana at >550 Ma; (2) collision of a microterrane (island

arc?) with Gondwana under persisting top-to-the-N kinematics, involving slab breakoff and associated low-pressure/high-temperature metamorphism at ca. 550 – 540 Ma; (3) crustal thinning and exhumation of high-grade metamorphic rocks, accomodated by dextral transtension and erosion of the orogenic wedge at ca. 540 – 550 Ma. Major crustal tilting of the Domažlice Crystalline Complex predates the emplacement of synkinematic Cambrian granitoids. The generally calc-alkaline characteristics of these granitoids do not necessarily indicate prolonged Cadomian subduction during the Cambrian. It can be equally well explained in terms of remelting of arc-type crust in a post-collisional high-heat flow regime.

The Variscan polyphase tectonothermal development of the West Sudetes (NE Bohemian Massif) *(D. Marheine, ISTEEM–CNRS, Univ. Montpellier 2, France, V. Kachlik, Faculty of Science, Charles University, Prague**, M. Fajst, F. Patočka** & H. Maluski, ISTEEM–CNRS, Univ. Montpellier 2, France)*

The orogenic wedge propagated generally westwards in the northwestern limb of the Variscan accretionary complex of the West Sudetes, i.e., in the Krkonoše–Jizera terrane. As a result, the Krkonoše–Jizera terrane is characterized by E-W-orientated successions of geological phenomena: inverse stratigraphic and metamorphic zonation, decreasing Ar-Ar ages of micas in metamorphic rocks (from ca. 360 Ma to 320 Ma) and a delay in the onset of flysch sedimentation. The dominant structure of the West Sudetes was, however, most probably established at 335-320 Ma as suggested by Ar-Ar data from micas of metavolcanic rocks, detrital metasediments and metagranitoids of the whole West Sudetic Unit, which corresponds to the earliest Late Carboniferous. The last phases of the evolution of the West Sudetes were synchronous with the emplacement of late Variscan granitoids of the Krkonoše–Jizera pluton. The end of the Variscan magmatic and tectonothermal processes in the West Sudetes in the Late Carboniferous is reflected by the youngest obtained Ar-Ar ages – 313-314 Ma.

Geochronology and structural evolution of granulites in the S part of the Moldanubian Zone, Bohemian Massif (***M. Svojtka & J. Filip***)

New fission-track dating on apatites was obtained from the South Bohemian granulites. Modelling of the apatite ages shows an average paleotemperature gradient 0.5°C/Ma from 230-210 Ma to the present. All the granulite-facies rocks reveal a distinct period of cooling which occurred at ca. 40-20 Ma. This episode can be attributed to the Neogene uplift of the Bohemian Massif. In order to define cooling ages and uplift of the South Bohemian granulites, Rb-Sr ages were determined. Biotite-whole rock Rb-Sr ages of ca. 330 – 339 Ma are interpreted as representing times of closure of isotopic systems associated with rapid cooling and uplift during the final stages D_2 of ductile deformation and metamorphism in the studied granulites.

Mafic metavolcanic rocks of the Sedlčany–Krásná Hora Islet (***P. Vítková*** *& V. Kachlík, Faculty of Science, Charles University, Prague*)

The Sedlčany–Krásná Hora Islet is an isolated remnant of the metamorphic host rock of the Variscan Central Bohemian pluton shaped into an uneven rectangle of ca. 20 to 10 km, elongated in the SE-NW direction, and composed of Late Proterozoic(?) to Early Paleozoic rocks. Bimodal metavolcanic rocks are present mostly within the metasedimentary sequence of the Late Proterozoic and/or Cambrian(?) Svrchnice Fm. Mafic metavolcanics (lavas or subvolcanic bodies) are of Late Proterozoic and/or Early Paleozoic age, and are distributed in the NW part of the Sedlčany–Krásná Hora Islet. In the metavolcanic suite, the mafic metavolcanics (primarily basalts and basaltic andesites) prevail over felsic rocks (metamorphosed rhyolites). The mafic rocks are distinguished into two texturally defined types. Metabasites of the first type are very fine-grained to almost massive

rocks, which exhibit somewhat more advanced degree of recrystallization compared to the representatives of the second type. The second type of the metabasites is rich in relics of clinopyroxene phenocrysts.
Magmatic mineral assemblage of the mafic metavolcanic rocks is obliterated due to regional and contact metamorphism. The existing mineral association of mafic rocks usually consists of pyroxene, amphibole and plagioclase. Some of the less altered samples contain relics of diopsidic pyroxene. Pyroxene phenocrysts are partly or completely replaced by uralitic amphibole. Amphiboles are calcic types represented by actinolite, actinolitic hornblende and magnesio-hornblende. Plagioclases show a wide variety of compositions from andesine to bytownite. Chlorite, epidote and biotite are accessory minerals.
In the TAS classification diagram, the mafic metavolcanics plot into the fields of basalts and basaltic andesites, with SiO_2 concentrations ranging from 48 to 52 wt.%. They include rather primitive basalts with MgO contents of 8-15 wt.%. The studied metabasites show high contents of transitional elements (Cr, Ni and Co) and low concentrations of LILE (such Rb and Sr), HFSE (Ti, Zr etc.) and REE. Many of the mafic metavolcanic rock samples are depleted also in Nb and Ta.
The Sedlčany–Krásná Hora Islet metabasites generally display typical tholeiitic patterns of chondrite-normalized trace element distributions. The REE contents are very low and REE chondrite-normalized patterns are relatively flat: the $(Ce/Yb)_N$ ratios are 3.1-6.7. The rocks correspond to tholeiitic low-Ti basalts and basaltic andesites. The major and trace element compositions of the rocks were locally modified by mobile element concentration changes during the Variscan tectonism.
Two samples of the metabasites – distinguished by the presence of pyroxene phenocrysts up to 1 cm in diameter – correspond to geochemically primitive Mg-rich boninitic to picritic rocks of the depleted mantle derivation. They show characteristic features of the high-Ca boninitic lavas identical to those of the Upper Pillow Lavas of the Troodos Ophiolite Complex in Cyprus. These features are: SiO_2 content generally above 49 wt.%, high Mg number ($Mg/[Mg+Fe_{TOT}]$) values (0.65-0.75), TiO_2 content below 2 wt.%, values of CaO/Al_2O_3 above 0.75 and sum of alkalis below 2 wt.%.

Metamorphic development of the Zábřeh Crystalline Unit: Formation of cordierite in metapelites of the northern part of the Zábřeh Crystalline Unit (***M. Němečková***)

Two types of metapelites were recognized in the northern part of the ZCU: (i) Al-rich with the assemblages Qtz+Plg+Bt+Ky(Sil)±Grt, Kfs, St and locally with cordierite and muscovite (ii) Al-poor with the assemblages Qtz+Plg+Bt±Ms, Grt, Kfs, Sil and locally also with cordierite and cummingtonite. Mineral assemblages and textural relations in metapelites suggest a polymetamorphic evolution of the ZCU. Early metamorphic event is characterized by the assemblage kyanite+staurolite common in Al-rich metapelites. The formation of garnet and sillimanite instead staurolite and kyanite may represent the peak of regional metamorphism.
Textural relations in Al-rich metapelites suggest the mineral reactions: (1) Bi+Sil+Qtz = Crd+Kfs+H_2O; (2) Bi+Sil+Qtz = Crd+melt; (3) Bt+Sil+Qtz = Grt+Crd+Kfs+melt; (4) Ms+Bt+Qtz = Crd+Kfs+H_2O.
The position of the mineral reactions involving cordierite in the PT diagrams and its chemical composition suggest pressures of about 4 kbar and temperatures of ca. 620 to 680 °C. The proposed pressure of the tonalite intrusion is lower than that given for tonalite in the Staré Město Unit (P = 6.5-7 kbar, T ~ 700 °C).

Diversified Cambrian assemblages of palynomorphs from the SE Bohemian Massif (***M. Vavrdová***)

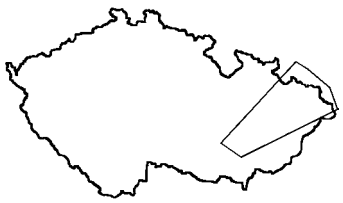
Well preserved and diversified assemblages of palynomorphs were separated from palynological residuum obtained from subsurface sample of dark grey siltstones (Němčičky 3 borehole, depth 5,396 m). Microfossils were studied in thin sections, strew slides and under Jeol SEM. 22 genera and 46 species of acritarchs and prasinophytes were identified, including age-significant forms. Recovered palynomorphs indicate the late Early Cambrian age of the analysed sample, corresponding to *Holmia/Protolenus* trilobite zones defined in

Baltoscandinavia and to Vergale/Rausve informal “stages” on the East European platform. Palynomorphs from the so-called ”basal clastics” reveal affinities to Baltoscandinavian and East European Platforms, as well as to SE and NE Poland.

Regional sea-level oscillations in the Late Lochkovian and Pragian of the Barrandian area (***L. Slavík***)

Two Early Devonian sections, Na Branžovech and Karlík Valley, were studied. Whilst the Na Branžovech section displays the most complete sequence of Pragian facies (limestones of the Koněprusy, Slivenec, Loděnice, Řeporyje and Dvorce-Prokop members) and lies within the northwestern limb of this synform, the Karlík Valley section in the opposite limb consists exclusively of the Dvorce-Prokop Limestone. The present biostratigraphic information based on 18 species with a total of 350 conodont elements is mostly related to the Late Lochkovian and Early Pragian, whilst the remaining parts of Pragian involve mostly long-range conodont species. The absence of stratigraphically significant species in the upper parts of the Pragian seriously constraints the attempts of better recognition of eustatic cycles. The late Lochkovian conodonts correspond to two zones, *eurekaensis* and *delta*. Further investigations in the Karlík Valley section confirmed reliable documentation of only one standard conodont biozone - the *eurekaensis* Zone. This zone marks older than the latest parts of the Lochkovian sequences. Thus, on condition that this sequence developed continuously, the *delta* and *pesavis* zones should follow the *eurekaensis* Z. in the several remaining metres of the Lochkovian sediments. Such unusual rate of condensation is very rare in the Kotýs Limestone and it is very unlikely to suggest it for the Karlik Valley section, because this sequence does not show significant thinning upward. Thus the reduction of the section should be seen in pronounced effects of submarine corrosion and erosion rather than in only simple sedimentary starvation. On the other hand, the latest Lochkovian zone *pesavis* was found in the northwestern limb of the synform, in the Na Branžovech section. The absence of the *pesavis* Zone in the south (Koněprusy) and, as now revealed, in the south-east of the central Barrandian synform (Karlík Valley) suggests that a prominent lowstand sedimentary starvation affected much larger areas than only the tops of elevated ridges. Two lower thirds of the Pragian sequence can be ranged using two newly suggested conodont zones, *steinachensis* and *serratus*, respectively, defined by the first and last occurrences of these taxa. The first occurrence of *Latericriodus bilatericrescens bilatericrescens* (Ziegler) seems to indicate the base of the Emsian in the Na Branzovech section. The entry of this taxon is connected with black-shale Graptolite Event within the uppermost Dvorce-Prokop Limestone, which is several beds higher than the levels usually considered for the entry of a debatable taxon *Polygnatus pireneae* Boersma. The base of the Graptolite Event gives a better chance for correlation of the Pragian/Zlichovian (Lower Emsian) boundary than any of the underlying levels.

Pre-Variscan tectonic regime recorded on the surface of the peneplained Brunovistulian unit and its evidence from geophysical logs in the Devonian cover *(**J. Hladil**, L.F. Jansa, Geological Survey of Canada - Atlantic, Dartmouth, A. Těžký, Geofyzika a.s., Brno, & K. Helešicová, Transgas, Brno).*



The gamma-ray logging in 32 wells at the edge of the Bohemian Massif revealed a significant correlation of the high-frequency sequence architecture of the middle and outer parts of the Devonian carbonate platform complex. The fluctuations in gamma-ray activity correspond directly to the changes between the stromatoporoid-algal limestone of highstand to highstand-falling systems tracts and impure, fine-grained carbonate rocks of the lowstand and transgressive intervals. The dip-directed vertical sections show arrangements of the sedimentary units with a regular, fan-shaped thickening toward the basin, in agreement with the documents given by V. Zukalová and J. Dvořák in 1980s. An origin of such considerably regular pattern in the sections across the platform, where the coral-sponge-algal carpets on the shallow sea floor were practically in the contact with sea level, requires conditions of eustatic sea level rise as well as continuous subsidence of the fundament, which was combined with the basinward tilting. Cutting or redundant cycles is very rare, and any erosion terraces with young sediments at relatively low altitudes

are absent. Therefore, the major part of the Givetian–Frasnian platform must be considered as extremely tenacious in these times. This integrity hardly allows an application of the tilting models operating with partial synsedimentary faults. Fluctuating subsidence patterns were found only alongside the platform edge and slope, where we can suggest shear and wedging deformations among the different lithospheric blocks. In addition, also an abrupt mid-Frasnian drowning of an isolated frontal reef at Hranice n.M. differs from the common subsidence trends. This exceptional change must be modelled as a large-scale gravitational slide into the basin. The above tilting of the wide Brunovistulian basement, without any faulting during the Givetian – middle Frasnian times, can be hardly compared with the common tilting models (such as compression-related forebulges or the extension-related halfgrabens). Possible causes of the observed tilting phenomenon are likely connected with the thermal isostasy, but it is unclear whether a relevant cause is only a simple movement away from the rift suture or rather a side-sliding over a deeply located avulsions of an old, subducted crustal segment in the mantle.

Paleomagnetic investigations aimed at global tectonic interpretations, paleogeography of the Paleozoic rocks and Variscides in Europe (***M. Krs, O. Man, P. Pruner & D. Venhodová***)

Paleomagnetic results obtained during the last 35 years for Phanerozoic rocks in the Variscan and Caledonian mobile belts as well as in stable East-Europen craton and for Permian to Neogene rocks in the Alpine tectonic belt in Europe resulted into some novel interpretations of paleomagnetic data and a critical insight into the interpretation procedures. Since the first report on paleotectonic rotations in the Western Carpathians, paleotectonic rotations have been recorded in all rocks affected by Alpine tectonics. In the Western Carpathians, these mostly anti-clockwise rotations were derived for individual small-scale rock formations as well as for larger rock complexes and nappes. Similar paleotectonic rotations were published by numerous geophysicists for the central and West European Variscan belt, but only for the rock formations older than early Permian and located SW of the Trans-European Suture Zone. This Zone separates the Precambrian lithosphere in the NE from the younger Hercynian and Caledonian mobile belts in the SW. These prevalently clockwise rotations can be well demonstrated on numerous paleomagnetic data from the Bohemian Massif, particularly on rock formations in the Barrandian (considered a peri-Gondwanide terrane), which was consolidated during the Variscan orogeny. The general agreement of the experimentally inferred data with model simulations of these rotations proves that the tectonic deformations in both the Hercynian and Alpine tectonic belts are dominated by rotations around vertical axis. Specific distribution of pole positions due to paleotectonic rotation is doubtlessly a typical feature for the collisional tectonic belts. Model simulations of paleotectonic rotations allow to separate the movements into those around a distant pole of rotation (continental drift) and those around a proximal pole of rotation and, consequently, to give a better definition of polar wandering paths.

Rock-forming minerals as products of the late-and post-magmatic processes in granites of the Krušné hory Mts. batholith (***J.K. Novák***)

It is generally accepted that the Krušné hory-Erzgebirge batholith is a composite body developed by successive emplacement of monzogranite to alkali-feldspar granite magma. This batholith is divided into three major plutons: western (WP) and eastern (EP) plutons in the Czech Republic and the middle pluton (MP) in Germany. The mineralized and Li-F-Sn-W-specialized granites usually form small isolated bodies, such as the stocks of Cínovec/Zinnwald and Krupka-Preisselberg II in EP as well as Hub and Schnöd stocks in the WP.
The origin of the highly evolved Erzgebirge granites, slightly peraluminous and phosphorus-poor types in the EP and peraluminous and phosphorus-rich types in the WP, is discussed in in the light of new petrogenetic and physicochemical data. The late- to post-magmatic effects of fluids (lithian or Li-deficient greisenization, feldspathization, sericitization, silicification, etc.) on the chemical composition of the individual granite types were quantified for the first time using a series of modal analyses recalculated to the reconstructed major-element compositions (n = 1 100).

The bulk compositions of rock-forming minerals with the substituting ability and sensitivity to fractionation crystallization of the granitic magma and/or to metasomatic changes, such as mica types, topaz, tourmaline and alkali feldspars, were determined using electron microprobe. Among composite lithian micas, different generations of zinnwaldite, transitional zinnwaldite to Fe-lepidolite and/or lithian siderophyllite ("protolithionite") with a higher F/(F+Cl+OH) ratio can be recognized. All early and secondary white micas consist of phengitic muscovite or, to a smaller extent, of Li-bearing muscovite, sometimes passing to Fe-lepidolite (e.g., at Cínovec and Přebuz). Zinnwaldite in mica-quartz greisens is the main carrier of deficient Rb and Cs and future potential raw material at the Cínovec greisen deposit. Topaz grains mostly belong to the fluorine-rich species with the exception of those from the Vykmanov greisenized cupola. Therefore, a higher fugacity of fluorine can be emphasized, which is a decisive factor in the genesis of granite-related ore deposits at Cínovec, Krupka-Preisselberg II and Hub stocks.
Zoned tourmaline of schörl-type is genetically related to nodular, two-mica syenogranite of the Karlovy Vary II exposure. The bulk composition of alkali feldspars reflects phosphorus-rich and phosphorus-poor varieties and confirms differences between highly perthitic K-feldspar, adularia (almost pure Or), and albite, while Rb-bearing end-member (rubicline) is only suggested (due to Rb enrichment).
The studied granite types with a clear relationship to attractive mineralization (Sn, W, zinnwaldite) at Cínovec in the EP and a group of cupolas at Krásno in the WP represent world-known standards for specific studies and correlation programmes.

Youngest tectonic activity on faults in the SW part of the Most Basin (***J. Adamovič***)

The Most Basin overlies the zone of Late Variscan juxtaposition of the Saxothuringicum and the Teplá-Barrandian Block in N Bohemia, and pertains to the fill of the Cenozoic Ohře Graben. Syn-depositional and post-depositional tectogeny of the Most Basin is a process, which can be subdivided into several separate stages – tectonic phases. The basin was filled and subsequently deformed under prominent tensional stress field designated as phase β. However, the most significant movements along major faults of the MB occurred only after the deposition of the Most Formation: two post-depositional compressional phases γ (WNW–ESE compression) and δ (NNW–SSE to NNE–SSW) and an extensional phase ε_1 were identified in the MB with their dating constrained to the Middle Miocene–Pliocene interval.
The youngest, post-Pliocene tectonic deformations documented in the MB are attributed to an older ENE–WSW compression and a younger NNE–SSW to ENE–WSW extension, which were responsible for movements on the order of first metres.

Metasediments of Variscan and pre-Variscan complexes of the Bohemian Massif (***M. Konzalová***)

Microfossils were first recorded in the metasediments of the Islet Zone (central Bohemia). The specimens are altered, adequately to the near granite body, but identifiable in gross morphology. They comprise three groups of plankters and can be correlated with the Paleozoic microorganisms. Compared to the Proterozoic assemblages obtained from the siliciclastic rocks (l.c.) They display different features. Even if the envelopes are thermally affected and analogously preserved, they are the only microfossils revealed in the sedimentary complex. Their evaluation is consistent with the lithological and geochemical conclusions (V. Kachlík, Faculty of Science, Charles University, Prague).
Another problem discussed related to graphitic scales discernible in crystalline rocks of South Bohemia (Varied Group of the Moldanubian complexes), in high-grade metamorphosed marbles in the amphibolite facies. They are assigned to quasi scolecodont remains and critically evaluated (l.c.). The problem of identification the graphitised organic remains in highly altered rocks was also discussed.

Paleomagnetic investigations aimed at the contact regions of the Bohemian Massif and the Western Carpathians (***M. Krs, O. Man, P. Pruner & D. Venhodová***)

Evaluation of paleomagnetic data so far inferred from volcanic (teschenite) and sedimentary rocks of the Outer Carpathian Flysch Belt, from carbonate rocks of the Klippen Belt and from volcanic (prevalently melaphyres) and sedimentary rocks of the Inner W. Carpathians was necessary to contribute to the elaboration of a geodynamic model for the Western Carpathians, with reference to global tectonic interpretation. The data from the Outer Carpathians indicated pronounced horizontal tectonic rotations of anti-clockwise sense; they refer to rocks of Eocene to Early Cretaceous ages of the Dukla, Magura, White Carpathians (Biele Karpaty) and Silesian tectonic units. Carbonate rocks of the Klippen Belt showed paleotectonic rotations of an anti-clockwise as well as clockwise sense, while volcanic and sedimentary rocks studied from several nappes in the Inner Carpathians showed horizontal rotations exclusively of anti-clockwise sense. Paleotectonic rotations around a vertical axis are characteristic for the W. Carpathians, indicating marked tectonic deformations of major rock units.

Virtual pole positions were calculated for the Early Cretaceous to Eocene rocks of the Outer W. Carpathians and for the Cenozoic rocks of the Inner W. Carpathians using previously and recently derived paleomagnetic data in order to assess the possibility of paleotectonic rotation within smaller areas and the waning of the Alpine tectonism in the whole region of the W. Carpathians. A typical example of two movements of poles can be demonstrated on paleomagnetic results from the rocks of the teschenite association of the Silesian Unit. Virtual pole positions lie close to the small circle corresponding to paleomagnetic inclination $I_p = 55^o$ (due to continental drift), and are distributed along the circle as a result of small-scale tectonic rotations (around proximal pole of rotation). Similar analysis was done for the Dukla, Magura and White Carpathian units and for sedimentary rocks of the Silesian Unit. Paleomagnetic data recently published for the Cenozoic (prevalently Miocene) rocks from three distinct basins in the Inner W. Carpathians were also analysed. Similar paleotectonic rotations as for the Outer W. Carpathians were also interpreted for sedimentary rocks of the Cenozoic age in the basins of the Inner W. Carpathians. Prevalent anti-clockwise rotations interpreted paleomagnetically both in the Outer W. Carpathians and in the Cenozoic sedimentary rocks in the basins of the Inner W. Carpathians are subject to global tectonic considerations. The rotations are similar in magnitude in both the zones but generally wane towards the Karpatian age. Paleotectonic rotations suggesting both small-scale and large-scale movements were found even within separate nappes and basins with horizontal or subhorizontal beds. The above briefly discussed paleomagnetic data from the Permian to the Karpatian, interpreted in terms of global tectonics, indicate paleogeographic affinity of the whole region of the W. Carpathians to the African Plate.

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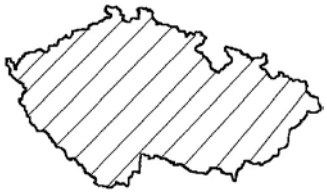
(12b) K1-042-603 Project No. 6: Atmospheric and lithospheric processes with special reference to the territory of the Czech Republic (*co-ordinator J. Laštovička, Institute of Atmospheric Physics, Academy of Sciences, Prague*)

Subproject: Dynamics of lithospheric processes (***V. Suchý, J. Fiala, J. Filip, A. Galle, J. Hladil, V. Houša, M. Konzalová, M. Lachmanová, R. Mikuláš, J. K. Novák, L. Peza, P. Pruner, M. Svobodová, P. Štorch, M. Vavrdová & J. Žítt***)

INDIVIDUAL RESULTS:

History of veining and paleofluid evolution in the Barrandian Basin (Lower Paleozoic), Czech Republic (***V. Suchý***)



In order to tie tectonic and thermal events that occurred through the history of the Barrandian Basin with the evolution of basinal fluids, the sequence of vein propagation and fluid composition was examined in the Silurian and Devonian limestones and shales at the Kosov Quarry. Three successive generations of veins were recognised, which can be attributed to different stages of a basinal cycle. Virtually all generations of fracture cements host abundant liquid hydrocarbon inclusions that evidence repeated episodes of petroleum migration through the strata during burial, tectonic compression and uplift.
The earliest veins that propagated prior to folding were displacive fibrous “beef” calcite veins, found parallel to the bedding of some shale beds. Hydrocarbon inclusions within this vein cement yield Th values between 58-65°C and document that the “beef” originated in deeper burial environment, during early petroleum migration from overpressured shales.
E-W-striking, extension veins that postdate “beef” calcite, propagated in response to early stages of Variscan orogenic deformations. Based on AFTA data and other geological evidence, the veins probably originated at 380-320 Ma, which roughly coincided with peak burial of the strata, folding and emplacement of Variscan synorogenic granites. The veins that crosscut burial diagenetic cements and low-amplitude stylolites in host limestones are oriented roughly perpendicular to the bedding plane and are filled with cloudy, twinned calcite, idiomorphic smoky quartz and residues of hardened bitumen. Calcite and quartz cements contain abundant blue and blue-green-fluorescing primary inclusions of liquid hydrocarbons that homogenise between 60-90°C. Geochemical characteristics of the fluids as revealed by GC-MS method, particularly the presence of olefins and parent aromatic hydrocarbons (phenantrene), suggest that the oil entrapped in the inclusions experienced intense but geologically fast heating that resulted in thermal pyrolysis of hydrocarbons. This implies that the organic fluids in the fractures may have been partly influenced by heating associated with igneous intrusions which, at present, are hidden below the surface. Subvertical, NNE- to NNW-striking sets of veins herald the youngest fracturing event in the basin. Some of these veins are only several mm thick and sparsely mineralized with thin leaf-like quartz crystals that bear tiny blue and yellow-orange-fluorescing hydrocarbon inclusions. Most of the N-S veins, however, are expressed as thick calcite veins that crystallized generally at 70°C or less from H_2O-NaCl solutions of variable salinity with admixture of petroleum. The origin of these fluids is interpreted in terms of deeply circulating meteoric waters that partially mixed with deep basinal fluids. Wider structural considerations combined with fission-track analysis of adjacent host sediments suggest that N-S veins were opened and/or reactivated only during the post-Cretaceous uplift of the area, probably in response to major Paleogene to Neogene deformations generated in the Alps and transmitted far into the Bohemian Massif.

Magnetostratigraphy susceptibility of the Silurian–Devonian (S/D) GSSP at Klonk and coeval sequences in the world (***J. Hladil****, R.E. Crick, University of Texas in Arlington, Dallas, B.B. Ellwood, State University of Lousiana, Baton Rouge, A. El-Hassani, Dept. of Geology, University at Rabat, I. Chlupáč & F. Hrouda, Charles University, Prague*)

Detailed measurements on samples from the outcrops on the Klonk hillside significantly completed and partly modified the previous knowledge based on the first complete section measurements. These large data sets on magnetic susceptibility of partly weathered rocks excavated at Klonk were also

completed by measurements of microsamples from the recent Klonk-1 borehole, where the coring operation was a cooperative effort between the Forschungszentrum Ltd., Jülich, and the Institute of Geology AS CR, Prague. The detailed investigation of the data was finished in 2000 and allows the definition of three new Silurian/Devonian-related magnetic susceptibility zones: 1) the Voskop magnetiosusceptibility zone (early Lochkovian) with 7 magnetosusceptibility subzones, 2) the Klonk MSZ (latest Přídolí and earliest Lochkovian) with 17 MSSZs, and 3) the Tmaň MSZ (latest Přídolí) with 13 MSSZ. The other three zones were suggested on the basis of rock-core investigation: 4) the Obcina MSZ (early late Přídolí), 5) the Telín MSZ (early and middle Přídolí) and 6) the Háj MSZ (latest Ludlow and earliest Přídolí). The extent of the MSZs and MSSZs away from the proposed magnetostratotype was positively tested by comparison with the Lochkovian succession in the western Sahara of southeastern Morocco. The transgressive and regressive character of events inferred from the petrology and magnetic susceptibility characteristics of sediments provide a picture of transgressive/regressive events around the Silurian-Devonian boundary. The same pattern of the T/R events in the boundary sequences developed in basins in Bohemia and Morocco argue for correctness of suggested sea-level control of iron-bearing condensed beds on at least the scale of northern Gondwana. The main carrier of these magnetosusceptibility records are paramagnetic minerals related to weathering products, thiospinels, siderite and magnetite. Generally, the high magnetic susceptibility values usually correspond to high primary contents of iron and are typical for various episodes from late falling stage systems tract to the next flooding surface and similarly in small scale. The long-range, high-resolution chronocorrelation value of the magnetosusceptibility events was thus demonstrated, including the applicability of formal zones defined at the GSSP.

Studies of aeolian and lacustrine sediments (***E. Růžičková***)

Localities of Pískový vrch near Vlkov and Švarcenberk Lake in southern Bohemia were studied to correlate sands of the two distinct, genetically different sediment types. Quartz grains, which are the main mineralogical clastic component in sediments of the aeolian sand dune (Pískový vrch) and in lacustrine sediments of Švarcenberk Lake, show surface structures typical for aeolian transport. This is supposed to be a proof of the presence of aeolian component in basal beds of the deposits of this lake. Detailed studies of structural features in dune deposits confirmed the deposition of this dune by wind from the east (or northeast).

Palynology of selected Late Cretaceous sequences (Bohemian Cretaceous Basin) (***M. Svobodová***)

Several palynomorph associations were found in the late Cenomanian-lower Turonian deposits NE of Prague. The aim of the study is the reconstruction of the environment in the coastal deposits of Markovice, Karlov and Radim and a comparison with coeval deposits at the locality of Velim.

Marine dinocyst taxa and diverse assemblages dominate the outcrop sections. Gonyaulacean genera prevail (i.e., *Florentinia mantelii, Florentinia ferox, Pterodinium cingulatum* a.o.). This suggests that in this period sediments were deposited in more offshore environment but with availabile nutrients, at increased water temperature and salinity (the presence of prasinophycean alga).

Both the presence of biostratigraphically important angiosperm pollen, namely *Complexiopollis-Atlantopollis* types, and the composition of dinoflagellate assemblage suggests Lower Turonian age for the section. Moreover, the high diversity of the *Complexiopollis-Atlantopollis* species indicates an assemblage younger than the base of the Lower Turonian.

Methodology and magnetomineralogical study to determine mineral-carriers of remanent magnetization for magnetostratigraphic investigations of karst sediments in Moravia and Slovakia (***P. Pruner, O. Man & D. Venhodová***)

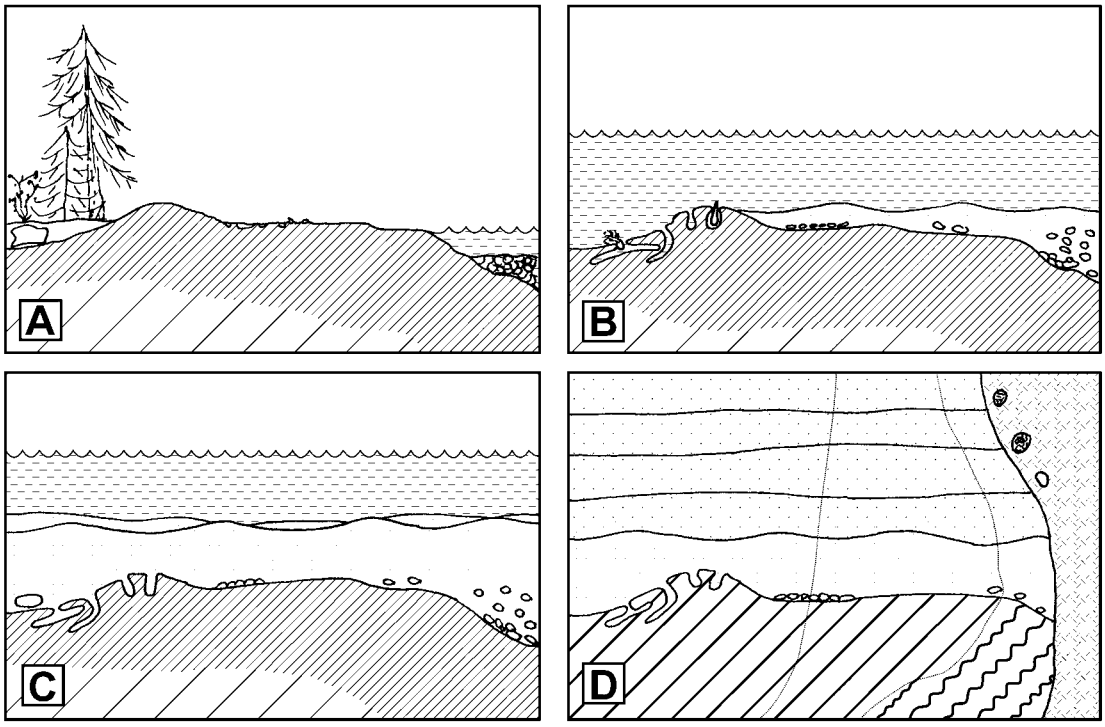
The aim of this project is to prepare the background for the correlation of sedimentary fills in selected Moravian, Slovenian and Slovak caves with the Earth´s global magnetoevents. We collected 223 samples for AF demagnetization and 31 samples for progressive thermal demagnetization from the Ochozská Cave, Sloupsko-Šošůvská Cave (Moravia), Črnotiče Quarry (Slovenia), Pocala Cave (Italy), Belianská Cave, Stratená Cave (Slovakia). However, the methodology of investigations had to be considerably modified according to varying physical properties of rocks. Laboratory studies in the early stages of the paleomagnetic and magnetostratigraphic investigation also included magnetomineralogical studies to determine mineral-carriers of remanent magnetization. The analysis of microcoercitive spectra showed that the tested samples display medium magnetic hardness. Results of these diagrams show phase changes of magnetically active (mostly Fe-oxides) minerals to occur during laboratory thermal processing, especially at low (200 – 350 °C) temperature intervals. Such laboratory procedures were selected which allowed separation of the respective remanence components and the determination of their geological-historical origin. The samples generally showed three remanence components: the A-components are of viscous or chemoremanent origin and were inferred after the progressive thermal demagnetization procedure in the temperature interval below 100 ^{o}C, the B-components were mostly derived in the temperature interval of 60 to (200) 240 °C; C-component is the most stable one, demagnetizable in temperature of ca. 280 to 400 (450) °C.

Detailed magnetostratigraphy and paleontology across the J/K boundary strata at Puerto Escano, S Spain (***P. Pruner, M. Krs & V. Houša***)

The section at Puerto Escano, Province of Cordoba, S Spain, located some 2 km from the synoptic section at Carcabuey, has been selected for detailed magnetostratigraphic studies across the J/K (Jurassic/Cretaceous) boundary strata. The limestone samples are relatively strongly magnetic, moduli of natural remanent magnetization vary in several thousands of 10^{-6} [Am^{-1}] units. They show three components of remanence: A-component, evidently of viscous origin; B-component of secondary origin and of exclusively normal polarity; and C-component either with N- or R-polarity. In the section at Puerto Escano, the magnetozones from M20r to M18n were precisely defined, including two narrow subzones with reverse polarity: The “Kysuca Subzone” and the “Brodno Subzone”. However, the normal segment between the “Brodno Subzone” and the base of M18r needs additional studies. The J/K boundary based on calpionellids (explosion of *C. alpina*) occurs approx. in the middle of M19n. The J/K boundary based on ammonites (base of *jacobi*) lies near the base of M19n. The base of the uppermost Tithonian ammonite *Durangites* Zone occurs approx. at the same level as the appearance of *C. grandalpina* and slightly below the base of M19r. At this level, prominent events of all three scales (magnetostratigraphy, calpionellids, ammonites) coincide.

Bioerosion and bioturbation on weathered (and subsequently re-compacted) metavolcanic rock (Cretaceous, Czech Republic) (***R. Mikuláš, M. Němečková & J. Adamovič***)

The locality of Maršovický vrch Hill (N Bohemia, Czech Republic) yielded an example of the Cretaceous sea bottom built of Na-metarhyolite. Two types of trace fossils penetrate the substrate, namely *Thalassinoides* isp. and ?*Gastrochaenolites* isp. *Thalassinoides* originated presumably in a firmground, i.e., the metavolcanic rock must have been “delithified” in some patches and subsequently re-hardened again. ?*Gastrochaenolites* isp. is interpreted as a boring trace of decapods.



Possible scenario of development of the fossil sea bottom at Maršovický vrch Hill. A, the situation immediately before the Cretaceous transgression; B, after the transgression; C, after the obrution of the rocky bottom; D, after the Tertiary magmatic activity (R. Mikuláš et al.)

Association of trilobites and minute ovoid pellets in the fill of an ichnofossil (Ordovician, Llanvirnian, Czech Republic) (***Radek Mikuláš*** *& Jana Slavíčková, National Museum, Prague*)

Old collection of the Ordovician fauna from the Barrandian area (Czech Republic) yielded an example of probably vertical shaft containing several dozens of specimens of a trilobite *Placoparia (Placoparia) cambriensis*, some of them enrolled. The fill of the trace fossil (which is classified with some doubts as *Skolithos* isp.) also contains minute ovoid pellets corresponding to the ichnogenus *Tomaculum*. The enrollment of a part of the trilobite exoskeletons in the traces fill might be a defence response. The pellets can be interpreted as faecal material or, less probably, eggs.

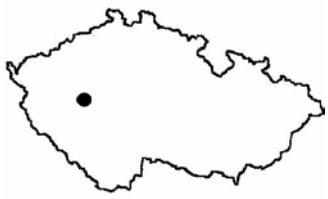
Investigation of the Lečice Member of the Barrandian Upper Proterozoic (***M. Konzalová***)

The finds of opaque threads and filaments in the silicified shales NE of Dobříš allowed to correlate these sediments with silicified shales and greywackes at other sites of the Bohemian Proterozoic. The co-occurring organic/inorganic opaque matter covering the thread bunches could not be proved by the current optical methods. The presence of the organic matter was evidenced in analogous rocks from the former borehole samples only. The rocks yielded, among others, thin grey vesicles of leiosphaerids (even of large size up to 30 μm), testifying the low alteration of organic matter, often associated with sulphides. The presence of Fe-sulphides was not proved in the samples and spots with filaments. Only one line of the seven spots showed a higher amount of Fe using the EDX analyses.

High-resolution graptolite biostratigraphy and correlation of selected Lower Silurian formations of peri-Gondwanan Europe (***P. Štorch***)

Research on graptolite biostratigraphy, paleobiogeography and paleoecology of peri-Gondwanan Europe continued in collaboration with J.C. Gutiérrez-Marco (CSIC) and D.K. Loydell (University of Portsmouth) in Spain. Additional part of a continuous section ranging from the Rhuddanian-Aeronian boundary to the upper Aeronian was logged and densely sampled near Cazalla de la Sierra (Ossa Morena Zone) – El Pintado Section. Dynamics of the graptolite assemblages was studied, particularly with regard to the major crisis at the base of the *sedgwickii* Biozone. A typical, post-extinction faunal assemblage of the lowermost *sedgwickii* Biozone was identified as a lateral correlative of so far tentatively dated graptolite-shelly fauna from Hýskov in the Barrandian area. The same faunal assemblage was further discovered in northern Murzuq Basin in Libya during the Conference field trip. Preliminary sampling of some selected Silurian sections of the Barrandian area (Hýskov, Kosov) focused on integrated graptolite-conodont stratigraphy was undertaken in selected sections of the Barrandian area to promote further collaboration with the University of Modena (Prof. Enrico Serpagli).

Microfossils in carbonaceous cherts from the Barrandian Neoproterozoic (Blovice Formation, Czech Republic) (***M. Vavrdová***)



Micropaleontological research of the Proterozoic silicites has been aimed at the recognition of dominant types of cryptalgal fabrics and of benthic microorganisms which produced various biosedimentary textures and structures. Close morphological similarities between cyanobacterial build-ups, which have been ascertained in carbonaceous cherts and in laminated limestones of the Blovice Formation, suggest that identical types of primitive microorganisms took part in their origin. The following types of organic remains were recognized: mat-forming benthic microorganisms, solitary allochthonous unicells, randomly dispersed in the rock matrix, colonial mat-dwellers and planktonic heterotrophic protist with organic vesicles. Silicification of biosedimentary stromatolitic accumulations was triggered by bacteriogenic reduction of sulphates in silica-rich brines.
Observation in scanning electron microscope in neccessary to distinguish primary biogenic lamination from diagenetic concentric banding (wood-grained cherts), tied to diffusive processes in siliceous mud.

Fauna of the Permo-Carboniferous limnic basins of the Czech Republic (***J. Zajíc***)

The Otovice Horizon (Intra-Sudetic Basin; Sakmarian) yielded the first shark remains after about 150 years of collecting. The ventral spine, teeth and crushed unidentified skull bones belong to *Xenacanthus decheni*. Shark teeth of species *Xenacanthus decheni* were also first found in the Veselá Horizon and upper part of the Klášterská Lhota outcrop (Krkonoše Piedmont Basin) during the last two years. The upper boundary of the *Xenacanthus decheni* Biozone (range zone) should be, therefore, changed for the Otovice Horizon (Intra-Sudetic Basin), for the Veselá Horizon (western part of the Krkonoše Piedmont Basin) and for the superincumbent beds of the Kalná Horizon (the rest of the Krkonoše Piedmont Basin).
Microvertebrate communities of Stephanian C (*Sphaerolepis* subzone) of the localities of Klobuky and Peruc (Klobuky Horizon; Kladno-Rakovník Basin), from the locality of Ploužnice (Ploužnice Horizon; Krkonoše Piedmont Basin), and from 6 boreholes (Zdětín Horizon; Kladno-Rakovník Basin, Mšeno Basin, Roudnice Basin) consist of the following vertebrate groups: acanthodians (*Acanthodes fritschi*, *Acanthodes* sp.), xenacanthid sharks (*Orthacanthus* sp., *Plicatodus* sp., *Triodus* sp., *?Xenacanthus* sp., and Xenacanthiformes indet.), hybodontid sharks (*Sphenacanthus* sp., *Lissodus* sp., and Euselachii indet.), actinopterygian fishes (*Sphaerolepis kounoviensis*, *Progyrolepis speciosus*, *Spinarichthys*

dispersus, *Watsonichthys* sp., and Actinopterygii indet.), crossopterygians (Crossopterygii indet.), dipnoans (Dipnoi indet.), and amphibians (Amphibia indet.). A syncarid remain and the inner casts of ostracod carapaces (*Carbonita* sp.) were also chemically separated.

Mineralized substrates in the Late Cretaceous sequences (Bohemian Cretaceous Basin) (***J. Žítt***)

A study of corrosion and colour alterations of lydite clasts found in the late Cenomanian conglomeratic deposits near Brandýs n. Lab. and Líbeznice continued, especially in the extension of field database. New finds come from conglomerates of the Kojetice and Korycany areas (excavations of the gas main) and vertically extend as low as to the early Late Cenomanian. The paleoenvironmental control of chemical alteration of lydite clasts is presently under study. At the same time, the study of hardgrounds in the rocky-coast facies is being finished and prepared for submission in the next year.

Coprolite beds were studied in the quarry at Plaňany and compared with old samples from Líbeznice heat pipeline and especially with the Zbyslav and Starkoč coprolite occurrences. Occurrences of coprolite beds are doubtlessly paleoenvironmentally controlled, being strictly associated with elevations on sea bottom in relatively deeper sea of transgressive phases (local post-abrasion environments) in the stratigraphic interval of the Lower to early Middle Turonian.

Calpionellid associations of the Štramberk limestone bodies (***V. Houša****)*

The distribution of calpionellid zones of the Upper Tithonian and Berriasian in the Štramberk limestones of the Horní Skalka limestone body was identified. The oldest part of the limestone body (early Tithonian without calipionellids) was found in its western part, the youngest one lies on its eastern margin. Calpionellid zones from the *Chitinoidella* Zone to the *Remaniella* Subzone of the *Calpionella* Zone are present.

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(12c) K1-017-602 Project No. 22: Influence of climate and anthropogenic factors on biosphere and geosphere *(co-ordinator V. Straškrabová, Institute of Hydrobiology, Academy of Sciences, České Budějovice)*

Subproject: The influence of climatic and anthropogenic factors on biological and geological environment (***V. Cílek, V. Ložek, A. Žigová, M. Lachmanová, J. Kadlec, J. Hlaváč, T. Navrátil, E. Růžičková, M. Svobodová, A. Langrová, L. Minařík, P. Skřivan, J. Martínek, I. Dobešová, O. Kvídová & M. Burian***)

This academic project was aimed at better understanding of climatic and environmental changes that take place in the Quaternary and especially during the Holocene. Due to the limited financial funding, no big individual projects were carried out but the finances were spread among researchers to support and extend the running projects (see the individual summaries). Two results were selected from the number of contributions. They deal with Quaternary climates and biogeochemical cycling of elements:

1. The central European loess bodies in hilly regions with their high accumulation rates frequently provide relatively high-resolution “floating” stratigraphies containing both climatic signals common to Europe and minor peaks arising from local factors such as slope processes, discontinuity events or their paleometeorological locations in the former ice-age landscape. The loess/paleosol series are often viewed from the angle of paleoclimate reconstruction but macroscopic features such as lamination of loess strata corresponding to individual dust storms are better explained by paleometeorological factors. The study of heavy minerals from different loess localities in the Czech

Republic points to the same wind pattern as the North Atlantic Oscillation (NAO) functioning even during the last glacial cycle. The rapid consolidation of the "dust accumulation" by cementation bonds represents the key factor in loessification. Calcite and "allophane" impregnations of clay bridges between individual silt grains can be observed. The very nature of "loessification" is associated with rapid evolution of cementation bonds. Experiments reported here demonstrate that significant quantities of white chalky powder loess calcite and Si-Al hydroxides are released during repeated freeze-and-thaw cycles.

2. Results of monitoring of the bulk atmospheric precipitation, beech- and spruce throughfall and surface discharge of the Lesní potok stream in 2000 are as follows: Deposition fluxes of SO_4^{2-}, F^-, As, Be, Cu, Cd, Pb and Zn, all (with the exception of Pb) connected with the emissions from coal-burning power plants, are decreasing due to their completed desulphurization. This tendency was observed both in the bulk precipitation and in beech- or spruce throughfall. In Pb, decreasing sales of leaded gasoline are the main reason of this positive trend. Equal emission sources of the above mentioned atmospheric contaminants were proved by strong mutual correlation of their deposition fluxes. Deposition fluxes of sulphur and fluorine are 3 to 5 times higher in throughfall than in bulk precipitation which can be attributed to the adsorption of gaseous compounds of the two elements - SO_2, H_2S, $(CH_3)_2S$, HF - onto the above-ground parts of the forest vegetation.

INDIVIDUAL RESULTS:

Malacostratigraphical investigation of the Quaternary: importance for paleoenvironmental and stratigraphical analyses (***J. Hlaváč***)

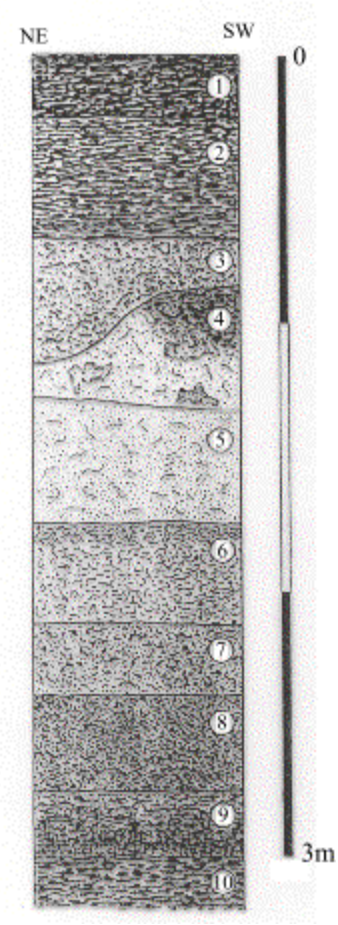
Subproject: Reconstruction of Holocene paleoenvironment from the Zadní Kopanina Valley (Bohemian Karst Protected Landscape Area)

Fossil molluscs of middle and late Holocene age from calcareous tufa terrace on the left side of the Mlýnský potok Creek were studied. These molluscs showed that the Zadní Kopanina area and its surrounding did not have fully developed woodland malacocoenoses. Species of freshwater molluscs (*Pisidium*) were also recorded, documenting the presence of periodic little basins with stagnant or very slowly flowing water. Podvojná Cave is a very small cave and the fossil molluscs found in its entrance reflect a parkland dominated by mesic to xeric woodland with patches of karst steppes. The Zubák cliff provides the opportunity of studying thanatocoenoses of molluscs and small vertebrates in a section beneath the cliff.

Subproject: Tufa deposit at Havlíčkův mlýn near Koněprusy (Protected Landscape Area of the Bohemian Karst)

Havlíčkův mlýn corn mill is a little settlement on the SE margin of the limestone area of the Bohemian Karst in the western vicinity of Koněprusy. Calcareous tufa was deposited by a small spring near the boundary of Silurian limestones and shales with tabular diabase bodies 100 metres east of Havlíčkův mlýn in the lower part of a mixed forest. The tufa deposit is of small extent and medium thickness. Malacostratigraphic investigation and correlation with sedimentological features yielded results similar to most tufa deposit in the Bohemian Karst. Rich molluscan fauna was recorded and selected from the samples taken from individual layers (9-1), sorted, determined and statistically estimated. The section consists of 10 beds. The lowermost bed (bed 10) contains small shale clasts mixed with black clay matrix. The overlying beds (9-8) show dark greyish brown calcareous tufa, very compact with minute shale fragments in the lower part of bed 9. These beds contain molluscan fauna confined to moist, closed woodland with declined occurrence of species *Discus ruderatus*, *Trichia sericea* and *Perpolita petronella*. Open-land molluscan species recorded in high numbers reflect occurrence of open patches and open woodland. Therefore, this horizon can be attributed to the Boreal/Atlantic transition. Climatic Optimum – the Epiatlantic – is characterized by intensive formation of

yellowish brown tufa (beds 7-4) and full expansion of woodland molluscan species (*Bulgarica cana*, *Vitrea diaphana*, *Platyla polita* etc.) whereas the open-land elements and the majority of mesophiles dissapear or became very scarce (*Vallonia* species completely absent in beds 6-4!). The Subboreal (1400-700 BC) and Subatlantic periods are documented in beds 3-2 and characterized by rapid increase in the frequency of open-land species and a decline of moist, woodland species, with some sensitive woodland elements even dissappearing. Tufa deposition strongly declines and dark yellowish brown to dark brown humus-poor matrix has the character of soil sediment with increasing clastic material coming from the upper parts of the slope. The uppermost bed is composed of dark brown humus-rich sediment with modern immigrants (e.g., *Oxychilus cellarius*).



A section in the calcareous tufa cascade exposed by a test-pit on the western foot of Kotýs Ridge (Havlíčkův mlýn) (*J. Hlaváč*)
1 – dark brown humic Rendzic Leptosol, 2 – dark brown humic soil sediment with rare limestone clasts, 3 – dark brown slightly humic sediment with abundant tufa encrustations, 4 – brown fine-grained tufa with coarse encrustation in the upper portion of the layer and dark stains coloured with Fe- and Mn-oxides, 5 – yellowish brown tufa, 6 - yellowish brown tufa with coarse encrustation in the upper portion of the bed, 7 – dark greyish brown tufa with rare shale clasts, 8 – black tufa with rare shale clasts, 9 – dark greyish brown solid tufa with shale clasts, 10 – black Silurian shales

Subproject: Living malacocoenoses in the territory of crystalline limestones between Sušice and Horažďovice (W Bohemia) and their importance for the reconstruction of nature conditions in the Postglacial (***J. Hlaváč***)

Natural habitats in the territory of crystalline limestones have highly developed variability of malacocoenoses, reflected by very high species diversity. The habitats consist of fresh mixed forest growing on scree, sunlit rocks, rocky steppes etc. Some new records of sensitive species, for example *Ruthenica filograna*, *Sphyradium doliolum*, *Merdigera obscura* or freshwater snail *Gyraulus acronicus* subsp. *stelmachaetius*, are very surprising and will contribute to their zoogeographical distribution in the Czech Republic.

Paleoecology of vertebrate assemblages of the Cenozoic of the Bohemian Massif (***E. Kadlecová***)

The *Sciuridae* from the localities of Tuchořice and Merkur were described. Both these localities belong to the mammal Biozone MN3 (early Lower Miocene - lower Orleanian). The composition of *Sciuridae* faunas are different, as the paleoecological conditions were different. The assemblages from these localities contain material of giant tree squirrel *Sciurus giganteus* Freudenberg, 1941, which was originaly described as *Ratufa obtusidens* Dehm, 1950, dwarf tree squirrel *Sciurus dubius* Schlosser, 1951 and several genera of ground squirrels: *Spermophilinus aff. bredai* Ziegler, R & Fahlbusch V., 1986; *Palaeosciurus aff. fissurae* (Dehm, 1950 and three genera of flying squirrels (*Petauristinae*): *Blackia (B.miocaenica* Mein, 1970), *Hylopetes (H. macedoniensis* Bouwens & de Bruijn, 1986 or *H. hoeckarum* de Bruijn, 1998) and *Miopetaurista* aff. *dehmi* de Bruijn et al., 1980. *Spermophilinus* aff*. bredai* Ziegler, R & Fahlbusch V., 1986; *Palaeosciurus* aff. *fissurae* (Dehm, 1950).

The influence of inorganic contaminants on the chemical composition of soils and surface waters in the area of Kostelec n.Č.L. (***L. Minařík***)

The distribution of inorganic contaminants (As, Be, Cd, Cu, Pb and Zn) was studied in the host granitic rocks, soil, surface water and atmospheric deposition in a forested area of the Lesní potok catchment near the town of Říčany (central Bohemia).
The host granitic rock of the investigated area is considerably enriched in As, Be, Cd and Pb, whereas the contents of Cu and Zn correspond to those of Ca-low granites. A similar distribution is displayed in the soil above the parent granite. A part of the total content of tested elements is released into the soils and surface waters during the natural rock weathering. The other significant input of metals into the environment is atmospheric deposition. The main antropogenic contaminant is As. The distribution of metals in the soil is controlled by the amount of clay fraction. Generally, the horizons rich in fine fraction contain more metals than those with the predominance of coarse fraction. The loosely bound species of metals (extractable in 0.1 M HNO_3) form 1 to 30 percent of their total content in soil.
The long-term study of metal concentration in the surface water and atmospheric deposition show a permanently decreasing tendency during the last decade. This favourable environmental trend is connected with the moderately increasing pH of both phases in the period of 1990 to 2000.

Comparison of the element mobility with respect to chronic acidification of the environment (***T. Navrátil***)

The study was aimed at changes in pH by increased H^+ input into an equilibrium system. Stream bottom and streambeds have very strong buffering capacity. Ionic exchange for the cations and anions passed quickly and reversibly. The speed of cation release is: $Na^+ > Ca^{2+} > Mg^{2+} > Al^{n+} > Be^{2+}$. After depletion of exchangeable Ca^{2+} its neutralisation role is taken by Al. The Al reservoir has not been depleted, which can be seen in the relationship of Al and Be (R = 0.99). Important correlation was revealed between Mg and Ca (R = 0.99). This correlation is based on very similar properties of both cations. The highest dependence on pH was documented in the case of Al and Be concentrations.

Study of Holocene fluvial sediments (***E. Růžičková***)

Study of Holocene fluvial sediments of the Labe River continued in studying of textures and structures of loams that are the youngest sediments of the flood plain sedimentary cycle. Along the middle course of the Labe River, two basic facies could be distinquished:
1) silt-dominated sediments (clayey-sandy silt)
2) sand-dominated sediments (silty sand, sand with clay-silt admixture)

The following features were observed in sediments in the junction area of the Jizera and Labe rivers. While both facies are present (silty facies overlying the sandy one) in sediments of the Labe River located upstream of the junction, the silty facies is missing downstream. This can be explained by the change in the stream competence. Such a change may be due to the higher water discharge (influence of the Jizera River tributary) or higher stream gradient.
Macro- and microstructural features of sediments were studied. Massive and subparallel structures were recognized in both facies, and can be used as criteria for reconstruction of sedimentary environments. While the massive and chaotic structures are typical for flood-basin sediments the subparallel and pseudofluidal structures are developed in sediments of crevasse-splay deltas or natural levee conditions).
Petrological and mineralogical studies of fluvial overbank sediments continued in the area of the middle course of the Labe River between Kolín and Mělník in relation to their stratigraphy. The work is a part of the monograph being prepared for print in cooperation with the Archaeological Institute AS CR.

Origin and evolution of fossil and relict soils (***A. Žigová***)

The evolution of soils was studied on different substrates. The Boubová area is covered by the non-buried paleosols (relict soils). Devonian limestone is parental material of these soils. Two typical sections in the soil cover were documented. The studied area is covered by terra fusca on the karst plateau and illimerized terra fusca in the karst depression. The Litovel locality is characterized by buried paleosol developed on loess. The soil units are different than in the Boubová area. Both studied localities were governed by the same climatic conditions in the Last Interglacial. Evolution of soil cover at these localities was influenced first of all by the parental material.

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13. Organization of conferences and scientific meetings

Conferences and Symposia organized in 2000

MAAR 2000 – Internationale Maar-Tagung Daun/Vulkaneifel, Germany, August 17-27, 2000. Field Trip to Saxony and Eger Rift area - A2 pre-excursion, August 18-19. **V. Cajz,** K. Goth & P. Suhr (Sachsisches Landesamt für Umwelt und Geologie, Freiberg) took the excursion guidance.

16th Conference on Clay Mineralogy and Petrology, Karlovy Vary, August, 2000. Co-organizers: **J.K. Novák** and **K. Melka.**

The International Conference on Past Global Changes - "Upper Pleistocene and Holocene Climatic Variations", Prague, September 6–9, 2000, organized with support of the PAGES IPO (Bern, Switzerland) **J. Kadlec** - head of the organizing committee.
Nearly one hundred climatologists, geologists, paleontologists, archeologists and other specialists from 19 countries joined the conference to discuss the problems of past climatic and environmental changes. Most of the contributions related to the proxy archives preserved in the central and eastern European regions. The Organizing Committee has addressed 6 specialists as invited speakers and Dr. Keith Alverson (the PAGES Project Executive Director Elect). Extended abstracts of almost all papers and posters were published in Vol. 11/2000 of *Geolines*, journal of the Institute of Geology AS CR. Some of the outstanding results will be published in the *Quaternary International* journal in 2001.

International Conference: Climate Changes - the Karst Record II, July 27-August 9, 2000, Cracow, Poland. Organized by the Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland (H. Hercman & T. Nowicki); the Institute of Geology, Academy of Sciences of the Czech Republic, Prague, Czech Republic (**P. Bosák** & **J. Kadlec**), the Administration of Slovak Show Caves, Liptovský Mikuláš, Slovakia (P. Bella), the Geological Institute of Jagiellonian University, Cracow, Poland (M. Gradziński), the Institute of Geology of Adam Mickiewicz University, Poznań, Poland (J. Głazek).
Pre-Conference excursions: Moravian Karst and North Moravian Karst (July 27-30, 2000), Conference: July 31-August 4, 2000 in Kraków, post-Conference excursion: Tatra and Low Tatra Mts. in Poland and Slovakia (August 5-9, 2000). **Scientific Sessions:** Palaeoclimatology, Karst evolution, Karst modelling, Sedimentology and palaeontology of karst deposits, Palaeokarst, Dating methods.
More than 100 scientists from about 15 countries participated in the event. The pre-Conference excursion was organised in the region of Moravian and North Moravian Karst. About 15 participants visited Punkevní Caves, Macocha Abyss, Amatérská Cave and surface karst landscapes in the Moravian Karst and Javoříčské, Mladečské and Zbrašovské Aragonite Caves in smaller karst area of North Moravia. A pre-Conference excursion guide was published by the Institute staff (see Bosák et al. 2000 in Publication Activity section). We participated also in the preparation of the post-Conference excursion to the Low Tatra Mountains (see Bella et al. 2000 in Publication Activity section).

Conferences and Symposia under preparation

International Conference "Hibsch 2002", Ústí nad Labem, Mariánské Lázně, May 2002. Organized by the Institute of Geology AS CR, Czech Geological Society, Czech Geological Institute Prague, Faculty of Science Charles University Prague, Geological Section of the Society of the Municipal Museum in Ústí n.L., Museum in Teplice and Museum in Mariánské Lázně, in cooperation with Naturhistorisches Museum Dresden, Landesamt für Umwelt und Geologie Freiberg, Universität Wien. Czech Organizing Commitee: **V. Cajz, J. Ulrych, J. Adamovič, J.K. Novák,** Č. Nekovařík (Czech Geological Institute), V. Kachlík (Faculty of Science Charles University), T. Wiesner (Museum Ústí n.L.), P. Bouše (Museum Mariánské Lázně), M. Radoň (Museum Teplice), F. Fediuk and N. Krutský. Preliminary registration will be announced in the latter half of 2001. Web presentation – http://www.gli.cas.cz/hibsch.

6th International Congress of Vertebrate Morphology, Jena, July 21-26 2001. Symposium: Nasal Region in Tetrapods.
Organizers and convenors W. Maier (University of Tübingen), **Z. Roček** and L. Witmer (University of Athens). Web presentation - http://icvm-6.zoo.uni-jena.de/ScientificProgram.html.

6th World Congress of Herpetology, Colombo, Sri Lanka, December 2001.
World Congress of Herpetology. **Z. Roček** is a member of the Executive Committee and of the Scientific Programme Committee. Web presentation of the Congress – http://www.4wch.com.

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14. Publication activity of the Institute of Geology

In 2000, the Institute of Geology published two issues of **GeoLines –** one volume of extended conference abstracts and one monothematic volume. Each issue is thematically consistent, containing several papers to a common topic. The journal accepts papers within their respective sectors of science without national limitations or preferences. However, in case of extended abstracts, the conferences and workshops organized and/or co-organized by the Institute of Geology are preferred. The papers are subject to reviews.

2000
GeoLines 11 (2000)
Proceedings of the International Conference on Past Global Changes: Upper Pleistocene and Holocene Climatic Variations (held in Prague, September 6-9, 2000). Edited by **J. Kadlec & M. Svojtka.**

EXTRATERRESTRIAL FORCING ON CLIMATIC VARIATIONS, EARTH'S MAGNETIC FIELD AND CLIMATIC VARIATIONS, MODELLING OF PALEOCLIMATE

*Philippe **TULKENS**, Michel **CRUCIFIX**, Marie-France **LOUTRE** and André **BERGER:*** Transient Holocene Model Simulations: Initial Conditions, Forcings and Feedbacks Analysis

*Andrei A. **VELICHKO:*** Global Warming – Does it Always Mean Regional Warming?

*George **KUKLA:*** Last Interglacial End

*Ivanka **CHARVÁTOVÁ:*** The Cycle of 2402 Years in Solar Motion and its Response in Proxy Records

*Michel **CRUCIFIX**, Fortunat **JOOS**, Philippe **TULKENS** and André **BERGER:*** Modelling the Physical and Biogeochemical Impacts of a Freshwater Discharge in the North Atlantic with a Model of Intermediate Complexity

*Václav **BUCHA*:** Geomagnetic Forcing on Climatic Variations

*Masa **KAGEYAMA**, Odile **PEYRON**, Sophie **PINOT**, Pavel **TARASOV**, Joël **GUIOT**, Sylvie **JOUSSAUME**, Gilles **RAMSTEIN** and **PMIP PARTICIPATING GROUPS*:** The Last Glacial Maximum Climate over Europe and Western Siberia: a PMIP Comparison between Models and Data

*Lisa **RICCI**, Nadia **PINARDI**, Marco **ZAVATARELLI**, Cesare **CORSELLI**, Lucilla **CAPOTONDI** and Paul **MYERS***: Numerical Modelling of the Mediterranean Sapropel S1 Ecosystem Structure

*Vladimír **ČERMÁK**, Jan **ŠAFANDA**, Milan **KRESL** and Petr **DĚDEČEK*:** Climate Warming: Evidence Monitored in the Subsurface

*Vladimír **BRŮŽEK*:** Extraterrestrial Influences on Meteorological Parameters

*Gilles **RAMSTEIN**, Sophie **PINOT**, Masa **KAGEYAMA** and Sylvie **JOUSSAUME*:** What do we Learn on Tropical Cooling at the Last Glacial Maximum from Data and Modelling within the Framework of Paleoclimate Modelling Intercomparison Project and Associated Sensitivity Experiments

*Jan **ŠAFANDA**, Vladimír **ČERMÁK** and Dušan **RAJVER:*** The Last Glacial - Interglacial Temperature Contrast Directly From the Present Subsurface Temperatures

CLIMATIC RECORD IN LAKE AND RIVER DEPOSITS

*Jef **VANDENBERGHE:*** Climate Impact on River Processes, Landforms and Deposits in the Last Glacial

*Leszek **STARKEL*:** Change in the Frequency of Extreme Events as the Indicator of Climatic Change in the Holocene

*Georg **SCHWAMBORN**, Volker **RACHOLD**, Mikhail **GRIGORIEV** and Matthias **KRBETSCHEK*:** Late Quaternary Sedimentation History of the Lena Delta

*Jun Q. **YU**, K.R. **KELTS**, K.Z. **CHEN**, P.X. **ZHANG** and Z.S. **AN*:** An Arid Event at the Younger Dryas Time Window in the NE Tibet - Qinghai Plateau: Evidence from Qinghai Lake

*Günter **LANDMANN**, Michael **KASELOW** and Stephan **KEMPE*:** Lake Level Fluctuation of Lake Lisan/Dead Sea and Lake Van (Turkey)

*Tomáš **NAVRÁTIL**, Petr **SKŘIVAN**1and Daniela **FOTTOVÁ*:** Human- and Climate- Induced Changes in the Surface Stream Activity Affecting the Element Cycling

*Andrzej **TATUR**, Rodolfo del **VALLE**, Maria-Martha **BIANCHI**, Valeria **OUTES** and Gustavo **VILLAROSA:*** Late Pleistocene Pluvial Phase in Patagonia

*Alexander **ALEXANDROVSKIY**, Maya **GLASKO**, Sergey **SEDOV**, Nikolay **KRENKE**, Boris **FOLOMEEV**, Olga **CHICHAGOVA** and Ekaterina **KUZNETSOVA*:** Buried Floodplain Soils as Evidences of the Holocene Environmental Changes in Eastern Europe

*Yosef **PLAKHT*:** Climate-Related Fluvial Morphology in the Central Negev, Israel

*Josef **VESELÝ:*** Sedimentary Deposits of Bohemian Forest Lakes as an Archive of Pollution by Metals

ARCHAEOLOGICAL EVIDENCE OF HUMAN IMPACT ON THE ENVIRONMENT; HISTORICAL EVIDENCE OF CLIMATIC VARIATIONS

*Rudolf **BRÁZDIL*:** Historical Climatology and the Study of Climate Fluctuations During the Past Millennium

*Jiří **CHLACHULA*:** Paleoenvironmental Implications of Cultural Records from Glacial and Glacigenic Geological Contexts

*Andrei **SELIVANOV*:** Thermal and Humidity Variations over East Europe and Asia during the Last 2500 Years by Proxy Data

*Alexander **ALEXANDROVSKIY**, Johannes van der **PLICHT** and Olga **KHOKHLOVA*:** Abrupt Climatic Change in the Dry Steppe of the Northern Caucasus, Russia, in the Third Millennium BC

*Václav **CÍLEK*:** The Holocene Sedimentation in Sandstone Rockshelters of Northern Bohemia

*Jan **RYBÁŘ** and Jan **SUCHÝ:*** The Influence of Climate on the České Středohoří Mts. Slope Deformations - Data Analysis since the 18th Century

*Jaroslav **STŘEŠTÍK** and József **VERŐ:*** Reconstruction of the Spring Temperatures in the 18th Century from Measured Lengths of Grapevine Sprouts

*Teresa **MADEYSKA*:** Evidence of Climatic Variations in Loess and Cave Paleolithic Sites of Southern Poland and Western Ukraine

CLIMATIC RECORD IN WIND-BLOWN DEPOSITS, PALEOSOLS

Norm R. ***CATTO****, Andrei A.* ***VELICHKO****, Anna N.* ***DRENOVA****, Svetlana N.* ***TIMIREVA****, Ted C.* ***LITTLE****, Nat W.* ***RUTTER*** *and Fred W.* ***BACHHUBER*****:** Aeolian Geomorphic Response to Latest Weichselian-Early Holocene Climate Change

Alexandra ***HILGERS****, Andrew S.* ***MURRAY****, Norbert* ***SCHLAAK*** *and Ulrich* ***RADTKE*****:** The Potential of Optically Stimulated Luminescence for Dating Late Glacial and Holocene Dune Sands - A Case Study from Brandenburg, Germany

Jiří ***CHLACHULA*** *and Rob A.* ***KEMP*****:** Late Pleistocene Climatic Variations in Siberia Based on Loess-Paleosol Records

Natalia ***GERASIMENKO*****:** Upper Pleistocene Climatic Variations in Ukraine Recorded by Loess-Paleosol and Vegetational Successions

Petr ***POKORNÝ*** *and Eliška* ***RŮŽIČKOVÁ*****:** Changing Environments During the Younger Dryas Climatic Deterioration: Correlation of Aeolian and Lacustrine Deposits in Southern Czech Republic

Valentina ***PEREDERIJ:*** Late Pleistocene Climate Changes in the Ukraine Territory (Based on Clay Matter Analysis Data)

Anna ***ŽIGOVÁ:*** Role of the Climatic Factor in Soil Formation at Boubová (Bohemian Karst, Czech Republic)

Laszlo ***HUM*** *and Pal* ***SÜMEGI*****:** Cyclic Climatic Records in Loess-Paleosol Sequences in Southeastern Transdanubia (Hungary) on the Basis of Sedimentological, Geochemical and Malacological Examinations

CLIMATIC VARIATIONS AND BIODIVERSITY, TREE RINGS

Vojen ***LOŽEK:*** Holocene of the Bohemian Karst

Ivan ***HORÁČEK*****:** Glacial Cycles and Mammalian Biodiversity of Central Europe: Large Scale Migrations or Vicariance Dynamics?

Helena ***SVOBODOVÁ*** *and Lenka* ***SOUKUPOVÁ*****:** Mires of the Šumava Mountains: 13,000 Years of Their Development and Present-Day Biodiversity

Petr ***KUNEŠ*** *and Vlasta* ***JANKOVSKÁ*****:** Outline of Late Glacial and Holocene Vegetation in a Landscape with Strong Geomorphological Gradients

Vlasta ***JANKOVSKÁ*****:** Komořanské jezero Lake (CZ, NW Bohemia) - A Unique Natural Archive

Hanns Hubert ***LEUSCHNER****, Marco* ***SPURK****, Michael* ***BAILLIE*** *and Esther* ***JANSMA:*** Stand Dynamics of Prehistoric Oak Forests Derived from Dendrochronologically Dated Subfossil Trunks from Bogs and Riverine Sediments in Europe

Dmitri ***OVTCHINNIKOV****, Mikhail* ***ADAMENKO*** *and Irina* ***PANUSHKINA*****:** A 1105-Year Tree-Ring Chronology in Altai Region and Its Application for Reconstruction of Summer Temperatures

Yuliya ***SAVVA*****:** Growth Variability from Different Provenances of Pinus Sylvestris L. Planted in the Southern Taiga, Central Siberia

Serguei ***ANDREEV*****:** On the Problem of Monitoring of Hydrological Conditions in the Baikal Region Using Dendrochronological Methods

Alexander ***KIRDYANOV*** *and Pavel* ***SILKIN*****:** Cell and Density Structure of Tree-Rings of Different Conifers as an Indicator of Different Climatic Parameters Changes

Dana ***NOVÁKOVÁ:*** Paleoecology of Small Peat Bogs in the Sandstone Region of the NE Czech Republic

Nata K. ***PANOVA*****:** Late Glacial and Holocene History of Lakes, Climate and Vegetation in the Middle Urals, Russia

Felix ***GLEBOV****, Lyudmila* ***KARPENKO*** *and Irena* ***DACHOVSKAIA*****:** Reconstruction of Zone Vegetation, Bogs and Climate in Holocene by the Data of Two Contrast Vertical Peat Profiles (West Siberia)

Jaroslav ***HLAVÁČ*** *and Helena* ***SVOBODOVÁ:*** Molluscan and Pollen Assemblages from the Ochozská Cave as Climate Indicators for the Late Glacial and Holocene (Moravian Karst, Czech Republic)

Pal ***SÜMEGI*** *and E.* ***KROLOPP:*** Quaternary-Malacological Analyses for Modelling of the Upper Weichselian Paleoenvironmental Changes in the Carpathian Basin

CLIMATIC RECORD IN GLACIAL AND MARINE DEPOSITS, GLACIAL CORES, PERIGLACIAL FEATURES

Andrew N. ***MACKINTOSH*** *and Andrew J.* ***DUGMORE*****:** Modelling Holocene Glacier Fluctuations and Climatic Change in Iceland

Lutz ***SCHIRRMEISTER****, Christine* ***SIEGERT****, Hanno* ***MEYER****, Alexander* ***DEREVYAGIN****, Frank* ***KIENAST****, Andrei* ***ANDREEV****, Victor* ***KUNITSKY****, Vladimir* ***TUMSKOY*** *and Piet* ***GROOTES***: Paleoenvironmental and Paleoclimatic Records from Permafrost Deposits in the Arctic Region of Northern Siberia

Jens ***ZINKE****, Johannes Jozef G.* ***REIJMER****, Wolf-Christian* ***DULLO*** *and Bernard A.* ***THOMASSIN*****:** Paleoenvironmental Changes in the Lagoon of Mayotte Associated with the Holocene Transgression

Chantal ***DE JAEGER*** *and Morgan* ***DE DAPPER*****:** Geomorphic Response to Quaternary Environmental Changes in the Wadi Mujib Canyon (Jordan)

Bernd ***WAGNER*** *and Martin* ***MELLES*****:** Biogeochemical and Palynological History of a Lake on Western Ymer Ř, East Greenland

*Barbara **DELMONTE**, Valter **MAGGI** and Jean Robert **PETIT***: Mineral Dust Record from the Antarctic Epica Ice Core

CLIMATIC RECORD IN CAVE DEPOSITS

*Wilfried **ROSENDAHL**, Stephan **KEMPE**, Bettina **WIEGAND** and Anton **EISENHAUER:*** Speleothems and Upper Pleistocene Climate - New Results from Caves in Germany

*Jana **HLADÍKOVÁ**, Karel **ŽÁK** and Václav **CÍLEK:*** Oxygen Isotope Climatic Record in a Carbonate Flowstone Layer from a Medieval Underground Mine in the Kutná Hora Ore District

*Yavor **SHOPOV**, Ludmil **TSANKOV**, Albena **DAMYANOVA**, Yasen **DAMYANOV**, Leonid **GEORGIEV**, Elena **MARINOVA**, Chas **YONGE** and Derek **FORD***: Quantitative Annual Speleothem Records of Temperature, Precipitation and Solar Insolation in the Past – A Key for Characterization of Past Climatic Systems

*Yavor **SHOPOV**, Diana **STOYKOVA**, Ludmil **TSANKOV**, Michael **SANABRIA**, Desislava **GEORGIEVA** and Derek **FORD***: Influence of Solar Luminosity Variation on Glaciations and their Significance for Time Shifting of Termination-II

*Brooks B. **ELLWOOD**, Francis B. **HARROLD**, and Steven L. **BENOIST***: The Magneto-Susceptibility Event and Cyclostratigraphy (MSEC) Method Used for Paleoclimate Estimates and Correlations at Archaeological Sites in Europe: Results for the Middle to Upper Paleolithic

*Nela **DOLÁKOVÁ***: Palynological Studies from the Ochozská Cave and from the Šošůvka Part of the Sloupsko-Šošůvská Cave (MoravianKarst)

*Jaroslav **KADLEC**, Helena **HERCMAN**, Karel **ŽÁK** and Tomasz **NOWICKI***: Late Glacial and Holocene Climatic Record in a Stalagmite from the Holštejnská Cave (Moravian Karst, Czech Republic)

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ENVIRONMENTAL GEOCHEMISTRY OF CENTRAL BOHEMIAN FORESTED LANDSCAPE WITH GRANITE BEDROCK

*Luděk **MINAŘÍK**, Petr **SKŘIVAN**, Anna **ŽIGOVÁ**, Jiří **BENDL***: Biogeochemistry of the Transition Elements in a Forested Landscape (beech, *Fagus sylvatica* L.) with the Granite Bedrock

*Tomáš **NAVRÁTIL***: Beryllium in Waters of Czech Forested Ecosystems and the Release of Beryllium from Granites

*Petr **SKŘIVAN**, Luděk **MINAŘÍK**, Miloš **BURIAN**, Jaroslav **MARTÍNEK**, Anna **ŽIGOVÁ**, Irena **DOBEŠOVÁ**, Olga **KVÍDOVÁ**, Tomáš **NAVRÁTIL** and Dana **FOTTOVÁ***: Biogeochemistry of Beryllium in an Experimental Forested Landscape of the Lesní potok Catchment in Central Bohemia, Czech Republic

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15. Publication activity of staff members of the Institute of Geology

15a) Papers published in 2000

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16. Laboratories

Laboratories of the Institute are not independent units. They are incorporated into the structure of scientific departments and into the unit of Service Laboratories of Physical Methods. The chapter summarizes the list of the most important laboratory equipment.

Paleomagnetic laboratory (head Ing. Petr Pruner, CSc.)
MAVACS demagnetizer (1981)
Rotary magnetometers JR-4 (1976, 1981)
Rotary magnetometers JR-5A (1993, 1998)
Astatic magnetometer LAM-24 (<1980)
Astatic magnetometer LAM-22 (<1980)
Magnetometrs ROCOMA (1992, 1993)
Inductors ROCOMA to MAVACS (1999, 1999)
MINOSECAR cutting machines (1992,1993)

KLY 2 (1992)
Demagnetizer KC (1992)
Kappameter KT5 (1992)

X-ray and DTA/TG laboratory (head RNDr. Karel Melka, CSc.)
PHILIPS X´Pert APD (1997)
CHIRANA Mikrometa II PŘI 32 (1963)
DRON UM1 (1983)
DERIVATOGRAPH Q 1500 Monimex (1982, computerized in 1998)
Goniometer Weissenberg KS A 2 (1964)
Goniometer BUERGER (1968)
Gandolfi chamber (1978)
Guinier T ENRAF-NONIUS chamber (1969)

Electron scanning and microprobe laboratory (head Ing. Anna Langrová)
Microprobe JEOL JXA-50A (1972)
EDAX System PHILIPS (1996)
Accesory devices for preparation of samples

Laboratory of rock processing and mineral separation (head Václav Sedláček)
Electromagnetic separator SIM-I (1968)
Electromagnetic separator (1969)
Laboratory table WILFLEY 13 B (1990)
Vibration processor VT 750 (1992)
Crusher CD 160*90 (1991)
Laboratory mill RETSCH (1970)
Crusher ŽELBA D 160/3 (1999)
Mill SIEBTECHNIK (1995)

Laboratory for thin and polished sections (head Ing. Anna Langrová)
MINOSECAR (1962, 1970)
DISCOPLAN (1990)
PEDEMOX PLANOPOL (1989)
Montasupal (1977)
DP.U.4 PDM-Force (1993)

8. Microscopic laboratory (head Mgr. Monika Němečková)
System for picture analysis: Steromicroscope NIKON SM2-U with adapters and CCD camera JVC TK 1381 (1998)
Polarization microscope ORTHOPLAN Photometr. LEITZ (1983)
Microscope MEF REICHERT (1964)
10x Polarization microscope AMPLIVAL ZEISS (1971, 1973, 1974, 1975, 1981, 1990)
Microscope DIALUX-PO 550012 LEITZ (1966)
3x Polarization microscope POLMI (1963, 1967)
4x Polarization microscope MEOPTA (1965, 1966, 1969)
3x Ore polarization microscope MIN (1961, 1967, 1968)
Ore polarization microscope MIN 8 (1967)
Ore polarization microscope MIN 9 (1968)
3x Microscope MPD (1966)
Microscope MST (1967, 1974)
Biological microscope OPTON (1991)
Microscope NIKON ALPHAHOT 2/HP (1995)
Microscope NF PK (1964)
4x Microscope (1963, 1968, 1969)
9x Polarization microscope (163, 1965, 1966, 1967)
27x Stereomicroscope (1957-1963, 1965-1968, 1973)

Spectrophotometrical microscope MSF 1 REICHERT (1970)
2x Microscope C36 (1958, 1975)
Microscope A36 (1960)
2x Microscope B36 (1961)
Binocular microscope (1959)
Stereomicroscope SM XX (1968)
2x Projection microscope (1968, 1969)
Microscope DNO 714 (1994)

Fisson track laboratory (head Mgr. Jiří Filip)
Analytical system for fisson track – Microscope AXIOPLAN ZEISS and Trackscan system 452110 AUTOSCAN (1999)

Laboratory of exogenic geology (head Doc. Ing. Petr Skřivan, CSc.)
AAS Spectrometer VARIAN SpectrAA 300 (1991)
lamps As, Be, Cd, Cu, Cr, Fe, Mn, Ni, Co, Pb, Sr, Zn, Rb, Ba+GTA96+VEA76
Analytical weights SARTORIUS Basic analytical (1992)
Filtration blocks B-2A Epi/FL (1996)
Gamma-Ray Spectrometer GS 256 (1988)
Analytical weights BALANCE 2000G (1999)
Decomposition unit PLAZMATRONIKA SERVICE S.C. (1995)
Set of vacuum lysimeters PRENART (1999)

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17. Financial Report

(in thousands Czech Crowns)

A. INCOMES	
1. From the annual budget of the Academy of Sciences CR	20,680
2. From the Grant Agency of the Acad. Sci. (accepted research projects)	2,605
3. From the Grant Agency CR (accepted research projects)	1,187
4. From the internal research projects of the Acad. Sci.	4,917
5. From other state sources (Ministry of Environment, etc.)	230
6. Applied research	1,461
7. Investments (for laboratory facilities)	3,437
TOTAL INCOMES	**34,517**

B. EXPENSES	
1. Scientific staff - wages, medical insurance	10,656
2. Research and scientific activites	11,218
3. Administration and technical staff - admin.expenses,wages,medical insurance	5,294
4. General expenses (postage shipping, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc)	3,149
5. Library (subscriptions etc.)	592
5. Editorial activites (Geolines, Annual Report)	171
6. Investments (for laboratory facilities)	3,437
TOTAL EXPENSES	**34,517**