Academy of Sciences of the Czech Republic

Institute of Geology
Annual Report 1999

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1. Preface

In 1999, the Institute of Geology of the Academy of Sciences of the Czech Republic represented a consolidated scientific body, efficiently working in a wide scope of geological and related sciences. A great number of scientific staff of the Institute obtained research grants from national and international grant agencies in the past 2 years. Also the collaboration with industrial companies increased in its intensity, allowing to obtain additional funds for research and for the presentation of results on national and international symposia.
Another phase of reconstruction of laboratories belonging to the Department of Endogenic Geology and Geochemistry and to the Department of Palaeontology and Stratigraphy was finished. Some new equipment has been installed, such as the system for fission track analyses composed of AXIOPLAN ZEISS Microscope and 452110 AUTOSCAN Trackscan system, supplementary devices for the MAVACS demagnetiser, and Želba crusher.
Two Institute scientists were awarded prestigious prizes of the Academy of Sciences of the Czech Republic for their life achievements in respective sciences: Ing. Miroslav Krs, CSc. was awarded the Pošepný Medal for achievements in geological sciences, and RNDr. Vojen Ložek, DrSc. was awarded the Mendel Medal for achievements in biological sciences. M. Krs is a world-known specialist in palaeomagnetism and a founder of this discipline in the former Czechoslovakia. V. Ložek is a leading specialist in modern and fossil Cenozoic molluscs, Quaternary stratigraphy and palaeoecology. Both of our colleagues are congratulated.

Dr hab. Pavel Bosák, PhD.
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
- Palaeogeography
- Terrane identification
- Taxonomy and phylogeny of fossil organisms
- Palaeobiogeography of Variscan Europe
- Palaeoecology (incl. population dynamics, bioevents)
- Palaeoclimatology as evidenced by fossil organisms and communities
- Biostratigraphy and high-resolution stratigraphy
- Basin analysis and sequence stratigraphy
- Exogenic geochemistry
- Quaternary geology and landscape evolution
- Palaeomagnetism
- Magnetostratigraphy
- Petromagnetism

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

Scientific departments

1. Endogenic Geology and Geochemistry
2. Stratigraphy and Palaeontology
3. Exogenic Geology and Geochemistry

4. Palaeomagnetism

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. Palaeomagnetic laboratory (head Ing. Petr Pruner, CSc.)
2. Micropalaeontological 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 Mg. 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.

***

3. Connections

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Library knih@gli.cas.cz

***

4. Staff (as of December 31,1999)

Management

RNDr. Dr hab. Pavel Bosák, CSc. 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)
Marcela Nováková (assistant to the Director)
Ing. Miroslav Fridrich (computer specialist)
Václav Javůrek (computer specialist)
Karel Jeřábek (garage attendant, driver)
Radek Jireš (civil military duty)
Jaroslav Kratochvíl (technical service)
Michal Krůta (civil military duty)
Petr Vachalovský (technical service)
Martin Mráček (boiler 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)
Prof. RNDr. Vladimír Bouška, DrSc. (geochemistry)
RNDr. Vladimír Cajz (volcanology)
RNDr. Miroslav Coubal, CSc. (structural geology)
Ing. Jiří Fiala, CSc. (structural geology, metamorphic petrology)
RNDr. Miloš Lang, CSc. (igneous petrology, mineralogy)
Mgr. Monika Němečková (structural geology, tectonics and metamorphic 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. Jarmila Waldhausrová, CSc. (petrology)

Technical Staff:

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

Department of Stratigraphy and Palaeontology

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 (palaeoecology)
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 Palaeozoic, 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, Palaeozoic and Mesozoic palynology and plankton)
RNDr. Jaroslav Zajíc, CSc. (Carboniferous and Permian vertebrates and stratigraphy, acanthodians)
RNDr. Jiří Žítt, CSc. (Cretaceous and Tertiary palaeoecology and sedimentology, echinoids and crinoids)
John Malinky, Ph.D. (hyolithids) – *research associate*

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, palaeosoils)
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)
Mgr. Marie Lachmanová (sedimentology)
RNDr. Vojen Ložek, DrSc. (Quaternary geology, malacozoology)
Ing. Jaroslav Martínek (exogenic and environmental geochemistry)
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)

Technical Staff:

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

Department of Palaeomagnetism

Scientific Staff:

Ing. Petr Pruner, CSc. – Head of the Department (geophysics, palaeomagnetism)
Ing. Miroslav Krs, CSc. (geophysics, palaeomagnetism)
prom. fyz. Otakar Man, CSc. (geophysics)
Mgr. Jana Štěpánková (geophysics – maternal leave)
RNDr. Daniela Venhodová (petrophysics)

Technical Staff:

Jana Drahotová (technician)
Věra Havlíková (technician)
Zuzana Kratinová (technician)
Richard Vašák (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 thermic 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
Jaroslava Břízová (phone operator)
Antonín Čejka (technical service)
Svatava Jandeková (human resources)
Jana Klímová (accountant)
Alena Sokolová (accountant)
Božena Trenzeluková (phone operator)

Scientific Council

RNDr. Petr Štorch, CSc. (Institute of Geology AS CR)
Prof. RNDr. Petr Čepek, CSc. (Faculty of Science, Charles University)
RNDr. Jan Cháb, CSc. (Czech Geological Institute)
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.	PhD
DrSc.	DSc
Doc.	Assoc. Prof.
Ing.	Dipl.-Ing.

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5. Staff News

January

1.1.1999	RNDr. Vladimír Cajz (volcanology) joined the Institute
1.1.1999	RNDr. Zuzana Korbelová (microprobe and scanning microscope operator) joined the Institute
1.1.1999	Bc. Tomáš Navrátil (aquatic and environmental geochemistry) joined the Institute
1.1.1999	Alena Sadílková (phone operator) joined the Institute
1.1.1999	RNDr. Jaroslav Zajíc, CSc. (Carboniferous and Permian vertebrates and stratigraphy, acanthodians) joined the Institute
1.1.1999	Ludmila Jilichová (phone operator) left the Institute
31.1.1999	Mgr. Štěpánka Táborská, Dr. (geophysics) left the Institute

February

12.2.1999	Alena Sadílková (phone operator) left the Institute
28.2.1999	Mgr. Ladislav Slavík (accomplished the civil military duty)

March

1.3.1999 Mgr. Ladislav Slavík (conodont biostratigraphy) joined the Institute

12.3.1999 Zuzana Kratinová (technician) joined the Institute

April

1.4.1999 Jaroslava Břízová (phone operator) joined the Institute

30.4.1999 Bc. Jakub Kanta (technician) left the Institute

November

1.11.1999 Richard Vašák (technician) joined the Institute

December

31.12.1999 Richard Vašák (technician) 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:__

Bosák P.: *Karstology and Palaeokarstology*. Graduate course, Faculty of Science, Charles University, Prague.

Cílek V. & Svoboda J.: *Mesolithics of the Northern Bohemia*. Field Archaeological course, Faculty of Pedagogy and Faculty of Science, Prague; Faculty of Science. Brno. July 1999. Elbe Sandsteine–Chribská.

Cílek V.: *Cultural geology*. Undergraduate–Graduate course, Faculty of Paedagogy. Charles University. Prague.

Cílek V.: *Field studies*. Undergraduate course, Simon Fraser University, Vancouver. Canada.

Cílek V.: *Landscape, language and history*. Field Undergraduate–Graduate course of the Summer Session. North-Western University, Evanston–Chicago.

Hladil J. & Jansa L. F.: *World of carbonates in sedimentary geology.* An advanced course for under- and graduate students, and experts from companies and state institutions. Organized by Faculty of Science, Masaryk University and Brno Branch of the Czech Geological Institute.

Hladil J.: *Methodology of documentation and interpretation of carbonate facies: Moravian Karst.* Undergraduate course, Department of Geology and Palaeontology, Masaryk University, Brno.

Hlaváč J.: *Field studies. The biological excursion of the South Bohemian University to Ukraine*.

Kadlec J.: *Causes and consequences of Quaternary climatic changes*. Undergraduate course. Faculty of Science. Charles University. Prague.

Konzalová M.: *Plant micropalaeontology: Palynology of Tertiary*. Undergraduate course, Institute of Geology, AS CR.

Lachmanová M.: *The 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 Science, Faculty of Philosophy (Archaeology), Charles University, Prague.

Minařík L.: *Environmental chemistry*. Undergraduate course, Faculty of Forestry, Czech Agricultural University, Prague.

Nehyba S. & **Hladil J.**: *Sedimentology.* Undergraduate course, Department of Geology and Palaeontology, 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.
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Roček Z.: *Evolution of vertebrates*. Undergraduate course. Faculty of Science, Charles University, Prague.
Roček Z.: *Laboratory dissection of vertebrates*. Undergraduate course. 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.
Skřivan P.: *Environmental chemistry*. Undergraduate course, Faculty of Forestry, Czech Agricultural University, Prague.
Štorch P.: *Principles and methods of stratigraphy.* Undergraduate course, Faculty of Science, Charles University, Prague.
Ulrych J.: *Interpretations of mineralogical data*. Undergraduate course, Faculty of Science, Charles University, Prague.
Ulrych J.: *Volcanic rocks of the Bohemian Massif*. Undergraduate course, Faculty of Science, Charles University, Prague.
Žigová A.: *Geography of soils and protection of soil resources of the Czech Republic*. 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 H. (MSc. thesis), Institute of Fundamentals of Learning, Charles University, Prague (*supervisor* ***V. Cílek***)
Dašková J. (BSc. thesis), Faculty of Science, Charles University, Prague (*co-supervisor* ***M. Konzalová***)
Erban V. (MSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***J. Ulrych***)
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***)
Královec K. (MSc. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Sedláčková L. (MSc. thesis), Faculty of Science, Masaryk University, Brno (*supervisor* ***Z. Roček***)
Suchá K. (MSc. thesis), Institute of Ecology of the Faculty of Science, 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***)
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***)
Filip J. (CSc.-Ph.D. thesis), Institute of Geology, AS CR, Prague (*supervisor* ***Z. Vejnar***)
Hlaváč J. (Ph.D. thesis), Institute of Geology AS CR, Prague (*external supervisor* ***V. Cílek****)*
Kundrát M. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)
Lachmanová M. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*external supervisor* ***V. Cílek****)*
Němečková M. (Ph.D. thesis), Faculty of Science, Masaryk University, Brno (*external supervisor* ***F. Patočka***)
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****)*

Slavík L. (RNDr. thesis), Faculty of Science, Masaryk University, Brno *(supervisor* ***J. Hladil)***
Slepičková J. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*external supervisor* ***P. Pruner***).
Střelcová E. (Ph.D. thesis), Czech Geological Institute, Branch Brno and Masaryk University, Brno (*scientific consultant* ***V. Suchý***)
Svobodová J. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*external supervisor* ***J. Fiala***)
Štorc R. (Ph.D thesis), Faculty of Science, Institute of Palaeontology and Geology, Charles University, Prague (*scientific consultant* ***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), Zoological Institute, Slovak Academy of Sciences, Bratislava (*supervisor* ***Z. Roček***)
Vejvalka J. (Ph.D. thesis), Faculty of Science, Charles University, Prague (*supervisor* ***Z. Roček***)

RNDr. František Patočka, CSc., Member of the Examination Commission of Graduate Studies in Geology, Faculty of Science, Charles University, Prague.
Doc. RNDr. Jindřich Hladil, CSc., Member of the Scientific Council and Member of the Board of Graduate Studies in Geology, 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.
Doc. RNDr. Jindřich Hladil, CSc. and RNDr. František Patočka, CSc., Members of the Board of Graduate Studies in Geology, Faculty of Science, Charles University, Prague.

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

Doc.
RNDr. Jindřich Hladil, CSc.: Philosophy of the Devonian insular elevations and evolution of porosity in the Macocha Formation (Insular highs on the platform and evolution of venting in the Macocha Formation – a new philosophy of survey of diagenetic traps)(in Czech). Associated Professor Inception Thesis, Faculty of Science, Masaryk University, Brno (May 26, 1999)

RNDr.

Mgr. Ladislav Slavík: Early Devonian conodont biostratigraphy from selected sections of the Prague Basin. (in Czech), Department of Geology and Palaeontology, Faculty of Science, Masaryk University, Brno (Nov. 12, 1999)

Mgr.

Bc. Tomáš Navrátil: Speciation of Be in waters of forested ecosystems and the origin of Be in granites (in Czech), Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles University, Prague (Sept. 23, 1999)

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7. Awards and Fellowships

Ing. **Miroslav Krs**, CSc. – Pošepný Medal of the Academy of Sciences of the Czech Republic for achievements in geological sciences
RNDr. **Vojen Ložek**, DrSc. – Mendel Medal of the Academy of Sciences of the Czech Republic for achievements in biological sciences
RNDr. Dr hab. **Pavel Bosák**, CSc. – Honorary Citizenship, City of Samchok, Republic of Korea for contribution to development of karst science in the region

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8. 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.: Secretary, International Geological Correlation Program UNESCO, Czech National Committee
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.: Vice-President, Societas Europaea Herpetologica, since 1995
Siblík M.: Correspondent, Geological Survey in Vienna, Austria, since 1999

Editorial Boards

Bosák P.: *UIS Bulletin*, Editor-in-Chief, since 1993
Bosák P.: *International Journal of Speleology*, L´Aquilla, Member of Advisory Board, since 1994
Cílek V.: *Encyclopedia of Life Support Systems*, Theme 1.1: Earth System: Variability and History, UNESCO Project, since 1999.
Ložek V.: *Studia Quarternaria*, Kraków, Poland, since 1999
Melka K.: *Clay Minerals*, Journal of the European Clay Groups, since 1999
Patočka F.: *Geologica Sudetica*, since 1997
Roček Z.: *Bulletin de la Société herpétologique de France*
Štorch P.: *Geological Journal*, Liverpool, Manchester, since 1993
Štorch P.: *Newsletters on Stratigraphy*, Berlin, Stuttgart, since 1999

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9. Department of Endogenic Geology and Geochemistry

Foreign Grants and Joint Projects

International Geological Correlation programmes, UNESCO.

IGCP Project No. 369: Comparative evolution of Peritethyan rift basins (*Project leaders: W. Cavazza, A. Robertson, P. Ziegler*)
Subproject 2a: Magmatism and rift basin evolution: Peritethyan region (*National representative:* ***J. Ulrych***) and Comparative volcanostratigraphy of the Neoidic volcanics of the Bohemian Massif and the Pannonian Basins (*K. Balogh, Institute of Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary &* ***J. Ulrych***)

Rhyolites in the Roztoky Instrusive Centre, České středohoří Mts.: dyke differentiates or xenoliths? (***J. Ulrych, E. Pivec, M. Lang****, J. Rutšek, DIAMO, Stráž pod Ralskem, K. Balogh, Institute of Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary, A Höhndorf, Bundesanstalt f. Geowiss. u. Rohstoffe, Hannover, Germany & J. Bendl, Ministry of Environment, Prague*)

Subvolcanic intrusions of monzodiorite, essexite and sodalite syenite, together with more than 1,000 almost radially arranged dykes are genetically associated with the Roztoky Intrusive Centre (RIC) formed by a crater vent filled with trachytic breccia. Weakly alkaline hypabyssal rock series of essexite – monzodiorite – sodalite syenite (DI=46–64) and coexisting dykes of weakly alkaline series (DI=39–81) trachybasalt – gauteite / camptonite – bostonite / sodalite syenite porphyry – trachyte – rhyolite? and strongly alkaline series (DI=39–87) tephrite / basanite – camptonite / monchiquite – tephriphonolite – phonolite / tinguaite / nepheline syenite porphyry were recognized. Geochemical characteristics of differentiation series of the RIC indicate its origin by assimilation fractional crystallization process (AFC) of mantle-derived magma. Layering and almost single-step emptying of magma chamber is a presupposed mechanism of their genesis. The $^{87}Sr/^{86}Sr$ ratios of the RIC rock suite, yielding values ranging from 0.70363 (hornblendite cumulate) in sodalite syenite (0.70374–0.70384), 0.70411–0.70431(essexite) to 70432–0.70439 (monzodiorite) and 0.70372 (nepheline syenite porphyry), 0.70385 (bostonite), 0.70405–0.70435 (camptonite–mochiquite) to 0.70446 (gauteite) confirm its primary mantle origin with limited degree of crustal contamination only. Recently found rhyolites (dykes or xenoliths?) inside a bostonite dyke in borehole at Malé Březno represent the first occurrence of quartz-bearing volcanic rocks in the České středohoří Mts. Geochemical and isotope data ($^{87}Sr/^{86}Sr$=0.70829, $^{143}Nd/^{144}Nd$=0.512285, ε^{t}_{Nd}=-6.5) of the rhyolites reflect substantial crustal contamination of the magma in comparison with data on spatially associated camptonites (0.70405–0.70435; 0.51263, ε^{t}_{Nd}=+0.6) or phonolite (0.70416; 0.51275, ε^{t}_{Nd}=+2.9). Unusual rhyolite (dykes or xenoliths?) was generated either by extreme AFC process or by partial melting and transformation of a felsic rock from the basement.

Czech-French Ministries of Education Integrated Program "BARRANDE 1997-3"

High-pressure metamorphosed complexes of the West Sudetes: evolution of the suture zone of Central European Variscides (Les series métamorphiques de Haute Pression dans les Sudetes Occidentales: évolution de la zone de suture des Variscides en Europe Centrale) (*H. Maluski, Institut des Sciences de la Terre, de l'Eau et l'Espace de Montpellier, Université Montpellier 2, Montpellier, France,* ***F. Patočka***)

Subproject: The Palaeozoic Polyphase Tectonothermal Record in the Krkonoše–Jizera Crystalline Unit (West Sudetes, Czech Republic) (*D. Marheine, H. Maluski, ISTEEM–CNRS, Univ. Montpellier 2, France, V. Kachlík, Faculty of Science, Charles University, Prague &* ***F. Patočka***)

The succession of Palaeozoic tectonothermal events is recorded in the metamorphosed rocks of the Krkonoše–Jizera terrane; the sequence of the events was specified by the Ar–Ar age determination method on micas:
(1) ca. 565 Ma (very Late Proterozoic) age on detrital white mica from the Ordovician(–Silurian?) quartzite of the Poniklá Group. This age indicates the Cadomian provenance of clastic sediments deposited during the Early Palaeozoic. According to mineral and lithic components of these quartzites, the Cadomian Lusatian basement (Lusatian pluton?) can be regarded as potential source area.
(2) ca. 465 Ma (Middle Ordovician) age on detrital muscovite from the Ordovician(–Silurian?) quartzite of the Poniklá Group. A rock of granitic type is presumed to be the source rock according to the muscovite grain dimensions. The age corresponds to the Rb–Sr whole-rock ages and the U–Pb and Pb–Pb zircon ages on the Izera and Krkonoše gneisses and the Rumburk granite (considered to be the protolith of gneisses) interpreted as the magmatic origin ages. The Middle Ordovician detrital muscovite found in the quartzite also documents the Late Ordovician (±younger) age of the primary sedimentation.
(3) ca. 360–365 Ma (Late Devonian) group of ages on the mafic blueschists of the East Krkonoše Complex. They date cessation of the HP–LT metamorphic event (related to subduction of oceanic lithosphere?) which was rather ubiquitous in the Krkonoše–Jizera terrane (with the exception of the Ještěd Unit).
(4) ca. 340–345 Ma (Early Carboniferous) group of ages on the East and South Krkonoše metabasites. This age is considered to mark the greenschist to lower amphibolite facies metamorphic overprint, which was connected with the onset of the Early Carboniferous thrusting and tectonic exhumation of the deeply subducted crustal slices.
(5) 320–325 Ma (the earliest Late Carboniferous) ages yielded by the Early Palaeozoic mafic metavolcanics and graphite phyllites as well as by the Izera and Krkonoše gneisses. They are interpreted as the time of the major late Variscan shearing and thrusting, which produced the dominant NW–SE-directed linear fabric of the Krkonoše–Jizera terrane. The later phases of this process may be contemporaneous with the Krkonoše–Jizera granite pluton emplacement.
(6) 313–314 Ma (Late Carboniferous) ages on the contact aureole rocks of the Krkonoše–Jizera granite and the minette representing the dyke rocks which were genetically related to the granite. The ages show the uppermost limit of duration of the Variscan magmatic and tectonometamorphic processes, including the pluton metamorphic zone cooling below closing temeprature of micas, and the late-tectonic granite intrusions. They also indicate waning of the late Variscan shearing and thrusting in the Krkonoše–Jizera terrane.
This contribution is involved in the European PACE-project.

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: The deformed metagranites of the Krkonose–Jizera terrane: controversies between protolith ages and stratigraphy (*V. Kachlik, Faculty of Science, Charles University, Prague,* ***F. Patočka****, D. Marheine & H. Maluski, ISTEEM–CNRS, Univ. Montpellier 2, France*)

The key problems now faced in the understanding of the Krkonoše–Jizera terrane (KJT) tectonomagmatic development are: (1) age relations of the KJT metagranites and enclosing metamorphosed volcano-sedimentary sequences, and (2) type of emplacement environment of the metagranite protolith. Primary contacts of the metagranites and host rocks are not known since the former experienced intense Variscan deformation (often mylonitization to phyllonitization in greenschist- to lower amphibolite-facies P-T conditions), and subsequent folding.

The primary granites were related either to compressional Caledonian event (subduction?) or to crustal extension (intracontinental rift development). Radiometric methods date the KJT metagranite protolith intrusion into the Cambro-Ordovician period. The absence of Caledonian deformation ages and the sole presence of Variscan ones in the metagranites and host rocks seem to support the second intrepretation. However, the metagranite protolith ages contrast with the Silurian paleontological evidence provided by the graphite phyllites of the KJT.

The following interpretations of the magmatic origin and tectonometamorphic development of the metagranites may be considered:

(a) The deformed metagranites may represent the Cadomian basement igneous rocks as well as granites emplaced into the basement during the Cambro-Ordovician rifting (as observed in the Lusatian foreland). By the effect of polyphase Variscan tectonism these rocks were incorporated into the Early Palaeozoic sequences and the metagranite bodies are completely lacking any intrusive contacts with the surroundings.

(b) The metagranite protolith was exclusively related to the Cambro-Ordovician intracontinental rift development of the KJT. The granite intrusions were (either completely or partly?) coeval with the host rock sedimentation. The start of sedimentation of the KJT sequences post-dated mid-Ordovician. This is evidenced by the diversified ichnofossil assemblage found in the KJT roofing phyllites, and the Ar–Ar age of 465 Ma obtained on detrital white mica identified in the Poniklá Group quartzite. Intrusive contacts of the metagranites and host rocks were modified and masked by the polyphase (340–320 Ma) Variscan shearing and folding.

(c) The primary granites were emplaced during a considerably longer (Cambrian to Silurian) time span into different stratigraphic levels of the KJT sequences. Xenoliths (graphitic shales, limestones and cherts) in some metagranite bodies seem to correspond to wide petrographic variety of Cambrian(?) to Silurian host rocks. Small bodies of usually leucocratic metagranites resemble sill- or dyke-like apophyses emplaced into metasediments. The metagranites occurring within the metamorphosed volcano-sedimentary sequences may be either intrusive bodies (with primary contacts masked by effects of Variscan shearing and folding) or tectonic slices juxtaposed with host rocks during the same events.

This contribution is involved in the European PACE-project.

Grant Agency of the CR

No. 205/97/1061 Flow directions of lava flows of Krkonoše piedmont Late Paleozoic andesitoids and location of their volcanic centres (***M. Coubal****, V. Prouza, Czech Geological Institute, Prague, & J. Málek, Institute of Rock Structure and Mechanics AS CR, Prague*)

The aim of the project was to determine flow directions of lava flows of the Late Paleozoic Krkonoše Piedmont Basin and to localize their volcanic centres by studying shapes of vesicles in andesitoids. The interpretation of the evaluated shapes is based on the assumption that the lava was being transformed from viscous into plastic matter during solidification, and the originally spherical shapes of the bubbles changed into shapes, which can be approximated by a triaxial ellipsoid. Within the project solution, the KVADRIK computer program was created and permitted to determine an average shape of the vesicles on the basis of measured dimensions of numbers of their cross-sections in three different orientations of rock faces. This way, 29 localities were documented in the Late Paleozoic Krkonoše Piedmont Basin. The determined directions of lava flows indicated several (3 or more) volcanic centres. Most of the assumed volcanic centres were associated with faults. The centres were very likely connected with the Lusatian Fault, particularly in the area northwest of Kozákov Hill The source of lava flows, exposed in the neighbourhood of the upper flow of the Jizera River, was found north of Peřimov, in the vicinity of the tectonic contact of the Krkonoše Basin fill and rocks of Krkonoše–Jizera Crystalline Complex. Westerly orientation prevailed in these lava flows. The second centre, from which the directions of the lava flows were predominantly northerly and northwesterly, was probably located in the area west of Nová Paka. There is a special volcanic centre in this area, which is assumed to be a stratovolcano in the area of the Levínská vysočina Highland north of Nová Paka. The third source of andesite lava was formed by a series of centres arrayed linearly along the Lusatian Fault between Kozákov and Proseč p.J. From these centres, lava flows were extruded predominantly in the westerly and southwesterly directions, where, in agreement with this assumption, considerable accumulations of these rocks were found beneath the Cretaceous sediments in boreholes. Within the individual lava flows, there are partial areas which can be categorized according to whether the lava flew in channels, was spread over a larger area or spilled without any dominant streaming direction.

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 Western Bohemia, tectonics and seismicity (***J. Ulrych, V. Cajz, E. Pivec, J. K. Novák***, *Č. Nekovařík, Czech Geological Institute, Prague & K. Balogh, Institute of Nuclear Research Hungary Academy of Sciences, Debrecen, Hungary*)

Three independent volcanic series were recognized in W Bohemia: (i) the old unimodal alkaline ol. nephelinite – tephrite (29–19 Ma) in the Ohře Rift (OR), (ii) two contemporaneous weakly (trachybasalt / trachyandesite – trachyte / rhyolite; 13–11 Ma) and strongly (ol. nephelinite – tephrite / basanite; 12–8 Ma) alkaline series in the flank of the Cheb–Domažlice Graben (CDG) formed by the Teplá Highland, and (iii) the young unimodal ol. melilitite / ol. nephelinite alkaline series (2.0–0.12 Ma) at the intersection of the above mentioned structures in the Cheb Basin. Magmas of all series are mantle-derived, in the case of the CDG series associated with the AFC (assimilation-fractionation crystallization). Two main fault systems: (i) ENE–WSW and (ii) NNW–SSE are developed in western Bohemia, corresponding to directions of both prominent taphrogenic structures of the OR and the CDG, respectively. The continuation of the OR to SW across the Mariánské Lázně Fault is marked by volcanics only.

Subproject: Alkaline basalt volcanism of the SW part of the Ohře (Eger) Graben (***J. Ulrych, V. Cajz, E. Pivec*** *&* ***J. K. Novák***)

Alkaline basaltic volcanism of the SW part of the Ohře (Eger) Graben between composite volcano of the Doupovské hory Mts. and the Franconian Line in Bavaria is characterized by unimodal, strongly alkaline series: melilite-bearing nephelinite, leucite/analcime basanite, rarely phonolite (29–19 Ma). The Plio-Quaternary volcanic suite (2.0–0.11 Ma) associated with intersections with the Mariánské Lázně fault indicates a primitive ultramafic character (melilite-bearing nephelinite lava flow and scoria cone) and may therefore have a deeper extent.

No. 205/97/0244 Isotope and chemical equilibria in the lower crust conditions (*J. Košler, Faculty of Science, Charles University, Prague &* ***M. Svojtka***)

Subproject: A possible exhumation mechanism for granulite gneisses of the southern Bohemian Massif (***M. Svojtka***)

Deformation of the granulite facies rocks in the Moldanubian Zone of the southern Bohemian Massif is expressed in two intersecting planar fabrics – steeply disposed (S_1) and flat-lying (S_2) that correspond to two deformation stages (D_1) and (D_2). The available Sm–Nd garnet ages from banded granulite gneisses, new U–Pb zircon data from syn-tectonic granite intrusions to the granulite gneisses, the existing PT information and field structural relations constrain the age and PT conditions of the two deformation phases. Early deformation (D_1) is associated with the HP–HT metamorphic stage with a minimum age of ca. 354 Ma that is followed by near isothermal decompression. The second deformation phase (D_2) followed the LP–HT metamorphism dated in the region at ca. 340–330 Ma and is constrained by a minimum U–Pb concordant zircon age of a syn-tectonic granite at ca. 320 Ma. A possible exhumation mechanism for granulite gneisses in the southern Bohemian Massif, that accounts for the presence of two sets of structures formed at different P-T conditions and separated by at least 15 Ma, is an extrusion of the soft orogenic root. Simple mathematical modelling of extrusion suggests that the rocks can be exhumed from the depth of 70 to 25 km in less than 10 Ma after the homogeneous thickening of the lithosphere assuming the strain rates of 10^{-15}–10^{-14} s^{-1} and the depth of softened orogenic root in excess of 80 km.

Grant Agency of the Academy of Sciences CR

No. A301203903 Tectonomagmatic position and evolution of the Permian–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: Late Paleozoic volcanism of the Bohemian Massif (*J. Pešek, Faculty of Science, Charles University, Prague,* ***J. Svobodová*** & ***J. Ulrych***)

Extensive Late Paleozoic syn- and post-tectonic basaltic, andesitic and rhyolitic volcanism occurred in the Bohemian Massif. It can be subdivided into several separate episodes on the basis of stratigraphic position of effusive rocks. First traces of volcanic activity, preserved as tuffitic intercalations in marine sediments of the Moravo-Silesian area, are known from the Early Carboniferous. Extensive production of tuffs is associated with the (i) Namurian–Duckmantian volcanic episode documented from the Upper Silesian Basin. The new (ii) volcanic episode began at the Duckmantian–Bolsovian boundary and intermittently continued till Westphalian D to middle Stephanian. During this episode, mainly acid volcanics and tuffs were produced in the Central and Western Bohemian basins and some acid and basic volcanics were intruded and extruded in the Sudetic basins. After an intra-Stephanian hiatus during the (iii) last volcanic episode (Stephanian C to Autunian), large volumes of acid and basic volcanics accompanied with tuffs were extruded in the northwestern Bohemia and mainly in the Sudetic basins. Individual volcanic episodes correlate with the Sudetic and Leonian phases of the Variscan Orogeny.

Geochemical characteristics were studied only in volcanic rocks of the second and the third episodes, showing typical bimodal distribution. Subalkaline type of basic volcanics of the second episode shifted towards the alkaline type of the third volcanic episode. Subalkaline volcanism is represented mainly by rocks of basaltic affinity, whereas andesitic rocks are developed preferentially in the alkaline series. High concentrations of LILE (Cs, Ba, K, Rb) and some HSFE (Th, Zr) together with relative Nb and Ti depletion and low K/Rb ratios reveal significant contamination of primary magmas by upper crustal material and characterize intra-continental volcanics. Different trace-element patterns of rhyolites indicate different magma sources for basalts and andesitic rocks. Geochemical similarity of rhyolites with upper crustal rocks may indicate their origin by anatexis of upper crust. The transition from subalkaline to mildly alkaline volcanism reflects a development from pre-rift to rift-related setting in continental environment. Subalkaline volcanism with some intra-plate characteristics may reflect early signs of later rifting. Active rifting was characterized mainly by alkaline (mostly acid) volcanism that occurred mainly in the second and third volcanic episodes. Primary mantle magmas were probably retained in the upper crust during their uplift, where they were contaminated by upper crustal material. Their thermal input probably caused melting of upper crustal rocks, which became a source of rhyolitic magma. Geochemical features of andesitic rocks and rhyolites show that fractional crystallization took place during their formation.

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

Sediments of the Bohemian Cretaceous Basin (94–85 Ma) in N Bohemia, Saxony and Lusatia are dominated by shallow marine sandstones and conglomerates, passing into aleuropelites basinward. In the late Cretaceous and Cenozoic (78–4 Ma), the basin fill experienced a complicated thermal history related to multiphase volcanic activity associated with the Ohře Rift in the NW and the Labe Tectono-Volcanic Zone in its axial part. In places, matrix of the sandstones was replaced by secondary cement of Fe-oxyhydroxides showing corrosive effects on quartz grains. The present project is aimed at the determination of spatial and genetic relations between young volcanic bodies and individual types of Fe-mineralization in sediments of the Bohemian Cretaceous Basin.

Field mapping, tectonic study and surface geomagnetic survey concentrated on several tens of localities, the most important of which being Houska, Pokličky and Střezivojický Špičák near Mšeno; Kamenný vrch near Dubá; Borek, Pavlovice, Vlhošť and Husa near Česká Lípa; Nonnenfels and Schwarze Loch Quarry near Kurort Jonsdorf; Střeleč Quarry, Kost and Zakopaná near Jičín.

Three different morphological types of Fe-mineralization can be distinguished: (1) subvertical planar tabular bodies filling open joints and faults and associated with dyke contacts, several centimetres thick, (2) thin, undulating crusts, often tube- and sheath-like in shape, mostly forming subvertical zones several metres or tens of metres wide, and (3) strata-bound subhorizontal bodies up to 4 m thick.

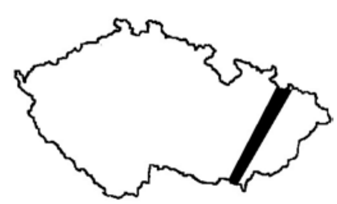
The most important factors controlling the distribution of ferruginous sandstones are: (A) proximity of basaltic bodies, (B) the degree of fracturing of the host sediment and favourable orientation of feeder structures, and (C) sufficient permeability of the host sediment. All the occurrences studied were found to be spatially associated with dykes or pipes of basaltic rocks. Most of the feeder structures (joints, faults) and dykes strike N–S to NE–SW.

Type 1 Fe-mineralization occurs, besides dyke contacts, along dyke-parallel ruptures in dyke continuation. The zones of *type 2* Fe-mineralization run perpendicular or oblique to the dykes and probably represent former zones of intensive fracturation, characterized by higher permeability; mineralization is best developed near their intersections with the dykes. Axes of Liesegang-type concentric cylindrical Fe-structures trend roughly parallel to the strike of this zone. At the hill of Střezivojický Špičák, a non-linear type 2 occurrence directly overlies a body of intrusive breccia intersected by a dyke. *Type 3* Fe-mineralization is developed in horizontal or gently inclined conglomerate beds on condition that they get into contact with a dyke or a feeder structure. At Pokličky, mineralization is best developed in the coarsest sediments overlain by less permeable finer-grained sediments, in the axial part of an anticlinal structure.

The above given facts indicate that all three types of Fe-mineralization in the Bohemian Cretaceous Basin are genetically linked with younger volcanic activity and are hydrothermal in origin. Nevertheless, this assumption has yet to be tested using geochemical evidence.

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***)

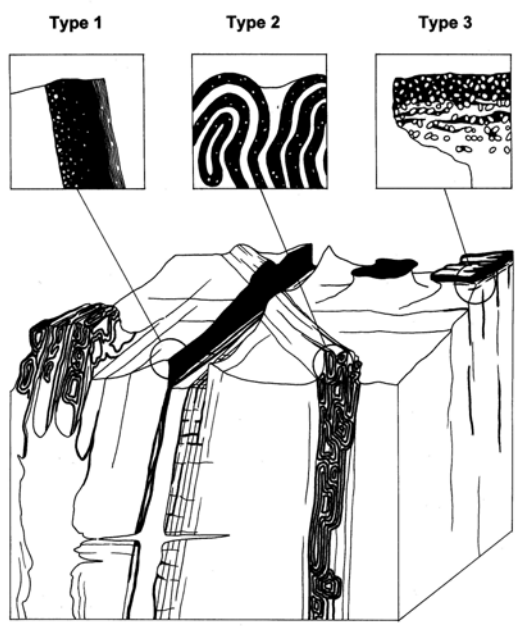
Subproject: Tremolite marbles in the Bohemian Massif (***M. Němečková*** & *M. Novák, Faculty of Science, Masaryk University, Brno*)



The present study of the distribution and geological position of tremolite marbles of the Bohemian Massif yielded the following results:

Tremolite marbles pose a specific rock type occuring in different geological units of the Bohemian Massif, mostly lying at its southeast margin, in the hangingwall of units undoubtedly Proterozoic or older in

age, e.g., the Dober Gneiss in the Moldanubicum of Waldviertel and the Světlik Gneiss in the Bohemian Moldanubicum, Bíteš Gneiss in the Moravicum. These marbles occur as components of rock complexes consisting of metapelites with intercalations of quartzites, metabasites and especially with frequent graphite-rich rocks of economic importance. However, tremolite marbles do not appear at the immediate contact with these graphite-rich rocks (typical for the areas of Český Krumlov and Uherčice). Tremolite marbles very often represent a subordinate component of larger marble bodies. Especially smaller, independent bodies are particularly rich in tremolite.
Marbles can be divided into two distinct types according to their chemical composition – calcite marbles and dolomite marbles – characterized by two different stability associations of Tr+Cal and Tr+Dol, respectively. These associations vary even in their stability during different P-T-X conditions. Structural study of the individual parageneses indicates the presence of 2–4 generations of tremolite even within the framework of one body. Part of tremolite I almost reaches the boundary of magnesiohornblende in its composition. In a more detailed study, it is possible to define associations of principal silicates with different ratios: Tr>Phl and Tr≤Phl. Younger post-tectonic association with Fo+Chl, Spl, Chu, which is connected with younger HT/LP peri-plutonic metamorphism in the Moldanubicum is absent from most of the tremolite marbles.



Schematic block-diagram showing the different types of Fe-mineralization in relation to dykes and pipes of volcanic rocks and fracturing of the host sandstone massif (J. Adamovič)

No. A3013906 Early Palaeozoic extension in the Central European realm: sedimentary, volcanic, fossil and palaeomagnetic record of the Barrandian (Bohemian Massif) (***P. Štorch, F. Patočka, P. Pruner*** & ***J. Svobodová***)

Subproject: Results of geochemical modelling of magma evolution and partial melting processes in the Kdyně massif, South-West Teplá–Barrandian Unit (***J. Svobodová***)

The latest information on Palaeozoic magmatism was collected and a first field study of the Barrandian Palaeozoic volcanics was accomplished. This year, the study concentrated on the southwestern Bohemia.
New results of geochemical modelling of magma evolution and partial melting processes in the Kdyně massif, southwestern Bohemia, showed the origin of the magma in the upper mantle and its modification by the

process of combined assimilation-fractional crystallization. The extent of Palaeozoic acidic magmatism, extensional environment during their emplacement reported by some authors and upper mantle origin of some basic rocks lead to the conclusion that magmatism took place at the rifting zone. Affinity of some acid magmatic rocks to the magmatism of active continental margins and isotopic inhomogeneity of some basic suites can be explained by magma contamination or partial melting of older material in a young rift, that originated by break-up of active continental margin. The age of the rifting event was middle Cambrian to the Ordovician, although the character of Ordovician volcanics changed in the northern part of the Barrandian terrane, and subduction in this area is probable.

No. A3013806 Pre-Variscan crustal evolution in the Central Europe: Combined trace element and Nd-isotope study of Upper Proterozoic igneous rocks from the Bohemian Massif (***J. Waldhausrová***)

Subproject: Trace element and Nd-isotope study of Upper Proterozoic igneous rocks from the Bohemian Massif (***J. Waldhausrová***)

The Barrandian Upper Proterozoic (the Teplá–Barrandian region) belongs to the western part of the Bohemicum, one of the geological units of the Bohemian Massif. The Bohemicum, the boundary of which is marked by a steep gravity gradient, is represented by major thrusts and strike-slip faults. It differs from adjacent geological units in geophysical, geological, structural and geochemical features. As the effects of the Variscan tectonometamorphic events are relatively weak in this domain, outcrops of Upper Proterozoic formations offer an excellent opportunity to study magmatic suites which might occur elsewhere throughout the Variscan Belt but were strongly metamorphosed during Cadomian and Paleozoic tectonometamorphic events.

The Teplá–Barrandian Upper Proterozoic is largely composed of low-grade metamorphosed Precambrian sedimentary and volcano-sedimentary sequences unconformably overlain by Early Paleozoic strata. The Precambrian sequences of this area are supposed to be of Late Proterozoic age, as shown by micropaleontological correlations with the Riphean and Vendian.

The Teplá–Barrandian Precambrian comprises several NE–SW-trending volcanic zones dominated by basaltic rocks, whereas andesites, dacites, rhyolites and alkaline volcanics are developed only locally. Three volcanic series are present in this area: (1) subalkaline (tholeiitic) volcanic series with very primitive geochemistry similar to that of chondrites, (2) alkaline volcanic series indicating more mature magma source, and (3) transitional volcanic series between the subalkaline and alkaline ones.

In the stratigraphic column, the geochemically primitive tholeiitic basalts (OFB, MORB, IAT) form the bottom of the volcanic sequence; basalts of the transitional volcanic series overlie them and the alkaline volcanics (hawaiites to trachytes) represent the youngest part of the Upper Proterozoic volcanic activity. In the areas where the OFB and IAT basalts are not exposed, transitional basalts form the lower part of the volcanic suite.

The present geochemical results confirm the previous assumptions and allow to interpret the Barrandian Proterozoic area during its early development stage as a basin with oceanic crust and operating subduction zones. Tholeiitic magmas (OFB, MORB, IAT) as well as some transitional basalts are derived from a mantle source; the alkaline volcanics (and the rest of the transitional volcanic suite) display some contamination with crustal components. The Jílové Zone, a continuous and well exposed belt of volcanic and subvolcanic rocks metamorphosed to the greenschist and amphibolite facies geochemically corresponds to the island-arc type volcanism. The results of the REE study confirm the existence of two geochemically different volcanic phases, the older tholeiitic one with steep isoclinal folds and the younger low-K calc-alkaline one, using the cleavage systems of the earlier folded and foliated tholeiitic suite as feeding channels. Both phases are derived from the mantle source, the younger being slightly more differentiated.

The modern data on the petrogenesis of the studied volcanics enabled to construct a geodynamic model of the Upper Proterozoic in the Bohemian Massif and contributed to our better understanding of the age and the mode of development of the continental lithosphere in the European Variscides.

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: Mariánská hora Hill in Ústí nad Labem: geological, petrological and mineralogical characteristics of a prominent nature monument (***J. Ulrych, J. K. Novák, V. Cajz, A. Langrová, K. Melka, J. Adamovič*** *& T. Wiesner, Municipial Museum in Ústí nad Labem*)

The irregular laccolith of the Mariánská hora Hill and the Kamenný vrch Hill formed by natrolite-bearing sodalite phonolite (analcimized in marginal parts of the body) reveals distinct compositional variations in association with assimilation of calcareous material of the Cretaceous marlstone envelope. Major- and trace-element compositions indicate strong differentiation of parental magma resulting from feldspar, Ti-oxides, sphene, clinopyroxene, olivine(?) and apatite fractionation. The rock is notably enriched in incompatible elements as Rb, Zr, Hf, Nb and Ta, partly in Sr and Ba and depleted in P, Ti and compatible Mg as well. Subvolcanic xenoliths of eudialyte foyaite, diorite to plagiotrachyte, hornblendite and pyroxenite originated from subvolcanic derivatives of the České středohoří Mts. volcanic rock suite. Hydrogrossullare-hibschite, wollastonite and apophyllite represent products of calcareous material assimilation. Classic minerals of autometamorphic hydrothermal alteration known from this locality (natrolite I and II – thomsonite – analcime – apophylite/albine, hyalite – fluorite – carbonates I and II, (Fe,Mn)-oxyhydroxide) are products of late-stage fluid crystallisation in vesicles and amygdules of parental phonolite.

Subproject: Brittle tectonics of the sodalite trachyte bodies of Mariánská hora and Kamenný vrch in Ústí n. Labem (***J. Adamovič*** *&* ***V. Cajz***)

Small-scale brittle tectonic structures were measured in the sodalite trachyte bodies of Mariánská skála and Kamenný hills in the city of Ústí n. Labem. Two phases of brittle deformation were identified. A phase of ENE–WSW compression (probably older) resulted in formation of coarse striae associated with plumose structures and reverse movements on planes striking E–W to NE–SW. Phase of WNW–ESE extension (probably younger) is associated with normal faulting on planes dipping steeply west, with fine striae and frequent fillings of zeolites. These results support the idea of post-emplacement left-lateral strike-slip deformation of the Mariánská hora-Kamenný vrch trachytic body along a E–W-striking fault zone following the Labe River course.

MC CR No. 4238 Slope movement hazards in the Labe River valley, Děčín district (*O. Moravcová, Czech Geological Institute, Prague &* ***V. Cajz***)

Rockfalls and landslides are the natural hazards, which restrict the development of the area near the Labe, Ploučnice and Kamenice rivers.
The studies were concentrated to the central and northern parts of the České středohoří Mts. volcanic range. Due to their cohesion, volcanic rocks are involved in the slope movement hazards by rockfalls and by landslides. Solid volcanic rocks, esp. with irregular and columnar jointings, are more predisposed to rockfall, if exposed by erosion in steep slopes. Volcaniclastics, which are mostly incoherent and argillaceous, pose material very prone to landslides. This is the case at the base of volcanic accumulations, especially if underlain by Cretaceous marlstones. As the erosion in river valleys is intensive, exposing the base of volcanic accumulations and producing steep slopes, geological setting is favourable for both types of slope movements.

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

Subproject: Palaeozoic lamprophyre dykes of the Krušné hory Mts. (***E. Pivec, M. Lang*** & ***J.K. Novák***)

Palaeozoic lamprophyre dykes were studied in the Krušné hory (Erzgebirge) region. The prevailing rock type is represented by kersantites (48 % vol.), spessartites (2 % vol.) and minettes (4 % vol.) are present in lesser amount. The occurrences of cognate porphyrites, diorite dykes, microgranites and granite porphyries (46 % vol.) are common. The study of these rocks focused on the optical and chemical study of rock-forming minerals. It revealed the presence of high-temperature minerals, e.g., ternary feldspars, high-temperature plagioclases, kaersutites, demonstrating the high-temperature origin of these rocks. The occurrences of multiple generations of amphiboles, feldspars and biotites in the same sample demonstrate their multiphase origin. Intrusions of lamprophyres are located on tectonic zones acting as channelways for ore-bearing fluids (this is documented by the occurrence of minerals of the so-called five-element formation and by greisenisation of lamprophyres). Later, some tectonic zones were used by neovolcanites. The maps of element distribution made by electron microprobe show high concentration of elements forming fluidal arrangement, documenting a progressive differentiation of these rocks.

Industrial Grants

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

The aim of the study was to document brittle structures in the area of the Čertovy schody Quarry (Devonian limestones, Prague Basin) and particularly in the zone of the Očkov Thrust Fault.
It has been documented that the Očkov Fault Zone with E–W-striking faults is dominated by right-lateral strike-slip movements as indicated by slickensides of calcite fillings on planes separating different limestone lithologies. These movements are combined with less prominent reverse movements, observed on faults dipping steeply south. Low-angle, southerly dipping thrust planes were observed both in the proximity of the Očkov Fault Zone and farther S in the central part of the Quarry. Four superimposed generations of striae were documented on these planes showing right-lateral strike-slip movements with different reverse movement components.
N–S-striking ruptures show mostly no movement at all, being filled with calcite. Some ruptures dipping at high angles towards WSW, however, show prominent striae indicating left-lateral strike-slip movements with different reverse movement components. This is in agreement with the sense of displacement of the Očkov Fault Zone observed in the field.

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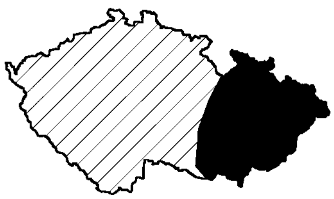
10. Department of Stratigraphy and Paleontology

Foreign Grants and Joint Projects

Grant projects with international cooperation

DFG Schwerpunktprogramms: Orogene Prozesse, ihre Quantifizierung und Simulation am Beispiel der Varisciden, 1999 "Vom Prozessverständnis zur Nutzung" *(W. Franke, University of Giessen, Germany, B. Merkel, P. Herzich, Polytechnical University of Freiberg, Germany)*

Subproject: Comparison of two explanations of curvature in Variscan Orogen of Moravia: terrane segmentation with clockwise rotation vs. strong effect of the Moravian Shear Zone (***J. Hladil*** & *R. Melichar, Masaryk University, Brno*)



The first concept operates with rotation of segments, which is seen as successive partial rotations of slices on the faults and/or wedging to tectonical extrusion on the most exposed borders of the blocks. This concept stresses a complex evolution of the orogen, where old terranes were partly incorporated in new terranes. The Middle Devonian closure of the Rheic basins means that crust of the basin floor was consumed under poorly preserved volcanic arc rimming the distant Laurussian borders. After a stacking of Barrandian facies over the Thuringian and Bavarian facies, respectively, and docking of Moldanubian precursor, the crustal thickening was followed by a significant late Devonian inversion, so that crust was underplated and consumed under peri-Gondwanan segments. This inversion must be connected with clockwise rotation of terrane-segment aggregates in a large dextral shear zone separating two Devonian supercontinents – Gondwana and Laurussia. Maps and sections show that the crystalline and Culm massifs of Moravia are detached terrane slices lubricated by Early Paleozoic, mostly Devonian sediments and volcanites. Strong Carboniferous wedging and tensile attenuation in western Moravia was reflected by tectonic and erosional erasure of many segments, which are present in other parts of the orogen outside Moravia. An attenuated zonation from Moldanubian, Barrandian and arc rocks on the West of Moravia continues toward the East by the zones of subsequently closed Rhenish-type basins. Practically, the all normal Variscan zones are present, but they have very attenuated to discrete shape.
The second concept stresses a pre-existing tectonically layered structure of two lithospheric blocks, i.e., Lugodanubicum and Brunovistulicum. The first block situated on the SW consisted of Drosendorf, Gföhl, Svratka and Bohemicum compartments, whereas the second block on the NE consisted probably of Bíteš gneiss and inner phyllites, and surely of the eastern part of the Brno Massif, metabasite, western part of the Brno Massif, western Culm and eastern Culm compartments. Suggested layered fabric of these blocks might result from the Devonian and Early Carboniferous tectonic stackings and interfingerings. The very late Carboniferous, but surely pre-Stephanian, Moravian Shear Zone is explained as a deformation connected to gently inclined Moldanubian Thrust Fault, where the SW block were pulled toward the NNE and the NE block were pulled toward the SSW. The elevated borders on the W imitate an anticlinal bending, whereas the borders on the E are pseudosynclinal. The shear zone between these two blocks contains inverted and tectonically reduced limbs of these "folds". Inversion of the Brno Massif–Culm sequence E of Boskovice is a good example from Brnuvistulicum and an inversion alongside the Lugodanubian borders was described by four authors: K. Zapletal and R. Melichar (Svratka Dome), F. Pauk (Silesia), and A. Fuchs (Thaya Dome).
These two models are not only concurrent concepts but also rather interconnected tools.

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, 28040, Madrid*, ***M. Vavrdová*** & ***J. Bek***)

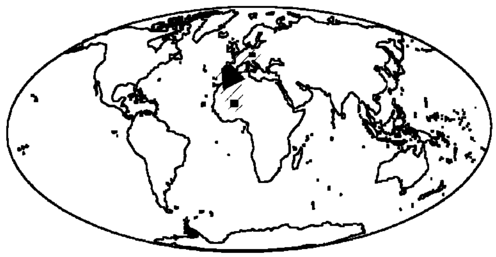
Well to moderately well preserved palynomorphs have been recovered from several stratigraphic sections in the Tarija-Titicaca basin. Palynological resiua yielded plant microfossils indigenous to the Malvinokaffric realm as well as cosmopolitan species, which allow long-distance correlation.
Distinctive palynomorphs associations have been recovered from selected samples in the Ananea and San Gabán formations, southern Peru (Río Imambari, Curva Esperanza). 33 genera and 53 species of acritarchs and prasinophytes have been identified in the samples collected in the Imambari region, which make possible to assign the Late Silurian (most probably Late Ludfordian) age to the Ananea formation.
Age diagnostic genera and species such as *Deunfiia, Domasia, Duvernaysphaera oa, Geron, Fimbriaglomerella divisa, Riculasphaera fissa, Tunisphaeridium whitcliffense* and *Thysanoprobo*lus polykion occur in samples investigated. Significantly, fossil remains of terrestrial plants (spores, plant tissues, wood fragments) are absent. Nature of acid-resistant cell wall indicates relatively intensive heating (thermal alteration index 3-4).
Veryhachids, micrhystrids and rare representatives of species *Neoveryhachium carminae* characterize the palynomorph assemblages obtained from the San Gabán Formation. Although stratigraphically inconclusive, palynomorphs from San Gabán formation suggest Early Silurian age of the formation, formed under a strong glacial influence. Acritarchs and prasinophyte association from southern Peru show affinities to coeval microfloras known from the Appalachian basin (namely in the presence of *Deunffia-Domasia* morphotypes and to the northern margin of Gondwana.
Provincialism in the distribution patern of fossil marine microplankton of late Famennian age, manifested in Umbellasphaeridium saharicum bioprovince, contrasts with apparent uniformity of coeval continental paleofloral record.

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: Reconstruction of palaeovegetation and pala-eoenvironment, stratigraphy. (***M. Konzalová** & Ziembinska-Tworzydlo, Warsaw University, Poland*)

Taxonomic evaluation of the microscopic plant assemblages of the Czech and Polish parts of the Zittawa basin has been done. The study was centred on the basal deposits and the lower coal seems known from the borehole sections only. The taxonomic characteristic and comparison of *Pteridopsida, Pinopsida* and *Angiospermophytina* has been carried out. Among *Pteridopsida, Polypodiaceae* and *Lygodium* types are well comparable in both parts of the basin, in the occurrence of *Polypodiaceoisporites* and *Neogenisporis* they differs. The thermophyllic representatives of flowering plants, *Sapotaceae* and *Symplocos*, occur in the Czech part, in contrary to the Polish part where they have been recorded only rarely. *Fagaceae, Taxodiaceae-Cupressaceae* and *Pinaceae* occur in the both parts as coal forming elements. Significant is the find of *Boehlensipollis* W. Kr. in the basal sediments. The taxon, considered as key fossil for Rupelian-Eochattian, was found in the Tertiary volcanic complex of Bohemia, in the Rupelian stratotype locality Flörsheim in Germany and in the marine deposits of the Carpathian area, in the biozone NP 22. It defines, for the first time, the beginning of the basal sedimentary cycle in the basin.

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, palaeobiogeography and palaeoecology of NW Gondwana (***P. Štorch***)

The studies concentrated in Spanish sections, especially in a continuous section ranging from the base of Silurian to the Early Ludlow was logged and densely sampled near Cazalla de la Sierra (Ossa Morena Zone). Several graptolite extinctions and subsequent recoveries were recorded including the post-



post-extinction faunal assemblage of the lowermost *sedgwickii* Biozone. The latter assemblage was identified as a lateral correlative of so far tentatively dated graptolite-shelly fauna from Hýskov in Barrandian area. Integrated (graptolite-conodont-chitinozoan) biostratigraphy has been developed across the Llandovery - Wenlock boundary at Corral de Calatrava Section in central Iberian Zone.

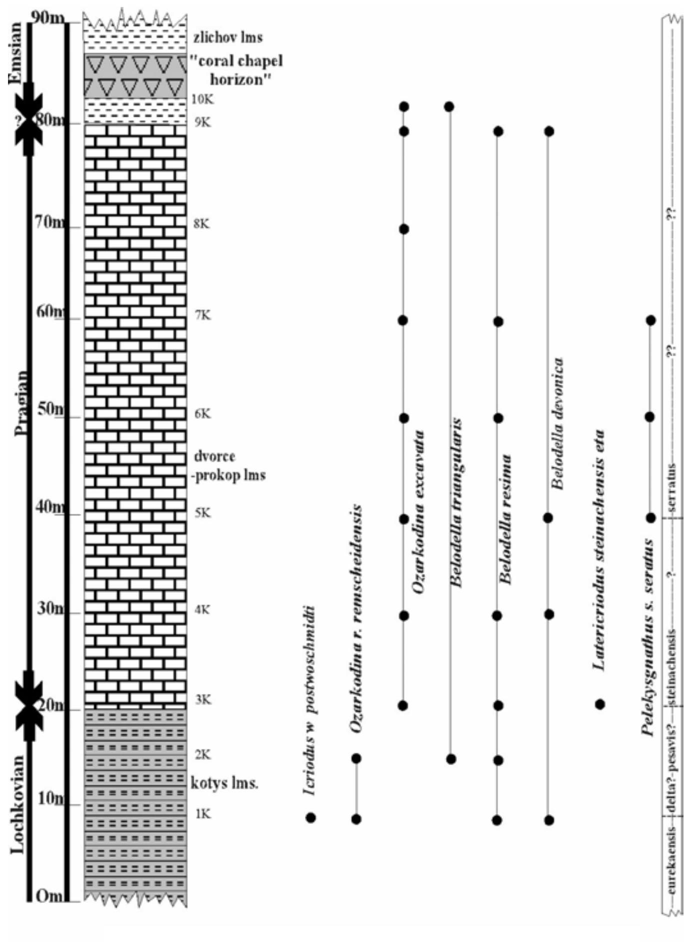
Paleontological Society USA, International Research Program (PalSIRP), Personal awards 1999

Project: Refinement of Pragian conodont zonal succession in the stratotype area ***(L. Slavík)***

The purpose of the ongoing research is to contribute to the solution of standard Pragian conodont zonal scale by refinement of local conodont zonation in Barrandian area. Furthermore, Pragian is generally the most poorly elaborated Devonian stage from this viewpoint. The present state of inaccurate Pragian standard conodont zonal scale reflects partly the real complications with conodonts in this stratigraphical interval. Besides large endemism of some Early Devonian species, the are two evolution characteristics connected with early Pragian times: (1) "conodont crisis" with (2) "a low diversity episode". Of course, the conodonts are major tool for the Devonian biostratigraphy and we can hardly leave a blank place in the Pragian stage. The principal aim is to describe the local conodont succession and consequently to draw the local conodont zonation. There is a sufficiency of appropriate sections to choose.
Present studies are concentrated on five Pragian sections (Prague Basin): Karlík Valley, Barrandov-Hlubočepy, Branžovy, Čertovy schody and Na Požárech produced more than 1,000 of conodont elements, with unusually low average concentration of conodont elements of 4.3 elements per kilogram of rocks. Twenty three described taxa yielded data for the recognition of the following standard conodont biozones - eurekaensis, delta, pireneae, dehiscens and serotinus. Besides these standard stratigraphic units several local zones were established and preliminary regional conodont scale for the Pragian stage was proposed. The most relevant taxa for biostratigraphic dating of the Pragian based on conodont fauna and also for consecutive constitution of local conodont zones appear to be *Latericriodus steinachensis* Al-Rawi *eta morph* Klapper et Johnson and *Pelekysgnathus serratus serratus* Jentzsch. The range of *L. steinachensis eta* starts near the base of the Pragian, whereas the latter appears approximately in the middle of Pragian sedimentation. *Eognathodus sulcatus sulcatus* appears to be rare and random in the stratotype area. Moreover, the index species for the kindlei Zone (*E. s. kindlei*) has never been found in the Pragian of Praha Formation. The late Pragian situation is sill very puzzling and it is a subject of future studies.

Project: A systematic revision of the ichnotaxa erected in "Problematica Silurica" by A. Fritsch (1908; in J. Barrande et al.: Systeme Silurien) (***R. Mikuláš.*** *in co-operation with M.G. Mangano, University of Tucumán, Argentina)*

Some taxa erected by A. Fritsch in the "Problematica Silurica" represent probably composite traces derived from hunting on in-fauna by trilobites: *Digitolithus rugatus* Fr., *Cuvolithus gregarius* Fr., and one specimen of *Crossochorda costata* Fr. are composed of a *Rusophycus*-like body crossing a tunnel of *Planolites* isp. Similar traces have very seldom been reported from the Early Palaeozoic so far. The Fritsch's specimens come from the Kosov Formation (Upper Ordovician of the Barrandian area).



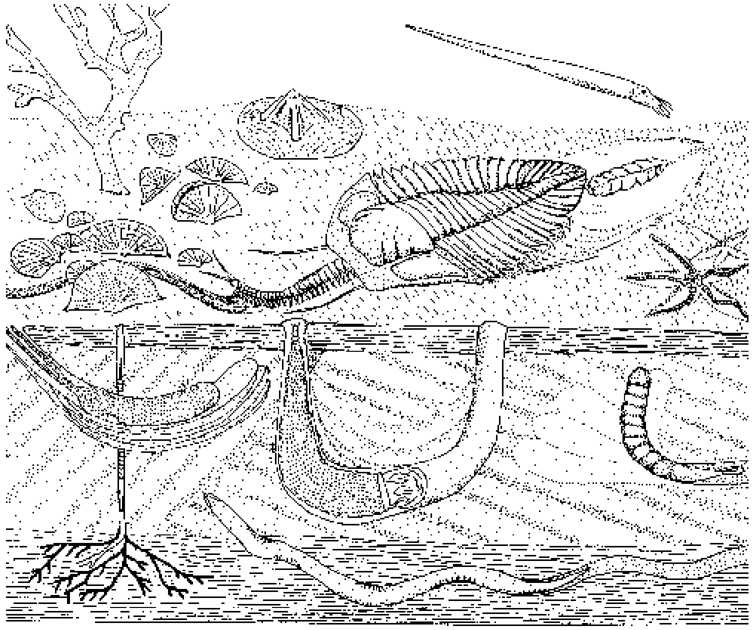
Distribution of conodont taxa in the Karlík Valley section (L. Slavík)

International Geological Correlation Programmes, UNESCO

IGCP Project No. 410: The Great Ordovician Biodiversification Event: Implications for Global Correlation and Resources *(B.D. Webby, Macquarrie University, Australia; F. Paris, Université de Rennes, France; M.L. Droser, University of California, USA)*

Subproject: Ichnopaleontological reflection of the Great Ordovician Biodiversification Event in the Barrandian and compared areas (***R. Mikuláš***)

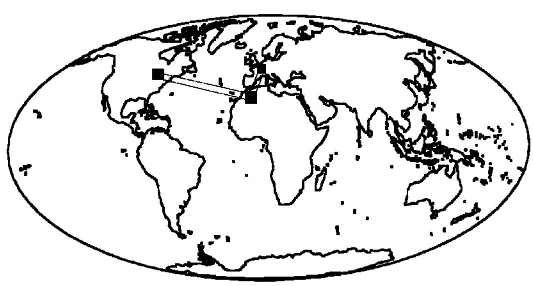
Rich associations of benthic fauna accompanied by diversified assemblages of ichnofossils have been found in the Ordovician of the Barrandian area, namely in the Klabava Formation ("Euloma Shales"), in the Šárka Formation (facies of black shales with concretions), in the Letná Formation (layers with the *Drabovia redux* Community), in the Zahořany Formation and in the *Polyteichus* Facies of the Bohdalec Formation. The associations of body-and trace fossils in the Letná, Zahořany and Bohdalec Formations are comparable to the *Dalmanella* Community of the Caradocian of North Wales; the remaining mentioned associations have no described analogies. As the number of analysed associations is limited, their comparison shows rather individual differences than recurring features. However, data compiled by previous authors for palaeoenvironmental indicators of marine siliciclastic facies (which comprises also body-fossils and trace fossils) are of the use in the analysis of joint occurrences of body-fossil and trace fossil assemblages.



Reconstruction of flora and fauna of the Bohdalec Formation (the *Polyteichus* Facies), Uppermost Berounian of the Barrandian area. Plankton is represented by a orthocone nautiloid; benthic forms on the sea floor involve bryozoans *Polyteichus* and *Monotrypa*, orthid and strophomenid brachiopods (e.g., Svobodaina, Aegiromena, Rafinesquina), calymenid trilobite leaving the resting trace *Rusophycus* to prey on an annelid "worm", and the ophiuroid *Taeniaster* in its resting burrow, *Asteriacites lumbricalis*; in-faunal elements are tracemakers of *Phycodes*, *Rhizocorallium* and *Teichichnus* (upper tier), *Planolites* and *Chondrites* (deep tier) (R. Mikuláš)

IGCP Project No. 386: Response of the ocean/atmosphere system to past global changes *(✞ H. Geldsetzer, ISPG Calgary, H. Strauss, Ruhr University of Bochum, Germany, D.M. Banerjee, University of Delhi, India)*

Subproject: Global correlation of the Silurian-Devonian magnetosusceptibility records: high-resolution and high-correlative reflection of astronomically forced climatic changes *(R. Crick, University of Texas in Arlington, USA, B. Ellwood, Louisiana State University, Baton Rouge, USA, **J. Hladil**)*



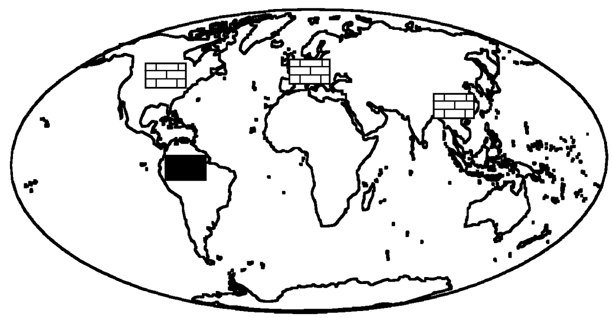
The Silurian-Devonian boundary sections in Europe, North Africa and eastern USA have been sampled with steps </=5 cm and carefully measured using the high quality bridges in Arlington, Baton Rouge and Prague, respectively. The Global Boundary Stratotype Section and Point (GSSP) at the Klonk (S of Beroun, Czech Republic) has primary significance for characteristics of fine-scale magnetic patterns.

The magnetosusceptibility records from the Přídolí-Lochkovian strata from the surface of Klonk are used for definition of three new standard MS-zones, which cover the Silurian-Devonian boundary interval. (1) The Tmaň MSZ (Late Přídolí) with 13 magnetosubzones; (2) the Klonk (latest Přídolí and earliest Lochkovian) with 17 magnetosubzones, and (3) the Voskop (Early Lochkovian) with 9 magnetosubzones. The base of Klonk magnetosubzone 2 is coincident with the base of Lochkovian (= the base of Devonian). This zonation can be developed largely to the bottoming Přídolí and Ludlow series, in co-operation with the DFG Schwerpunktprogramms "Evolution des Systems Erde während Paläozoikums" *(U. Mann, H.S. Poelchau, and others, Forschungszentrum Jülich, Germany).*

Correlations between the MS-record and astronomically forced sea-level fluctuations show, in general, that the rising sea level corresponds to decrease of MS values, and vice versa, sea level fall is usually expressed as decreasing trend in MS values. In this way of interpretation, the Silurian-Devonian boundaries in the Prague Basin and the Anti-Atlas falls between a short-lived transgressive pulse in the latest Přídolí and an equally short-lived regressive pulse in the earliest Lochkovian.

IGCP Project No. 421: North Gondwanan Mid-Palaeozoic biodynamics (*J.A. Talent, Macquarie University, North Ryde, N.S.W., Australia, R. Feist, Institut des Sciences de l'Evolution, C.N.R.S. Montpellier*)

Subproject: Late Devonian glacieustatic changes: time correlation of redeposited tillite material in South America with rising of sea level on carbonate Platforms of N America, Europe and Asia *(P.E. Isaacson, University of Idaho, Moscow, Idaho USA, **J. Hladil**, J. Shen, Macquarie University, North Ryde, N.S.W., Australia & J. Kalvoda, Masaryk University, Brno)*



The Late Devonian glaciation in Gondwana show several progradding maxima. Thickening of ice sheets was reflected by emergent carbonate banks in tropical belt. Global lacunae mark the maximum depressions of sea level alongside the paleo-continental cratonic margins in present N America, Europe and Asia. Lowstand eutrophication is common, if the basins cannot sufficiently communicate with basic ocean reservoir.
Gondwana's Devonian glaciation events occurred over a broad area, including much of Brazil (Paranaiba, Amazonas, and Solimoes basins) and Bolivia (Madre de Dios and Altiplano areas of the Paleozoic foreland basin). There is evidence of its extent into Equatorial Africa. It is dated within at least the LE, LN and VI palynozones. In North America, central Europe and southern China there is a coeval sea-level fall that exhumed and eroded carbonate platforms, deposited siliciclastics, and generated lacunae in the Famennian record. The lowstand resulted in extensive carbonate breccias, shoal-deposits and evaporites in western USA Lowstand clastic-wedges were deposited in a major forced regression in black shales (eastern USA).
The glaciation was apparently responsible for lacunae in the Famennian rock-record in many places. In Moravia, Famennian physil and siliclastic influx increased as a result of weathering in newly-emergent highs that resulted from sea-level drop.
Partial sea level drops were manifested by ferruginous oolites, which developed in nearshore environments and were subsequently dispersed onto adjacent slopes by storm resedimentation. In southern China, aggradation, siliciclastic influx, dolomitization from evaporation, and shallow-water carbonates resulted from Famennian sea-level lowering. Microbial reefs were present at this time. The coupling of glacial and lowstand events explains the sudden appearance of shallow-marine, as well as subaerially-affected features within a previously transgressive sea.

Subproject: 3D reconstruction of environmentally and stratigraphically significant organisms (***P. Čejchan***)

A 3D reconstruction of the morphology of an index tabulate coral *species Caliapora battersbyi* from the serial sections, actually peels, using the computer tomography. Preparation of serially arranged peels (0.1 mm interval). Documenting, and registration of peels. Digitalization using a stereomicroscope with a digital camera. Vectorization of the data, digital contour maps. A volume 3D reconstruction using Delaunay triangulation.

Other established international research groups

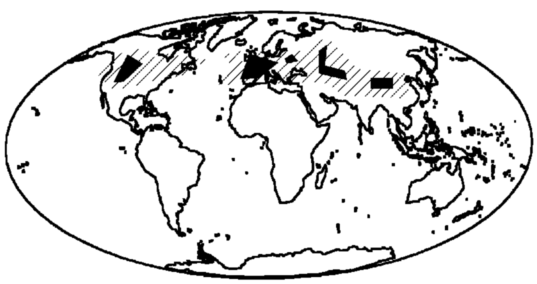
SEPM Research Group on Marine Authigenesis (FROMAGE); (*C. Glenn, University of Hawaii, K. Follmi, University of Neuchatel*)

Subproject: Invertebrate coprolite investigations in the rocky-coast facies (late Cenomanian-early Turonian, Bohemian Cretaceous Basin) (***J. Žítt***)

Studies of coprolites from deposits presently exposed at the locality Plaňany revealed that together with small invertebrate faecal pellets also the large shark coprolites occur in both sandy and marly facies above the conglomerate bodies. Maximum concentration of invertebrate coprolites occurs in beds closely below the firm siltstones called "scyphia opuka" and in their basal horizon. Similar type of distribution is confirmed in some other rocky-coast sections (e.g., Velim, Nová Ves). In the coprolite associations the ovoid types prevail. The distributional data on coprolites combined with those on microfauna and taphonomy of macrofauna (presently under the study) will be used for precision of knowledge of the Cenomanian-Turonian boundary deposition and environments in the basin.

Grant Agency of the CR

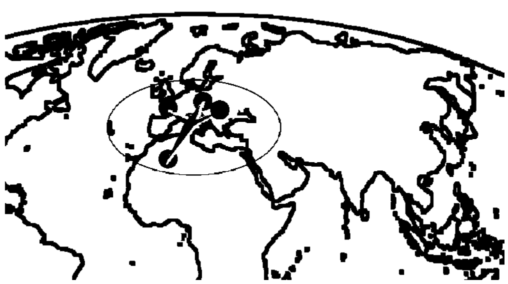
No. 206/99/1321 Review of the fossil discoglossids of Europe and their role in evolution of European anurans (***Z. Roček***)



Discoglossidae are among the earliest representatives of anurans and, at the same time, they are comparatively well represented today as well. By their extraordinary broad stratigraphic range they belong among those extant terrestrial tetrapods which have extremely long span of their existence (nearly 200 million years). This makes them available as an object for studies of rate of morphological evolution, of evolutionary adaptability, etc. In Europe, Mesozoic discoglossids are well documented by *Eodiscoglossus* from the Middle Jurassic, and by a new material from the Upper Jurassic, all in Great Britain. The Lower Cretaceous discoglossids are represented by *Eodiscoglossus, Neusibatrachus* and some other firms from Spain, Portugal and southern France. The earliest Tertiary record of discoglossids in Europe comes from the Middle Paleocene, Danian of Belgium. Then, the record is moreless continuous till the Recent, being represented by the genera *Latonia*, *Discoglossus* and *Bombina*.

No. 205/98/1347 Paleobiogeography of Central European Variscides (***A. Galle, J. Hladil, P. Čejchan & L. Slavík***)

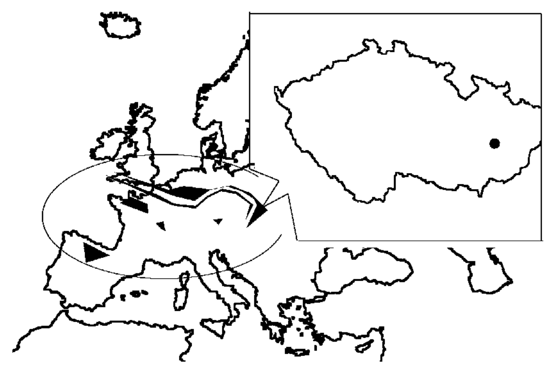
Subproject: Migration routes of Hyostragulidae and evolution of mid-Paleozoic basins (***A. Galle***)



Known species of *Hyostragulum* occur in central Bohemia and Morocco, *Marekstragulum* is known from Moravia and from Armorican Massif.
Paleogeographical reconstructions position the East Avalonia Terrane (EAT) containing Moravian Paleozoic close to Baltica as soon as at Early Silurian while Armorica-Perunica Terrane (APT) with Armorican Massif

and Barrandian were close to N Gondwana with Morocco. To enable the exchange of hyostragulids among Armorican part of the APT and Moravian part of the EAT, and among Perunica part of the APT and Morocco, the APT should have rotated. Such counter-clockwise rotation (140°) after the end of Silurian and before the Middle Devonian has been proved paleomagnetically.
Hyostragulidae are considered tabulates of uncertain affinities. Presumed planktonic planulae of the tabulate corals enabled considerable geographical distribution of some genera. Hyostragulids occur in relatively small area of peri-Gondwanan terranes and of nearby mainlands which indicates short planktonic stage. The distribution of hyostragulids indicates that through the Early Devonian, Perunica with Morocco and Armorica with Moravia, respectively, reached such position as to enable mutual exchange of hyostragulids.

Subproject: Significance of cupressocrinitids for paleogeography of eo-Variscan basins (***J. Hladil*** & *J. Le Menn, University of West Brittany and Oceanographic Institute, Brest, France*)



The Middle Devonian crinoid columnal assemblage from Čelechovice comprises at least eleven taxa, which may be considered as a medium biodiversity for this stratigraphic interval. Morphological disparity presents an important variety of articular facet types with pentameral, radiate, tetrameral symmetry, well-developed perilumen and very simple radiate. The Čelechovice association is dominated by three species: *Grisetocrinus uresi* Le Menn, *Cupressocrinites* sp. "M" and *Fleckenbergocrinus moravicus* Le Menn. Other taxa are scarce.
The genus *Fleckenbergocrinus* has been recorded at present only from the Eifel (Germany) and Dinant (Belgium) basins. Also, *Grisetocrinus uresi* shows the closest affinities *with G. diversiformis* from late Givetian of Boulonnais (northern France). These data are indicative of paleobiogeographic relationships of columnals from regions extending from the Boulonnais to the Dinant Basin through the Eifel to the Holy Cross Mts. and belonging to the southern margin of the Laurussia.
Occurrences of the same *Cupressocrinites* remnants may be drawn among Čelechovice, Konice and Horní Benešov (CZ), Gondelsheim in Eifel (D), and Skały-Grzegorzowice (PL). However, the cupressocrinitid columnals from Barrandian area differ from the Moravian specimens. Specimens from north Hungarian Szöndrö Hills display slightly increased similarity to Čelechovice, but the Graz specimens are again very different. This pattern of dispersal is basically in agreement with conclusions based on corals and trilobites by Hladil and Chlupáč, respectively. Although cupressocrinitids have been recorded in numerous regions in the world, their absence in some regions of the North Gondwanan domain (Armorican Massif, Aragon, Saoura and Tindouf) or in Laurentian subcontinent of the Devonian times is significant. The Eifelian bloom of these Laurussia-related ("Čelechovice") cupressocrinitids keeps the Rhenish and Harz basins together. And it is a good argument against the ultranappistic opinions about Harz-Giessen nappe as a portion of Devonian peri-Gondwanan or "African" sediments. It is also seen in Moravia, where mid-Devonian cupressocrinitid links among Čelechovice, Konice, Leskovec and Horní Benešov also keep these basins together.

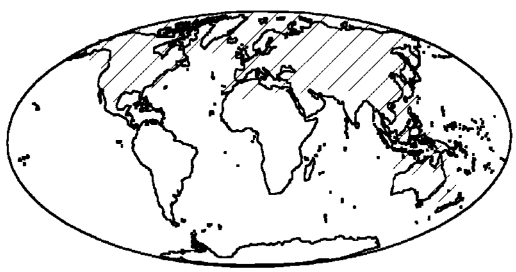
Subproject: Programming of the existing similarity and distance coefficients for quantitative paleobiogeographic reconstructions: implications for data about rugose corals (***P. Čejchan***)

Performance in the main models of possible paleobiogeographic evolution has been investigated (vicariance vs. amalgamation, formation and ceasing of barriers, or migration pathways). Version 2.22 is programmed as a C library and published, due to its volume and character, electronically. It is accessible anonymously at ftp://ftp.uchicago.edu. Application of a new algorithm for palaeobiogeographic reconstruction to occurrences of lower to middle Devonian rugose corals of the Perigondwana. Studies are realized in co-operation with *A. Galle*, who took care of the database. Comparison of Pragian faunas of Iberia, Barrandian, and Thuringia. Pragian faunas of the Barrandian are similar to those of Thuringia, but they differ, surprisingly, from the Iberian ones. This surprising result apparently supports the idea of a peri-Gondwanan ancestry of the Saxo-Thuringia, at least their connection without distinct palaeobiogeographic barrires. Lesser similarity of Barrandian and Iberian faunas we explain by differrent bathymetric conditions (Barrandian faunas are relatively shallow water ones, whereas the Iberian ones come from deep water). There is also a possibility of small-scale isolation of Iberian terranes, presumingly in the Prototethys area (sensu Ziegler).

Main results: (1) support of the idea of the Perigondwanan ancestry of the Saxo-Thuringia; (2) Migration of the Givetian faunas out of Gondwana; (3) separation of Moravia and Poland in the Frasnian is apparent; (4) 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 palaeogeographic reconstructions, a system of sub-parallel ridges and valleys developed in the Mid-European Varscides, represented by the Devonian and Carboniferous precursors of the units, which were later, during the Variscan orogeny, built into the Rheno-Hercynian, and Bohemian Units, and to the Moravosilesian and Moravian Units that surrounded the southern margin of the Laurussia. Faunal and floral assemblages of individual ridges differ from each other,and, moreover, they are influenced by the migration from the Barrandian terrane of the North-Gondwanan origin. Comparison of assemblages with the PAUP program helped to asses the faunal similarity between the individual ridges of the Mid-European Variscides.

Subproject: Review of conodont endemism and its significance for paleobiogeography ***(L. Slavík)***



An extensive review of worldwide Lower Devonian conodont distribution and biostratigraphy was elaborated and more than 300 quotation were treated. However, global coverage of adequately described Devonian conodont faunas is certainly not uniform, nor is it as densely spaced as might be desired. The largest amount of information derives from North America, Europe and Australia, with some data from North Africa and Asia. But, nearly nothing is known as yet of Devonian conodonts from any part of circumpolar Gondwana, except the Peruan and Bolivian findings. Although many of Devonian conodont genera were cosmopolitan, this proposition cannot be applied as regards the level of individual species and subspecies. The highest conodont diversity and concentration of endemic taxa of Lower and Middle Devonian can be observed in North America (especially in Yukon Territory, central Nevada, East-Central Alaska), eastern Australia (Queensland, New South Wales, Victoria) and Spain (Santa Creu d´Olorda, Central Pyrenees, Guadarrama). Other endemics could be also found in other areas of the world (e.g., Tian Shan, Zeravshan Range in Uzbekistan, Morocco and Europe). In contrast with the prevailing concept of cosmopolitanism (= Late Devonian open with *Palmatolepis*-dominated biofacies), the existence of Early Devonian provinces has been suggested in several studies. The restricted distribution of some conodont species and the widespread distribution of others can be explained by endemism developed largely in isolated, near-shore biofacies and by dispersal of the widely distributed taxa of the offshore biofacies via oceanic currents. For example, there exist many faunal similarities between Nevadan and Spanish Lower Devonian (Lochkovian) conodont zonation, which could be also applied for both Hercynian and Rhenish magnafacies in Europe. The faunal assemblages from Europe also well correspond with those in Morocco. Furthermore, preliminary results of biostratigraphic studies from Barrandian area strongly support this idea. However, here should be pointed out, that every comparison is based on similar facial development, and the real dispersal of faunas was strongly controlled by paleogeography and ocean circulation. Conodont fauna and stratigraphic ranges described from several Barrandian sections correspond with those from Moroccan Meseta and partly also from Anti-Atlas. It reflects a close paleogeographic relation of these areas, as they were a really interconnected sub-region. On the other hand, there exist many differences in juxtaposition between Australian, Asian and European conodont faunas.

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

Subproject: Development of "heavy" oxygen isotopic anomaly in Devonian of Prague Basin: geochemical, paleogeographical and stratigraphical constraints (***J. Hladil**, J. Hladíková, Czech Geological Institute, Prague & J. Košler, Charles University, Prague*)

Further documents for unusual heavy oxygen anomaly in Prague Basin have been collected.
The $\delta^{18}O$ values of brachiopod shells from Wenlock to Lochkovian oscillate between -6.5 and -4.5 %, samples from Pragian show higher $\delta^{18}O$ values, but the highest $\delta^{18}O$ values (about -1.5 %) were found for Emsian. Comparing oxygen isotopic composition of brachiopods and micrite from Pragian-Eifelian stages, it is evident that micrite is richer in ^{18}O than brachiopods. The one reason for enrichment of micrite in heavier oxygen isotope could be lithification of micrite in separate, deep- and cold-water basin. The $\delta^{18}O$ values for Givetian brachiopods were close to -4 %, whereas for Givetian sediments were found $\delta^{18}O$ values close to -7 % (inverted difference). According to international state-of-the-art, the "normal" values of unaltered Devonian brachiopods are lower than -4 % PDB.
Higher $\delta^{18}O$ values, which were found for the Emsian and Eifelian samples of Prague basin, are typical for material formed in colder water or material originating in water with higher $\delta^{18}O$ values. The Prague basin formed probably a depression within the peri-Gondwanan shelf; sheltered by linear archipelagos. Of course, the Prague basin was never separated completely from the open ocean because the migration of the open sea fauna was uninterrupted. These anomalous isotopic compositions of carbonate materials end in late Kačák sediments, Eifelian-Givetian, when exchange of water with surrounding ocean restored. High $\delta^{18}O$ values of the Pragian-Eifelian basins behind the Koněprusy reef corresponds to separation of basin water, because the Koněprusy reef was close to ocean and reflected this $\delta^{18}O$ anomaly to a smaller extent.
Analyses of trace elements on ICP MS (J. Košler) allow to parallel increased amounts of zinc and nickel in brachiopod calcite with the occurrence of the above mentioned "heavy oxygen" anomaly, giving supplementary evidence about different composition of the sea water behind the Koněprusy reef. However, the low La/Ce ratios warrant almost primary oxygen isotope compositions in the analyzed brachiopods, because the contents of cerium are not depleted. The diagenetically changed samples compared as undesirable for our studies show both depletion in cerium and enrichment in manganese.

Subproject: Sedimentological and paleobiological data about environment on Devonian Koněprusy reef and comparison with adjacent areas: new corals and new implications (***A. Galle, J. Hladil** & A. May, Universität Münster, Germany*)

The study of the rugose coral *Joachimastraea barrandei* added to the knowledge of the paleoenvironment of the Early Devonian Koněprusy reef. Two groups of the corals were recognized: common thickened corals worn as pebbles postmortally and resedimented in the reef gravel, and attenuate unworn corals often in the life position.
J. barrandei is considered the member of the second - younger - group of corals. We suppose that the massive forms of the first group lived at, or close to, the wave-resistant reef wall and their skelets were then deposited on the reef flat A. After lithification they were freed through the wave or current action and worn as pebbles on another, younger reef flat B together with other material such as clasts of older reef rocks, crinoid columnals, or stromatolith fragments. Reef flat B have been populated with numerous large coral heads of attenuate species. Even more delicate forms of corals and other sessile and vagile benthos lived in the lee of the coral heads or gravel banks or in the depressions, while small rugosans dwelled in the deeper quiet-water pools of the reef flat B. The coral *J. barrandei* probably lived in the protected cavities of the coarse reef debris.

We presume that the Koněprusy Devonian is the remnant of the large reef complex comparable to Recent oceanic atolls or barrier reefs. Such structure requires massive supply of the oceanic water from the deep large basin to supply the reef with nutrients, carbonates, and oxygen. As known non-reef Pragian of Barrandian does not meet such requirements we presume the existence of large deep oceanic basin in the close vicinity of Barrandian (Galle et al., 1999).

Subproject: Biostratigraphic framework for isotope studies based on conodonts, Late Lochkovian to Early Pragian ***(L. Slavík)***

The evolution Early Devonian sedimentary environment in Barrandian area represents a complicated succession of geological causes and effects. It is documented by great facial diversity of Lower Devonian sediments, and, what is very distinctive, expressed also in composition of conodont assemblages. The conodont facies and thanatocoenoses considerably fluctuate between the sections in close neighborhood. This situation concerns also biozones or index taxa between Lochkovian and Pragian:
In the lower part of the Karlík Valley section was documented Ozarkodina eurekaensis Zone from samples taken from Kotýs Limestone. This zone is characteristic for lowermost Lochkovian. In stratigraphically continuous succession, other Lochkovian ones should follow this zone, but no zonally diagnostic taxa were found above this interval. About 10 meters upward from the last sample with eurekaensis Zone already begins Pragian sedimentation of Dvorce-Prokop Limestone with characteristic Pragian conodont fauna (e.g., *Latericriodus steinachensis* Al-Rawi *eta morph* Klapper et Johnson, 1980 and *Pelekysgnathus serratus* Jentzsch, 1962). As well as in the Čertovy schody section, where is also upper part of Lochkovian missing (namely Pedavis pesavis Zone), here also may be supposed the global eustatic lowstand that well corresponds with the cycles pre-Ia and Ia of the North American Eustatic Curve. In two other studied sections (Barrandov-Hlubočepy and Na Požárech quarry), the uppermost Lochkovian pesavis Zone was not recognized. Based on the above given facts, in several Barrandian sections exist considerable stratigraphic lacunae (or condensations), which are connected to mostly sharp facial change from Lochkovian to Pragian facies.

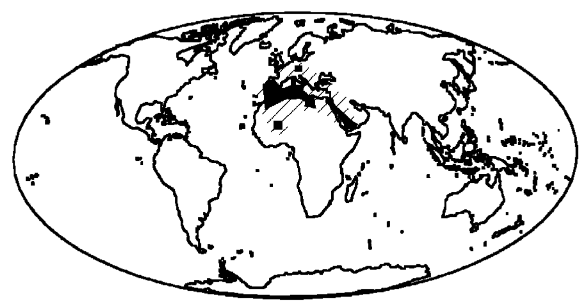
No. 205/99/1315 Nearshore taphocoenoses across the Cenomanian-Turonian boundary (Bohemian Cretaceous Basin) (***J. Žítt, L. Peza*** & *B. Záruba, National Museum, Prague*)

Sampling in the rocky-coast facies of the Karlov and Radim sections was finished in 1999, while in some others (e.g., Velim, Nová Ves, Starkoč, Zbyslav) they will continue in the year 2000. The attention was focused on the hardground horizons (omission or decreased rate of sedimentation) with apparent mineralization (phosphatization), boring and encrustation by epibionts. The age and sedimentary environment of the overlying silty beds will be precised by use of foraminifers and palynomorphs (under study). The taphonomic macrofaunal features of the pre- and post-hardground environments preliminarily show clear differences in biostratinomic aspects, lack of category of massive bioclasts, upwards decreased rate of fragmentation etc. In hardground areas, the post-omission sedimentation started with a slight local reworking and most basally by enrichment of phosphatized sponge-derived intraclasts, small oysters and invertebrate faecal pellets. The basal enrichment by sand particles is more expressed in Karlov (here with enormous content of heavy minerals with garnets and rutile prevailing) and absent in Radim. Skeletal features of some oysters limit the possibilities of their fossil record in this horizon (find and study of thin wrinkled shells as yet unknown in the BCB). The study of massive skeletons in limestone and conglomerate bodies (pre-omission) was started on materials of rudists and oysters. In this sense the new exposures in Plaňany seem to be very important (*Rastellum diluvianum* and extremely massive shells of ?*Ostrea*? *leymerie* Deshayes (new species in the BCB), recording the long-term environmental characters). The problems of *Amphidonte (A.) reticulata* and *A.(A.) haliotoidea*, and their mutual relationships (principally the record of closely similar juveniles) in connection with taphonomy (determination of "major fragments") is solved.

Taphonomic features of remains of benthic species coincide with existence of suitable living conditions near or directly in the sheltered depressions of the bottom and trapping effects of these environments, especially during intervals of lowered sedimentation rate and burial of organic remains (case study of echinoids, taphocoenose with *Gisilina rudolphi* and *Goniopygus* cf. *menardi*). The same effect shows the rapid deposition of bioclastic sediments with extraordinary preservation of local populations of minute platidiid brachiopods (?*Aemula*).

The rudist genera are represented as follows: *Monopleura* Matheron, 1843 (one species), *Araeopleura* Cox, 1965 (=Stenopleura of Počta, 1889), (five species), *Petalodontia* Počta, 1889 (seven species), *Simacia* Počta, 1889 (one species), *Valletia* Munier-Chalmas, 1873 (one species), *Caprotina* d'Orbigny, 1850 (13 species), *Caprina* d'Orbigny 1822 (3 species), *Caprinula* d'Orbigny, 1847 (one species), Ichtyosarcolites Desmaret, 1817 (3 species), *Plagioptychus* Matheron, 1843 (one species), *Vaccinites* Fischer, 1887 (one species, given for the first time), *Radiolites* Lamarck, 1801 (8 species), *Durania* Douville, 1908 (one species)**,** *Cryptaulia* Počta, 1889 (3 species)

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



Graptolite faunas so far described from North Africa and Arabia have been reviewed (together with D.K. Loydell, Univ. of Portsmouth, UK) from the point of view of using graptolites to date black "hot shales" which are the most important petroleum source rock on the Saharan Platform and also an important source rock on the Arabian Peninsula.

Since many papers provided only a list of fossils identified without any descriptions and figures and major revisions of earlier described taxa still remain to be done, only a limited amount of published graptolite data may be employed in high resolution correlation of the area in question. Recent revisions suggest that many species have been regularly misidentified.

The graptolite assemblages differ significantly between inner and outer shelf environments. Outer shelf assemblages are characterized by diverse graptolites well assignable to biozones. Inner shelf graptolite assemblages are usually monospecific or oligospecific associations, usually of long-ranging taxa. Thus, it is quite often difficult to date inner shelf assemblages with a precision higher than to a few biozones and a series respectively. Unfortunately but not surprisingly, most of the faunas are of this latter, low diversity type in Niger, Mauretania, Libya, Algeria and, less so, Tunisia. When using graptolites to date the NW Gondwanan "hot shale" the most serious deficiency is almost entire absence of basal Silurian biozonal index *Parakidograptus acuminatus* and of many other Rhuddanian and Aeronian zonal diagnostic species. Of zonal index taxa, just *Cystograptus vesiculosus*, *Stimulograptus sedgwickii* and few Wenlock species are present. Not only are the North African inner shelf faunas of low diversity but several of the taxa exhibit some degree of endemicity (e.g., *Normalograptus tilokensis*, *Glyptograptus tariti*, *Neodipl. africanus* div. ssp). Other species originally described from North Africa, however, are now being identified also in adjacent peri-Gondwanan Europe (*Neodiplograptus fezzanensis*, *Paraclimacograptus*? *libycus* (syn. *brasiliensis*), *Parapetalolithus meridionalis*, *Metaclimacograptus asejradi*, *Metacl. flamandi*) where they co-occur with diverse, zonal diagnostic assemblages. Despite some limitations, the North African and Arabian graptolite records made possible to date the Lower Silurian black shale sequence in which the "hot shale" deposition interval corresponds to Early Llandovery (Rhuddanian). Locally, additional "hot shale" horizons developed in Late Llandovery and Wenlock respectively.

Along with above described research, the OMV Oil Company provided a new graptolite material collected from two localities in Kufra Basin. Single but important species – *Neodiplograptus fezzanensis* indicates monospecific inner shelf assemblage of Late Rhuddanian age (correlatable to *cyphus* Biozone).

Grant Agency of the Academy of Sciences CR

No. 301-3-906 Early Palaeozoic extension in the Central European realm: sedimentary, volcanic, fossil and palaeomagnetic record of the Barrandian (Bohemian Massif) (***P. Štorch, F. Patočka, P. Pruner*** & ***J. Svobodová***)

The Present state of knowledge of the Barrandian area was reviewed be means of both new and old, reevaluated data. The Barrandian (or Teplá–Barrandian) terrane represents one of the easternmost relics of the Late Proterozoic (Cadomian) terrane chain incorporated into the Variscan belt of Europe from the northern Bohemian Massif to the eastern Paris Basin. Early Palaeozoic volcanism of the Barrandian area splits into two different types. Cambrian subaerial explosive and mostly intermediate to acid WP-like volcanism (andesites, rhyolites and scarce basalts) accounts for crustal contamination (via the AFC) and/or crustal origin of anatectic melts. This volcanism ceased during the early Ordovician, and was rapidly substituted by predominantly submarine WP-like basaltic volcanism, which lasted with several interruptions until the middle of Devonian. Both Early and Late Cambrian volcanics indicate tectonic setting of incipient extension of thinned continental lithosphere. This corresponds with high subsidence rate along NE–SW-striking synsedimentary normal faults during the deposition of the Early to Middle Cambrian continental siliciclastics, and development of transtensional structures and associated granitoids dated at 480–530 Ma (U–Pb zircon) penetrating the Cadomian basement of the western part of the Barrandian terrane. From the Ordovician (Arenig) to the Middle Devonian (Eifel), the volcanics trend from alkaline WP-basalts towards tholeiitic to alkaline basalts. Extensional regime continued and resulted in considerable widening of the Barrandian Prague Basin. Early Ordovician granitoid inclusions in the Barrandian Ordovician basalts are considered by some authors to be a further evidence for continental lithosphere extension. Maximum extension of the Prague Basin was achieved in about the middle of the Silurian as indicated by geochemical features of synsedimentary basaltic volcanism and the Silurian sedimentary record (indicating withdrawal of the clastic material source regions). Local conditions were, however, significantly overprinted by large-scale eustatic fluctuations. Sequence stratigraphic analysis of the Late Ordovician–Early Silurian sedimentary fill of the basin is being tested in order to separate local geotectonic movements from eustatic sea-level changes. The existence of accurate, high-resolution biostratigraphic data is the key to the sequence stratigraphic interpretation.

No. 301-3-801 Brachiopod fauna of the Kössen Beds (Uppermost Triassic) (***M. Siblík***)

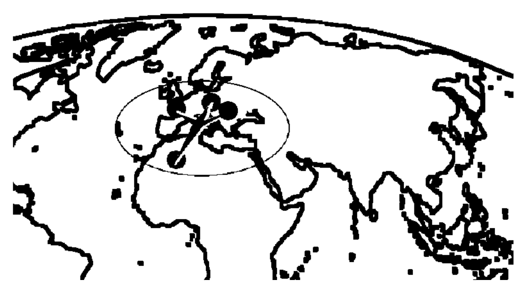
Field works in the Kössen Formation at Hochalm near Unken (Tirol, Austria) were focused on Units 2 and 3 of the Hochalm Member in the area among Kuhstein, Rosskar and Hochalm. Clusters of *Rhaetina gregaria* and of pelecypod *Gervillia inflata* are characteristic of the *Rhaetina*-Biofacies, resp. *Gervillia*-*Atreta*-Biofacies (all sensu Golebiowski, 1991). *Rhaetina gregaria* is practically the only species occurring in Unit 2 – biodetrital limestones with limonite crusts (partly "Schwabische Fazies" of Suess and Mojsisovics, 1868). Younger biodetrital limestones along the road from Hochalm to Rosskar yielded already more varied brachiopod fauna: *Rhaetina pyriformis, Zeilleria norica, Zugmayerella uncinata* and rare *Fissirhynchia* cf. *fissicostata* (? juv.). These limestones correspond with the *Zugmayerella*-Biofacies of Golebiowski and lithostratigraphically to his Units 3–?4 of the Hochalm Member (partly "Karpatische Fazies" of Suess and Mojsisovics 1868).
Sampling in the Upper Triassic Dachstein Limestone in the area of the Karlhochkogel Mt. (Hochschwab Mts., Styria) yielded material comparable to some Kössen species, e.g., *Sinucosta* ex gr. *emmrichi* and numerous specimens of *Oxycolpella eurycolpos* – a Norian forerunner of Kössen *Oxycolpella oxycolpos*.
Study of brachiopods coming from the type locality of the Kössen Member – Weissloferbach Valley near Kössen in Tirol – and deposited in the collections of the Staatliches Museum für Naturkunde in Stuttgart (coll. Urlichs 1972) showed much lesser average size of the characteristic rhynchonellid

Fissirhynchia fissicostata in comparison both to the specimens of the same species from classical localities of the Kössen Member in the Piesting Valley near Vienna, and from another localities in the surroundings of Kössen. The fieldwork planned for the next year in the Kössen area will possibly show the facies differencies at different localities that could substantially influence the size and other characteristics of brachiopod shells.

No. 601-3-701 Evolution of the amphibian assemblages of the central and eastern Europe in the Tertiary, in context of palaeoclimate and palaeogeography (***Z. Roček***)

In Europe, succession of the amphibian assemblages can be followed from the middle Paleocene up to the Pliocene/Pleistocene boundary. Altogether eight anuran and six urodele families both with nearly 40 species were recorded at 291 fossil sites. The only family present throughout the whole Tertiary is the Discoglossidae. Since the late Paleocene the amphibian assemblages are joined by the Palaeobatrachidae, permanent water-dwellers which are the only anuran family to become extinct (as a consequence of Pleistocene climatic deterioration). During the Eocene, these two families (endemic for Europe) became accompanied by the Pelobatidae and Pelodytidae. Eocene amphibian assemblages are represented by hyperossified forms typical for contemporary warm tropical regions. It is of great palaeogeographical importance that these forms may include *Thaumastosaurus* which is the only leptodactylid frog found in Europe; this supports the hypothesis of the terrestrial connection between the today‘s Europe and former Gondwana. Leptodactylids penetrated only to western part of the continent and disappeared at the end of the Eocene.

No. 301-3-807 Hyolith-Epibiont Relationships: Taxonomy, Nature of Symbiosis, and Spatial/Temporal Distribution (***A. Galle***)



Family Hyostragulidae fam. nov. with a new genus of *Marekstragulum* was introduced. True septa were observed in hyostragulids, a structure originally called “septum” was newly named “clitella”. *Hyostragulum* occur in the Barrandian and in Morocco, *Marekstragulum* is known from Moravia and from the Armorican Massif. The distribution of hyostragulids indicates that during Early Devonian the respective terranes reached the position which enabled mutual exchange of the hyostragulids. Studies on non-hyolithid benthos from the St. Prokop Quarry (Pragian, Dvorce–Prokop Lst.) proved that epibionts preferred the hyolithids to other groups. 509 hyolithid individuals bear 132 epibionts, i.e., 26 %. Epibionts occur only on hyolithids, not orthothecids. They are known only on *Pterygotheca* (386 individuals) and are represented by only one species *Hyostragulum mobile* Marek and Galle, 1976 (132 individuals), i.e., 34 %. No other epibionts but *Pterygotheca* occur on *Hyostragulum.*

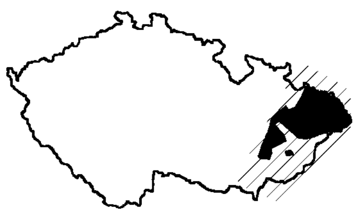
Epibiontic bryozoans are known on hyolithids from the Ordovician of Wisconsin, Scandinavia, and Baltic states. Their zoaria cover an entire hyolithid shell, zooecia on the ventral part of the shell being shorter than those on the dorsal part. We consider it proved that bryozoans grew on hyolithids during their life. Serial sections show “bald” ventral parts close to apex of the shell: we speculate that the apertural part of the Ordovician hyolithid was elevated above the sea bottom, resting on its apex and helens.

As argumented above, various faunal groups in distant geological times preferred the hyolithid shells as their substrate. We speculated of following possible reasons: (1) Hypothetically, the hyolithid shells may have differed from the shells of other groups in their chemical or physical properties. Larval stages of epibionts could have settled also on other shells but they did not survive or preserve because of the

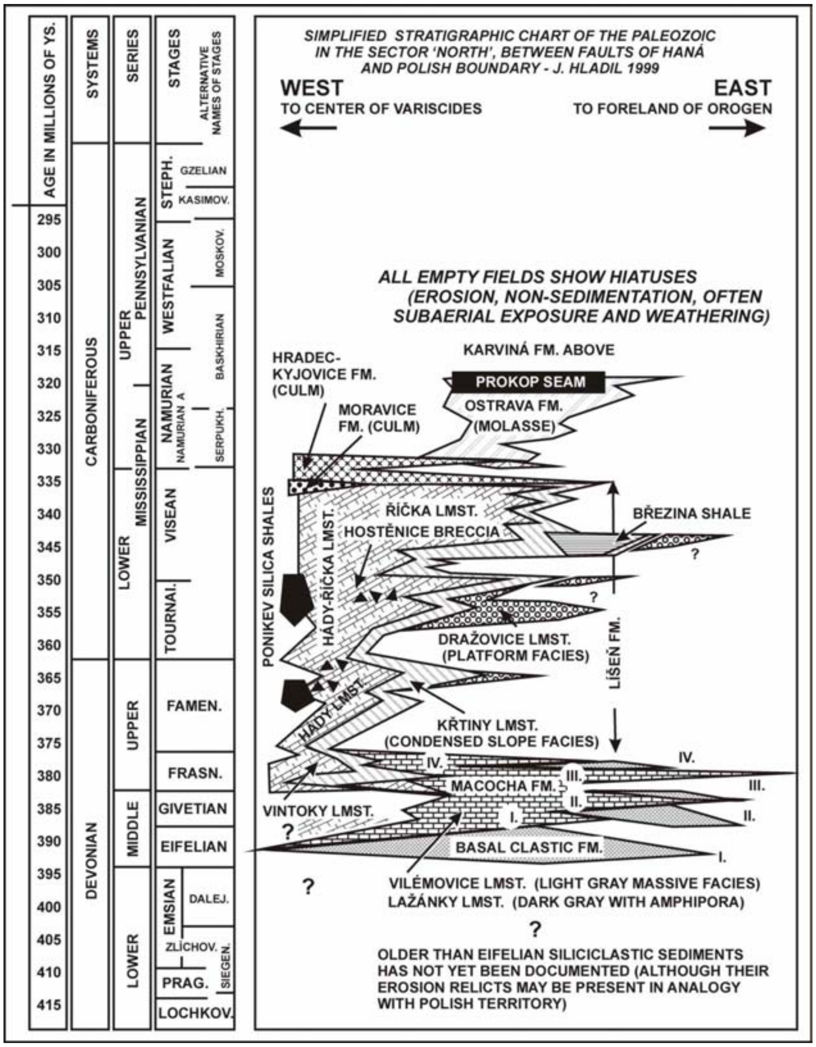
shell properties; (2) Hyolithids did or produced something extremely attractive for the epibiont's nutrition (as is the acceleration of the nutritional current according to Bernoulli's principle because of hyolithid's ligula-operculum profile).
Epibionts of a new enigmatic genus *Quotusquisque* are described from the Bohemian Devonian. They lived on extremely small (up to 3 mm) hyolithid shells, preferring certain hyolithid taxa. As the non-hyolith benthos from the localities with *Hyostragulum* and *Quotusquisque* bears rare or none epibionts, we consider hyolithids not a mere substrate but attractive hosts of epibionts of some, yet unknown reason.

No. 301-3-809 Assessment of regional and eustatic sea-level changes on the Devonian carbonate platform bordering southeastern edge of the Bohemian Massif (***P. Bosák, J. Hladil, A. Galle, P. Čejchan & L. Slavík***)

Subproject: Revision of basic rock characteristics and major cycles in the Macocha Formation (***J. Hladil*** & *L.F. Jansa, Geological Survey of Canada, Atlantic Branch, Halifax*)



The carbonate rocks of the Macocha Formation (M. to U. Devonian carbonate platform and reefs) are accessible in outcrops in the Moravian Karst, in the neighborhood of Čelechovice and Hranice n. M., and are widely distributed in the foreland and basement of the West Carpathian Mountains in Moravia. Current information from exploration wells and models of subsurface distribution indicates a subcrop area of 20,000 km^2 within the Czech Republic. Total volume is estimated at approximately 7,000 km^3, i.e., 26 trillions (10^{12}) tons of carbonates. With the exception of the lowermost parts of transgressive tracts in carbonate cycles, the carbonate rocks consist mostly of calcite (usually 97 wt. %). The contacts between the cycles show increased amounts of clay, quartz sand or mica, with dolomitization and silicification. Similar impurities and alterations are characteristic for sediments deposited at nearshore, where the carbonate complex was originally thinner. Predominant lithologies are biodetrital wackestones to packstones (43 % vol.). Floatstones, bafflestones, boundstones and other reef- or platform-related types of sediments, rich in micrite, form 23 vol. % of this carbonate complex. Bioherms, patch reefs and reef banks occur only in the upper parts of sedimentary cycles. Many rocks (65 % vol.) are darker than MUNSELL N4 but show relatively small amounts of C_{org} > 0.02 % wt. This dark colour is attributable to minute inclusions of pyrite and iron oxides dispersed in carbonate crystals as well as along microscopic dissolution seams. The isotope compositions of these carbonates show significant cyclic changes, where $\delta^{13}C$ values increase higher in the cycle but $\delta^{18}O$ values decrease in the same direction. This divergence is interpreted as a result of rising activity of algae (carbon) and vadose alterations in upper parts of the cycles (oxygen).
The whole carbonate complex corresponds to one huge cycle, which persisted for 20 Ma. Such duration is in general agreement with the ranges of the largest eustatically controlled sequences. Four main cycles of this complex correspond to several millions of years (Čelechovice Cycle – Late Eifelian and Earliest Givetian; Býčí skála Cycle – Early to Middle Givetian; Ochoz Cycle – Late Givetian to Middle Frasnian; Mokrá Cycle – Late Frasnian with rare continuation after F-F). These cycles involve other cycles about 1m.y. long and 120,000–140,000 years long. Very characteristic is a short sequence of strata consisting of three depositional phases: intertidal laminite, lagoonal Amphipora bank and reef-bank boundstone. These cycles fluctuate from 0.2 to 1.2 (0.6) m in thickness. These short cycles may correspond, very roughly, to 20,000-year intervals.



The most extensive transgression of Paleozoic seas south of Ostrava was of Frasnian age (Macocha Formation, the Ochoz Cycle) (J. Hladil)
The global sea-level depressions during the Famennian and Tournaisian caused repetitive subaerial exposure in the east and south of sector "North"

Subproject: Investigation of prominent biostratigraphical markers in limestones of carbonate platform (Devonian, southestern border of the Bohemian Massif): study on *Wapitiphyllum laxum* (***A. Galle***)

Wapitiphyllum laxum (Gürich, 1896) is the index species of W. laxum Biozone in the Moravian Karst and in the subsurface Devonian of Moravia. Its uppermost occurrence has served as a marker for the Givetian/Frasnian boundary. The species occurs in the following boreholes and depths of the drilling areas "Center" and "North": Švábenice-1 # 1,834.6 # 1,860.0 # 1,863.5; Janovice-7 # 1,719.6; Ostravice-NP824 # 1,885.5; Nítkovice-2 # 1,702.0 # 1,707.0; Morávka-NP828 # 1,488.7; Kozlovice-SV4 # 2,084.0; Dražovice-2 # 1,048.0 # 1,051.0; Dřevohostice-1 # 1,694.5 # 1,700.0; Choryně-9 # 1,292.8; Rataje-1 # 1,481.0 # 1,485.0.
An ideal section – point 1071 (Habrůvka Gulch) – lies in the Moravian Karst. Beds 1071-2 and 1071-1 indicate fast sea-level rise with "drowning" of the underlying patchreef. Bed 1071-1 is considered a contourite and indicates considerable deepening of the sedimentary basin, as well as the presence of the sterile mudstone in bed 1071-2. The overlying bed 1071-0 contains numerous *W. laxum*, bed 1071-

3 contains the last occurrence of *Caliapora battersbyi* (*J. Hladil,* pers. comm). The W. laxum Biozone may thus indicate a considerable, short-lived sea-level rise throughout the Moravian Middle Devonian. This biozone is a prominent biostratigraphical marker for the termination of late Middle Givetian.

Subproject: Studies on detection of eustatically controlled periodicities in gamma-ray well-logs from platform limestones (***P. Čejchan & J. Hladil***)

Comparison of the gamma-ray, neutron and electric resistance records indicates good similarity in discrete high-frequency intervals. These intervals are relatively short in very shallow parts of the platform, at places with small thickness of the whole carbonate sequence. Lacunae in sedimentation usually increase landwards and they may represent significant intervals of the transgressive, falling-stage and lowstand phases. Records of early highstand intervals prevail. This fact is reflected by two significant technological constraints in the application of fast Fourier transformation (FFT) on the raw data sets from profiles: (1) Linearity of the scale is postulated, but the rate of sedimentation caused significant deflections in this linearity of the scale in many natural sections. (2) An uninterrupted record is theoretically required, but many sections in shallow-water parts of the platform show significant cuts in this record (hiatuses between sedimentary sequences of higher order and hiatuses between beds). It can be concluded that a search for eustatically controlled periodicities requires recalculation of the raw data to match the basic postulates of linearity and integrity of the data sets. Runs on strongly deflected raw series are not recommended, as they can provide completely misguiding results. Methods for corrections are developed.

Subproject: Environment-related characteristics of Late Devonian conodont assemblages ***(L. Slavík)***

Revision of conodont material from the Jedovnice and Křtiny boreholes show remarkable differences in conodont facies within the time span from Pa. rhenana to Pa. marginifera Zones, although the geographical distance between the southernmost Jedovnice and HV-105 Křtiny borehole is less than 5 km. Commonly composed, *Palmatolepis*-dominated assemblages are characteristic for Jedovnice (*Palmatolepis* 70 % in average), but the assemblages of Křtiny show remarakable amounts of *Polygnathus* elements (*Polygnathus* 40 %, in average). This trend is massively expressed as early as during the Pa. rhenana Zone, because many samples from Křtiny Road Junction are filled by minute polygnathids platform specimens (*Po.* ex gr. *webbi*). Monospecific blooms of different small polygnathids were depressed during the Kellwasser crises, but they re-appeared since Pa. crepida Zones and continued during the Pa. marginifera Zones. (*Polygnathus* 40 %, again). A very suggestive, well-documented time difference exists in the time ranges of otherwise common *Icriodus*-bearing interval. In this connection, the Jedovnice assemblages show almost normal rising abundance of Latest Frasnian icriodids (just before and during the F-F perturbations), whereas the "delayed" icriodid rise in the Křtiny assemblages occurs within the Pa. crepida Zone. Interpretation of this fact stresses very sigificant differences in early Famennian environmental dynamics in the Moravian Karst, where (1) the Jedovnice boreholes, and probably the Northern Moravian Karst Segment as well, show a deepening trend with spread of open-sea facies, and (2) the Křtiny borehole, and probably the Central Moravian Karst Segment as well, show prograding formation on carbonate shelves (*Polygnathus* – *Icriodus* biofacies of Dreesen and Thorez, 1980, contact with shallow tidal sediments). Sedimentation in the southernmost segments of the Moravian Karst is also specific. The assemblages around the F-F boundary are rather poor in taxa and elements. Preliminary, these southern parts would be characterized as a gradual development of subtidal *Palmatolepis*–*Polygnathus* biofacies (exactly, their thanatocoenoses). This biofacies was registered within the Famenian Pa. trachytera and Pa. postera Zones in the Mokrá quarries.

No. 301-3-802 Mineralogy, geochemistry and paleomagnetism of Variscan diastrophic sediments in the Bohemian Massif: provenance and paleotectonic interpretation ***(P. Pruner, F. Patočka** & **J. Hladil)***

Subproject: Vertical and lateral extents of Culm nappes during Variscan deformation: an evidence based on burial and exhumation history of carbonate rocks ***(J. Hladil** & **P. Pruner)***

The diagenetic, deformational and magnetic overprint on the Devonian carbonate rocks of the Moravian Karst (between Křtiny and Mokrá, NNE to E of Brno) show different timing of thermal and crystallization changes than assumed. The colour alteration index (CAI) for conodonts indicates a notable difference between "hot" and "cold" Variscan burial conditions in central and southern part of the Moravian Karst, respectively. However, a relatively well-preserved crystallization stages related to orogenic burial at Křtiny contrast with their damage at Mokrá.
Our study of crystallization and magnetic overprint in carbonate rocks shows that *this overprint is not related with orogenic deformation as it was formerly assumed, but is evidently post-orogenic.* This corresponds with isostatic end-Carboniferous exhumation of rocks from greater depths to shallow layers (of the partial Mokrá–Horákov nappes in this case). Especially, the B-component of remanent magnetization of rocks provides a good evidence for timing of this overprint. For example, the characteristics related to this component are practically the same in the Tišnov area (Brunnides/Moravicum) and Moravian Karst (Brunovistulicum/Culm Nappes). These diagenetic and magnetic overprints occurred at the time when Variscan orogenic deformations ceased to generate angular differences in movement of rock slices.
The convergence of diagenetic and paleomagnetic characters, which is seen on Paleozoic rocks of different paths, corrects our opinions and approaches in several directions:
(1) Lots of "Variscan" thermal gradients in sedimentary sections of Moravia reflect the end-Carboniferous crustal thinning and heating. This record (below 200 or 250 ^{o}C) is practically a post-orogenic overprint.
(2) The temperatures related to overprint do not differ to greater extent from the pre-existing deep-burial stages, because location in an accretionary prism is a relatively "cold" but deep place. Very roughly, an imaginary average path of exhumation can be realized as an isothermal decrease in pressure.
(3) Assessment of the pre-existing burial conditions must be based on information, which is older than this overprint (pre-existing crystallization stages, magnetic component(s) of A-type, mineral relicts, etc.). These data rather increase the possible extension and thickness of the eroded Culm nappes.

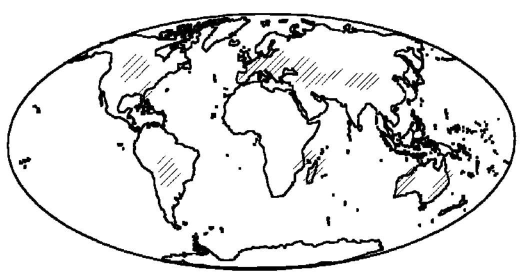
No. A 3013902: Fructifications and spore populations of plants of groups *Lycopodiophyta, Equisetophyta* and *Polypodiophyta* from Carboniferous limnic basins of the Czech Republic (***J. Bek**, S. Opluštil, Faculty of Science, Charles University, Prague, J. Drábková, Czech Geological Institute, Prague & J. Pšenička, West Bohemian Museum, Plzeň*)

Various fructifications and their spore populations of Carboniferous plants of lycopsid, sphenopsid, pteropsid and progymnospermopsid affinity were studied during the first year of the project. Fourty-four specimens of nine *Lepidostrobus* species of Langsettian to Stephanian B were studied. Miospores isolated from *Lepidostrobus crassus* belong to the dispersed species *Lycospora parva,* from *Lepidostrobus nemejcii,* sp. nov. and *L. setlikii* sp. nov. to the dispersed species *Lycospora subjuga* and *L. micrograna,* from *Lepidostrobus* sp. A to the dispersed species *Lycospora microgranulata,* from *Lepidostrobus thomasii,* sp. nov., to the dispersed species *Lycospora pellucida,* from *Lepidostrobus* cf. *haslingdenensis* to the dispersed species *Lycospora noctuina,* from *Lepidostrobus obovatus* to the dispersed species *Lycospora brevijuga,* from *Lepidostrobus ronnai* sp. nov., to the dispersed species *Lycospora rotunda* and from *Lepidostrobus stephanicus,* miospores belong to the dispersed species *Lycospora punctata.* Lectotypes of *L. crassus* and *L. stephanicus* are established. From fructifications of selaginellalean affinity, two species of *Se-*

laginella cones of the Bolsovian and Westphalian D age were studied. Two specimens of *Selaginella gutbierii* yielded miospores closely resembling those of the dispersed species *Cirratriradites saturnii* and megaspores closely resembling those of the dispersed species *Triangulatisporites vermiculatus.* Miospores closely resembling those of the dispersed species *Cirratriradites annulatus* and megaspores closely resembling those of the dispersed species *Triangulatisporites* cf. *tertius* were isolated from cones of *Selaginella* cf. *leptostachys.* A review of all palynologically studied *Selaginella* and *Selaginellites* fructifications is given. A review of all *in situ* and dispersed *Cirratriradites* and *Triangulatisporites* was performed. From fructifications of the family *Schizeaceae*, three specimens of *Senftenbergia plumosa* were studied from the Kladno–Rakovník and Plzeň basins of the Bolsovian to Westphalian D age. Emended diagnosis of *S. plumosa* is given. Three degrees of maturity of miospores of the *Raistricia* type are decribed. Genera of *Dactylotheca* and *Tedelea* are suggested as junior synonyms of *Senftenbergia.* Species of *Tedelea glabra, Botryopteris spinosa* and *Ankyropteris brongniartii* seem to be synonymous with *Senftenbergia plumosa* based on the morphology of reproductive organs and *in situ* miospores. From fructifications of progymnospermophyte affinity thirty-one specimens of seven *Discinites* species from the Kladno–Rakovník, Radnice and Lísek basins of Bolsovian to Westphalian D age were studied. Emendations of the genus *Discinites* and species *D. hlizae, D. raconicensis* and *D. bohemicus* are suggested. A new species *D. němejcii* is erected. Isolated miospores represent various degrees of maturity when relatively least matured forms consist of strongly irregular primary and secondary reticulate peripore enveloping the central bodies. The occurrence of a similar type of miospores is known only from a few sphenophyllalean fructifications and their occurrence in fructifications of the *Discinites* type is reported for the first time. Laevigate megaspores resemble those of the dispersed species *Calamospora laevigata.*

Grants of the Charles University, Prague

GAUK 95/1998/B Development of the frontoparietal bone in the Anura (*K. Královec, Charles University, Prague* & ***Z. Roček***)



The frontoparietal bone is a complex bone of the anurans, not found in any other group of amphibians. Within the Anura themselves, it displays a considerable degree of variation. It may be paired (both parts being in contact in a median suture or leaving a fontanelle) or fused together in a single bone. Accordingly, its shape and extent over endocranial (=chondrocranial) structures is a matter of variation, too. It may be also pierced by various canals for vessels, or these vessels can cause groove-like imprints on the dorsal surface of the bone.

This considerable broad variation range found in adults is a result of several profoundly different ways of the developmental origins of this compound bone, which are characteristic for various anuran taxa. Usually, it is supposed that the frontoparietal bone develops from two ossification centres, corresponding to the frontal and parietal bones of ancestral temnospondyls. The frontal develops on the dorsal edge of the braincase wall within its orbitotemporal extent, whereas the parietal on the top of the otic capsule. Both coalesce with one another on each side, giving rise to the paired frontoparietal, and may fuse with its counterpart on the opposite side so that a single compound bone is formed. The latter case occurred as early as in the proanuran stage represented by *Triadobatrachus* from the Early Triassic of Madagascar.

Detailed developmental studies, however, suggest that the origin of the frontoparietal bone is more complex. First, investigation using discrete histological techniques of the most significant ontogenetic stages of *Bombina* revealed that the frontal itself takes its origin from three ossification centres. They are distinguishable in histological sections only, for a very short period of development (chronologically equal to several hours). They fuse with each other in very early stages of ossification when ossification cannot be detected by clearing-staining methods yet. For these reasons, they were not identified by the

earlier authors. In contrast to the composite frontal, the parietal has never been observed to develop from multiplied ossification centres.
Besides these hardly discernible centers, there are also additional ones in some taxa, which are easy to observe even on the mounted specimens. A well documented is a median element on the dorsal surface of the tectum synoticum (the roof of the braincase between both otic capsules) in the genera *Pelobates* and *Eopelobates*. It can be well seen even in fossil tadpoles from the Oligocene/Miocene of Europe, but it may become preserved as a separate element in some adults (e.g., not yet formally described anuran from the Lower Eocene of Wyoming). Some other ossifications, not necessarily in median position, can be observed within the anterior section of the frontoparietal fontanelle in *Bombina*.
Rather different is the development of the frontoparietal complex in pipids. Here, too, it takes its origin from paired ossification centres, however, they soon fuse in their anterior and posterior ends, leaving thus a broad fontanelle in the middle. No separate ossifications have ever been observed by staining methods. Moreover, there are no ossification centres above the otic capsules which would correspond to the parietals. Instead, separate centres are present above the postnasal wall, which later join the main body of the frontoparietal.
The question arises what is the identity of these separate ossification centres, which enter the anuran frontoparietal in the course of its development, and whether they are of any phyletic significance. It is well known that in contemporary osteichthyans (e.g., *Amia*, *Esox*), three paired ossification centres develop on the dorsal margin of the braincase walls within its orbitotemporal extent. Later, they fuse in a paired frontal bones. A similar situation was described in the primitive contemporary tailed amphibian *Ranodon sibiricus*. Also in some specimens of the primitive Devonian osteolepiform crossopterygian fishes (*Eusthenopteron*, *Osteolepis*) the frontal is divided into similar paired units. All these cases support the view first published by Säve-Söderbergh that the frontal bones in adult osteolepifom fishes and primitive Palaeozoic amphibians develop from three paired frontals. It seems that this situation is conserved in the early development of contemporary anurans and urodeles. Descriptionally, these ossification centres are designated as the frontal 1, frontal 2 and frontal 3 (in anterior-posterior direction).
The identity of the unpaired element between both parietals is a matter of discussion. With regard to a condition in various fossil forms, it is usually taken as the interparietale. Similarly, the element, which appears within the anterior portion of the frontoparietal fontanelle is called the median rostral. However, whether it can be taken a homologue of a bone occurring in extinct taxa, can be decided only after its developmental and topographic stability in contemporary forms.
This is why our further research will be focused on (1) the variation of the frontoparietal development in various anuran taxa, (2) stability (both topographic and chronological) of various components entering the frontoparietal, and (3) interpretation of these in the context of phylogeny.

No.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*)

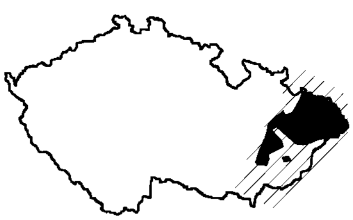
Coal-bearing strata of the Radnice Member fill incised or tectonically formed river valleys. They were deposited during a short interval approximately coinciding with the Lower Bolsovian. Besides local tectonics, compaction and pre-sedimentary palaeotopography the deposition was controlled by regional tectonic subsidence described in terms of base-level changes. It was responsible for the formation of basin-wide isochronous horizons (Radnice Group of Seams and its equivalent) and changing facies pattern. Periods of significant base-level rise are marked by development of extensive peat bogs occasionally grading upward into lake during the maximum base-level rise. The most important base-level fall led to a short-term hiatus and varying depth of erosion of previously deposited sediments. The resulting erosional surface with significant relief of max. 20 m divides the Radnice Member into two units corresponding to its formal subdivision into the Lower and Upper Radnice members. Lower unit (Lower Radnice Member) is marked by the upward transition from colluvial and fluvial deposition at or near the base to peat deposition (Radnice Group of Seams) terminated by lacustrine transgression, reflecting the period of maximum base-level rise. Filling of the lake was followed by a short-term hiatus and varying depth of erosion of previously deposited lacus-

trine sediments and coal due to a rapid base-level fall. Upper unit (Upper Radnice Member) is characterized by base-level fluctuations, which resulted in predominance of coarse-grained clastics while flood-plain deposits are poorly developed (?preserved). The periods of maximum base-level rise are marked by the presence of overbank deposits locally passing into coal seams of the Lubná Group. Extractable coal seams are developed only in minor depressions with low rate of clastic input due to palaeotopography configuration (so-called ”sedimentary shadows”). The proposed scheme is valid for incised valleys of the SE part of the Kladno–Rakovník Basin where the regional tectonic subsidence was the main mechanism controlling the deposition of this unit. Its validity in valleys with similar tectonic setting outside the study area has to be proved yet. However, this model is not applicable to the NNE-trending grabens driven by local tectonics, which occur in the axial part of the Plzeň Basin and Rakovník part of the Kladno–Rakovník Basin.
The studied coal seams were formed in rheotrophic mires with open water table or with water table corresponding to the peat surface and with high to limited clastic input. Due to permanently favourable edaphic conditions in mires (medium to high-ash coals), the vegetation changes (documented by changes in dispersed spore assemblages or petrographic composition) are mainly related to base-level changes induced by water-table fluctuations. Only minor changes in vegetational composition are related to the ash-fall event. They are characterized by alternation of the assemblage dominated by arborescent lycophytes (genera *Lepidodendron* and *Lepidofloyos*) with the assemblage of subarborescent lycophyte plants of the genus *Omphalophloios*. The absence of ombrotrophic mires may have been related to seasonally drier climate within the Variscan hinterland. Dispersed spores are divided into few groups according to their parent plants. The number of parent plants species is estimated. The reconstruction of paleaoecological conditions is supported by the graph of relative abundances of miospores of the *Densosporites* type and the genus *Lycospora.*

Grants of the state departments

No. VaV/603/1/97, Ministry of the Environment of CR, Czech Geological Institute <u>Geodynamic model of the contact between the Bohemian Massif and West Carpathian Mountains</u> (*O. Krejčí, P. Müller, J. Franců, et al., Czech Geological Institute, Brno* & ***J. Hladil***)

Subproject: <u>Character of secondary generations of venting and their relationsphips to pre-existing diagenetic fabric of carbonate rocks</u> (***J. Hladil,*** *K. Helešicová, Transgas, Brno, A. Těžký & J. Hrubanová, Geofyzika, Brno*)



Recalculation of well-log data in comparison with the available core material considerably lowered the estimates of porosity made by the expert-teams of the last decades. The Devonian carbonate-platform limestones on SE borders of the Bohemian Massif, at least 95 vol. % of them, have porosity < 5 % (mostly between 0.3–0.6 %). Although the myth on preservation of intraskeletal primary porosity is still popular, there is not a real reason to believe it. A significant western part of this platform was buried under Culm nappes during the Visean/Namurian and all-pervading calcite neomorphic mosaics level the sonic response of the sediments to common values, irrespective of their originally different fabrics. All investigated examples of effective porosities are younger and correspond to Late Paleozoic and Mesozoic/Tertiary exhumations. Typical examples of hydrothermal venting were found in Janovice area, whereas alternation of phreatic freshwater and brines was effective in the Krásná area.
The secondary venting crosses all prograding burial crystal generations as well as the structures relevant to exhumation. However, this secondary porosity shows strong selectivity on the rocks. The massive reef banks and rhythmically stratified lagoonal sediments were fairly resistant to dissolution, whereas the inhomogeneous breccias, spotty neomorphics and sand-bearing carbonates dissected with unconformities and speleothems were easily dissolved. In reflection seismic profiles, the latter type of sediments correspond to thinning to wedging out of carbonate cycles. These strangulations in the section correspond to synsedimentary Devonian elevations (sea-islands). Sluggish emergence of these islands on generally peneplenized mid-Paleozoic surface was controlled by buyoancy uplift of

low-density Cadomian rocks (quartz gneisses and light granites). Note that very thick sequences rest on basic rocks – Jablůnka-1 borehole. This relative uplift of islands worked from the time, when seas flooded the continent and the peneplenization of crystalline basement was stopped. Of course, still unknown heat-flow and density changes in unknown deep crust (mainly the Devonian rifting and cooling) make this simple correlation with the composition of crystalline basement rather vague.

Industrial grants

Čertovy schody Quarries Ltd. Project A/1: Studies on facies, tectonics, biofacies and biostratigraphy of Paleozoic rocks from the Koněprusy and other related quarries in the Barrandian area (***J. Hladil, P. Bosák, A. Galle**, **L. Slavík**, **J. Adamovič & M. Coubal***)

Subproject: Documentation of the limestone facies based on progressive quarrying and drilling: implications for quality of the rocks and assessment of the systems in terms of dynamic stratigraphy ***(J. Hladil**, **P. Bosák & A. Galle**)*

Spectrum of facies has been complemented during documentation of drilled rock core from a new series of boreholes. For example, a gastropod-algal facies with alternating micrite and shell-hash layers, so far unknown, was drilled below the northern borders of the Quarry East. This facies alternates with flat bryzoan bioherms and lies very close to poorly-sorted crinoid talus on the slopes of the reef. Very shallow depositional character of this sediment (algal mats and spongiostromes) documents an elevated sea-floor paleorelief in the northernmost part of the quarried area.
Other indicators of this elevated parts are small remnants of lagoonal facies in the upper NE corner of the Quarry West: (1) hummocky-cross bedded carbonate sands with oncoids and algalites; (2) horizontally bedded calcilutites/calciarenites with 0.5 m large colonies of rugose corals (0.5 m large, spaced laterally 1.5–2.5 m).
An interesting component of the sediment – big solitary rugose corals worn as pebbles – was documented in several other facies along the northern borders of the quarried area. Sparitic fills of coral skeleton cavities are worn together with this skeleton. These corals have dilated septa indicating that they were near-shore dwellers and were recycled into the sediment as pebbles in gravel derived from the emerged parts of the reef.
Significant documents originate from the "reef" in the so-called Marble Wall below Zlatý kůň Hill. Block-and-fill structures of this "reef" could be originally interpreted in two ways: collapsed reef margin with cavities and/or olistolite to blocky-megabreccia material sliding on this margin. The latter interpretation is more realistic, because calm-water micrite sediments with tube-shaped corals were found within the large cavity filling among irregularly accumulated megablocks of highly contrasting lithological composition. To conclude, the Koněprusy limestones in the northern part of quarried area provide many documents that the emerging reef was in their close neighborhood (in the N), although this continuation was damaged by tectonic deformation.
The large volume of sediments in outer reef periphery (on the S) corresponds to open-sea atoll or ocean barrier, which may be compared with major structures of this type in present conditions. Thus, the Koněprusy reef provides a direct evidence for existence of an another basin, which has a real ocean character. However, the relation of this ocean basin to sutures in theThuringian or Moldanubian Paleozoic is unknown.

Subproject: Stratigraphically significant conodont taxa in the Early Devonian of Čertovy schody quarries ***(L. Slavík)***

Early Devonian conodont fauna was studied on flanks of the Koněprusy skeletal accumulation in the Čertovy schody quarries. Conodont biostratigraphy represents a very effective dating method of carbonate rocks. Till the present, more than forty samples were taken from the stratigraphic section and produced more than 400 discrete conodont elements. Paleontological material enabled characteristics of 13 conodont taxa. Ancyrodelloides delta Zone was recognized near the base of the studied section in the western part of the quarry between samples No. 1 and No. 3.2. within the well-bedded gray biomicritic limestones of the Kotýs Member. This zone is characterized by the first occurrence of significant representatives of the genus *Ancyrodelloides* Bischoff et Sannemann, 1958-*A. trigonicus* Bischoff et Sannemann, 1958, *A. kutscheri* Bischoff et Sannemann, 1958 and *A. transitans* (Bischoff et Sannemann, 1958). The stratigraphic range of these taxa including the index species of *A. delta* (Klapper et Murphy, 1980) is closely limited in time, and therefore this zone is commonly distinguishable in the Late Lochkovian. Samples from the delta Zone also produced elements belonging to the apparatus of *Ozarkodina remscheidensis remscheidensis* (Ziegler, 1960), whose stratigraphic range in the upper part of this zone is restricted. No further Late Lochkovian zone was recognized in the section. The Eognathodus sulcatus sulcatus Zone as the next chronostratigraphic unit just above the delta Zone is assumed herein by the presence of *Ozarkodina remscheidensis repetitor* (Carls et Gandl, 1969), which is largely restricted worldwide even to this zone and characterizes lower Pragian sequence boundary in the Čertovy schody section. Unfortunately, an extremely low amount of stratigraphically significant species characterize the entire Pragian sedimentation. Only long-ranging belodellids and *Ozarkodina excavata* (Branson et Mehl, 1933) of little stratigraphic value are dominating in the Pragian interval. Therefore the presence of other Pragian zones cannot be reliably identified. The presence of Eognathodus sulcatus kindlei Zone is expected with respect to the large extent of the Pragian sedimentary interval in the section and certain faunal change just above the last sample of the Eognathodus sulcatus sulcatus Zone. But there is neither any firm evidence of any other Late Pragian zone. Polygnathus serotinus Zone, which represents approximately mid-Emsian age, was well recognized in the upper part of the section from sample taken from the first bed of reddish Suchomasty Limestone.

Cement and Lime Works of Mokrá Ltd. Project M/2 Studies on physical stratigraphy of Paleozoic rocks from the Mokra and other quarries in the Moravian Karst (***J. Hladil, P. Pruner, L. Slavík*** & *B. Ellwood, Louisiana State University, Baton Rouge, USA*)

Subproject: Gamma-spectrometric and magnetosusceptibility measurements at Mokrá: high-resolution tools for stratigraphic correlation and relationships to mineral composition of the rocks *(**J. Hladil, P. Pruner** & B. Ellwood, Louisiana State University, Baton Rouge, USA)*

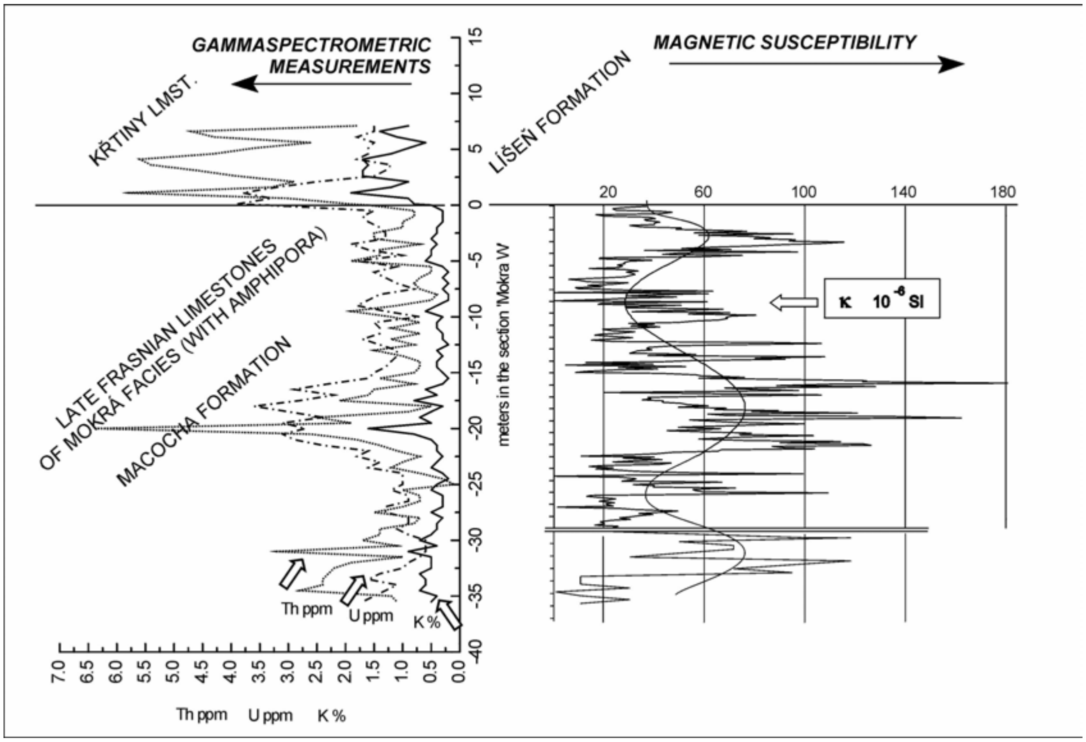
Gamma-spectrometric measurements in Mokrá Quarries (E of Brno) were mainly concentrated to Middle to Late Frasnian sections, with continuation up to mid-Famennian strata. The plotted data show clear correlations between the contents of potassium and thorium, which both can be reasonably attributed to increased amount of fine-grained siliciclastic component in the carbonate rocks.
Consequently, the correlation between the contents of potassium and silicates indicates that most of finely dispersed clay minerals in carbonates correspond to illite. It considerably reduces the previous findings of smectite-chlorite and chloritoid minerals only to bedding-conformable erosion surfaces, where thin siliciclastic claystones/mudstones were concentrated. Non-carbonate character of these horizons locally became stronger due to dissolution of carbonate on bedding-parallel seams. In majority of the Frasnian inter-tidalites and stromatoporoid banks, the content of illite can be stoichiometrically calculated from the gamma-spectrometric measurements of potassium.
However, changes in uranium contents do not follow the distribution of thorium and silicate component. Increased amounts of uranium in carbonates occur together with increased amounts of organic carbon. These joint uranium-and-organics maxima match (sometimes moderately antecede) the increased magnetic susceptibility values with magneto-mineralogical reason in occurrence of very fine magnetite crystals.
Developed fine-scale sections using the methods of physical stratigraphy show remarkable time-characteristic patterns, which are high-resolution markers for stratigraphic correlation.

Subproject: Abundance and character of phosphatic bioclasts in Late Devonian rocks from the neighbourhood of Mokrá ***(L. Slavík)***

A revision of conodonts from active limestone quarries of Mokrá was concentrated on all available characters, which can be used as a background information for development of physical stratigraphy (Gamma and MSEC). In general, the Křtiny Limestone contains more conodonts than the Hády or Říčka Limestones (calciturbidite facies). This is a result of the rate of deposition rather than bathymetry. Paleontological material acquired enables the recognition of several standard conodont biozones. The first Famennian conodont zone recorded – Pa. crepida – is represented by numerous elements of the genus *Palmatolepis* (besides the index species, remarkably numerous *Pa. minuta minuta, Pa. minuta wolskae*, rare *Ozarkodina*). Within the following Pa. rhomboidea Zone only few palmatolepids are present. This zone is marked by a hiatus in the section of Mokrá West (Transformer), and detrital limestone in the section of Mokrá Centre (Crusher) from the 1970s. The absolutely highest faunal diversity and the largest amount of discrete conodont elements were found within the interval of Pa. marginifera Zone. For example, such assemblage includes more than 150 elements of the genus *Palmatolepis*, about 40 elements of *Bispathodus*, about 200 elements of *Ozarkodina* and some polygnathids. A prominent faunal change – practically a depression – can be observed within the Pa. trachytera and Pa. postera Zones, where the absolute prevalence of *Polygnathus* is connected with depressed diversity and abundance of conodonts (only 20 elements obtained from 8 samples!). The conodont assemblages from Pa. expansa to Siph. praesulcata Zones document new diversification and rise in abundance related mainly to *Bispathodus* and *Ozarkodina*, which outweigh *Palmatolepis*. In connection to biofacies, a new, slightly corrected concept can be introduced: (1) The early to middle Famennian sediments at Mokrá are mainly among the Palmatolepis biofacies and correspond to open-sea, deeper-water carbonates, whereas (2) the remaining part of the Famennian is the Palmatolepis–Polygnathus biofacies, which is exactly indicated by the presence of subtidal shallow-water sediments (or at least, a source of these sediments in this shallower bathymetric zone).
A very significant task of the survey was the revision of conodonts from two pilot structural boreholes, which generally define the structures at the southern tectonic border of the Moravian Karst (Mokrá–Horákov SV-1 and SV-3). The revision of assemblages acquired from the depth interval of 185–388 m in the SV-3 borehole confirmed the well-known tectonic repetition of the Frasnian and Famennian sedimentary sequences. However, the conodonts mark only the overthrust basinal sequences, not the shallow-water sponge-coral facies in the lower part of the section. The Late Frasnian Palmatolepis rhenana Zone was recognized at a depth of 185 m. However, a slightly younger fauna occurs in strata several metres below (*Polygnathus brevilaminus* Branson et Mehl, 192.5 m, *Icriodus alternatus alternatus* Branson et Mehl, 204.6 m – both ranging from Pa. triangularis to Pa. crepida Zones). This implies a tectonic duplication or a stretched limb of a fold, because the conodont assemblages obtained from the thick interval of rhythmic sediments at depths of 213–278 m again range within the Late Frasnian Pa. rhenana Zone. However, the previously supposed Late Famennian age of dark gray limestone from the depth of 388 meters cannot be reliably confirmed based on the conodont material.

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

Facies and assemblages of coal-forming plants were evaluated from forty samples contemporaneously subjected to coal-petrographic studies. Several communities can be recognized on the basis of microscopic record of pollen, spores, fungi remains, wood particles and resin bodies: swamp forest with prevailing *Taxodiaceae–Cupressaceae,* riparian forest of the deltaic lithofacies, mixed mesophytic forest surrounding the area of swamp and riparian forests, and the poorly recorded aquatic plants. The characteristic elements of the microscopic assemblages are *Alnus, Liquidambar, Nyssa, Tiliaceae, Quercus* and *Fagaceae.* Swamp cypressus and *Pinus* are evidenced also by the fragments of wood tissues and resins. Relations between coal facies and fossil record of plants were documented.



Physical stratigraphy of the Late Devonian sequences of limestones in the section Mokrá West *(J. Hladil)*
The gamma-spectrometric measurements using the GS-256 show contents of uranium, thorium and potassium (left). The measurements of samples in a Kappa bridge show apparent volume magnetic susceptibility (right). Thorium and potassium reflect the overall amount of siliciclastic terrigenous admixture, whereas the increased contents of uranium are connected with organic matter in the rocks. Note that these fluctuations of uranium closely correlate with the magnetic susceptibility log, not the contents of thorium and potassium. This is an another very significant evidence that the increased magnetic susceptibility cannot be directly connected with the influx of siliciclastic component (paramagnetic minerals). The increased amount of non-oxidized organic matter corresponds to a larger amount of microscopic magnetite, which must be the main carrier of the positive magnetic susceptibility reactions.

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11. 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***)

Thirty new Mesolithic sites located mostly under the sandstone rockshelters were found by the team during the last several years. Sixteen rockshelters were excavated in detail with the assistance of students of cultural anthropology (Institute of the Fundamentals of Learning, Charles University). The finds of fossil man, rich collections of flintstone artifacts, molluscan and vertebraete fauna assembalges, charcoal and seed determinations, sedimentology and mineralogy of the cultural layers, the ichnofossil and bioturbation study, radiocarbon dating and ceramic archaeology lead to wide inter- and multidisciplinar research of several academic institutions and the team of up to 50 students annualy working in the field. This year, we were working in otherwise almost unknown area of the Bohemian Switzerland (Elbe Sandstones), where, with the help of ranger V. Sojka (Administration of the Labské pískovce Protected Landscape Area), seven new Mesolithic sites were discovered. Three rockshelters close to Chřibská were excavated in detail providing 4–5,000 artifacts, a rich collection of several ceramic fragments (especially from Early Iron Age period). Three new cultures for the local sandstone area were unearthed – Neolithic and two Eneolithic cultures.

UNESCO Project: Encyclopedia of Life Support Systems (EOLSS), editorship of the opening chapter 1.1 Earth´s System: History and Natural Variability (*Honorary Theme Editor **V. Cílek***, 1999–2000).

The Encyclopedia of Life Support Systems (www.eolss.co.uk) represents one of the large UNESCO projects. V. Cilek was nominated as the editor of the geological (opening) part and asked to cooperate on the Nature reserve theme. The Theme 1.1 with 63 contributors covers the origin of the Earth (astronomy), history of the Earth´s system, materials, rocks, minerals, function and development of the Earth´s biomes (aquatic and terrestrial systems), biogeochemical cycles of elements, renewable and non-renewable reserves and other subjects. The EOLSS consists of the essays in the style of Macropedia of Encyclopaedia Britannica (about 5–15,000 words). The total length of the Theme 1.1 is about 4,000 pages. The EOLSS will be published as a CD set and distributed in all UN countries.

Czech–US Science and Technology Program (Ministry of Education, Youth and Sports CR)

No. 95 051 Reconstruction of the Upper Pleistocene and Holocene paleoenvironment from cave sediments of the Moravian Karst, Czech Republic (***J. Kadlec***)

At the Michigan Technological University the study of mineral magnetic properties (magnetic susceptibility, magnetic granulometry, magnetic anisotropy) of the Kůlna Cave deposits was finished. All data and results were completed and interpreted. The final conclusion is that the magnetic susceptibility variations in the Last Glacial deposits exposed in Kůlna Cave indicate changes in climatic condition. These variations correlate with marine Foraminifera isotope record. The study of mineral magnetic properties verified the validity of stratigraphic division of Kůlna sections based on archaeological and paleontological studies. A stable isotope study of a stalagmite from the Holštejnská Cave (Moravian Karst) yielded a detailed climate record from the Pleistocene/Holocene transition (time span of 16 to 9 ka). The age of the stalagmite was determined by $^{230}Th/^{234}U$ method in the dating laboratory at Institute of Geology of the Polish Academy of Sciences.

Czech–US 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 at the Inst. of Geology: **P. Skřivan**, collaborating researchers: **M. Burian, I. Dobešová, O. Kvídová, T. Navrátil, L. Minařík, A. Žigová***)

Recent results show that the Recent exogenic cycling of beryllium is controlled by the following factors:
(1) low Be input from atmospheric sources,
(2) its presence mostly in particulate matter of the atmospheric deposition, where it is soluble under acidic conditions,

(3) increased atmospheric input of protons from strong inorganic acids of anthropogenic origin, which enhances the mobility of Be in soil and surface water,
(4) presumably low metabolic uptake of Be by forest trees.
The increased concentration of Be in the bedrock and its weathering products is an additional specific factor of the study area (the Lesní potok catchment in the Kostelec n. Č. lesy region near Prague). Both types of granites forming the bedrock of the Lesní potok catchment (syenogranite of the Jevany type, and monzogranite of the Říčany type) are enriched in Be, with plagioclase being its dominant source. In soil profiles, exchangeable and total Be contents increase downward. The output of Be through the surface discharge greatly exceeds the atmospheric input. Be is released mostly from soil and weathered rock. The concentration of Be in surface stream draining the Lesní potok catchment varies inversely with pH.
The Be concentration in most samples of the bulk precipitation has been below the detection limit of the applied analytical determination (ETA AAS) since 1998 as a result of improving quality of the environment. Extensive preconcentration of samples was therefore necessary to obtain correct analyses of Be. Estimated annual Be flux in bulk precipitation, based on the pre-concentrated samples, is below 20 $\mu g.m^{-2}.yr^{-1}$. Export is approximately 990 $\mu g.m^{-2}.yr^{-1}$. The concentration and flux of Be in throughfall are moderately higher, which is attributed to the possibility of an impact of local emission sources. Comparison of the results obtained by means of two different types of throughfall collectors has shown the importance of their construction and principles of their operation. Concentration of Be in the tissues of the forest vegetation, including leaves seem to confirm its certain metabolic uptake.

Joint Project of the Forschungszentrum Jülich, FRG and Institute of Geology, AS CR, Prague

Integrierte Bilanzierung der thermischen Geschichte eines paläozoischen Sedimentbeckens am Beispiel des Barrandischen Becken unter spezieller Berücksichtigung der Fluidmigration (***V. Suchý, J. Filip****, I. Sýkorová, Institute of Rock Structure and Mechanics AS CR, Prague; E. Franců, Czech Geological Institute, Brno, U. Mann, H. Wilkes & H. Volk, Institute für Chemie und Dynamik der Geosphäre, Jülich, Germany*)

The reconstruction of the thermal history of the Barrandian Basin (Cambrian–Middle Devonian) was carried out using the techniques of time–temperature (PDI) modelling. Computer-aided simulations produced two geologically viable explanations. In the first model, the present maturation rank of the sediments may have been reached by deep burial during the Devonian (5,800 m, ~240 °C), whereas the second model indicates the most intense heating and burial during the Permo-Carboniferous (5,000 m, ~240 °C). Both models, however, clearly evidence that a substantial thickness of the overburden, now completely eroded, must have been present to explain the observed rank of organic matter coalification and mineral diagenesis.
The AFTA data also provided unique insights into the post-Variscan history of the area. In particular, some rock samples from the SW part of the Barrandian evidence much later heating that occurred during the Triassic–early Cretaceous time. The interpretation of this heat pulse (increase in burial temperature for about 40 °C) remains uncertain at this state of knowledge. Virtually all the Barrandian samples also exhibit a sudden decrease in burial temperature at some 25–30 Ma which may correspond to Paleogene uplift of the area, possibly induced by the Alpine orogenic deformations(?).
Another wealth of new data on the Barrandian tectono-thermal evolution were produced by a detailed analysis of the deepest cored borehole in the basin – Tobolka-1. Coalifiction grade of the dispersed organic matter that generally increases with the depth, exhibits several distinct "jumps" that can be best attributed to the influence of thrust tectonics. This finding implies that the stage of flat thrusting that influnced much of the Barrandian sediments followed only after the peak burial temperatures (post-coalification tectonics).

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 (*A. Zeman, Praha;* ***V. Suchý****, Zhu Rixiang, Pan Yongxin & Guo Bin, Institute of Geophysics, Chinese Academy of Sciences, Beijing, People's Republic China*)

During 1999, the research has continued on a newly described section of Chinese loess deposits near Renjiapo (Lingtai County, Central China Loess Plateau that contains a complete record of the last Glacial–Interglacial period.
As a result of detailed paleomagnetic research, two short-term paleomagnetic excursions were discovered in the upper part of the section. Parallel geological and paleopedological investigations revealed that both excursions coincide with the layers of solifluction and wash deposits that apparently reflect the termination of cold continental climate and the onset of more humid climatic conditions. The ages of these paleomagnetic excursions are 27.1–26.0 and 46.8–37.4 ka B.P., respectively. The younger excursion seems to be consistent with the Mono Lake excursion whereas the older one may correspond to the Laschamp excursion. Similar two anomalous directional intervals associated with low relative paleointensity were also recognized in well-dated Weinan section of the Chinese Loess Plateau.

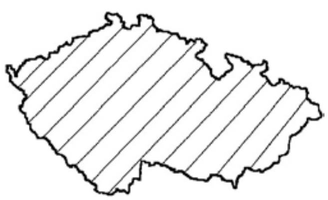
Grant Agency of the CR

No. 205/98/1551 Analysis of the deep slope deformations in neovolcanic rocks of the České Středohoří Mts. (*Principal investigator: J. Rybář, ÚSMH ASCR, co-investigator* ***V. Cílek****, contributions:* ***V. Cajz*** *&* ***J. Hlaváč***)

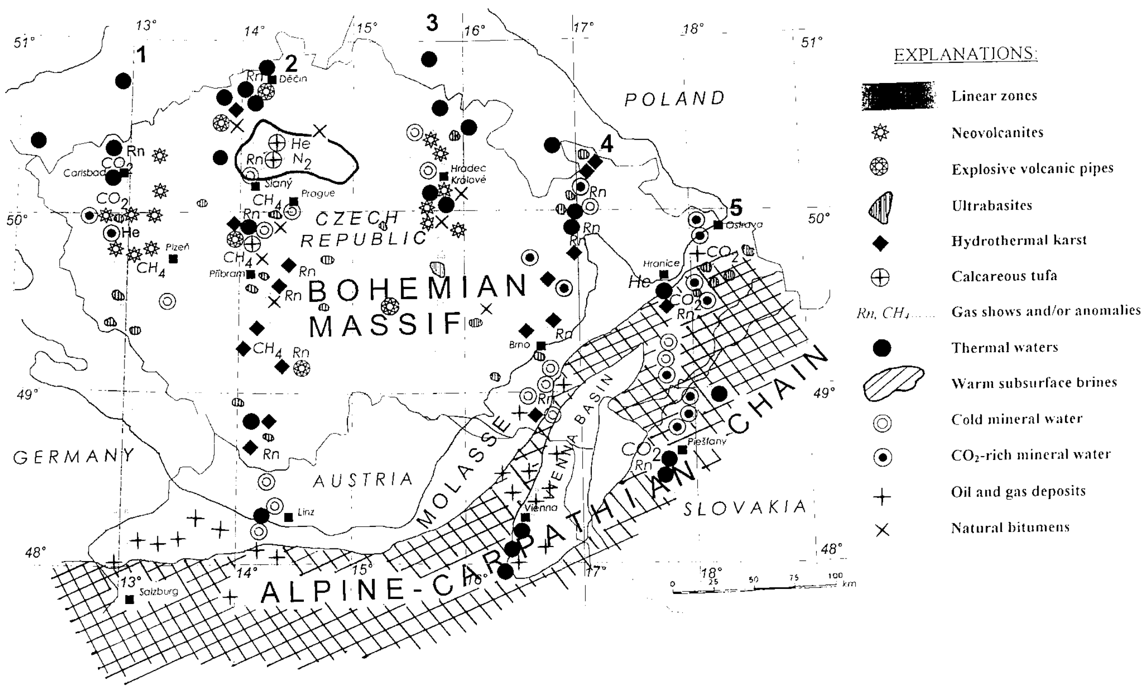
The large landslide area of Čeřeniště is formed by an almost 1 km long and 20 m high gravitational fissure in its upper part. The landslide is deep seated – the undisturbed underlying rocks can be found according to the former drilling project at a depth of about 150 m. The landslide consists of several large rock debris waves divided by relatively flat terraces of enigmatic origin. This year, the geological and mineralogical research concentrated on thin volcano-sedimentary intercalations containing silica diatom mud, coal seam, fine-grained red weathering products and greenish tuffitic claystones. The seemingly homogeneous body of the landslide is in fact subdivided by several (at least 4) sedimentary intercalations into at least 6 individual lava flows. Local Tertiary landscape can be compared to the initial rift valley with uneven morphology. The volcanic elevations and lava-flow barriers helped to create small ponds and lakes with coal and diatom sedimentation. The sediments then weathered to poorly definable mixtures of materials where the principal role belongs to smectite (montmorillonite). This clay mineral was found to be the most important constituent (besides calcite, chlorite, augite, rutile and some other common minerals) of all sedimentary intercalations. This find has some profound consequences for slope stability. We have to expect several impermeable hydrological horizons developed on smectite layers which probably caused sheet movement of the individual lava flows to the Elbe Valley. The malacozoological research failed to find fossiliferous Holocene or Pleistocene profile but a rich assemblage of 42 contemporary molluscan species was collected. A special attention was paid to the Alpine relicts which often indicate ground ice in the free spaces of rock debris flows. This ice functions as the smectite layer – it enhances the slope movement. No such species have been recovered but molluscan aquatic fauna was found around the main terrace – a flat terrace some 600 m long and more 100 m wide. The presence of aquatic fauna points to the existence of an intermittent small lake developed on a smectite layer. The terrace developed probably as solifluctional or cryoplanation terrace. The basic data on the geologic nature were summarized as a background for mathematical modelling of the landslide development performed by a team of J. Rybář.

Grant Agency of the Academy of Sciences CR

Additional grant for edition of the Atlas assigned by the Grant Agency of ASCR, No. E3013916 Quaternary clastic sediments of the Czech Republic. Structures and textures of the main genetic types (*Principal investigator **E. Růžičková**; M. Růžička, Czech Geological Institute & **J. Kadlec***)



Revision and supplement of the original final report of the grant project were made both in the text and photo-documentation parts. Some additional new photos were taken in the field. The final text was delivered to the Publishing House of the Czech Geological Institute and revised by two specialists chosen by the Editorial Board. Consequently, some modifications were done upon their recommendation.



A map showing positions of individual linear zones and associated fluid phenomena (V. Suchý)
The zones were identified by comparing the known geological, hydrogeological and geomoprphological data with features observed on Landsat images.

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

An extensive system of equidistant, N–S-trending linear zones was found to cut across crystalline and sedimentary units of the Bohemian Massif, Czech Republic and peripheral parts of the Alpine–Carpathian chain in Austria and Slovakia (Fig.). The system represents the lines of weakness that were

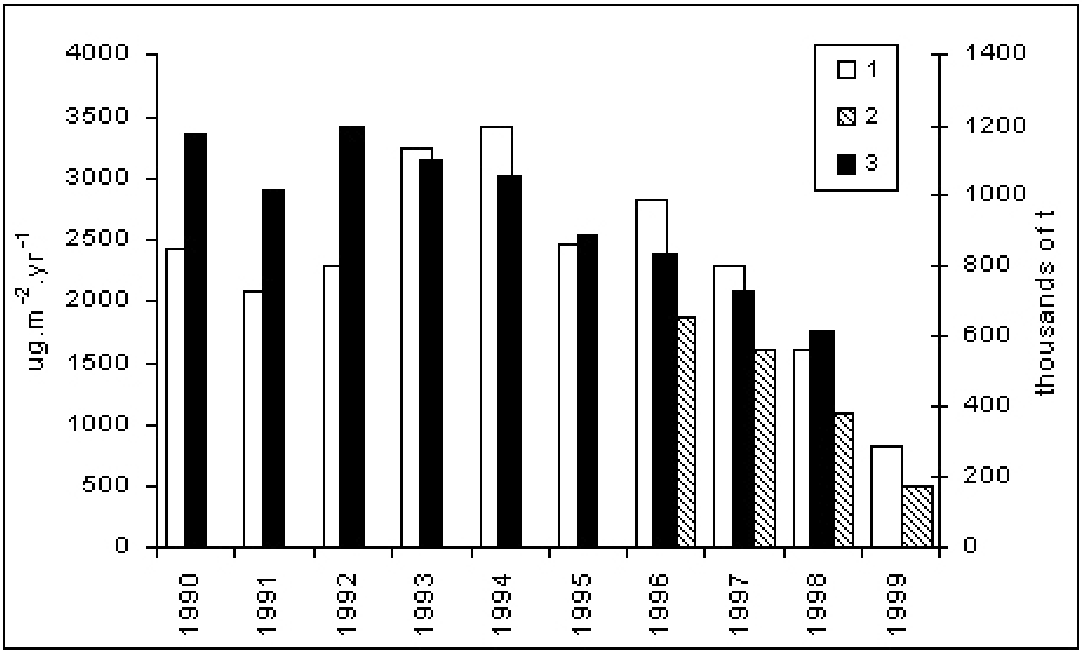
periodically reactivated and provided conduits for hydrothermal fluids of deep-seated origin. Post-Variscan fluid events were recorded through lineament-associated occurrences of volcanic intrusions, calcareous tufas, mineralized veins and hydrothermal karst that occur along these lineaments. Discharges of mineral and thermal waters, warm subsurface brines, and periodical microearthquakes and gas fluxes along some lineaments demonstrate present-day activity of the system.
Equidistant N–S linear zones and/or lineaments similar to those of the Bohemian Massif have already been recognized in Nigeria and Saudi Arabia. These linear zones appear to be deep-seated and repeatedly activated in the geological history. A comparable major system of equidistant lineaments was recently discovered in the territory of the former Soviet Union. These lineaments are interpreted as Pre-Cambrian tectonic features that form “a rigid primordial framework above the inhomogeneities of the lower mantle”. Circulation of various fluids that made use of these lineaments has been called upon to explain the origin and distribution of major ore and hydrocarbon deposits. The latter tend to be concentrated within linear zones whereas wide areas between the zones often lack any substantial deposits. This pattern can be of fundamental importance for future exploration strategies.

Grants of the state departments

Grant of the Ministry of Education of the CR (MŠMT, FRVŠ) G4

No. F950/1999 Balances of selected elements in a model central Bohemian catchment (*Principal investigator:* ***P. Skřivan****, contributions:* ***I. Dobešová, O. Kvídová, L. Minařík*** & ***A. Žigová***)

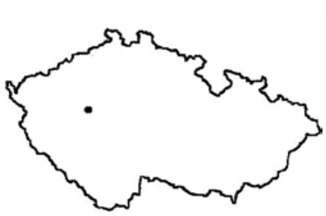
The main biogeochemical fluxes of selected elements (As, Be, Ca, Cd, Cu, K, Mg, Mn, Pb, and Zn) were monitored in the experimental forested cachment of ”Lesní potok”, Kostelec n. Černými lesy area, 30 km SE of Prague, in the years 1997–1999. Balances of their input through bulk atmospheric precipitation, output through surface- and subsurface discharge, internal fluxes through beech and spruce throughfall and litterfall, and sinks through their incorporation into the tissues of forest trees revealed the following results:
The litterfall of assimilation organs of trees is the dominant flux in the main nutritional and essential elements (K, Mn, Ca, Mg, Zn, Cu). Precipitation below the tree canopy (the throughfall) is an another, very important flux of these elements in the studied model landscape. Output through surface and subsurface discharge is the most important flux for the very mobile element – Mg. Fluxes of matter insinuated by biological activity of the vegetation are contingent in toxic trace elements. Values of the ”net” throughfall (reflecting the metabolic fluxes only) reach negative values in these elements (mainly As, Pb), as their atmospheric particles are attached to the surface of the tree assimilation organs, and reach the Earth’s surface with the litterfall only. The bulk atmospheric precipitation represents the dominant flux of As and Pb, in both cases resulting from the anthropogenic emission sources (coal burning and road traffic). Lead is retained in the system to a considerable extent, whereas the balance of arsenic is equable. It is expectable, however, that additional amounts of arsenic escape from the catchment in the form of gaseous volatile compounds, which are permanently created under anaerobic conditions through biological methylation of its inorganic ions. Markedly negative balance of beryllium results from its high mobility in the acidified surface waters. The mobilization of Be in waters of the Lesní potok Stream is promoted by high concentration of F^- ion in the solution (median value from 75 measurements is 0.73 mg $F^-.l^{-1}$). Considerable flux of Be in the litterfall supports the hypothesis of its biological accumulation.
Long-lasting study of the chemistry of atmospheric precipitation in the area of Kostelec nad Černými lesy revealed continuing decrease in the concentration of several technogenic elements, such as As, Pb, Cu, and Zn. This tendency is also evident from the input values of these elements into the monitored territory for the last three years.



1 – Sampling site of Truba (μg Pb.m^{-2}yr^{-1}) 2 – Sampling site of Arboretum (μg Pb.m^{-2}yr^{-1}) 3 – Sales of leaded gasoline in the CR (thousands of t)

Industrial grants

Grant of the Čertovy schody Quarry Management, Heidelberger Cement and LHOIST group, project: The complex research of the mining area of the Čertovy schody–East limestone quarry (*Principal investigators* ***P. Bosák*** *&* ***V. Cílek****, contributions:* ***J. Hlaváč*** *– malacozoology,* ***A. Žigová*** *– pedology, the team of Faculty of Forestry of Agricultural University, Prague: F. Fér, J. Möllerová, J. Viewegh & M. Anděra – biology, National Museum, Prague*)



The Koněprusy area represents one of the most important European deposits of high-quality (chemical) limestones. The total reserves may provide raw material for another 300–500 years if the present level of excavation (2–4 million tons) is maintained. This large deposit is surrounded by three national nature reserves and one nature reserve. As a result, one of the most valuable mineral deposits in the Czech Republic struggles with some of the most important natural sites. The three-year research is aimed at the complex understanding of the character of the mining area (karst phenomena, geology, paleontological sites – conodonts, Tertiary vertebrates, Devonian fauna; botany, forestry, archaeological sites, pedology, ornithology, zoology and other disciplines. A working compromise between the mining enterprise and the State Office of Landscape Protection should be reached. The Nature Reserve of Kobyla was enlarged over a part of the mining area after complex environmental negotiations with the industrial giant in 1999, and the newly proposed Nature Reserve of Voskop, which will block an important part of high-quality limestone reserve (at least 100 millions of t) can be established in the next two years. The results of extremely wide inter- and multidisciplinary research should appear in the planned monograph. Other activities such as geophysics, geochemical cycles, study of fillings of karst depressions and cavities, entomology, archaeological research, stratigraphy etc. are covered by other projects paid by different institutions (e.g., Ministry of the Environment).

Českomoravský cement a. s.: Biogeochemical monitoring (***J. Martínek, P. Skřivan, I. Dobešová & M. Burian***)

Concentrations and fluxes of 10 ions and 11 selected minor and trace elements are the objects of study of various forms of atmospheric precipitation in the area of the Čertovy schody Quarry, Koněprusy area (Bohemian Karst). The same samples were collected at other localities – at the Kosoř Quarry and in the centre of Beroun. Such configuration of sampling localities allows to compare the different sources of pollution in the region. The aim of the study is to determine sources of the monitored chemical components in relation to activities in the quarry. The third hydrological year of monitoring was completed in 1999. On the basis of the preliminary results, enhanced deposition of components connected with lime exploitation and its processing was documented. Concentrations of hazardous elements and compounds, nevertheless, are not significantly higher than the values common in central Bohemia.

Českomoravský cement a. s.: Study of the Cenozoic sediments in caves in southern part of Moravian Karst (***J. Kadlec***)

Two sections were studied in cave sediments of the Ochozská Cave. Paleomagnetic orientations of fine fluvial sediments in these two sections were measured (61 samples). All samples reveal normal magnetic orientation. This indicates that the sediments are probably younger than 730 ka (paleomagnetic Brunhes/Matuyama boudary). The age of speleothems covering fluvial sediments in both sections were determined by ^{230}Th/^{234} U method in the dating laboratory at the Institute of Geology of the Polish Academy of Sciences. The youngest speleothem generation precipitated at 4.2 ka BP. Pollen analyses from these fluvial sediments were conducted in the Botanical Institute AS CR and the Masaryk University. Geophysical measurements (electrical resistivity and seismic survey) indicate 6–8 m thick fluvial fill in the in the Main Chambers of the Ochozská Cave. A test-hole will be excavated in this part of the cave next year.

Another test-hole was excavated in front of the Ochozská Cave entrance, exposing a sedimentary section 6.7 m deep. Based on malacozoological and paleontological studies, these exposed sediments represent the end of the Last Glacial (*Pupilla* sp., *Vallonia* sp., *Succinella oblonga* cf. *elongata*, *Ochotona*, *Dicrostonyx*) and the Holocene (*Fruticicola fruticum*, *Arianta arbustorum*, *Monachoides incarnatus*).

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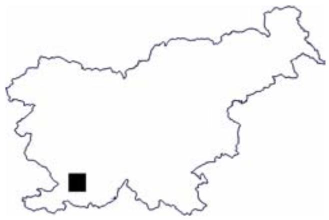
12. Department of Palaeomagnetism

Foreign Grants and Joint Projects

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

No. ME 251 (1998) Study of karst sediments on the example of the Classical Karst, Slovenia (***P. Pruner, P. Bosák, O. Man, D. Venhodová,*** *N. Zupan Hajna & A. Mihevc, Karst Research Institute, SAZU, Postojna, Slovenia*)

Palaeomagnetic and magnetostratigraphic investigations carried out on 106 orientated laboratory specimens of clay, sand, limestones and flysch rocks yielded data concerning basic magnetic properties and identification of palaeomagnetic directions. Generally, the AF demagnetization procedure was



more effective than the thermal one due to phase changes of magnetically active minerals during thermal treatment. Zijderveld diagrams were constructed for all samples and the measured data were subjected to the multi-component analysis of remanence using Kirschvink's method. All samples showed two components of remanence, A- and B-components. The A-components are carried by minerals of soft magnetic properties. Viscous and magnetically very soft properties are typical for the A-components representing up to 90 % or even more of the natural remanent magnetization. Harder B-components were clearly revealed by AF procedure within the intervals of 200–250 up to 300–1,000 Oe. However, there are still problems pending to be solved in the future: separation of syngenetic and epigenetic remanence components carried by minerals of low unblocking temperatures and soft magnetic properties.

The application of the magnetostratigraphy of cave sediments of the Classical Karst seemed to be an ideal tool for dating. It is generally known that fossils can be found only in the upper parts of sedimentary fill here (especially large mammals max. 200–250 ka in age). The time range of numerical dating methods applicable in karst is too short (cca 350 ka). Nevertheless, the magnetostratigraphic approach is facing numerous real problems. The examples of studied profiles of cave sediments belonging to inner-cave facies from different positions of the Classical Karst of the SW Slovenia may serve as a good case study.

Sedimentary fills of all studied sections were separated into individual sequences and cycles divided by numerous signs of breaks in deposition. Some breaks were expressed by erosion features (channel incision, intercalations of clays in speleothem sequences) and/or precipitation features (ferruginous crusts). Some of the magnetostratigraphic zones are bounded by such manifestations of unconformities. These features document an enormously complicated deposition dynamics with numerous breaks in deposition and periods of erosion, which resulted in presumable absence of parts of the original sections; whole caves and cave systems could have been completely filled and emptied even several times. Therefore, unconformities within the sections may represent a substantial geological time and the rate of deposition cannot be calculated in such sections. The time range of the individual magnetozones cannot be calculated, the geometric character of the obtained magnetostratigraphic picture cannot be compared with standard scales, and the detailed internal division and scarcity of fossils make the correlation of the obtained magnetostratigraphic zones with standard palaeomagnetic scales problematic.

Subproject: <u>Cave fill in the Črnotiče Quarry, mineralogy, geochemistry, palaeomagnetism</u>

Fossil cave in the Črnotiče Quarry was opened from 1990 to 1999. Its total length was about 150 m. About 10 m high profile of the cave completely filled with gravels, sands, clays, speleothems and other cave sediments was gradually opened by quarry operations. About 1.75 m high section of banded carbonate rocks intercalated with red clays was deposited on corroded/eroded surface of older speleothems, which were highly recrystallized. Red clays covered the corroded/eroded surfaces.

Banded and laminated carbonate rocks are composed of slightly recrystallized calcilutite. Typical columnar texture of flowstones and other speleothems is missing, except of limited bands. Carbonate rocks resemble common freshwater limestones, rather than classical flowstones. Characteristics of the lamination may indicate its origin from organic-rich films (algal or diatom mats) on which fine carbonate grains were trapped of crystallized.

Red clays are composed of dominating quartz, smectite, vermiculite, gibbsite, pM kaolinite, goethite, anatase, rutile, haematite, calcite, micas and feldspar. They contain abundant small pellets with very similar composition plus relatively high amount of Mn oxyhydroxides (todorokite, MnO content is up to 68 %). Remarkable is the increased chromium content. Pellets have a homogeneous, locally also concentric fabric. Selective replacement by Mn or Al-rich mineral phases was detected within outer pellet zones (enrichment in kaolinite, gibbsite or todorokite). Chemical characteristics indicate that red clays are close to terra rossa type of soils known from karst areas along the Adriatic Sea. Red clays represent redeposited weathering products of terra rossa type. Nevertheless, the presence of abundant Fe-Mn pellets, and some mineralogical and geochemical data indicate that red clays intercalated within the succession of carbonate rocks may represent reworked older paludal deposits. Such sediments were deposited from eroded weathering profiles both on limestones and flysch in water-saturated environment of lakes to marshes. Paludal sediments underwent an initial phase of bauxitization, as indicated by increased chromium content, indications of aluminium replacement of some of Mn-rich pellets and abundant gibbsite.

Samples are characterized by intermediate to high magnetic values of J_n=104.79 ± 69.61 [nT] and k_n=1,778±1,204.10^{-6} [SI], which are explained by the proved presence of relatively high amount of Fe-minerals (haematite, goethite). Mean palaeomagnetic directions equal to D=10.6° and I=55.0° for the group of normal palaeomagnetic polarity, and D=173.0°; I=-31.3° for the group of reverse polarity.

Magnetostratigraphic investigations defined normal and reverse polarity magnetozones. Magnetostratigraphic results indicate also one unknown polarity. A long normal magnetozone was interpreted in the lower half of the log. The top part of the profile shows reverse palaeomagnetic direction interrupted by two normal magnetized zones. The arrangement of the distribution of normal and reverse polarity magnetozones depends on abundant unconformities of unknown duration. According to the arrangement of individual magnetozones in standard scales, it can be assumed that the top of the highest normal-polarity magnetozone of our section can be correlated with the top of the Olduvai event (1.76/1.79 Ma) as the youngest possibility; therefore, the rest of the section must be older.

Subproject: Methodology of palaeomagnetic dating of karst fills in selected caves of Slowakia (***P. Pruner, P. Bosák, J. Kadlec, O. Man, D. Venhodová, J. Hlaváč***)

Palaeomagnetic investigations of sedimentary fills in selected Slovak caves open to the public have been carried out since 1998. The investigations yielded important preliminary results, changing our ideas on the age of the speleogenetical process in the most important cave systems of Slovakia. Investigation in the Demänovská jaskyňa Slobody followed the uranium series dating of speleothems in the whole Demänovka systém (Hercman et al. 1995–1999). Sediments in the Žulová chodba (Granite Passage) show normal magnetic polarity, and are younger than the Brunhes/Matuyama boundary (0.78 Ma). The profiles in the Medvedia chodba (Bear Passage) and at the Hviezdoslavov dóm show reverse magnetic polarity. They are older than the Brunges/Matuyama boundary (i.e., over 0.78 Ma). The Medvedia Passage represents the upper course of the depression vadose channel.

Data from the Demänovská jaskyňa Mieru show normal polarity of sediments at levels 4 and 5. Measured palaeomagnetic data correlate with the uranium series dating of speleothems. Both methods substantially changed the present genetic model. The speleogenetic process must have been much older than supposed earlier, and no link with the dated Pleistocene river terraces was proved.

Study of the Belianská jaskyňa showed the most complicated magnetostratigraphic setting. In the upper part of the sedimentary fill, a zone with reverse magnetic polarity was detected. The lower part of the section was normally polarized with a narrow reverse zone. Sediments are substantially older than the Brunhes/Matuyama boundary. Sediments may belong to the Matuyama chron (about 1.77–2.15 Ma), or to the Gauss chron (about 2.58–3.58 Ma), and/or to the Gilbert chron (cca 4.18–6.15 Ma). Therefore, the age of sediments must be Early Pleistocene or older, yet preceded by the speleogenetical process.

The section in the Suchá chodba (Dry Passage) of the Domica Cave shows normal magnetic polarity. It contains a very narrow reverse magnetozone. Flowstones overlying the section show the age of 124 and 131 ka. The sediments probably belong to the Brunhes chron (younger than 780 ka). The narrow reverse magnetozone may belong to a short excursion of Earth´s magnetic field older than the Blake event (Jamaica, Levantine?).

Sediments in the Ochtinská aragonitová jaskyňa contain, most probably, also the Brunhes/Matuyama boundary (0.78 Ma) in the uppermost part of the section. The section is covered by flowstone with a stalagmite dated to about 164 ka.

Grant Agency of the CR

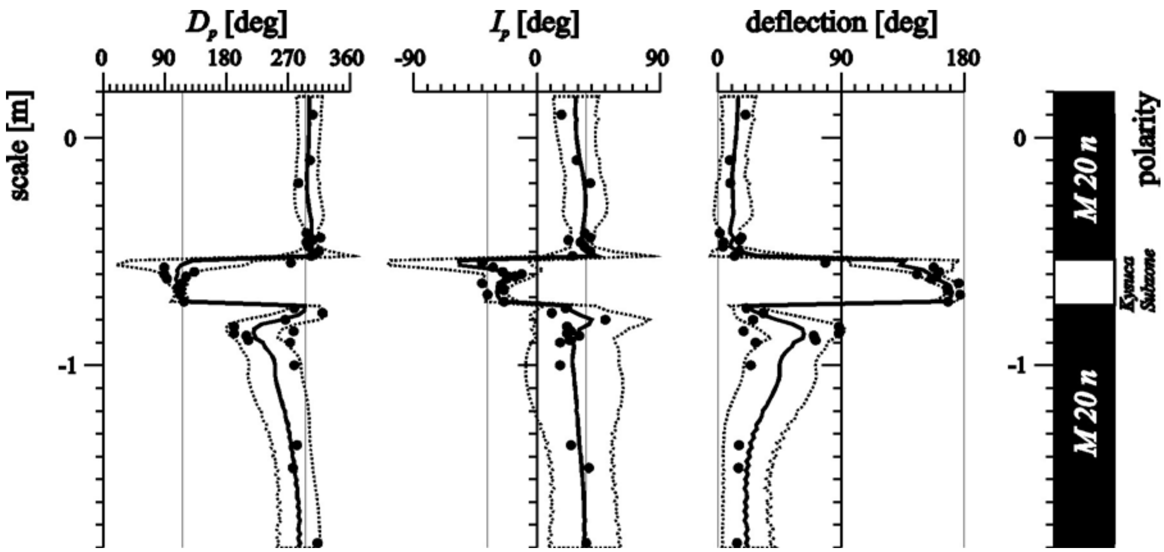
No. 205/97/0063 Magnetostratigraphic investigation and correlation of key profiles of Jurassic/Cretaceous boundary formations in the Tethyan realm (Río Argos, Spain; Brodno, Slovakia) (***P. Pruner, V. Houša, M. Krs, D. Venhodová & O. Man***)

The main objective of magnetostratigraphic investigations was to complete the profile at the Bosso Valley, Umbria, central Italy, and to carry out detailed magnetostratigraphic studies at Puerto Escaño, Province of Cordóba, southern Spain. These studies represent the follow-up programme of similar investigations carried out previously at Štramberk, northern Moravia; Brodno near Žilina, western Slovakia and the Río Argos, Caravaca, southeastern Spain. As mentioned in the Reports from previous years, the data from Štramberk are synoptic only, those from Brodno yielded high-resolution results while the limestones from the Río Argos were found syn-tectonically or post-tectonically remagnetized and unsuitable for the inference of a magnetostratigraphic profile. Consequently, a section at Puerto Escaño, substituting the Río Argos section, was subjected to magnetostratigraphic investigations.

The section at Bosso Valley, Umbria, central Italy, has been evaluated in the final form. In total, 237 orientated hand samples of 267 originally collected samples yielded reliable palaeomagnetic directions; the values of moduli of natural remanent magnetization are comparable with those of limestone samples from Brodno. Magnetozones M20n to M17r were precisely identified in the basal 40-m thick section. Two magnetosubzones with reverse palaeomagnetic polarity were indicated in the Bosso Valley section, in magnetozones M20n and M19n, in an analogous relative position as in the Brodno section. They were proposed to be named “Kysuca Subzone“ and “Brodno Subzone“, respectively. The inference of palaeomagnetic directions required a separation of remanence components (by means of multi-component analysis) from samples progressively demagnetized in the temperature range of ca. (350) 400 ^{o}C to the unblocking temperature of magnetite (around 550 ^{o}C), which is the carrier of palaeomagnetism. Three prominent events of calpionellid stratigraphy are applicable to precise correlation between the Brodno and the Bosso Valley sections: a) sudden appearance of *Calpionella grandalpina*, b) “explosion“ of *Calpionella alpina*, and c) short acme of *Crassicolaria parvula* in the Early Berriasian. In both of the sections, Brodno and Bosso Valley, the event sub a) lies slightly below the base of M19r. No prominent palaeomagnetic events occur in the nearest vicinity of the events sub b) and c), but both the calpionellid events lie approximately in the same relative position within M19n.

The section at Puerto Escaño, recently studied palaeontologically by F. Olóriz and J.M. Tavera, was selected for a detailed magnetostratigraphic investigation upon their recommendation. It allows the correlation of ammonites, calpionellids and nannofossils with magnetostratigraphic zonations. During 1998 and 1999, 229 samples were collected in total along a relatively short profile (condensed sedimentation). All the samples were subjected to progressive thermal demagnetization using the MAVACS demagnetizer, and all of them yielded well defined three-component remanence (A-, B-, C-components). The C-components are the carriers of palaeomagnetic directions. Unblocking temperatures of ca. 560 ^{o}C were detected, pointing to magnetite as the main carrier of magnetization. The measured data were evaluated and magnetozones M20r to M17r were interpreted. Both subzones with reverse palaeomagnetic polarity, “Kysuca Subzone“ and “Brodno Subzone“, were detected in M20n and M19n yielding the same pattern of magnetozones and subzones as the profiles at Brodno and Bosso Valley. However, to complete the Puerto Escaño profile as a high-resolution one, some additional samples have to be collected from the normal segment within M19n, i.e., between the top of the “Brodno Subzone“ and the base of M18r.

A



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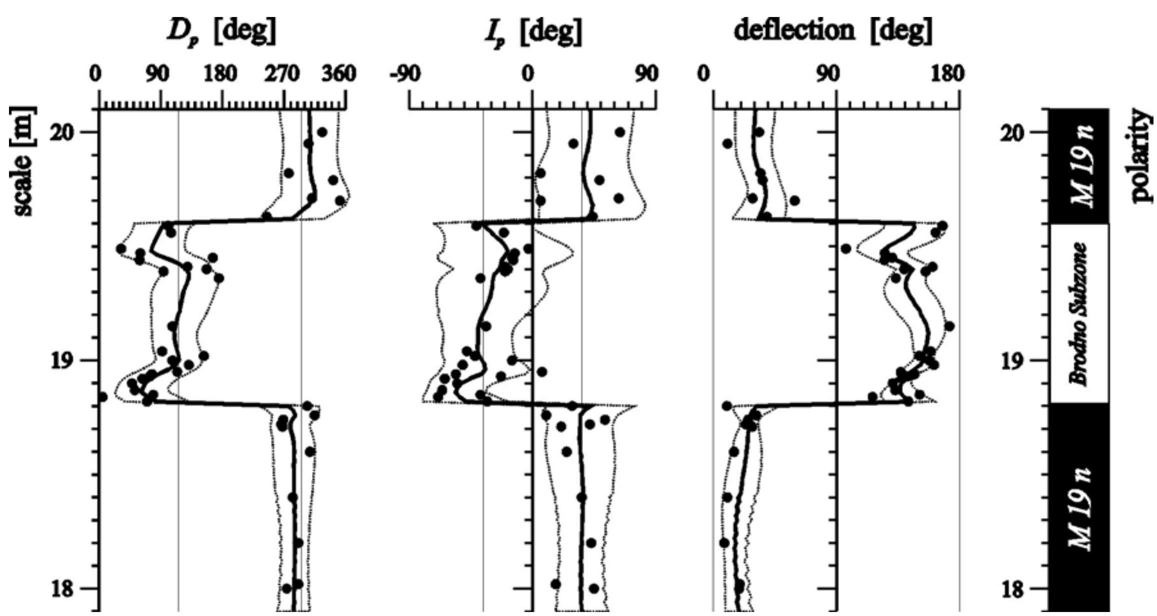


High-fidelity magnetostratigraphy at the Bosso Valley (P. Pruner et al.)
A – Delineation of the "Kysuca Subzone" in about the middle of magnetozone M20n; B – delineation of the "Brodno Subzone" in the upper part of magnetozone M19n.

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

In the course of the Variscan Orogeny, many Early-Variscan and pre-Variscan rocks underwent an intensive, even total remagnetization. The effect of the Variscan overprint was recognized already in the initial stages of palaeomagnetic investigations using the method of remagnetization circles. Later, more sophisticated methods were developed for separation of overprint components based mainly on progressive thermal demagnetization by means of the MAVACS demagnetizer and multi-component analysis of remanence. Considerable progress has been made by introducing theoretical models simulating the effect of palaeotectonic rotations. All the pre-Variscan formations of the Barrandian bear signs of this effect, which may be considered a confirmation of palaeomagnetic directions. Palaeomagnetic data so far derived for the Cambrian and the Late Silurian to Devonian are in agreement with the all-European data, incl. the data of Armorica considered a peri-Gondwanan terrane. Contradictory results were hitherto reported especially for the Ordovician and particularly for the Early Ordovician. Low palaeolatitude 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 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 North Africa) but, in the case of the palaeogeographic affinity of the Barrandian to Armorica, it implies an anomalous rapid drift of Armorica and Gondwana as well. Moreover, the palaeomagnetic directions reported with high values of inclination and hence high values of palaeogeographic latitudes, do not meet the conditions of the R. Fisher´s statistics; the calculated virtual pole positions do not follow the paths of palaeotectonic rotations confirmed for all other formations of the Barrandian so far studied. Consequently, additional rock samples for palaeomagnetic and palaeoclimatological studies were collected from several outcrops of rocks of different origin (sedimentary and volcanic). The samples collected represent the epochs of the Arenigian, Llanvirnian, Llandeilian and Caradocian; at present, they are subjected to laboratory studies.

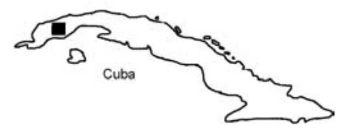
Grant Agency of the Academy of Sciences CR

No. A3013802 Mineralogy, geochemistry and paleomagnetism of the Variscan diastrophic sediments of the Bohemian Massif: provenance and paleotectonic implications (***P. Pruner, J. Hladil, F. Patočka, D. Venhodová, O. Man, P. Štorch & J. Slepičková***)

Palaeomagnetic investigations were carried out on the Middle Devonian to the Early Carboniferous sediments in the Ještěd Mts. complex (West Sudetes), the Jeseník Mts. and in the Moravo-Silesian region. Samples were collected from 30 localities – 126 samples (Karlov, Jitrava area, Machnín area, Vrbno, Světla, Anenský vrch, Suchá Rudná, Kozov, Ptení, Stínava, Kobeřice, Náměšť na Hané, Luleč, Mokrá, Šošůvka, Bedřichov, Jesenec and Slavoňov). The principal objective of the investigations was to find localities of rocks with properties suitable for palaeomagnetic analyses, and hence for palaeotectonic and palaeogeographic reconstructions. Laboratory specimens were subjected to progressive thermal demagnetization using the MAVACS demagnetizer. Results of the multi-component analysis of remanence show that samples of limestone from these localities display three-component remanent magnetization. Variscan overprint components were found in pilot samples from some localities of the Drahany Upland. Principal carrier of the magnetization is pyrrhotite. Primary magnetic components of the Devonian age were found in rocks from the localities of Ptení, Stínava, Bedřichov and Lesní lom near Brno. Devonian rocks show palaeotectonic rotation. Primary (palaeomagnetic) magnetization components of the Devonian age were found in some samples from the locality of Slavoňov (shale). A complicated situation was found at this locality: samples show different properties due to different degrees of alteration. Carrier of the secondary magnetization is pyrrhotite, the carrier of primary magnetization in some rock samples is haematite. Computed palaeogeographic latitude is about 13° S. The rocks show palaeotectonic rotation similar to that derived from rocks of the Moravian Karst, approx. 90 to 140° clockwise. Secondary magnetic components of the Variscan age were found in limestones from Jesenec. Samples from Jesenec were investigated using the Thellier method. Overprint magnetization components of the Early Permian age at this locality show thermoremanent origin.

Grant of the Charles University, Prague

No. 169/1998/B GEO/PrF 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. Slepičková****, J.R. Sánchez, CEINPET, Habana, J. Pérez, Universidad de Habana, & M. Fundora, IGA Habana*)



The aim is to prepare the background for the correlation of Late Tithonian and Early Berriasian boundary (J/K) limestones at the locality of Majagua in the area of 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. Samples of the studied limestones belong to weakly to medium magnetic materials, but their remanent magnetization (RM) was easily measured using JR-5 spinner magnetometers and their magnetic susceptibility was measured using a KLY-2 Kappabridge. Mean values of the moduli of natural RM (J_n) is 1.854 ± 3.919 pT and of volume magnetic susceptibility (k_n) is 1 ± 9 [10^{-6} SI] for 116 samples of late Tithonian and early Berriasian limestones.
Laboratory studies in the early stages of magnetostratigraphic investigations also included a magneto-mineralogical study to determine minerals – carriers of RM. The analysis of microcoercitive spectra showed that the tested limestone samples display medium to high magnetic hardness. Several samples were experimentally subjected to alternating field demagnetization using the Schonstedt GSD-1 demagnetizer. However, the method of progressive demagnetization in a thermal field using the MAVACS demagnetizer proved to provide considerably better results. Each of the total of 116 studied samples was subjected to thermal demagnetization in 12 to 14 thermal fields. Results of the multicomponent analysis of remanence show that the samples of limestone from these localities display a three-component remanent magnetization. The A-component is undoubtedly of viscous origin and is demagnetizable in the temperature range of 20 to 60 (90)°C; the B-component is also of secondary origin being demagnetizable in temperature range of 60 to (200) 240 °C; the 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. The predominant reverse directions of the C-components of remanence and low unblocking temperatures of minerals – carriers of C-components – indicate that these directions do not represent palaeomagnetic directions. To test the possible influence of phase changes of magnetic minerals, diagrams of k_t/k_n values were also constructed for all samples. Results of these diagrams show phase changes of magnetically active (mostly Fe-oxides) minerals to occur during laboratory thermal processing, especially at low (300–400 °C) temperature intervals.

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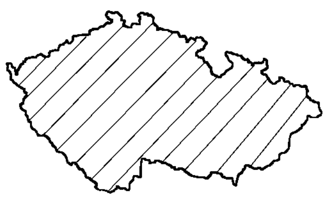
13. Programme of Advancements in Scientific Research in Key Directions

(13a) 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: Palaeozoic evolution of the Bohemian Massif terranes integrated into the history of the European Variscides (***F. Patočka, J. Fiala, J. Filip, J. Hladil, M. Konzalová, M. Krs, J.K. Novák, P. Pruner, M. Svojtka, M. Vavrdová, Z. Vejnar & J. Waldhausrová***)

Introduction (***F. Patočka***)



The Bohemian Massif has a unique position as the largest exposed part of the Variscan orogen in central Europe. It is interpreted as a collage of terranes differing in protolith and tectonometamorphic history. The terrane amalgamation was a result of the Variscan multiple collisions of peri-Gondwanan microplates with Baltica and terranes attached to it during the previous cycles. The subsequent late Variscan large-scale thrusting and horizontal shear movements generated the dominant architecture of the Bohemian Massif. Numerous attempts were made to identify individual terranes in the Bohemian Massif, define them regionally and describe their histories. The purpose of this project is to summarize relevant conclusions obtained by variety of methods and evaluate the results in order to precise the concept of the terrane architecture of the Bohemian Massif and to define the sequence of the prominent events in the Massif development as well as their significance for the Palaeozoic evolution of the Central European part of the Variscan orogen.

INDIVIDUAL RESULTS:

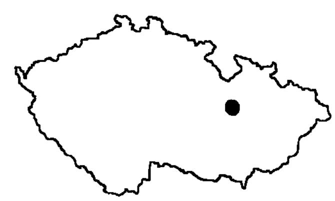
U–Pb zircon ages and structural development of metagranitoids of the Teplá Crystalline Complex: evidence for pervasive Cambrian plutonism within the Bohemian Massif (Czech Republic) (*W. Dörr W.,* ***J. Fiala, Z. Vejnar****, G. Zulauf – joint research with Institut für Geowissenschaften und Lithosphärenforschung and Geologisch-Paläontologisches Institut*)

U–Pb zircon dating of three metagranitoids, situated within a tilted crustal section at the northwestern border of the Teplá Barrandian Unit (Teplá Crystalline Complex, TCC) yielded similar Cambrian ages. The U–Pb data of zircons of the Teplá orthogneiss define an upper intercept age of 513+7/-6Ma. The $^{207}Pb/^{206}Pb$ ages of 516±10 and 511±10 Ma of nearly concordant zircons of the Hanov orthogneiss and the Lestkov granite are interpreted to be close to the formation age of the granitoid protolith. Similar to the Cambrian granitoids of the southwestern part of the Teplá–Barrandian Unit (Domažlice Crystalline Complex, DCC), the Middle Cambrian emplacement of the TCC granitoids postdates Cadomian deformation and metamorphism of the Upper Proterozoic country rocks, but predates Variscan tectonometamorphic imprints. Structural data as well as sedimentological criteria suggest a dextral transtensional setting during the Cambrian plutonism, related to the Early Paleozoic break-up of northern Gondwana. Due to strong Variscan crustal tilting, the degree of Variscan tectonometamorphic overprint is strikingly different in the dated granitoids. It is the lowest in the weakly or undeformed Lestkov granite located in the greenschist-facies domain. The Teplá orthongeiss in the north underwent pervasive top-to-NW mylonitic shearing under amphibolite-facies conditions. There is no indication for a resetting of the U–Pb isotope system of the Teplá orthogneiss zircons that could be attributed to this imprint. Radiation damages accumulated till the present are probably responsible for lead loss.

Geochronology of the granulite facies rocks (***M. Svojtka***)

New major element and isotope data from HP–HT felsic granulites, granulite-grade gneisses and syn-tectonic granites of the Gföhl Unit in the Bohemian Massif were examined.
The studied garnets are zoned in major cations with Fe/(Fe+Mg) decreasing from core to rim. The outer rim shows retrograde zoning with increasing Fe/(Fe+Mg), decreasing Ca and increasing Mn content. The studied garnet profiles show both the prograde and retrograde zoning.
The Rb/Sr isotope ratio of biotites and muscovites (from reference materials and previously identical samples) were examined by ICP-MS analyses on the Plasmaquad III mass spectrometer and the $^{87}Sr/^{86}Sr$ isotope ratio on the FINNIGAN MAT 262 mass spectrometer. Whole-rock and biotite $^{87}Rb/^{86}Sr$ isotope ratios from these samples yielded a cluster within the range: 135.323±29.75–136.754±29.26 and $^{87}Sr/^{86}Sr$ 0.7154884±0.0000366 (1σ)–0.7825141±0.0000309 (1σ).
The thermal history from high-grade rocks of the southern Bohemian Massif dates the decompression and uplift followed the prograde evolution.

Comparison of metamorphic events in the areas of the Svinov–Vranová Crystalline Unit and southern part of the Zábřeh Crystalline Unit (***M. Němečková***)



The Svinov–Vranová Crystalline Unit (SVU) is the nothernmost of small crystalline blocks exposed along the branching Marginal Fault of the Permian Boskovice Furrow, and regarded as equivalents of the Moravicum.The Svinov–Vranová Crystalline Unit is exposed as a narrow, NE–SW-oriented, wedge-shaped slice in the NW part on the Drahany Upland between the towns of Jevíčko and Mohelnice. It separates two different Palaeozoic sedimentary areas: the Mohelnice Formation in the west and Bouzov Culm in the east. The Mohelnice Formation lies in the hangingwall of the Zábřeh Crystalline Unit (ZCU). The contact in the NW part of the Svinov–Vranová crystalline unit was described as the Moldanubian or Vacetín Thrust Fault by the earlier authors. The SVU is composed of garnet mica-schists with intercalations of garnet amphibolites, quartzites to quartzite gneisses, marbles and graphite-rich rocks. The SVU corresponds to the Olešnice group of the Moravicum according to its lithology.
Small-scale structures and their relationships as well as mineral assemblages indicate a polyphase evolution of the SVU. Relics of mineral association garnet–biotite–sillimanite and S-shaped inclusions in garnets document an older metamorphic phase in amphibolite facies.
Chloritization of biotites, altered garnets and recrystallization of muscovite (new mineral associations) indicate a younger retrogressive metamorphic stage in the greenschist facies conditions.
The temperature of metamorphism has been estimated at around 600 °C by means of garnet–hornblende thermometer. Metamorphic conditions of the southern part of the ZCU differ from those of the near SVU. Amphibolite found in the southern part of the ZCU near Pěčíkov shows metamorphic conditions of granulite facies T 730–740 °C, P 10–11 Kbar. Explanation of the common occurrence of these high-grade metamorphosed rocks and low-grade metamorphosed greywackes, phyllites and garnet phyllonites is questionable. The highest metamorphic conditions in each unit show their different developments at this stage. Retrogressive metamorphism in the greenschist-facies conditions recorded in both units may indicate a proximity of these units during this stage of their development.

Eo-Variscan evolution of basins and timing of deformation in central Sudetes: sedimentary and biostratigraphic evidence (***J. Hladil**, joint research with P. Alexandowski, R. Kryza, S. Mazur, University of Wroclaw and State Institute of Geology, Wroclaw, Poland*)

Pre-Late Devonian unconformity was interpreted from a record of Middle/Late Devonian exhumation of Eo-Variscan metamorphic complexes in structural units adjacent to the Góry Sowie Massif, the Sudetes and the NE Bohemian Massif.

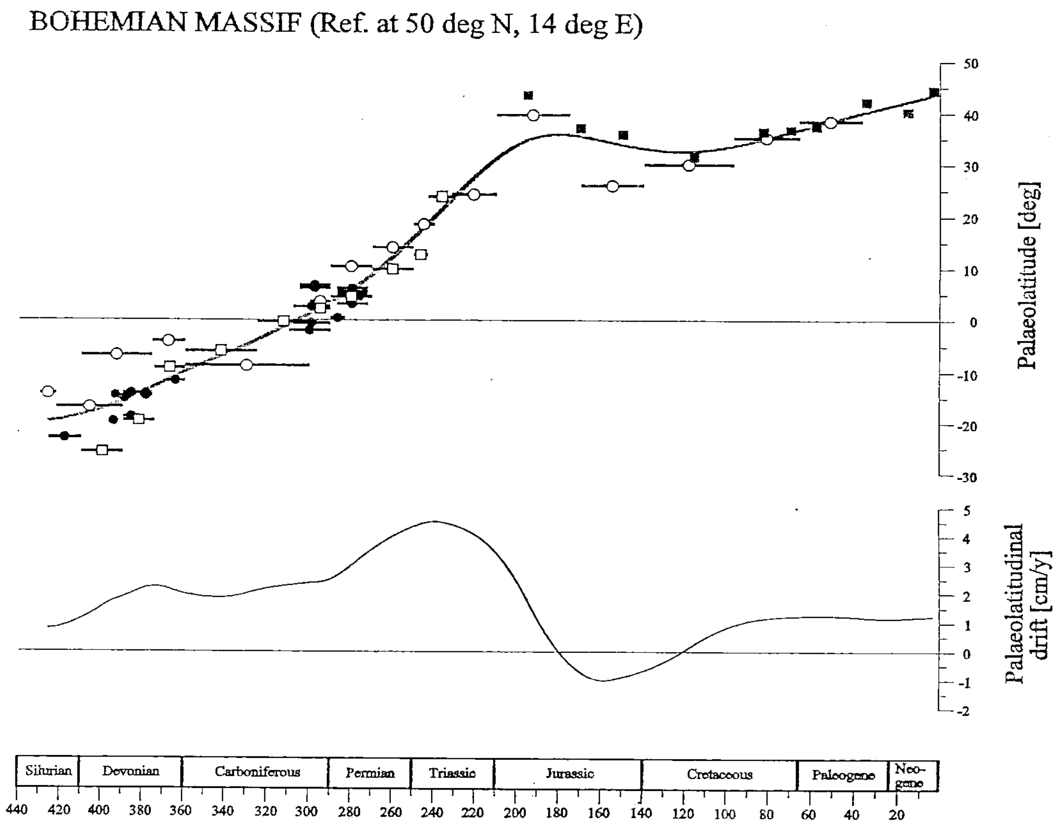
SE of the Góry Sowie Gneiss Massif, a crystalline basement of the Kłodzko Metamorphic Unit, is unconformably overlain by unmetamorphosed Upper Devonian conglomerates, sedimentary breccias and limestones of the Bardo Unit. This relationship has been long considered evidence of the Caledonian Orogeny in the Sudetes. The unconformity must have formed during approximately 10 m.y., between the early Givetian and late Frasnian, as constrained by the late Frasnian age of pelagic limestones directly overlying the basal conglomerates and by the early Givetian age of coralline fauna from the metamorphosed limestones of the Kłodzko Unit (previously interpreted as Late Silurian). This unconformity implies that at the turn of Middle and Late Devonian times, freshly deformed and metamorphosed rocks were exposed and transgressed by sediments of the Bardo sequence. The overstepping of the Bardo sedimentary rocks onto the Kłodzko Unit is equivalent to the presumed basal unconformity of the late Frasnian–early Tournaisian clastic sequence of the (Swiebodżice Basin, NW of the Góry Sowie Massif). Pebbles in conglomerates in both Bardo and Swiebodżice onlap sequences indicate that a number of metamorphic/igneous complexes in the Sudetes or in the neighboring areas were already exhumed and undergoing erosion in the Late Devonian times. Similar effects of the pre-Late Devonian metamorphism and Middle–Late Devonian exhumation are widespread in the Variscan Belt and interpreted as reflecting early to mid-Palaeozoic, Eo-Variscan convergence. The convergence was due to subduction and may have involved arc/microcontinent or microcontinent/microcontinent collisions, but, in general, did not result in mountain building.

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

Palaeomagnetic investigations carried out in both the Bohemian Massif (BM) and the Western Carpathians (WCA) were evaluated on global scales with the aim to study palaeogeographic affinities of rock formations affected by Variscan and Alpine orogens, respectively. The study of palaeotectonic deformations of rocks in the BM associated with the Variscan orogen was the starting point for the interpretation of the palaeomagnetic data of pre-Variscan formations. These data were compared (in a broader context) with the model interpretation of data inferred from the Alpine–Carpathian–Pannonian Zone and of all data so far published for the WCA. Such a procedure allowed to understand the nature of palaeotectonic deformations, especially palaeotectonic rotations around vertical axis, in the Variscan and as well as Alpine tectonic (collisional) belts, comprising rock formations close to the contact regions in the BM and the WCA. However, the rock formations belonging to the BM show predominantly large-scale clockwise palaeotectonic rotations while formations of the WCA show predominantly counter-clockwise rotations. In order to critically evaluate palaeomagnetic results from both the BM and the WCA, as relatively small areas from the viewpoint of global tectonics interpretations, all the hitherto derived palaeomagnetic data were recalculated into the form of palaeolatitudes and palaeomagnetic declinations extrapolated to a single reference point in the WCA ($\varphi=49^{o}$ N; $\lambda=20^{o}$ E). Accordingly, also the palaeolatitudes and palaeomagnetic declinations inferred from the APWP for the stable Europe and Gondwana were recalculated to the same reference point. From these calculations, a gap of about 10 to 15^{o} in palaeolatitudes was obtained for the Early Permian rock formations, evidently as a result of Palaeo-Tethys in the realm of the WCA.

Petrology and geochemistry of the polyphase intrusions of the eastern part of the Krušné hory Mts. batholith (***J. K. Novák***)

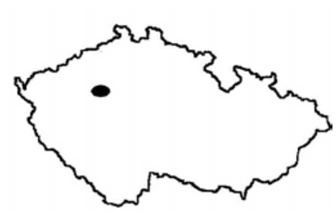
The Krušné hory Mts. batholith is a composite magmatic body, consisting of geochemically heterogeneous Western- and Eastern Granitic Plutons. Some of them are dominated by the OIC monzogranites, other by the YIC granites and transitional granites. Where observed, the Western Pluton monzogranites are slightly anisotropic and syn-collisional at magma emplacement (flow of melt), whereas the youngest granite phases occur in the extensional setting. The latter are usually altered alkaline-feldspar granites (affected by greisenization, etc.) being of economic interest until 1991.



Palaeolatitudes and palaeolatitudinal drift derived from different sources and extrapolated to a single reference point in the Barrandian (Pruner et al.)

Upper portion of the Figure: open squares – Stable Europe; open circles – Stable Europe; black squares –Eurasia; black circles – palaeomagnetism of rocks in the Bohemian Massif. Lower portion of the Figure: palaeolatitudinal drift (note increased drift for Permo-Triassic period).

Cyanophyta in Proterozoic cherts (***M. Vavrdová***)



Dark carbonaceous cherts (lydites, phtanites) of Neoproterozoic age (Kralupy–Zbraslav Group, Teplá–Barrandian Late Proterozoic) contain large agglomerations of coccoidal cyanobacteria and filamentous microbial mats. Three-dimensional preservation of microfossils indicates a chemogenous, most probaby carbonate nature of dark carbonaceous cherts. Together with additional petrological, mineralogical and geochemical evidence ecovered microfossils enabled the recognition of coastal biofacies such as subtidal fragmentary sequences, oolitic shoals, tidally influenced algal build-ups and evaporitic supratidal algal marshes. Stromatolitic textures and structures were recognized in cherts from the vicinity of Nepomuky–Příbram volcanic belt, Main volcanic belt and Stříbro–Plasy metamorphic belt. 20 localities of cherts were investigated using thin sections, palynological macerates and SEM observations of surface of rock fragments.

Silicification of microbial crusts was probably triggered by bacteriogenic reduction of sulfates in environment with abundant decaying organic matter. Evaporitic nature of newly recognized biostromes in the area north of Prague is confirmed by replacement of quartz seams. Stromatolitic layers show microfabrics, which originated by regular alternation of populations of microbial microorganisms.

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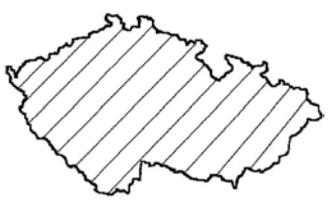
(13b) K1-042-603 Project No. 6: Atmospheric and lithospheric processes with special reference to the territory of the Czech Republic (*co-ordinator J. Laštovička, Institute of Atmospheric Physics, Academy of Sciences, Prague*)

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:

Evolution of geofluids and present-day outgassing along selected tectonic lineaments of the Bohemian Massif (***V. Suchý, J. Filip, A. Galle, J. Hladil, V. Houša, M. Konzalová, R. Mikuláš, L. Peza, P. Pruner, M. Svobodová, P. Štorch, M. Vavrdová & J. Žítt***)



Major tectonic system of equidistant, N–S-trending linear zones has been identified to cut across crystalline and sedimentary units of the Bohemian Massif, Czech Republic and peripheral parts of the Alpine–Carpathian chain in Austria and Slovakia, respectively. The zones, typically 25–40 km wide and regularly spaced about 40–60 km apart, probably represent lines of weakness that were periodically reactivated and provided conduits for hydrotermal fluids of deep-seated origin. Most of the zones were recogized by comparison of known geological, hydrogeological and geomorphological data with the features observed on Landsat images. Typically, the zones are expressed as lineament-associated concentrations of mineral and/or thermal springs, intensification of intrusions, sedimentation or mineralization. The age of the aligned intrusions shows that the linear structures are at least 15 m.y. old, but where sedimentary rocks of the Cretaceous and Tertiary are affected, the lineaments have presumably propagated from below by later movements.

Our analysis shows that many, if not most, of the present-day major discharges of mineral and thermal water in the Czech Republic are in fact concentrated within some of these N–S-trending linear zones. Some of the known occurrences of oil and gas deposits in the Alpine–Carpathian molasse foredeep and in the Vienna Basin seem to be also tied to N–S linear zones.

Mineral veins and impregnations, metasomatic effects in enclosing rocks and deposition of freshwater calcareous tufas commonly occurring along linear zones provide information on earlier, generally post-Variscan stages of fluid evolution. Spectacular examples of N–S-striking calcite veins that postdate Variscan deformations were recently described from the Barrandian Basin (linear zone 2). The veins precipitated from warm (50–115 °C) saline fluids with admixture of petroleum. Similar system of meridional late- to post-Variscan hydrothermal carbonate veins were also identified in the Devonian limestones in Moravia (linear zone 4). Where the hydrothermal fluids invaded carbonate sequences, peculiar phenomena of hydrothermal karst developed, characteristically linked with subvertical, N–S-striking calcite veins. Geomophological observations and the absolute age dating of speleothems, now in progress, suggest that much of the dissolution processes may have occurred only during the most recent geological period. Examples of present-day active processes of hydrothermal karstification controlled by the lineaments can be still observed near Hranice (linear zone 5) and Děčín (linear zone 2) where post-Cretaceous cavities were mineralized with fluorite, barite and aragonite.

Present-day outgassing processes are also still active along some of the linear zones. Pilot measurements of gas fluxes at several localities situated within linear zone 2 show elevated concentrations of methane (3–20 ppm), CO_2 (0.07–10 % vol.), C_2–C_{12} hydrocarbons and radon in soil gas and free air samples. Both concentrations and compositions of the gases sampled from hydrothermal caves and tectonic fractures appear to fluctuate in time. At some localities, a considerable decline in CH_4, C_2–C_{12}

hydrocarbons and CO_2 concentrations was recorded after the major western Turkey (Izmir) earthquake (magnitude 7.8 Ms) that occurred on August 17, 1999.

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

New grain-size composition data of Holocene fluvial loams were added confirming the previous results of lithological, morphogenetical and geochemical studies along the Labe River and its tributaries. The lithology reflects not only the geology of the source area, but the relief energy of both the source and sedimentation areas.
From this point of view, the Holocene flood-plain loams (overbank sediments) of the area studied can be divided into 3 groups: loams of highlands, hilly countries and of platform areas. Silty sands prevail (mean size Mz around 0.18 mm, sorting degree δ 3.0) in highlands with the altitude of flood plains reaching 150–300 m a.s.l., clayey-silty sands to clayey-sandy silts are dominant (mean size Mz 0.03 mm and sorting degree δ 3.2) in hilly areas with the altitude of flood plains between 80–150 m a.s.l. In platform areas with flood plain altitudes reaching max 75 m a.s.l., grain-size distribution shows that silty clay to clayey sandy silt are dominant (mean size Mz 0.002 to 0.01 mm, sorting degree δ 2.5).
Simultaneously, mineralogical analyses indicated different clay mineral contents in sediments of these groups: illite is dominant in sediments of highlands and kaolinite prevails in platform areas.

Relicts of sedimentary fabric and fossils in slightly metamorphosed rocks: Drahany Upland and adjacent areas *(**J. Hladil** & R. Melichar, Masaryk University, Brno)*

Stacking of tectonically sliced Paleozoic rocks is seen at the southern border of the Moravian Karst, where deeper water sedimentary sequences of Late Devonian to Early Carboniferous ages were tectonically placed over the shallow ones (boreholes Horákov SV-1, 2 and 3). Tectonic segments related to this deformation show the WNW–ENE elongation in the present erosion surface. However, the tectonic slicing of the Paleozoic alongside the northwestern border of the Moravian Karst to Němčice–Vratíkov Zone is superimposed on the previous structures. These segments show the NNW–SSE elongation in the map.
In this territory, the sedimentary sequences start at least from the Emsian and Eifelian and shallow-water sediments were stacked over the basinal facies (in opposite order than in the south). However, the basinal facies were never found in direct tectonic contact with granitoids of the Brno massif. This unusual contact was found by R. Melichar and his students during the mapping course in the neighbourhood of Valchov, where the tectonic slices of the granitoids alternate with clayey-limestone lubricant on the shear zones.
According to the present studies, the Paleozoic sediments occur in stretched slices, which are very thin (10 cm at maximum) and several metres long. Limestones are pale grey and banded in many parts, with an exception of microscopic boudins and tectonoclasts. Granitoid tectonoclasts are also present. Careful investigation of microscopic tectonoclasts in foliation-parallel, polished thin sections revealed several fragments of fossils. The most significant finds concern the flattened part of a big trilobite eye (probably a phacopid trilobite), shells of planktonic styliolinids (dacryoconarids) and fibres and spines of brachiopods (probably chonetids).
The assessment of the pre-existing lithological and stratigraphical characters suggests the Early Devonian offshore environment, which can be compared with carbonaceous layers in the Petrovice Shale or deep slope facies from the Konice area. This type of sediments differs from the Middle to Late Devonian limestones with crinoids (proximal slope facies), which are known from close neighbourhood. Comparison with platform and reef carbonates of the Moravian Karst facies shows even larger difference. Westerly dipping cleavage and relative movement of folds and slices towards the NNE correspond to very late Variscan deformation style related to the Moravian Shear Zone.

Assessment of original dimensions of the Koněprusy reef structure (***A. Galle***)

The Koněprusy Devonian is presumed to be the remnant of a large reef complex comparable to the Recent oceanic atolls or barrier reefs. Such structure requires massive supply of the oceanic water from the deep large basin to supply the reef with nutrients. As the known non-reef Pragian of the Barrandian does not meet such requirements, the existence of a large deep oceanic basin is presumed in the close vicinity of Barrandian area.

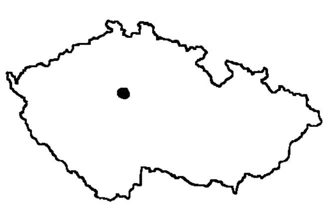
Palaeomagnetic and palaeogeographic investigations in the Barrandian area and the Western Carpathians (***M. Krs, P. Pruner, D. Venhodová, O. Man & J. Slepičková***)

Palaeomagnetic data from the Variscan and pre-Variscan formations of the Bohemian Massif (BM) were interpreted both tectonically and palaoegeographically with respect to the all-European palaeomagnetic results. The Trans-Eropean Suture Zone (TESZ) as a prominent palaeolithospheric boundary played a significant role in the distribution of palaeomagnetic pole positions. Pre-Early Permian rock formations SW of the TESZ show marked horizontal palaeotectonic rotations whereas no such rotations were recorded to the NE of this zone, in the territory of the East European Craton. Palaeolatitudes inferred for the Devonian to Early Permian rocks of the BM are in agreement with the all-European data and can be considered definitive. Variations in mean palaeolatitudes through geological time indicate that the palaeolatitudinal drift increased from 2 cm/year to about 4 cm/year during the Middle Devonian–Early Triassic interval. Similar increased palaeolatitudinal drift was derived also for the Western Carpathians, within the Permian–Triassic interval. This interpretation is based on derivation of mean values of palaeolatitudes extrapolated to a single reference point in the Western Carpathians, with respect to all palaeomagnetic data so far derived from the Western Carpathians and those extrapolated from Gondwana.

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

The rarely scattered unicellular organisms and the cyanobacterial filaments of *Eomycetopsis* together with benthic silicobacteria were found among the prevailing graphitic and semigraphitic organic matter. The aim of the present topic is the comparison with different lithofacies, especially siliciclastic sediments, in the Barrandian Proterozoic.

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



During studies of phosphatic crusts and coatings of lydite substrates, interesting new phenomena were found in the late Cenomanian–lower Turonian deposits NW and NE of Prague. Lydite clasts (mostly coarse pebbles to medium boulders, i.e., 3.2 cm–2.0 m) found both as sedimentary conglomeratic relics "in situ" and redeposited in the Quaternary deposits show interesting as yet only little known or completely unknown features. These features belong to two categories: (1) corrosion, (2) colour alterations. Corrosion affected rounded clasts and may be so deep that the original shapes of smaller clasts are sometimes hardly distinguishable. Colour alterations are mostly developed in only thin superficial layer of lydite. However, the superficial corrosion is accompanied by more intense colour changes affecting also clast internals at several localities west of Brandýs nad Labem. There is a yellow zone extending from the surface and, in smaller clasts, including the whole clast. Dark cores of larger clasts are mostly unaltered. The yellow zone of clasts may be rarely altered into a green, relatively thin zone, forming clast surface. The age of both colour changes follows from the deposition of clasts in the Late Cretaceous deposits and their encrustation by Cretaceous epibionts. Altered (i.e., corroded and coloured) clasts are mixed with normal clastic component of conglomeratic rocks (the age of which is mostly late Cenomanian), which indicates their redeposition from older (?middle–late Cenomanian) beds. Palaeoenvironmental control of the mentioned chemical effects on lydite clasts is studied at present.

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

Six principal calpionellid associations were found in the limestone body of the Municipal Quarry, from which 4 are characteristic for the Štramberk Limestone (Upper Tithonian, Lower Berriasian) and 2 for the Olivetská hora Limestone (Upper Berriasian). According to the distribution of calpionellid associations, the limestone body in the Municipal Quarry can be divided into three main tectonic units.

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

A detailed study of the Llandovery–Wenlock boundary strata was carried out at Corral de Calatrava Section in central Iberian Zone. Whilst the latest Llandovery *Cyrt. lapworthi* and *Cyrt. insectus* biozones and the lower Wenlock *Monograptus riccartonensis* Zone were identified for the first time in the Central Iberian Zone, the most important *Cyrt. centrifugus* Zone of basal Wenlock as well as *Cyrt. murchisoni* Zone remained obscure. Common shelly fauna (bivalves, brachiopods, nautiloids, cornulitids) account for temporary incursions of better oxygenated waters and, perhaps, temporary shallowing across the boundary interval. Owing to the occurrence of conodonts and chitinozoans, an integrated stratigraphy will be elaborated in cooperation with J.C. Gutiérrez-Marco, D.K. Loydell, G. Sarmiento and G. Mullins.
Densely sampled section at El Pintado Dam near Cazalla de la Sierra (Ossa Morena Zone) ranges from the base of Silurian to the Early Ludlow. This section yielded richly fossiliferous *Lituigraptus convolutus* Biozone (first record) as well as entirely complete and fossiliferous *Stimulograptus sedgwickii* Zone. Early mid-Llandovery biozones seem to be either missing or extremely condensed. A search for potential unconformity is under discussion. 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 so far tentatively dated graptolite–shelly fauna from Hýskov in the Barrandian area. Post-extinction graptolite fauna from Hýskov was described and the paper is going to be submitted.

Palynology of selected exposures in the localities of Neue Welt Gosau Group (***M. Svobodová***)

Palynomorphs were found in seven samples (of 17). Terrestrial flora, especially triporate angiosperm pollen of the Normapolles group is the most abundant and diverse in the Grünbach and Maiersdorf sections. The presence of dinoflagellate cysts and acritarchs, together with faunal rests of scolecodonts and chitinous linings of foraminifers, is taken as indicative of marine influence. Microbial activity associated with weathering may explain the scarcity and poor preservation of dinoflagellate cysts. Angiosperm pollen dominate at most localities with the species *Pseudopapillopollis praesubhercynicus, Suemegipollis germanicus* and *Ocullopollis,* whereas the locality of Maiersdorf is dominated by *Pseudopapillopollis praesubhercynicus, Pseudopapillopollis* sp., *Trudopollis minimus* and *Vacuopollis* cf. *minor.* The dinoflagellate assemblage shows low species diversity. Most species are long-ranging forms, only *Pyxidinopsis bakonyensis* is stratigraphically important.

This palynological analysis shows that the assemblages of GRÜ2, GRÜ3 and partly MAI1 are very similar to the assemblage from the Polány Marl Formation of Hungary and can be assigned to the *Paleostomocystis bakonyensis–Pseudopapillopollis praesubhercynicus* Zone. Góczán, Siegl & Farkas placed this zone within the Upper Maastrichtian. Based on the foraminifers near the Campanian/Maastrichtian boundary and both palynomorphs and nannoplankton, the Polány Marl Formation is assigned to the end of the Late Campanian.

Taxa locality	Grü 2	Grü 3	Grü 4	Grü 6	Mai 1	Zw 2	Dö 1
Dinoflagellate cysts and acritarchs							
Canningia sp.					*		
Dinogymnium sp.		*					
aff. *Dinogymnium* sp.					*		
Isabelidinium sp.					*		
Oligosphaeridium sp.				*			
Pyxidinopsis bakonyensis Góczán					*		
Micrhystridium sp.							
Annelida-Polychaeta -scolecodonts		*					
Spores of pteridophytes							
Appendicisporites sp.					*		
aff. *Converrucosisporites* sp.		*					
aff. *Dictyophyllidites* sp.			*				
Gymnosperm pollen							
Corollina torosus (Malj.)						*	
Angiosperm pollen							
Oculopollis sp.			*	*			
Pseudopapillopollis praesubhercynicus	*	*	*				
Pseudopapillopollis sp.			*				
Suemegipollis germanicus		*	*				
Suemegipollis sp.		*					
Interporopollenites sp.			*				
cf. *Pseudoplicapollis peneserta*		*					
Trudopollis minimus Góczán					**		
Vacuopollis cf. *minor* Pacltová & Krutzsch					**		
Minorpollis sp.		*	*		*		

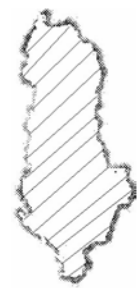
Distribution of dinocysts, spores, pollen and other organic-walled microfossils in productive samples from Gosaumulde near Grünbach , *…present, **… 2–5 specimens, R…redeposition (M. Svobodová)

Subproject: Selected groups of Czech and Albanian Cretaceous gastropods and bivalves: taxonomy, taphonomy, sedimentary environment and geological and paleogeographical aspects of their outcrops (***L. H. Peza***)

(I.) Echinoid remains from the Lower Cretaceous deposits of Albania (Mirdita zone) (***Peza L. H.*** & ***J. Žítt***)

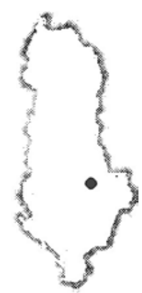
There are few localities containing echinoids in the Barremian–Aptian deposits of the Mirdita Zone. The most important of them are the sections of Fareti and Llënga (in the central part of the Mirdita zone), Voskopi section and small outcrops near the town of Leskovik (southern part of the Mirdita Zone). The deposits containing echinoids consist of conglomerates and limestones, which unconformably overlie ophiolites. *Cidaris lordyi* Devor, *Cidaris* sp., *Balanocidaris ryzacantha* (Grass), *Rhabdocidaris* sp and *Pseudocidaris* sp. were found and described for the first time in Albania. This fossil collection is similar as in France, Bulgaria and other Balkan countries.

(II.) Nerineacean Gastropods in the Upper Jurassic–Cretaceous of Albania (***L.H. Peza***)



Nerineacean gastropods are very frequent in the shallow-water deposits of the Upper Jurassic and Cretaceous of Albania. They are found at many places in these deposits in the Sazani, Kruja, Albanian Alps and Mirdita zones. The representatives of the following genera of the nerineacean gastropods genera were found: *Nerinea, Ptygmatis, Endioplocus, Cryptoplocus, Diozoptyxis, Adaptyxis, Aphanotaenia, Plesioptygmatis, Plesioplocus, Neoptyxis, Diptyxis, Nerinella, Aptyxiella, Faretella, Poliptyxis, Multiptyxis, Phaneroptyxis, Costaella, Nerineoides, Pleioptyxis, Trochoptygmatis, Itieria, Favria, Campichia*. Some genera and species of nerinacean gastropods, yet unknown from the literature, were described for the first time from the Cretaceous deposits of the Albanides: *Plesioptygmatis myslimi* Peza, 1970, *P. albanica* Peza, 1970, *P. hasani* Peza, 1970, *Plesioplocus futtereri* (Pchelintsev) Peza, 1987, *Faretella biplicata* Peza,1988 gen. et sp. nov., *Aphanotaenia elongata* Peza, 1988, *Plesioptyxis ronchetti Peza*, 1988, *P. preolisiponensis* var. *delpey* Peza, 1988, *Costaella korçensis* Peza, 1988, *Trochoptygmatis vinjollensis* Peza, 1989, *Adaptyxis lavdaris* Kollmann and Peza, 1997, gen.et sp.nov. and *A. carinatus* Kollmann and Peza, 1997.

(III.) Rudists and other fossils from the Voskop section, Mirdita Zone, southeast Albania (***L.H. Peza***, *P. Theodhori* & *E. Peza, Institute of Geology, Tirana*)



Many blocks of Kimmeridgian–Berriasian age lie at the base of the Voskopi section, containing many ammonites and calpionellids. They were transported some ten kilometres west during the Mirditean phase (Hauterivian). Originally, they represented the earliest deposits on the ophiolites in the Mirdita Zone. Barremian–Aptian, Albian, Cenomanian and Turonian deposits with many micro- and macrofossils (forams, gastropods, rudists and other bivalves) were studied for the first time in detail. During the Aptian–Albian, deltaic conditions were established in the region, as opposed to the platform conditions during the Cenomanian and Turonian. While the Albian deposits are not proved, the Cenomanian and Turonian ones are very well proved by the presence of many forams, rudists and other molluscs.

(IV.) Jurassic, Cretaceous and Early Paleogene tectonics in the Internal Albanides (***L. H. Peza***)

Some orogenic phases in the Internal Albanides were studied for the first time in detail. Cimmerian, Mirditean, Austrian, Mediterranean, Subhercynian, Laramide and Illyrian phases were recognized along with their effects in the Albanian territory. Three nappes were formed during the Hauterivian (Mirditean phase) in the Internal Albanides: Kurbneshi nappe and the Vanas–Perroi Varoshit nappe in the northern part and Vithkuqi nappe in the southern part of the area. Three other nappes are recognized during the Illyrian phase (Middle Eocene): Shkodra nappe in the northern part and Devolli nappe and Kolonja nappe in the southern part of the territory. These overthrust sectors are proposed for the first time as an effect of major orogeny. These results were reached after many years of studies in stratigraphy, sedimentology and fossil content of the Jurassic, Cretaceous and Early Tertiary deposits.

(V.) Environmental impacts of pyritic bauxite from the Dajti Mine, Albania (***J. Novák, L. Minařík, L.H. Peza & K. Melka***)

Owing to the complexity of mature karst systems and the vulnerability of vital karst aquifers, the environmental impacts of pollution in the Dajti Mine are more sensitive than those of other rock terrains, even though the acid-neutralizing capacity of the calcareous environment is high. This bauxite is Serravalian (Middle Miocene) in age. The principal impact of acidity induced by pyrite oxidation was recognized mainly at the Dajti bauxite mine (Kruja Zone, central Albania), where pyrite-bearing gibbsite-boehmitic bauxite is now exposed to weathering at spoil tips and mobile metal ions induce ecologic problems after copious rainfalls. The polluting metals such as water soluble (bioavailable) Al, Fe, Cd, Zn, Ni Mn and Co are leached into the aquatic environment and their concentrations in leachates are higher than those in American Maximum Contamination Levels for drinking water, as shown by acid leaching experiments. The extremely acid, hydrated sulphate-producing bauxite (with melanterite, halotrichite) is at least phytotoxic, while oxic, haematite-bearing one is regarded a more appropriate raw material for mining and economic processing because of lower extraction degree of toxic metals. Haematite-bearing boehmitic bauxite from the new locality of Mali Korites (Mali Thate Mts., southeastern Albania) was also treated with HNO_3 solutions in laboratory. This bauxite fills karstic depressions in the Triassic limestones. It is richer in transition metals such as Fe, Cr, Mn, Ni, Co and Be. Due to the local hydrological conditions and the absence of derived acidity, it is predicted that these metals remain immobile (adsorbed in bauxite particles and haematite).

Triassic sandstones of the Krkonoše Piedmont Basin (***R. Mikuláš***)

In the northeastern Bohemia, uppermost layers of the Triassic sandstones of the Krkonoše Piedmont Basin were evaluated from the ichnological point of view (i.e. fossil traces of organisms were studied). It has been shown that the Triassic sandstones (well exposed in the Devět Křížů Quarry) gradually pass into overlying yellowish sandstones with strong bioturbation, with the intensity of bioturbation increasing towards the base of the overlying Cretaceous strata. All the biogenic structures (i.e. tunnels, tunnel/shaft systems, three-dimensional boxworks and shafts made by invertebrates and partly by plant roots) are opened on the erosional plane of the marine Upper Cretaceous. The bioturbation, although affecting the Triassic substrate, is therefore Upper Cretaceous in age, and all rocks of the Devět Křížů sandstone were deposited during a sole non-marine sedimentary cycle in the Middle or Upper Triassic.
The Middle to Upper Triassic sandstones in the Devět Křížů Quarry are important as the locality of the first dinosaurian footprint from the Bohemian Massif.

Ichnology joined with archaeology, Holocene of the Northern Bohemia (***R. Mikuláš***)

The area of the "castellated sandstones" at Dubá (northern Bohemia, Czech Republic) yielded several tens of Late Pleistocene to Recent sand taluses with archaeological context (Mesolithic to modern). Most of the taluses are richly stratified; the stratigraphy is, however, often affected by bioturbation. The ichnofabric of the taluses was evaluated using actualistic observations and autecological knowledge. The most important features of the ichnofabric are (1) homogenized sand layers; the "mixed layer" (usually uppermost 10 cm of the substrate) is bioturbated mostly by resting pits of large mammals (pigs, roe deer) and by ants, ant-lions and beetles; (2) spotting caused by roots (mostly the pine roots); (3) "krotovinas" of small mammals (e.g., moles); (4) deep, complexly filled burrows of fox and badger; (5) actively back-filled tunnels of insects; (6)

cultural human activities (ash layers, fireplaces, pits).

Acritarchs in oolitic ironstones (***M. Vavrdová***)

Oolitic ironstones of the Early Ordovician age from Klabava and Šárka Formations contain well preserved, richly diversified assemblages of acid-resistant microfossils. Mass occurrences of palynomorphs, predominantly representing durable stages of unicellularmarine microplankton, and excellent preservation of specimens in iron-rich sequences may coincide with the presence of ascending currents, bringing nutrient-rich bottom waters to the coast.
Peri-Gondwanan microplates of Avalonia, Ibero-Armorica and Perunica, situated at high latitudes on the Southern Hemisphere, are distinguished by the common occurrence of synsedimentary oolitic ironstones, most of which are richly fossiliferous. Mudstones with chamositic oolites may yield up to hundreds thousands of specimens per gram of rock. Most extensive iron ore deposits accumulated during the Llanvirnian and early Caradocian in Algeria, Morocco, Portugal, Spain, Thuringia and Bohemia. High-density, high-diversity acritarch assemblages have been reported from iron ores. Microfossils were investigated from the localities of Velíz NW of Zdice, Krušná hora near Beroun (main deposit) and Ejpovice east of Plzeň. Abundant specimens were observed in thin sections of ironstones (borehole KH 21/1960). Ironstones, commonly associated with black shales and claystones with tuffitic admixture, reflect the regressive and earliest trasgressive phases of eustatic changes of sea level, coinciding with the Ordovician glaciation.
A decline of acritarchs at the end of the Devonian corresponds to a radical restriction in the formation of oolitic ironstones in global scale in the Carboniferous, Permian and Triassic.
New interpretation of the origin of oolitic iron ores relates the formation of oolites with coastal upwelling. Lateral alternation of iron ores with black shales rich in iron and organic matter does not support terrestrial origin of the accumulated iron. Coincidence of acritarch blooms and ancient zones of upwelling, suitable for the phytoplankton production, can be confirmed by further study of accumulations of palynomorphs in the vicinity of iron ore occurrences.

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

Microvertebrate remains (ichthyoliths) were categorized. Ichthyoliths sensu lato are isolated fossil skeletal elements (like scales, teeth or bones) of aquatic or semi-aquatic vertebrates. This term can be subdivided according to practical aspects into the two following terms. Ichthyoliths *sensu stricto* are free, chemically separated ichthyoliths. Ichthyoliths on the bedding surfaces are ichthyoliths, which are attached to sediment surface. Microvertebrate community is an assemblage of ichthyoliths in a clearly defined fossiliferous horizon or stratigraphic unit. Microvertebrate communities of Stephanian C (*Sphaerolepis* subzone) are quite different from the communities of the lowermost Permian (*Acanthodes gracilis* biozone). *Acanthodes fritschi* was replaced by *Acanthodes gracilis*. Actinopterygian species with distinctly sculptured scales (e.g., *Sphaerolepis*, *Watsonichthys*, *Progyrolepis*, *Spinarichthys*) were replaced by species with mostly smooth scales (e.g., *Paramblypterus*). The rich assemblage of shark teeth, scales and mucous membrane denticles of the *Sphaerolepis* Subzone is represented by xenacanthids *Orthacanthus*, *Plicatodus*, *Triodus*, *?Xenacanthus*, and *?Lebachacanthus* and by hybodonts *Limnoselache* and *Lissodus*. The xenacanthid genus *Bohemiacanthus* (*Triodus*) is known from the lowermost Permian *Acanthodes gracilis* Biozone only. The important and strong change of fauna was detected at the Carboniferous/Permian boundary. On the contrary, the forthcoming important floral change was detected in the Westphalian. The Lower Permian vertebrate communities progressively turn to meagre as a result of climatic changes (lake water chemistry).

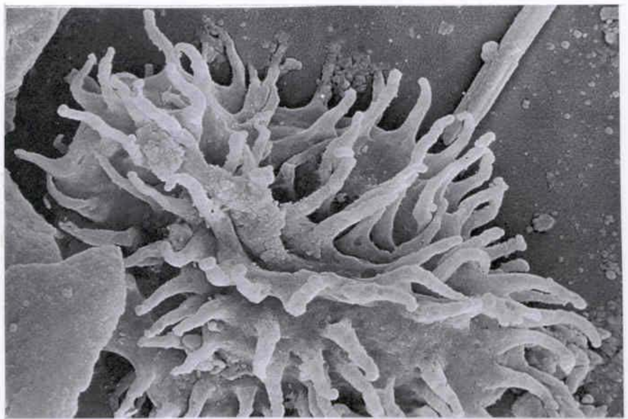
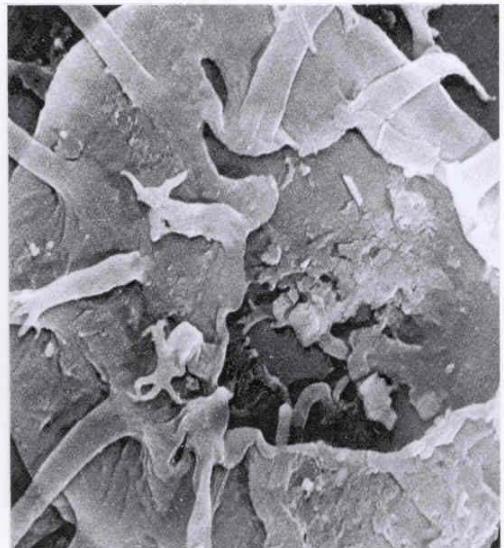
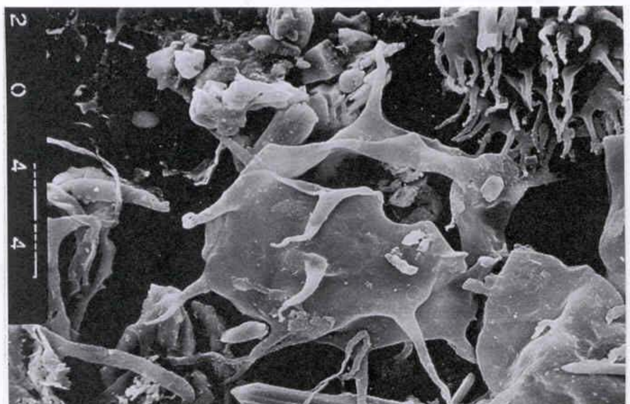


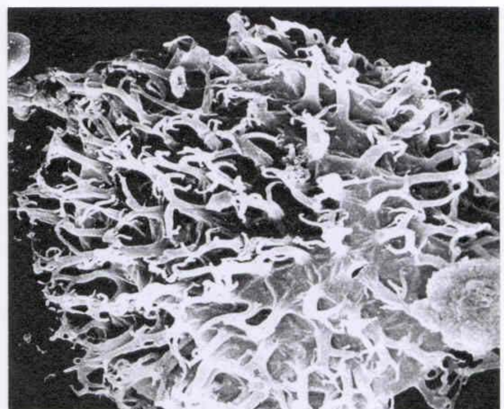
Fig. 1 Athabascaella cernuta, Klabava Formation, Arenig
Locality: Mýto near Rokycany x2000



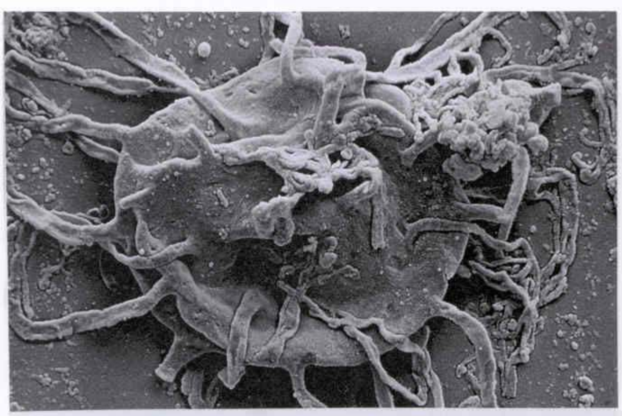
Stelliferidium sp., Šárka Formation, Llanvirn
Locality: Krušná hora near Beroun, x2000



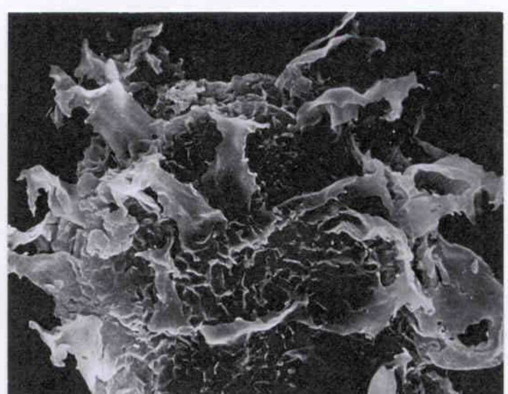
Polygonium gracile, Klabava Formation, Arenig
Locality: Mýto near Rokycany, x1500



Stelliferidium furcatum, Klabava Formation,
Locality: Mýto near Rokycany, x2000



Kladothecidium eligmosum, Klabava Formation, Arenig
Locality : Mýto near Rokycany, x2000



Peteinospharidium cristatum, Klabava Formation
Locality : Mýto near Rokycany, x 2000

Acritarchs in oolitic ironstones (M. Vavrdová)

		Orthacanthus	*Plicatodus*	*Xenacanthus*	*Triodus*
height (mm)		up to 3-12	up to 1-6	up to 1-7	up to 1-3
base	aboral surface	often punctated		more or less smooth	
	MD/LL	0,8-1,0	1,3-1,4	1,0-1,5	0,7-1,0
	shape (outline)	cordiform, oval, round, rhomboid or pentagonal	oval to rhomboid.	cordiform, ovoid, oval or rhomboid	round, oval, round square, rhomboid, pentagonal or asymmetric
	relative thickness	thick	flat	flat	relative flat
basal tubercle	shape (outline)	without concave depression; labially round	rhomboid or round, labially bulged	with concave depression; oval, ± shaft	with concave depression; round, oval to ovoid, ± shaft
	relative thickness	mostly strong	relatively strong	mostly strong	strong
nutrient foramina, bottom side		small number	10-15, occasionally slot-shaped	numerous (2-10 larger ± up to 20 smaller)	2-9
apical button	shape (outline)	oval, cordiform or rhomboid; often reaches up to labial border	round; flat	low; round, oval or rhomboid	strong; round, oval, ovoid or rhomboid
	relative size	35-46%	23-36%, distal teeth up to 45%	27-51%, mostly 33-48%	39-56%, mostly 39-50%
	shaft	yes (sometimes with large opening) or not	yes	yes (narrow to wide, sometimes with large opening) or not (reaches up to lingual border)	mostly yes (sometimes with large opening)
central foramen		yes	yes	?	?
nutrient foramina, upper side		small number	9-16 irregularly arranged; (2 in case of commissural teeth)	numerous (6 to more than 20)	2-9
angle between crown and base		> 90°	100-115°	> 90°	90-135°
median cusp	number	1	1, sometimes 1-2 additional cusps	1	1
	relative length	up to 1/2 lateral cusps	1/4-1/2 lateral cusps	1/5-2/3 lateral cusps	1/2-3/4 lateral cusps; slender
	mesio-distal edges	2, serrated	2	2 (sometimes marked)	2-4
	labial cristae	0	1	0-1	
	lingual cristae	0	1	0-1	
lateral cusps	shape	labio-lingually compressed; broad dagger-shaped	distal part with sigmoid curvature	distal part with sigmoid curvature	slender conical
	cross section	lanceolate	elliptical to lanceolate (near base), polygonal (distal part)	round, oval to lanceolate (*X. decheni* labial flat, lingual distinctly convex	round to oval (near base), polygonal (distal part)
	mesio-distal edges	2, serrated (up to 2 systems)	2 (sometimes weakly serrated)	2, smooth	3-9
	labial cristae	0	4-14; 3/4 to whole cusps length	0 (mostly)-4	
	lingual cristae	0		0 (mostly)-2	
	cristae bifurcation	none	curved or wavy, sometimes splitted vertical cristae (hybodontid pattern)	none (mostly) or irregular	Y-shaped or irregular (*Bohemiacanthus*)

The tooth morphology of the main European shark genera of the family Xenacanthidae (non-marine Upper Carboniferous to Lower Permian only). Majority of data is adopted, the relative mesio-distal prolongation of the base (MD/LL means maximal mesio-distal size/maximal labio-lingual size of the base) and the relative size of the apical button (proportional in maximal mesio-distal size) were measured on the basis of pictured specimens (Boy 1976; Fritsch 1889, 1890; Hampe 1988a, 1988b, 1989, 1993, 1995; Schneider 1985, 1988, 1996; Schneider & Zajíc 1994; Soler-Gijón 1990, 1997b; Soler-Gijón & Hampe 1998). The following genera are not mentioned in the chart: *Hagenoselache* is known only as the holotype (Heidtke 1997). Teeth morphology of the genus *Bohemiacanthus* differs essentially from that of genus *Triodus* in the variant (irregular) bifurcation of the cristae (Schneider 1996, Schneider & Zajíc 1994, Soler-Gijón & Hampe 1998). Tooth morphology of the genus *Lebachacanthus* is almost identical as that in the genus *Orthacanthus* but the former genus belongs in the family Lebachacanthidae (Boy 1976, Hampe, 1988a, Heidtke 1982, Soler-Gijón 1997a).

(13c) 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***)

INDIVIDUAL RESULTS:

Loessification Processes (***V. Cílek***)

Pécsi (1990) stated that "loess is not just the accumulation of dust" and this sentence can be almost literally found in the important Czech paper on loess published by Ambrož in 1947. The aeolian dust falls in the form of clay-silt sediment called "prachovice" in Czech (sandy loam). Such sediment occurs below altitudes of 350–420m a.s.l. and rapidly changes into loess, while at higher and usually more humid elevations its development continues as decalcified, silty or clayey brown soils or slope sediments. The loessification must be almost sudden process as the unconsolidated dust with total porosity of ca. 50 % could not otherwise survive more than 2–3 years. The authigenic minerals were analysed in order to establish the major loessification processes:

(1) "Clay bridges" among quartz grains are often impregnated by calcium carbonate and by Al–Si hydroxides. The identification is rather problematic since the composition is blurred by clay mineral composition. However, individual crusts or tubular and stalactitic microconcretions of an amorphous mineral close to composition to allophane (Al:Si approx. 1:1) were found with elevated Fe content (up to 7 wt.%) and alkalis (Ca, Mg, K, Na, total less than 1 %). Some amorphous coatings and clay mineral impregnations are close in composition to opal or Si–Al mixed hydroxide where silica prevails. Three most important cementation bonds can be basically distinguished: (1) calcitic bonds; (2) allophane bonds (heterogeneous composition ranging from 1:1 allophane to almost pure opal); (3) siderogel bonds of usually epigenetic origin. The fast impregnation of clay particles between quartz grains and the general consolidation of porous "accumulation of dust" by these three types of cement is probably the key factor in loess formation. The porosity of loess ranges between 40–55 %. The capillary movement of fluids to the surface induced by dry air and high temperatures during hot continental summer or the cycles of water condensation in loess pores may be responsible for the release and precipitation of cement minerals and hydroxides.

(2) The most common authigenic mineral is calcite in the form of pulver, needle-like crystals often concentrically arranged around pores (former organic filaments with CO_2 uptake), concretions of various size and different monocrystals or crystal aggregates. The most important part of the authigenic carbonate is not derived from clastic fraction because fragments of Jurassic limestone in Dolni Vestonice loess section (and elsewhere) are not weathered. Other sources of calcium carbonate may come from rainfall, marine spray or more probably a "typical" bicarbonate ground water as proposed by Ambrož (average CaO content in groundwaters of the Bohemian Massif ranges between 35–360 mg $CaO.l^{-1}$). Ambrož performed a simple experiment when decalcified soil was watered from below: fine-grained calcite was found in the soil and carbonate crusts formed at the surface in two weeks. The evaporation transport of the capillary soil solutions during hot and short, continental glacial summers seems to be the leading mechanism of the sudden internal hardening of the loess structure via impregnation of clay bridges between silt particles.

(3) Less important loessification processes include the formation of authigenic dolomite, phosphate precipitation in the form of Ca-phosphate coatings on carbonates or Fe-Al or Al-phosphate grains and cement in paleosols, phosphate impregnation of faecal pellets, metasomatic exchange of chalk carbonate by Fe-hydroxides and uneven, mosaic-like weathering of the clasts. The presence of deeply weathered and fresh mineral grains in loess suggests possibly both the inhomogeneity of the source material and biogenic weathering around roots accompanied by limited subsequent bioturbation.

Vižina – the Miocene basin (***M. Lachmanová***)

The study of relics of Tertiary fluvial sediments (Miocene and Pliocene) in the Bohemian Karst revealed that the river system was different from the present state. A presumed source area of these rivers is located in the northeastern Bohemia and in the area south and southwest of Prague. The study of Tertiary fluvial sediments from sand pits ”U Ručiček” near Liteň, Sulava–Kosoř, Běleč, Sloup, Klínec, and the Tertiary relict above the quarry of ”Hvížďalka” near Radotín involved analyses of heavy minerals and clay minerals of sand samples, and microscopic study of pebbles. The localities of ”U Ručiček” and ”Hvížďalka” also enabled statistical analysis of paleocurrent directions in river channels.

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

Soil cover of Bacín Hill is represented mostly by relict karst soils. The archaeological site is covered by terra fusca soil unit. Analyses of micromorphology, grain-size composition, chemical characteristics and clay mineralogy were used to determine the following stages of soil development: terra fusca type – slight pseudogleyization – slight brown earhification and formation of mull-like moder of A horizon. This relict soil has a polygenetic character. Evolution of soils at this locality included at least the Riss/Würm interglacial.

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

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

Recent and fossil molluscs of the Zadní Kopanina Valley were studied in 1999. This locality is located in the eastern part of the Bohemian Karst. Numerous karst phenomena including caves, Holocene debris and a tufa terrace were studied with respect to the present and past malacozoological character of this highly diversified area. Fossil molluscs of Middle and Upper Holocene period were recorded in the tufa terrace on the left side of the Mlýnský potok Creek. These molluscs showed that woodland malacocoenoses never fully developed in the Zadní Kopanina area during the Holocene. Species of freshwater molluscs (*Pisidium*) were also recorded, documenting the existence of periodic small basins with stagnant or very slowly flowing water. Podvojná Cave is a very small cave and the fossil molluscs recorded in the entrance reflect a parkland dominated by mesic to xeric woodland with patches of karst steppes.

Subproject: Malacocoenoses living in the territory of crystalline limestones between Sušice and Horažďovice (West Bohemia) and their importance for the reconstruction of nature conditions in the Postglacial

Natural habitats in the territory of crystalline limestones have highly developed variability of malacocoenoses reflected by high species diversity. Habitats consist of fresh mixed forest growing on scree, barren rocks, rocky steppes etc. Some records of environment-sensitive species, for example *Ruthenica filograna*, *Sphyradium doliolum*, *Merdigera obscura*, are very surprising and will contribute to their zoogeographical distribution in the Czech Republic.

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14. Organization of conferences and scientific meetings

Conferences and Symposia organized in 1999

2nd Regional Scientific Meeting of the UNESCO-IGCP representatives of the European and Neighbouring Countries, Hotel Expo, Prague-Holešovice, June 7-9, 1999. Field Trip to North Bohemia. Czech National Committee for IGCP, J. Pašava (Czech Geological Institute, Prague) and **J. Hladil**, in cooperation with J. Zuzková, E. Riedlová, O. Hodanová, J. Godany and D. Mašek, under the auspices of the Ministry of Foreign Affairs CR, Ministry of the Environment CR, Czech Geological Institute, Institute of Geology AS CR, and North Bohemian Coal-Mines, Co.
Representatives of 15 countries attended the meeting: Austria, Belarus, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, Italy, Poland, Slovakia, Slovenia, Sweden, Switzerland and the United Kingdom. After opening addresses of European and Czech authorities, three scientific reports of the IGCP projects coordinated from the Czech Republic (405, 428 and 429) were presented. Representatives of the Czech MAB and IHP National Committees exemplified prospects for useful horizontal links among separate streams of international science. The chief national representatives presented short summary reports in alphabetical order of countries. Much information was summarized in the Minutes of the Regional Meeting, available from the Chairman or Secretary of the CzNC IGCP. Several new projects were formulated and/or suggested, five of them from Austria. A generally decreasing number of newly starting projects may correspond to the higher number of funding agencies in Earth Sciences (e.g. INTASS, NATO, EU and others). Although listed as one of UNESCO's inter-Governmental programmes together with IHP, IOC, MAB and MOST, it differs from these four bodies in having a "grass roots" tradition and in operating in responsive mode. Further on, the participants agreed and recommended that the fundamental science should not disappear from the scope of the IGCP. The open communication on WEB may particularly be of service to developing of present IGCP goals, as well as policy of UNESCO.

10th Ordinary General Meeting of the Societas Europaea Herpetologica, September 1999, Irakleion, Crete, organized by Natural History Museum of Crete & Societas Europaea Herpetologica (**Z. Roček** - Vice-President of the Society).

VIIIth International Symposium on the Ordovician System**,** Prague, June 20-25, 1999, organized by Faculty of Science, Charles University, Prague and Czech Geological Institute, Prague and the Institute of Geology AS CR, Prague (**R. Mikuláš** & **P. Štorch** took excursions guidance)

3rd Workshop of The Czech Zeolite Group, March 11, 1999, Prague, Institute of Geology AS CR, Prague/Faculty of Chemical Technology, Prague. The organizing Committee: R. Rychlý, Purkyně Medical Academy, Hradec Králové, **J. Ulrych** & D. Koloušek, Faculty of Chemical Technology, Prague.

4 th Meeting of the Czech Tectonic Studies Group, Blansko-Češkovice, April 15-19,1999.
Organized by the Czech Geological Institute, branch Brno in co-operation with the Department of Geology and Paleontology, Masaryk University, Brno and the Institute of Geology AS CR, Prague – **M. Svojtka** edited a special meeting volume of Geolines (Vol. 8).

2nd National Speleological Congress and IVth Meeting of Cavers in the Moravian Karst, Jedovnice, September 7-12, 1999.
Organized by the Czech Speleological Society in co-operation with the Institute of Geology AS CR, Prague – **P. Bosák** & **J. Kadlec**, Administration of the Moravian Karst Protected Landscape Area, Blansko, The Agency for Nature and Landscape Conservation-Administration of Caves of the Moravian Karst, Blansko.
Participation of more than 300 cavers from 15 countries. Excursions to caves, surface geological and geomorphological excursions. Lectures, posters, slide and video shows. Regular annual session of the Executive Bureau of the International Union of Speleology.

Conferences and Symposia under preparation

International Conference on Past Global Changes, Praha, 6-9 September 2000. Organized by the Institute of Geology AS CR, Prague and Czech Geological Institute, Prague; Organizing Committee: **J. Kadlec**, **E. Růžičková**, D. Nývlt (Czech Geological Institute, Prague). We register 132 scientists as potential participants, who responded to preliminary conference announcement. The Organizing Committee addressed 8 scientists as invited lecturers and Dr. Oldfield (executive president of the PAGES Project). Web presentation of the conference – **J. Zajíc**.

International Conference: Climate Changes-the Karst Record II, July 27-August 9, 2000. Organized by the Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland (H. Hercman & T. Nowicki), Institute of Geology AS CR, Prague (**P. Bosák** & **J. Kadlec**), the Administration of Slovak Show Caves, Liptovský Mikuláš, Slovakia (P. Bella), the Geological Institute of Jagiellonian University, Kraków, Poland (M. Gradziński), the Institute of Geology of Adam Mickiewicz, Poznań, Poland (J. Głazek).
Pre-Conference excursions: Moravian Karst and karsts in northern Moravia (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. **Website:** www.ing.pan.pl/kras2000

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15. Publication activity of the Institute of Geology

In 1999, the Institute of Geology published two issues of **GeoLines –** two monothematic volumes of extended conference abstracts. 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. This year, a new editorial and advisory board of **GeoLines** was constituted:

Editorial Board:
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Jiří OTAVA (Czech Geological Institute, branch Brno)
Pavel UHER (Slovak Academy of Sciences, Bratislava)

David ULIČNÝ (Charles University, Praha)
Andrzej ŹELEZNIEWICZ (Polish Academy of Sciences, Wroclaw)

1999

GeoLines 8 (1999), 104 pp., 37 figs., 1 tab., 1 colour poster (supplement)
Abstracts of Contributions and Excursion Guide to the 4th Meeting of the Czech Tectonic Studies Group (Česká tektonická skupina, Associated to the Czech Geological Society) held in Blansko-Češkovice on April 15-18, 1999. Edited by **M. Svojtka** & P. Hanžl.
Contents:
(73 abstracts and short communications presented at the 4th meeting of the Czech Tectonic Studies Group, a guidebook to the field trip to the Brno massif and its Variscan cover)

Stanislaw ***ACHRAMOWICZ****:* The Saxothuringian/Moravosilesian Boundary Duplex Structure in the Fore-Sudetic Block
Jiří ***BABŮREK****:* Phase Petrological Study of the Bohemicum/ Moldanubicum Boundary Zone (an Example from its Westernmost Part at the Czech/German State Border)
Wojciech ***BARTZ*** *and Stanisław* ***MAZUR****:* Quartz <c> Axis Patterns in the Syntectonic Intrusion of the Doboszowice Orthogneiss (Sudetic Foreland, SW Poland)
Dawid ***BIAŁEK****:* Magmatic and Tectonometamorphic Evolution of the Zawidów Granodiorite, Lusatian Granodiorite Complex, Sw Poland
Alena ***BOUŠKOVÁ****, Josef* ***HORÁLEK*** *and Aleš* ***ŠPIČÁK****:* Earthquake Swarms in the Western Part of the Bohemian Massif
Karel ***BREITER*** *and Friedrich* ***KOLLER****:* Contrasting Styles of Magmatic Zoning in the Central Moldanubian Pluton
Kristýna ***BURIÁNKOVÁ****, Pavel* ***HANŽL****, Stanislaw* ***MAZUR****, Rostislav* ***MELICHAR*** *and Jaromír* ***LEICHMANN****:* Geochemistry of the Doboszowice Orthogneiss and its Correlation with Rocks of the Silesicum and Moravicum
Stanisław ***BURLIGA****:* Mesoscopic Indicators of Shear Zones in Salt Rocks within the Kłodawa Salt Diapir, Central Poland
Martin ***CHADIMA*** *and Rostislav* ***MELICHAR****:* Structural Investigation of the Paleozoic of the Drahany Upland, Moravia
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Elżbieta ***FELICKA****:* Chemical Composition of Heavy Minerals as Indicators of Alimentary Areas Based on a Study of Lower Carboniferous Sediments of the Intra-Sudetic Basin
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Josef ***HAVÍŘ****:* Results of the Simple Stress Analyses of Micro-earthquake Focal Mechanisms in the Area of Western Bohemia
František V. ***HOLUB****:* Geochemistry and Significance of Dyke Swarms in the Central Bohemian Plutonic Complex
František ***HROUDA****:* Magnetic Fabric in Granitic Rocks: its Intrusive Origin and post-Intrusive Tectonic Modifications
František ***HROUDA****:* Petrophysical Properties of the Brno Massif and their Tectonic Implications
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Milan ***KOHÚT****:* The Story of One Pluton-The Veľká Fatra Mts. (Western Carpathians)
Petr ***KONÍČEk*** *and Jiří* ***PTÁČEK****:* Evidence of Variscan Accretionary Wedge in the Eastern Part of Upper Silesian Basin in OKR
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Jana ***KOTKOVÁ*** *and Bedřich* ***MLČOCH****:* Granulite Xenoliths from the Doupov Volcanic Complex Area - Petrology and Geochemistry
Martin ***KOVÁČIK****:* Tectonics and Pre-Alpine Metamorphic Features of Basement in Central Part of Kohút Zone - Veporicum, Western Carpathians
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Izabella ***NOWAK****:* Growth of Garnet Porphyroblasts during Decompression of the Eclogite-bearing Mica Schists in the Fore-Sudetic Block, SW Poland
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Pavel ***UHER****:* Two Types of Granitic Rocks in Boulders from Cretaceous to Paleogene Flysch, the Pieniny Klippen Belt, Western and Eastern Carpathians
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Pavel ***HANŽL*** *and Jaromír* ***LEICHMANN****:* Stop 3: Kuřim - old quarry near railway
Pavel ***HANŽL****, Kristýna* ***BURIÁNKOVÁ*** *and Jiří* ***BABŮREK****:* Stop 4: Skalka - Zlatý potok
Jaromír ***LEICHMANN****:* Stop 5: Anenský mlýn
Pavel ***HANŽL****, Kristýna* ***BURIÁNKOVÁ*** *and Antonín* ***PŘICHYSTAL****:* Stop 6: Želešice-abandoned quarry
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GeoLines 9 (1999), 140 pp., 126 figs., 38 tab.
Extended Conference Abstracts of Final Session of the IGCP No. 369, Subproject 2a "Magmatism and rift basin evolution: Peritethyan region" held at Liblice Chateau on September 7-11, 1998. Edited by ***J. Ulrych***, ***V. Cajz*** & ***J. Adamovič***
Contents (18 papers presented in the Final Session of the IGCP No. 369 project)

Jiří ***ADAMOVIČ*** *and Miroslav* ***COUBAL****: Intrusive Geometries and Cenozoic Stress History of the Northern Part of the Bohemian Massif*
Kenneth D. ***BAILEY*** *and Alan R.* ***WOOLLEY****: Episodic Rift Magmatism: the Need for a New Paradigm in Global Dynamics*
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Ferry ***FEDIUK*** *and Hassan Al* ***FUGHA****:* Dead Sea Region: Fault - Controlled Chemistry of Cenozoic Volcanics
Joachim ***GOTTSMANN****:* Tephra Characteristics and Eruption Mechanics of the Komorní Hůrka Hill Scoria Cone, Cheb basin, Czech Republic
Peter ***IVAN****, Dušan* ***HOVORKA*** *and Štefan* ***MÉRES****:* Riftogenic Volcanism in the Western Carpathian Geological History: a Review
Stefan ***JUNG****:* The Role of Crustal Contamination During the Evolution of Continental Rift-Related Basalts: a Case Study from the Vogelsberg Area (Central Germany)
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Vlastimil ***KONEČNÝ****, Jaroslav* ***LEXA*** *and Kadosa* ***BALOGH****:* Neogene-Quaternary Alkali Basalt Volcanism in Central and Southern Slovakia (Western Carpathians)
Felicity E. ***LLOYD****, Allan R.* ***WOOLLEY****, Francesco* ***STOPPA*** *and Nelson G.* ***EBY****:* Rift Valley Magmatism - is there Evidence for Laterally Variable Alkali Clinopyroxenite Mantle?

Linia ***TAVARES MARTINS****:* Cretaceous Alkaline Magmatism in Algarve Littoral (South Portugal): a Basanite-Lamprophyre Rock Suite
Gordon L. ***MEDARIS****, Jr., Herbert F.* ***WANG****, John H.* ***FOURNELLE****, John H.* ***ZIMMER*** *and Emil* ***JELÍNEK****:* A Cautionary Tale of Spinel Peridotite Thermobarometry: an Example from Xenoliths of Kozákov Volcano, Czech Republic
Jan ***MRLINA****:* Geophysical Characteristics of the Roztoky Volcanic Centre, The České Středohoří Mts., Bohemia
Jiří K. ***NOVÁK*** *and Dobroslav* ***MATĚJKA****:* Apatite Enrichment in Nephelinite from Slánská Hora Hill, Central Bohemia
Antoneta ***SEGHEDI****, Ariel* ***HEIMANN*** *and Barbu* ***LANG****:* K-Ar Problematics of Basalts from the Triassic Succession of North Dobrogea (Romania)
Henning ***SORENSEN****, Ulla* ***BERNTH*** *and Robert* ***BROUSSE****:* Trachytes and phonolites from the Mont-Dore region, Auvergne, France
Peter ***SUHR****:* Phreatomagmatic Structures in the Northern Environs of the Ohře Rift (Saxony)
Jaromír ***ULRYCH****, Edvín* ***PIVEC****, Miloš* ***LANG****, Kadosa* ***BALOGH*** *and Vladimír* ***KROPÁČEK****:* Cenozoic intraplate volcanic rocks series of the Bohemian Massif: a review

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

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Bek J.: Miospores *in situ* from some sphenophyllalean fructifications from Bohemian Carboniferous basins of the Czech Republic. *Lecture. XIV. International Congress on Carboniferous-Permian 1999, Calgary, Canada.*

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Cajz V.: Přehled kenozoického vulkanismu Českého masívu. Lecture. *Seminář GFÚ AV. Praha.*

Cílek V. & Havel I.M.: Artefakty v krajině, krajina jako artefakt. Artefacts in Landscape, landscape as artefact. Lecture. *Fakulta architektury ČVUT. Praha 9.12. 99.*

Cílek V.: Geochemické procesy vzniku pískovcového reliéfu. Geochemical processes in the formation of the sandstone relief. Lecture. *Seminář: Pískovcový pseudokras. Turnov. 25.9. 1999.*

Cílek V.: Loessification Processes. Poster. *Loessfest, Bonn. March 1999.*

Cílek V.: Panelová diskuze: Ložiska a ochrana přírody. Mineral deposits and nature protection. Lecture. *Př.F. UK. 23.2. 1999.*

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Cílek V.: The Lower Pleistocene scree fields of the Slovak Karst and their significance for karst morphology. Lecture. *The protection, utilization and management of caves. Demänová, November. 1999.*

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Hladíková J., **Hladil J.** & Jačková I.: Evolution of Silurian and Devonian sedimentary environments in Prague Basin using isotopic compositions of carbon and oxygen in brachiopod shells (Central Bohemia, Barrandian area). Poster. *Third International Symposium on Applied Isotope Geochemistry (AIG-3), September 21-25, 1999, Orléans.*

Hladil J. & Melichar R.: Terrane Segmentation with Clockwise Rotation vs. Strong Effect of Shear Zone: Documents from Moravia. Invited lecture. *89th Annual Meeting of the German Geological Society, Final Colloqium of the project 'Orogenic Processes' - From Understanding of the Processes to Applications, February 22-26, 1999, Freiberg.*

Hladil J., Pruner P. & **Krs M.**: Relationships among diagenesis, magnetic overprint and tectonics near Mokrá (E of Brno). Invited lecture. *Conference Moravian and Silesian Paleozoic 1999, February 4, 1999, Brno.*

Hladil J.: Conception of the Devonian Reef-Rimmed Islands in Moravia and Silesia: relationships to dynamic geology from Paleozoic to Recent. Lecture. *Division of the Earth Sciences, Faculty of Sciences, Masaryk University, April 29, 1999, Brno.*

Hladil J.: Conception of the Devonian Reef-Rimmed Islands in Moravia and Silesia: implications for oil survey. Lecture. *Scientific Council of the Earth Sciences, Faculty of Sciences, Masaryk University, May 26, 1999, Brno.*

Hladil J.: Crises of the biota in the past and present: with special emphasis on coral reefs. Lecture, *Open Educational Courses of Palacký University, December 6, 1999, Olomouc.*

Hladil J.: Different goals, results and methods of sequence stratigraphy on passive and active continental margins (orogenic belts). Invited lecture. *Czech Geological Society and Czech Stratigraphic Committee, Meeting 'Sequence Stratigraphy' at Charles University, December 14, 1999, Praha.*

Hladil J.: Changes of carbonate coral skeletons in deep burial and slight metamorphic conditions: eastern part of the Variscan Orogen in Europe. *Invited lecture. VIII International Symposium on Fossil Cnidaria and Porifera, Session Diagenesis of Carbonates, September 12-16, 1999, Sendai.*

Hladil J.: Philosophy of the Devonian synsedimentary elevations and the evolution of porosity in the Macocha Formation. *Lecture. Conference Moravian and Silesian Paleozoic 1999*, *February 4, 1999*, *Brno*.

Houša V., **Krs M.**, **Man O.**, **Pruner P.**, **Venhodová D.**, Tavera J. M. & Oloriz F.: Magnetostratigraphy across the boundary strata at the Puerto Escaño (S. Spain): Correlation with high-resolution data at Brodno nad Bosso Valley. *Poster*. *IUGG XXII General Assembly, 26.6.-30.6. 1999, Birmingham.*

Houša V., **Krs M.**, **Pruner P.**, **Venhodová D.**, Cecca F., Pisticelo M., Oloriz F. & Tavera J. M.: Magnetostratigraphy and micropalaeontology across the J/K boundary strata in the Tethyan realm. *Poster. International Geological Conference Carpathian Geology 2000, October 11-14, 1999, Smolenice, Slovak Republic*.

Chlupáčová M., Hrouda F. & **Novák J. K.**: Emplacement of the Altenberg granite porphyry: AMS data constraints. *Lecture. 4th Meeting of the Czech Tectonic Studies Group, Blansko-Češkovice, April, 15-18, 1999.*

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Kadlec J.: The Cenozoic history of cave systems in the Moravian Karst. *Invited Lecture. 2nd National Speleological Congress, 8.-12.9.1999, Jedovnice.*

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Krs M. & **Pruner P.**: Comparative paleomagnetic, paleotectonic and paleogeographical investigations in the Alpine and Variscsan tectonic belts: case histories from the Western Carpathians and the Bohemian Massif. Lecture. *International Geological Conference Carpathian Geology 2000, October 11-14, 1999, Smolenice, Slovak Republic.*

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Krs M. & **Pruner P.**: To the palaeomagnetic investigations of palaeogeography of the Barrandian terrane, Bohemian Massif. Lecture. *8th International Symposium on the Ordovician System, Prague, Czech Republic, June 20-25, 1999*.

Krs M., **Man O.** & **Pruner P.**: Palaeomagnetism and palaeogeography of the Barrandian terrane in the Bohemian Massif: Aspects of interpretation. Lecture. *IUGG XXII General Assembly, 26.6.-30.6. 1999, Birmingham.*

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Marheine D., Kachlík V., **Patočka F.** & Maluski H. (1999): The Variscan polyphase tectonothermal development in the South Krkonosze Complex (W-Sudetes, Czech Republic). Poster. *EUG 10, March 28 - April 1, 1999, Strasbourg*.

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Melichar R. & **Hladil J.**: New Evidence for Early Variscan Nappe Structures in Central Bohemia. Poster. *89th Annual Meeting of the German Geological Society, Final Colloqium of the project 'Orogenic Processes' - From Understanding of the Processes to Applications, February 22-26, 1999, Freiberg.*

Melichar R. & **Hladil J.**: Resurrection of the Barrandian Nappe Structures (Central Bohemia). Lecture. *4th Meeting of the Czech Tectonic Studies Group, April 15-19, 1999, Blansko-Češkovice.*

Melichar R., **Hladil J.** & Leichmann J.: Stop 8 Valchov. The carbonate lubricants on thurst faults in granodiorite-Early Devonian age of open-sea carbonates. Lecture. *Field Trip of the 4th Meeting of the Czech Tectonic Studies Group, April 19, 1999, Blansko-Češkovice / Valchov.*

Mikuláš R.: Geologické zajímavosti Kunratického lesa. Lecture. *Otvírání studánek, Praha-Kunratice 24.4.1999.*

Mikuláš R.: Ichnology joined with archaeology: Ichnofabric of Holocene sandy taluses of "castellated sandstones" landscape, Czech Republic. Lecture. *5th International Ichnofabric Workshop IIW 5, Manchester, 12.7.1999.*

Mikuláš R.: Ordovician of the Prague Basin: Development of ichnoassemblages. Lecture. *8th International Symposium on the Ordovician System, Praha 24.6.1999.*

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Pašava J. & **Hladil J.**: Effectivity of the IGCP national committees, cooperation among IGCP, MaB, IHP and other UNESCO projects, and WWW information strategy for IGCP. Invited lecture. *Regional Scientific Meeting of the UNESCO-IGCP Representatives of the European and Neighboring Countries. June 7-9, 1999, Praha.*

Pašava J. & **Hladil J.**: Situation of Young Geoscientists in Basic Research: Experience from Czech IGCP National Committe. Invited lecture. *Third Central European Workshop (UNESCO) on themes of Basic Research for National Development, March 25-26, 1999, Praha.*

Patočka F. A brief outline of the Krkonoše-Jizera Unit geology: Open questions - both long time unsolved and newly emerged enigmas. Invited Lecture. *Institut des Sciences de la Terre, de l'Eau et l'Espace de Montpellier, Université Montpellier 2, September 9, 1999, Montpellier, France*.

Pruner P., **Bosák P.**, **Kadlec J.**, **Venhodová D.** & Bella P.: Paleomagnetický výzkum sedimentárních výplní vybraných jeskyní na Slovensku. Výskum, využívanie a ochrana jaskyň. Lecture. *2. Vedecká konferencia s madzinárodnou účast´ou, November 15-18, 1999, Demänovská Dolina, Slovak Republic*.

Roček Z. & Hanák V.: Feathered dinosaurs. Lecture. *Department of zoology, Faculty of Natural Sciences, Charles University, Praha*

Siblík M.: Upper Triassic brachiopod fauna of Steinplatte (Austria). Poster. *Conference Carpathian Geology 2000, 11.-14. October 1999, Smolenice, Slovak Republic.*

Slavík L.: Constraints and prospects for conodont zonation in the stratotype area of the Pragian (Prague Basin, Barrandian, Czech Republic). Lecture. *Errachidia meeting SDS-IGCP 421. Morocco, April 1999.*

Suchý V. & Zeman A.: Hydrothermal Caves and Spelean Carbonates of the Bohemian Karst, Czech Republic. Poster. *11th Bathurst Meeting, July 13-15, 1999, Cambridge, UK.*

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Timmermann H., Parrish R.H., Noble S.R., Kryza R. & **Patočka F**. (1999): Single cycle Variscan orogeny inferred from new U-(Th-)Pb data from the Sudetes mountains in Poland and the Czech Republic. *Poster. The PACE mid-term review and 4th PACE network meeting, Geological Institute, University of Copenhagen, Denmark, October 9-10, 1999, Copenhagen.*

Ulrych J., **Cajz V.**, **Pivec, E.**, **Novák J.K.**, Nekovařík Č. & Balogh K.: Cenozoic Intraplate Alkaline Volcanism of Western Bohemia. *Poster. Workshop Seismic Processes and Associated Phenomena in West Bohemia and in theVogtland, Teplá, October, 13-15, 1999.*

Vavrdová M.: Acritarch succession in Klabava and Šárka Formations: Evidence of ancient upwelling zone? - „Quo vadis Ordovician?" *Lecture. 8th International Symposium on the Ordovician System Praha, 20-25 června 1999*

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Waldhausrová J., Ledvinková V. & Palivcová M.: A Variscan mafic/felsic stratified complex (Teletín quarries, Central Bohemian Pluton, Bohemian Massif) and a possible explanation of its origin. The origin of granites and related rocks. *Poster. Fourth Hutton symposium, Clermont Ferrand, France, 20 - 25.9. 1999.*

Žigová A., Matoušek V. & Šťastný M.: Pedogenesis of a poly-cultural archaeological site in the Bohemian Karst (Czech Republic). *Poster. Soil with Mediterranean type of Climate. 6th International Meeting, 4-9 July 1999, Barcelona, Spain.*

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Cajz V. (1999): *Geologická stavba okolí Čeřeniště, podklad pro řešení svahových pohybů podél potoka Rytina.* - MS, Český geologický ústav. Praha.

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Konzalová M. (1999): *Project proposals. Contribution to project Tertiary fresh-water and wetland ecosystems of the North-Bohemian lignite Basin*. - MS: 1-4. Praha.

Pašava J. & **Hladil J.** (1999): *Summary Report: The Czech National Committee for the International Geological Correlation Programs within the Network of UNESCO.* - MS: 1-13. Praha-Paris.

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17. 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.

Palaeomagnetic 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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18. Financial Report

(in thousands Czech Crowns)

A. INCOMES	
1. From the annual budget of the Academy of Sciences CR	16,322
2. From the Grant Agency of the Acad. Sci. (accepted research projects)	2,562
3. From the Grant Agency CR (accepted research projects)	1,157
4. From the internal research projects of the Acad. Sci.	4,200
5. From other state sources (Ministry of Environment, etc.)	559
6. Applied research	1,772
7. Investments (for laboratory facilities)	3,461
TOTAL INCOMES	**30,033**

B. EXPENSES	
1. Scientific staff - wages, medical insurance	9,764
2. Research and scientific activites	7,497
3. Administration and technical staff - admin.expenses,wages,medical insurance	5,542
4. General expenses (postage shipping, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc)	3,166
5. Library (subscriptions etc.)	493
5. Editorial activites (Geolines, Annual Report)	110
6. Investments (for laboratory facilities)	3,461
TOTAL EXPENSES	**30,033**