Academy of Sciences of the Czech Republic

Institute of Geology
Annual Report 1998

CONTENTS

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

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1. Preface

The Institute of Geology of the Academy of Sciences of the Czech Republic represents the scientific institute with multi-disciplinary rank of interests. The research is not concentrated only on a single branch of geological sciences and/or some limited problem. Nevertheless, the main interest is focused especially on the territory of the Bohemian Massif and adjacent areas, including the Alpine-Carpathian system covering the eastern part of the territory of the Czech Republic.

The co-operation of the Institute with foreign scientific bodies became more intensive in 1998. Our specialists operated in the field in different areas e.g. of Poland, Austria, Slovakia, Slovenia, Spain, Italy, Germany, Kazakhstan. Agreements on scientific co-operation exist, e.g., with the Institute of Geology, Slovak Academy of Sciences (Bratislava, Slovakia), Institute of Geological Sciences, Polish Academy of Sciences (Warsaw, Poland), Karst Research Institute, Slovenian Academy of Sciences and Arts (Postojna, Slovenia), Institute of Gephysics, Chinese Academy of Sciences (Beijing, China), Institute of Nuclear Research, Hungarian Academy of Sciences (Debrecen, Hungary). The Institute staff collaborates on numerous international projects and grants.

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 Center (Library and Computer Network)

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 Mgr. 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)

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

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3. Connections

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Information about the Institute of Geology is available on Internet: http://www·gli.cas.cz

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Geolines Editorial Board	GEOLINES@GLI.CAS.CZ

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4. Principal Administrative Changes in 1998

During 1998, several researchers left the Institute for other Academy Institutes or for the non-academic sphere. At the same time approximately the same number of specialists joined the Institute either from different institutions or from universities after their graduation or post-

graduate study. Several specialists retired to pension. The assistant to the director, Mrs. Jana Čadková died (see Staff News).

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5. Staff (as of December 31,1998)

Management

RNDr. 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)
Ing. Jana Čadková (assistant to the Director)
Marcela Nováková (assistant to the Director)
Ing. Miroslav Fridrich, CSc. (computer specialist)
Václav Javůrek (computer specialist)
Karel Jeřábek (garage attendant, driver)
Jaroslav Kratochvíl (technical service)
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. Miroslav Coubal, CSc. (structural geology)
Ing. Jiří Fiala, CSc. (structural geology, metamorphic petrology)
RNDr. Miloš Lang, CSc. (igneous petrology, mineralogy)
prom. geol. Jiří Novák (petrology)
Mgr. Monika Němečková (structural geology, tectonics and metamorphic 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)

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 (Devonian and Carboniferous spores)
RNDr. Petr Čejchan (palaeoecology)
prom. geol. Arnošt Galle, CSc. (Devonian corals)
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)
John Malinky, PhD (hyolithids)
Doc. RNDr. Luftulla H. Peza, DrSc. (Mesozoic molluscs)
Doc. RNDr. Zbyněk Roček, DrSc. (origin and evolution of the Amphibia, Tertiary Anura and Sauria)
Mgr. Ladislav Slavík (conodonts)
RNDr. Miloš Siblík, CSc. (Mesozoic brachiopods)
RNDr. Petr Štorch, CSc. (Ordovician and Silurian stratigraphy, graptolites)
RNDr. Milada Vavrdová, CSc. (Proterozoic, Palaeozoic and Mesozoic palynology and plankton)
RNDr. Jiří Žítt, CSc. (Cretaceous and Tertiary palaeoecology and sedimentology, echinoids and crinoids)

Technical Staff:

Marcela Šmídová (secretary of the Department, technician)

Department of Exogenic Geology and Geochemistry

Scientific Staff:

RNDr. Václav Cílek, CSc. - Head of the Department (Quaternary geology)
RNDr. Anna Žigová, CSc. - Deputy Head of the Department (pedology, palaeosoils)
Ing. Irena Dobešová (geochemistry)
Ing. Ottomar Gottstein, CSc. (geochemistry of magmatic and metamorphic rocks)
Mgr. Jaroslav Hlaváč (Quaternary geology, malacozoology)
RNDr. Jaroslav Kadlec (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)
RNDr. Eliška Růžičková (petrology, Quaternary geology)
Doc. Ing. Petr Skřivan, CSc. (exogenic and environmental geochemistry)
Ing. Václav Suchý, CSc. (sedimentology and basin analysis)
Pavel Zajíc, Bc. (exogenic geochemistry)

Technical Staff:

Jaroslava Bednářová (editorial services - maternal leave)
RNDr. Miloš Burian (chemical analyst)
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 Slepičková (geophysics)
Mgr. Štěpánka Táborská (geophysics)
RNDr. Daniela Venhodová (petrophysics)

Technical Staff:

Jana Drahotová (technician)
Věra Havlíková (technician)
Jakub Kanta, Bc. (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 thermal analyses)
Jaroslava Jabůrková (maternal leave)
Ivana Konopáčová (preparation of thin/polished sections)
Milena Kozumplíková (microprobe and scanning microscope operator)
RNDr. Karel Melka, CSc. (X-ray and thermal analyses)
Mgr. Jiří Filip (fission track dating)

Information Center 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
Antonín Čejka (technical service)
Svatava Jandeková (human resources)
Ludmila Jilichová (phone operator)
Jana Klímová (accountant)
Michaela Reiterová (accountant)
Alena Sokolová (accountant)
Božena Trenzeluková (phone operator)

Scientific Council

RNDr. Petr Štorch, CSc. (Institute of Geology AS CR)
Prof. RNDr. Vladimír Bouška, DrSc. (Faculty of Science, Charles University)
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)
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. (since September 1998, Institute of Rock Structure and Mechanics AS CR)
RNDr. Jan Šílený, CSc. (since September 1998, Institute of Geophysics AS CR)
Doc. RNDr. Jaromír Ulrych, CSc. (Institute of Geology AS CR)

Foreign consultants

Prof. Petr Černý (University of Manitoba, Winnipeg, Canada)
Prof. Jaroslav Dostal (Saint Mary's University, Halifax, Canada)
Prof. Peter E. Isaacson (College of Mines and Earth Resources, University of Idaho, U.S.A.)
Prof. Ronald Parsley (Tulane University, New Orleans, U.S.A.)

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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6. Staff News

January
1.1.1998 Pavel Zajíc (exogenic geochemistry) joined the Institute

April
1.4.1998 RNDr. Jaroslav Kadlec (Quaternary geology) joined the Institute
10.4.1998 Mgr. Jan Vejvalka (palaeontologist, PC specialist) left the Institute

May
1.5.1998 RNDr. Miroslav Coubal, CSc. (structural geology) joined the Institute

1.5.1998 Mr. Václav Javůrek (PC specialist)
joined the Institute
15.5.1998 Miss Marcela Nováková (assistant to the Director)
joined the Institute
31.5.1998 Pavel Zajíc, Bc. (exogenic geochemistry)
left the Institute

June
1.6.1998 Mgr. Jaroslav Hlaváč (malacozoologist)
joined the Institute

July
21.7.1998 Mgr. Václava Škvorová (librarian)
joined the Institute

August
3.8.1998 Miss Alena Sokolová (accountant)
left the Institute

September
1.9.1998 Miss Michaela Reiterová (accountant)
left the Institute
1.9.1998 Mgr. Štěpánka Táborská (geophysics)
joined the Institute

October
3.10.1998 Ing. Jana Čadková (assistant to the Director)
died

November
1.11.1998 Dr. John M. Malinky (palaeontology)
left the Institute
26.11.1998 Mrs. Milena Kozumplíková (technician)
left the Institute

December
1.12.1998 Prof. RNDr. Vladimír Bouška, DrSc. (geochemistry)
joined the Institute

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7. Undergraduate and Postgraduate Education

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

Bosák P.: *Karstology and Palaeokarstology*. Postgraduate course, Faculty of Science, Prague.
Cílek V.: *Field course*. Institute of the Fundamentals of Learning, Charles University, Prague.
Cílek V.: *Field Archaeological course - Mesolithic of the Northern Bohemia.* Field Course, Institute of the Fundamentals of Learning, Charles University, Prague.
Cílek V.: *Development of the Mid-European Landscape*. Summer session course, Simon Fraser University, Summer Study Abroad, Vancouver, Canada.

Cílek V.: *Mind and Landscape*. Field School, North-Western University, Evanston, USA.
Hladil J.: *Sedimentology of Carbonate Rocks*. Postgraduate course, Faculty of Science, Masaryk University, Brno.
Hladil J.: *Carbonate Solids in Geology*. Undergraduate course, Faculty of Science, Masaryk University, Brno.
Houša V.: *Taxonomy and nomenclatorics*. Undergraduate course, Faculty of Science, Charles University, Prague.
Houša V.: *Palaeobiogeography*. Undergraduate course, Faculty of Science, Charles University, Prague.
Kadlec J.: *Causes and Consequences of Quaternary Climatic Changes*. Undergraduate course, Faculty of Science, Charles University, Prague.
Lachmanová M.: *Essentials of geology and palaeontology*. Undergraduate course (seminars), Faculty of Science, Charles University, Prague.
Lachmanová M.: *Essentials of geosciences.* Undergraduate course (seminars), Faculty of Science, Charles University, Prague.
Ložek V.: *Special lecture on Quaternary research for archaeologists.* Philosophical Faculty, Charles University, Prague.
Ložek V.: *Development of the Nature during the Quaternary Era*. Undergraduate course, Faculty of Science, Charles University, Prague.
Minařík L. & Skřivan P.: *Environmental chemistry*. Undergraduate course, Faculty of Forestry, Czech Agricultural University, Prague.
Němečková M: *Practice course in petrography of magmatic rocks.* Undergraduate course, Faculty of Science, Masaryk University, Brno.
Němečková M.: *Practice course in petrography of metamorphic rocks.* Undergraduate course, Faculty of Science, Masaryk University, Brno.
Němečková M.: *Practice course of geological mapping.* Undergraduate course, Faculty of Science, Masaryk University, Brno.
Roček Z.: *Evolution of vertebrates*. Undergraduate course, Faculty of Science, Charles University, Prague.
Roček Z.: *Review of fossil vertebrates*. Undergraduate course, Faculty of Science, Charles University, Prague.
Roček Z.: *Comparative anatomy of the vertebrates.* Undergraduate course, Faculty of Science, Charles University, Prague.
Roček Z.: *Morphology of animals.* Undergraduate course, Faculty of Science, Charles University, Prague.
Štorch P.: *Principles and methods of stratigraphy*. Undergraduate course, Faculty of Science, Charles University, Prague.
Ulrych J., Matějka D.: *Geochemistry of volcanic rocks of the Bohemian Massif*. Undergraduate course, Faculty of Science, Charles University, Prague.
Ulrych J.: *Interpretations of mineralogical data*. Undergraduate course, Faculty of Science, Charles University, Prague.

Supervision in Undergraduate Studies

Čápová H., Institute of Fundamentals of Learning, Charles University (*supervisor V. Cílek*)
Dašková J., Faculty of Science, Charles University, Prague (*supervisor M. Konzalová*)
Dvořáková M., Faculty of Forestry, Czech Agricultural University, Prague (*supervisor P. Skřivan*)
Erban V., Faculty of Science, Charles University, Prague (*supervisor J. Ulrych*)
Hoření M., Facultry of Science, Masaryk University, Brno (*supervisor J. Hladil*)
Jarošová P., Faculty of Forestry, Czech Agricultural University, *Prague (supervisor P.*

Skřivan)
Královec K., Department of Zoology, Charles University, Prague (*supervisor Z. Roček*)
Kvítková L., Faculty of Science, Masaryk University, Brno (*scientific consultant J. Kadlec*)
Samek L., Faculty of Forestry, Czech Agricultural University, Prague (*supervisor P. Skřivan*)
Sedláčková L., Department of Zoology, Faculty of Science, Masaryk University, Brno (*supervisor Z. Roček*)
Šandera M., Department of Zoology, Charles University, Prague (*supervisor Z. Roček*)
Zajíc P., Faculty of Forestry, Czech Agricultural University, Prague (*supervisor P. Skřivan*)

Supervision in Postgraduate Studies

Adamovič J., Mgr., Institute of Geology AS CR (*supervisor P. Bosák*)
RNDr. J. Bek, Institute of Geology AS CR, Prague (*supervisor M. Vavrdová*)
Cajz V., RNDr., Czech Geological Institute, Prague (*supervisor J. Ulrych*)
Čejchan P., RNDr., Institute of Geology AS CR, Prague (*supervisor J. Žítt)*
Filip J., Mgr., Institute of Geology AS CR, Prague (*supervisor Z. Vejnar*)
Kvaček J., RNDr., National Museum, Prague (*supervisor M. Konzalová*)
Lachmanová M., Mgr., Faculty of Science, Charles University, Prague (*external supervisor V. Cílek)*
Němečková M., Mgr., Faculty of Science, Masaryk University, Brno (*external supervisor F. Patočka*)
Novák J.K., prom.geol., Institute of Geology AS CR, Prague (*supervisor E. Pivec*)
Píša R., Dipl.-Ing., Faculty of Forestry, Czech Agricultural University, Prague (*supervisor P. Skřivan*)
Slavík L., Mgr., Institute of Geology AS CR, Prague (*supervisor J. Hladil*)
Slepičková J., Mgr., Faculty of Science, Charles University, Prague (*external supervisor P. Pruner*).
Střelcová E., RNDr., Czech Geological Institute, Branch Brno and Masaryk University, Brno (*scientific consultant V. Suchý*)
Štorc R., Mgr., Faculty of Science, Charles University, Prague (*scientific consultant J. Žítt*)
Svobodová J., Mgr., Faculty of Science, Charles University, Prague (*external supervisor J. Fiala*)
Trbušek J., Mgr., Faculty of Science, Palacký University, Olomouc (*supervisor Z. Roček*)
Vach M., Mgr., Faculty of Forestry, Czech Agricultural University, Prague (*supervisor P. Skřivan*)
Vater M., RNDr., Zoological Institute of the Slovak Academy of Science, Bratislava (*supervisor Z. Roček*)
Vejvalka Jan, Mgr., Faculty of Science, Charles University, Prague (*supervisor Z. Roček*)

RNDr. František Patočka, CSc., since 1996 the member of the Examination Commission of Postgraduate Studies in Geology, Faculty of Science, Charles University, Prague.
RNDr. Jindřich Hladil, CSc., since 1997 the member of the Scientific Council and the member of the Board of Postgraduate Studies in Geology, Faculty of Science, Masaryk University, Brno.
RNDr. Jindřich Hladil, CSc. and RNDr. František Patočka, CSc., were the members of the Board of Postgraduate Studies in Geology, Faculty of Science, Charles University, Prague.

Degrees obtained on the Institute of Geology AS CR

Candidate of Science (PhD equiv.)

RNDr. Jiří Kvaček: Cuticle analysis of Gymnosperms of the Bohemian Cenomanian (23.6.1998)
Dr. Nicolas A. Poulianos: Pleistocene Mammals of Petralona Cave, Chalkidiki, N. Greece (25.11.1998)
RNDr. Jiří Bek: Spore associations of some Lycophyta, Sphenophyta, Pteridophyta and Progymnospermophyta from Carboniferous limnic basins of the Czech Republic (25.11.1998)

Degrees obtained by the staff of the Institute of Geology AS CR on other institutions

Dr hab.

RNDr. Pavel Bosák, CSc.: Palaeokarst of the Bohemian Massif in the Czech Republic, Institute of Geological Sciences, Polish Academy of Sciences, Warsaw (25.11.1998)

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8. Department of Endogenic Geology and Geochemistry

Foreign Grants and Joint Projects

Joint projects of the Geologisch-Paläontologisches Institut der Johann-Wolfgang-Goethe-Universität Frankfurt a. Main, FRG, and GLI AS CR, supported by the Deutsche Forschungsgemeinschaft, Bonn, FRG:

(1) Balance and modelling of a tilted crustal section from the anchizone up to the amphibolite facies, western margins of the Teplá-Barrandian area (Bilanzierung und Modellierung eines angekippten Krustenprofils von der Anchizone bis zur Amphibolitfazies, W-Rand Teplá-Barrandium (*G. Zulauf, G. Kleinschmidt, Geologisch-Paläontologisches Institut Johann Wolfgang-Goethe-Universität Frankfurt a. M., FRG,* ***J. Fiala*** *&* ***Z. Vejnar***)

The Upper Devonian (ca. 370 Ma) collision between the Teplá-Barrandian Unit (TBU), Saxothuringian and Moldanubian units led to a large-scale pop-up structure in the area of the TBU. This pop-up structure formed a high plateau, particularly in the western part of the TBU, which started to collapse still during the Upper Devonian (ca. 360 Ma). The TBU was tilted towards the east. After this phase of gravitationally driven, largely supracrustal collapse, large parts of the thickened mantle lithosphere became also gravitationally unstable and subsided down into the asthenosphere (at ca. 350 Ma). This removal of the mantle lithosphere led to (i) isostatically controlled fast uplift and exhumation of the high-grade Moldanubian and Saxothuringian rocks; (ii) a dramatic increase in heat flow in the lower and middle crust (most intense in the Moldanubian part), and (iii) anatexis and intrusion of melts, parts of which have been derived from the mantle. Microfabrics of the granulite-facies rocks of the North Bohemian shear zone (Ohře granulites) suggest that the heated lower crust underwent strong lattice diffusion (Nabarro Herring creep) besides dislocation creep. Thus the rheology of the granulites was more and more close to that of Newtonian material, the strength of which is by several orders of magnitude lower than the strength of non-linear-viscous materials. The TBU subsided down into this weak substratum. Elevator-style movements along the Bohemian shear zone (BSZ) led to the juxtaposition of the “cold" TBU against its "hot" surroundings (Moldanubian and Saxothuringian unit). The strong rheological contrast between these units does not only explain the steep attitude of the BSZ but also accounts for the large displacement that is possible only within strongly thickened crust. The steep mylonites of the BSZ formed suitable pathways for rising melts and thermally softened lower crust that could "extrude" at the flanks of the TBU. The above-presented model explains how both the thickened mantle lithosphere and the thickened crustal root have been removed during the waning stages of the Variscan orogenic cycle.

(2) Structural and kinematic evolution of the Central Bohemian shear zone (CBS) between Klatovy and Rittsteig (Strukturelle und kinematische Entwicklung der Zentralböhmischen Scherzone (CBS) zwischen Klatovy und Rittsteig (*G. Zulauf, G. Kleinschmidt, D. Scheuvens, Geologisch-Paläontologisches Institut Johann-Wolfgang-Goethe-Universität Frankfurt a. M., FRG,* ***J. Fiala*** *&* ***Z. Vejnar***)

The supracrustal rocks of the Teplá-Barrandian Unit (TBU) are juxtaposed against high-grade metamorphic rocks of the Saxothuringian and Moldanubian units. The boundary between these units is the Bohemian shear zone (BSZ) which dips steeply (60^{o}) towards the TBU. Because of several 90^{o} bends of the BSZ, it can be sub-

divided into the North-, West-, and Central-Bohemian shear zone, all of which were active at the same Lower Carboniferous time. The BSZ is characterised as follows:

(1) It is a normal (extensional) shear zone, and its movements occurred under retrograde metamorphic conditions.
(2) Several granitoids emplaced into or close to the BSZ (partly synkinematically); Pb-Pb and U-Pb zircon ages suggest that these granitoids intruded between 350 and 330 Ma.
(3) The BSZ cuts through the entire crust as deep as to Moho.
(4) The normal displacement of the BSZ is more than 10 km.
(5) Fragments of granulite and mantle-derived peridotite are partly included in the BSZ where the granulites show similar metamorphic and exhumation ages like the synkinematic granitoids.

Czech-French Ministeries of Education integrated programme "BARRANDE 1997-2 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) (This contribution is involved within the European PACE-project)

The Variscan polyphase tectonothermal development in the South Krkonoše Complex (W-Sudetes, Czech Republic) *(D. Marheine, Laboratoire de Géochronologie CNRS-UMR, Montpellier, France, V. Kachlík, Faculty of Science, Charles University, Prague,* ***F. Patočka*** *& H. Maluski, Laboratoire de Géochronologie CNRS-UMR, Montpellier, France)*

The northern and north-eastern margins of the Bohemian Massif are complex mosaic of tectonometamorphic units or suspected terranes, respectively. The terrane juxtaposition is the result of multiple Variscan collisions of Gondwana derived microplates with Baltica and/or East Avalonia, and subsequent late Variscan large-scale shear movements.

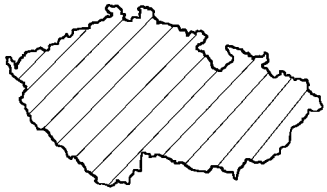
The South Krkonoše Complex forms the southern rim of the suspected terrane of central West Sudetes. The South Krkonoše Palaeozoic sequences experienced Variscan polyphase metamorphism; the succession of the tectonometamorphic events was precised by Ar-Ar age determination method. The results distinguished several main clusters of ages: (1) ca. 360 Ma, cessation of subduction related blueschist facies event; (2) ca. 345 Ma, greenschist up to lower amphibolite facies overprint (probably related to the Early Carboniferous tectonometamorphic and igneous activity); (3) 325-320 Ma, late Variscan shearing, and (4) 314-313 Ma, upper limit of magmatism and metamorphism, including late-tectonic granite intrusions.

The cooling age of 465 Ma (Middle Ordovician) of the detrital muscovite from the Ordovician(-Silurian?) quartzite (Poniklá Group) indicates that the mineral isotopic system was undisturbed by the polyphase tectonothermal history. However, two blueschist samples from the underlying(?) lithostratigraphic subunit (in the midst of the South Krkonoše Complex) provided ages ca. 320 Ma which are the evidence of complete resetting of the earlier blueschist event. On the contrary, in the easternmost part of the Krkonoše Complex, the LP-HT overprint at ca. 340 Ma simply followed the HP-LT event (terminated at 360 Ma), and left its record quite undisturbed. That is, one lithostratigraphic unit includes undisturbed Ordovician (-Silurian?) quartzites and the Late Devonian blueschists which are showing late Variscan overprint.

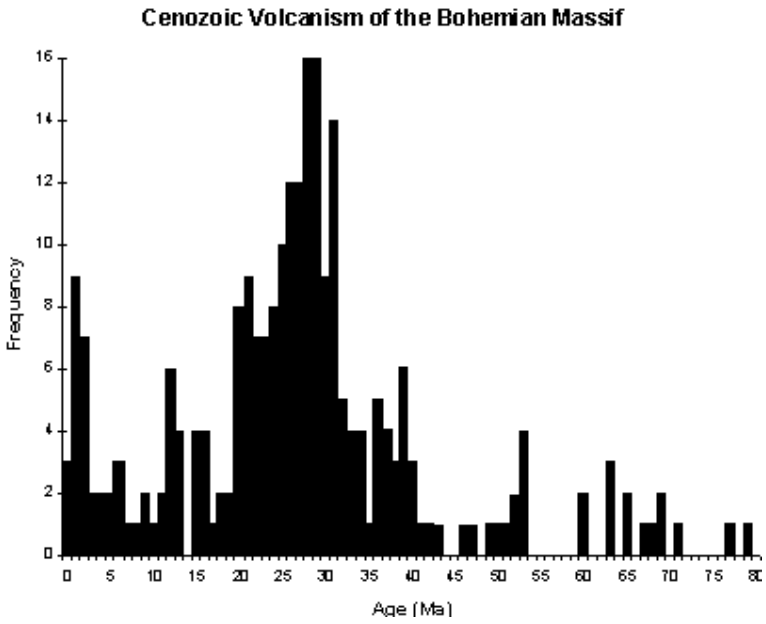
The distribution of the determined Ar-Ar plateau ages suggests that the Variscan polyphase tectonothermal development - involving events (1) to (4) - affected individual lithostratigraphic units of the South Krkonoše Complex in different ways. The differences reflected propagation of the orogenic wedge towards the NW. This is evidenced by both inverse metamorphic pattern (from chlorite zone on the north-western side up to garnet zone on the eastern side) and reversed stratigraphic ages (the Late Devonian to Early Carboniferous units are overthrust by several Early Palaeozoic crustal slices). This structural pattern was modified by late postorogenic extension and shearing. The present position of the South Krkonoše Complex units is the result of late Variscan (Late Carboniferous) juxtaposition.

IGCP Project No. 369 Comparative evolution of Peritethyan rift basins (Project leader: W. Cavazza, A. Robertson, P. Ziegler):

Subproject 2a Magmatism and rift basins 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 Res., Hungarian Academy of Sciences &* ***J. Ulrych****)*



The young intra-plate volcanism of the Bohemian Massif is an integral part of the Cenozoic Central European Volcanic Province associated with a rift system originated as a repercussion of the Variscan foreland to the collision of the African and Eurasian plates. The alkaline volcanism was initiated by adiabatic decompression of up-domed asthenospheric mantle developed in associations with the Alpine Orogeny. The continuous Late Cretaceous to Quaternary volcanism of 79(87?) to 0.26(0.11?) Ma ages of the Bohemian Massif displays two principal maxima: (1) the pre-rifting event producing ultra-alkaline volcanism (79-49 Ma) and (2) riftogenic event with alkaline volcanism (42-0.26 Ma). The bimodally distributed volcanism is formed by two coexisting differentiation olivine nephelinite/basanite-trachyte and nephelinite/tephrite-phonolite series. The volcanism of the Bohemian Massif is concentrated (more than 99 vol.%) in the Ohře (Eger) Rift (ENE-WSW) in addition to transverse structures as the Labe and Odra tectonovolcanic zones (WNW-ESE) and the Cheb-Domažlice Graben (NNW-SSE). Approximate volume and area extent of the preserved volcanic products is about 180 km^3 and 1,100 km^2, respectively.



Grant Agency of the CR

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

Mineral ages from metamorphic terranes are usually interpreted as cooling after the peak of metamorphism and, in high-grade terranes, this age information is also often related to exhumation (i.e. decompression). However, cooling and exhumation may not be synchronous. We report Ar-Ar (mica and hornblende), Sm-Nd (garnet) and U-Pb (zircon) data on granulite facies gneisses and syn-tectonic granites from southern part of the Bohemian Massif to demonstrate that decompression and cooling can be dated separately.

IR laser probe Ar-Ar dating of the hornblende, biotite and muscovite revealed that these minerals contain variable proportions of excess Ar, the amount of which decreases from centres towards the rims of the mineral grains. Accordingly, the rim ages are interpreted as representing maximum cooling ages for hornblende in amphibolite (331±1 Ma), biotite in granulite gneiss (319±1 Ma) and muscovite and biotite in syn-tectonic granite (316±1 and 310±1 Ma, respectively). A concordant zircon fraction for this granite yields a U-Pb age of 320 Ma. The data suggest a cooling rate of 9-22 $^{o}C.Ma^{-1}$ following MP-HT metamorphism dated in this part of the Bohemian Massif at ca 345-338 Ma.

Isotopic data from high-grade rocks of the southern Bohemian Massif point to a clockwise PT evolution and indicate that decompression and cooling were at least 10 Ma apart.

Grant Agency of the Academy of Sciences CR

No. A3013610: The development of the Early Palaeozoic volcanic complexes of the West Sudetes: the Železný Brod as an example (*co-author M. Fajst, Faculty of Science*, *Charles University, Prague*): Early Palaeozoic intracontinental rifting in the central West Sudetes, Bohemian Massif: geochemistry of metavolcanic rocks of the Krkonoše-Jizera Crystalline Unit (*M. Fajst, V. Kachlík, Faculty of Science*, *Charles University, Prague & **F. Patočka***)

The Krkonoše-Jizera crystalline unit (KJCU) is a suspected terrane within the central West Sudetes mosaic, which was amalgamated during the Variscan collision of Baltica and Armorica (±eastern Avalonia). The Early Palaeozoic metavolcanic rocks, showing a considerable diversity both in the metamorphic grade and the nature of protolith, are abundant in minor units distributed along the northeast, east and south margins of the KJCU - in the Kaczawa Mts., East Krkonoše Mts., Železný Brod region and the Ještěd Mts. The available geochronological results date the outset of the volcanism around the Cambro/Ordovician boundary (the East Krkonoše Mts.). According to the fossil evidence yielded by the intercalated metasediments the volcanic activity was rather protracted, lasting until Silurian (and possibly Devonian?) (the Železný Brod region) and/or Early Carboniferous (the Ještěd Mts.). The succession of the individual geochemical types of the KJCU Early Palaeozoic volcanics (±shallow intrusives) may have been as follows: transitional to alkaline WPBs + continental intraplate felsic rocks » N- to E-MORBs + attenuated continental lithosphere related felsic rocks » picritic ultrabasites; the MORB-like rocks are more abundant in the eastern complexes of the KJCU. However, this sequence is short of the Late Devonian/Early Carboniferous (the Ještěd Mts.) volcanics as they have not been studied from the viewpoint of the tectonic setting of origin yet. The succession of rocks is suggested to indicate magmatic devel-

opment of laterally extending and linearly propagating (under present geographical conditions from E to W) rift arm. The extensional tectonics was presumably related to the Early Palaeozoic northern Gondwana fragmentation which preceded the origin of the peri-Gondwanan microplates.

No. A3131410: Geochemical development of volcanic complex of the central part of the České středohoří Mts (***J. Ulrych***)

The České středohoří Mts. is an erosion relict of the Cenozoic volcanosedimentary complex in the Ohře Rift. On the basis of a new volcanological model and geochemical investigation the following volcanostratigraphical formations were recognised:

(1) the Lower Formation - lavas and volcaniclastites of basanitic character (36-26 Ma, 12 % norm. Ol; Mg# = 65-82, aver. 75; high contents of Cr, Ni, Co, Sc; common presence of lherzolite xenoliths; low $^{87}Sr/^{86}Sr$=0.703128-0.703526; high $^{143}Nd/^{144}Nd$=0.512738-0.512849, E_{Nd}=+2.8 to +4.8) corresponding to undifferentiated and only weakly crust-contaminated upper mantle products;

(2) the Upper Formation - lavas and pyroclastics of tephritic type (31-25 Ma, 2 % norm. Ol; Mg# = 60-72, aver. 65; low contents of Cr, Ni, Co, Sc; lack of lherzolite xenoliths; higher $^{87}Sr/^{86}Sr$=0.704428-0.704649; lower $^{143}Nd/^{144}Nd$ = 0.512679-0.512742, E_{Nd}=+1.5 to +2.6) representing differentiated and partly crustal-contaminated evolved products;

(3) the probable Uppermost Formation - flow(s) of basanite similar in geochemical characteristics to those of the Lower Formation (24 Ma); (iv) the Group of the Late Miocene Intrusives (13 Ma) similar to those of the Lower Formation (13 Ma, 16 % norm. Ol; Mg# = 70-79, aver. 75; high contents of Cr, Ni, Co, Sc; somewhat higher $^{87}Sr/^{86}Sr$ = 0.703651-0.703761; somewhat lower $^{143}Nd/^{144}Nd$ = 0.512845-0.512847, E_{Nd}= +4.4 to +4.3) probably associated with rejuvenation of tectonic movements in the OR or pulsation character of magmatic activity.

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

The Jílové zone is the Upper Proterozoic volcanic and subvolcanic complex situated in the Bohemicum Unit. The Bohemicum - one of the major geological units of the Bohemian Massif - comprises several NE-SW-trending volcanic zones, the Jílové Zone being the most southeastern one. The rocks of the Jílové Zone display regional metamorphism of the greenschist facies (in the NE part of the zone) up to the amphibolite facies (in the SW part).

The Jílové zone includes metavolcanics corresponding to basalts, basaltic andesites, andesites, dacites and Na-rhyolites; subvolcanic rocks are represented especially by tonalites, trondhjemites, and subordinately by diorites and gabbroic rocks.

Chemical and petrological studies of the rocks from the Jílové Zone have proved two different volcanic phases in this complex zone. The older is of tholeiitic character, while the younger resulted from low-K calc-alkaline magmatism. According to the author, the tholeiitic suite (similar to the ocean floor basalts) was folded into isoclinal folds even before the emplacement of younger low-K calc-alkaline magmas. These younger magmas during their ascent

towards the surface used the cleavage systems of the earlier folded and foliated tholeiitic suite as feeding channels. Trace element and REE studies confirmed two distinct suites:

The older suite shows very primitive and uniform tholeiitic geochemistry. The REE distribution patterns are flat, only ten to twenty times higher than those of chondrites. This suite comprises tholeiitic basalts, high-Al basalts, prevailing part of basaltic andesites and andesites, small amount of dacites, but rather abundant rhyolites. Subvolcanic rocks belonging to this suite are especially trondhjemites and diorites; tonalites and gabbros occur subordinately.

The younger volcanic suite comprises low or middle differentiated rocks belonging to the low-K calc-alkaline series with REE distribution patterns slightly enriched in LREE. Andesites, dacites and rhyolites prevail, while basalts form only a minor part of the suite. Prevailing subvolcanic rocks are tonalites, while gabbros, diorites and trondhjemites are subordinate.

Basic dykes, geochemically corresponding with alkaline rocks, show steeper REE distribution patterns (La contents 100 times higher than in chondrites). These dykes represent probably the youngest and geochemically most mature rocks of the Jílové Zone. However, the effusive or explosive equivalents of these alkaline basic dykes have not been found yet. Some alkaline volcanics lying near the subalkaline-alkaline rock boundary in the TAS diagram have the REE distribution patterns similar to the tholeiitic or low-K calc-alkaline suites and could represent transitional volcanic types.

The studied volcanic and subvolcanic rocks of the Jílové Zone provided evidence of the island-arc type volcanism as well as the existence of two geochemically different volcanic suites.

Grants of the Charles University, Prague

241-96-B GEO-PřF: Mechanism of fractional crystallisation of the rocks of the Kdyně massif (*J. Košler, Faculty of Science, Charles University, Prague &* ***J. Svobodová***)

The assessment of mechanism of magma evolution in the rock suite of the Kdyně Massif involving liquid line construction is using new theoretical model for the solid-liquid equilibria. The model is based on previous models for estimation of coefficients for element partitioning between mineral and magma upon equilibrium crystallisation. Accuracy of the model has been tested using a set of about 300 published experimental data. The data on trace element partitioning agree with the experimental data on Ti, Cr and Ni contents in the liquid being in equilibrium with the rock forming minerals of the Kdyně Massif rocks. However, the errors of established major elements partition coefficients according to tested models propagate and yield large variations in liquid estimation. That is why new semi-empirical thermodynamic expressions for two-valence elements partitioning between ferromagnesian minerals and magma have been derived.

The model was used for the assessment of FeO, MgO, MnO and CaO contents in the liquid of the studied rocks. According to the model the Kdyně massif diorites and ferrodiorites represent solidified magma and the liquid line can be constructed from their bulk rock composition. The composition of parental liquid of the gabbronorites and gabbros differ substantially from bulk rock composition. The composition of initial liquid according to the rock forming minerals of the olivine gabbros and gabbronorites were established at: FeO = 9.9 wt%, MgO = 6.8 wt%, MnO = 0.13 wt%, CaO = 11.3 wt.% and TiO_2 = 0.3 wt.%.

The compositional trends during fractional crystallisation were established using Melts programme. The programme models the mineral assemblages that crystallise from the magma by minimising free Gibbs energy of the system. The results show the importance of olivine fractionation at the beginning of magma evolution, then pyroxene and plagioclase crystallisation, and amphibole and biotite crystallisation in final stage of rock formation.

The results of several natural thermometers yield equilibration temperatures 1,164±20 °C for the olivine gabbros and gabbronorites, 1,108±20 °C for the diorites, two pyroxene thermometer yielded 895±20 °C for the ferrodiorites. The starting crystallisation temperatures for the diorite and ferrodiorite magmas according to the Melts programme are similar to the mentioned equilibration temperatures. Two pyroxene thermometry on the basic rocks shows instability of mineral assemblage in the olivine gabbros caused by cumulating of minerals from different levels of magmatic chamber. Extremely low equilibration temperatures for Fe-Mg exchange reaction between pyroxene pairs (800 °C) and absence of plagioclase zonation in the gabbros is the evidence for slow cooling of the rocks. Maximum depth of intrusion has been estimated according to mineral transitions in the Kdyně massif contact aureole metapelites and stability of the corona mineral assemblage to be 14 km in the south and 11 km in the north. Higher intrusion depth compared to other plutons in the Teplá-Barrandian Unit show tilting of the region to the north.

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

The lamprophyric dykes and dyke swarms are controlled by deep fault zones in the whole Krušné hory (Erzgebirge) Anticlinorium. The lamprophyres and cognate dyke rocks in the Jáchymov mining district represent four main rock-types: (1) amphibole kersantites; (2) spessartites; (3) biotite porphyrites, and (4) granodiorite porphyrites.

Some of the spessartite dykes pass into the uralitised diorites. Carbonatisation and hematitisation accompanying usually the U-bearing veins and quite common in Krupka area is rare here. On the other hand, a new type of alteration was recognised here - greisenisation of kersantite characterised by the origin of Li-biotites and Li-Fe micas and locally formed topaz aggregates. These features, very important from genetic point of view, were also observed within the Eastern Krušné hory Pluton in the rocks of Preisselberg stock.

The investigation of magnetic susceptibility and anisotropy indicates that the ratio anisotropy/magnetic susceptibility depends on the stage of uralitisation; the lowest value was detected for the biotite porphyrite which is almost anisotropic, the highest values are displayed by the uralitised diorites with disseminated pyrrhotite.

No. 12-960 239/1966**:** Application of apatite crystal chemistry on interpretation of genesis of volcanic rocks (*D. Matějka, Faculty of Science, Charles University, Prague,* ***J. Ulrych*** *and* ***E. Pivec****,* ***J. Novák****,* ***A. Langrová****, in co-operation with J. Frána, Institute of Nucler Physics, Academy of Sciences, Prague-Řež*)

The Cenozoic diatreme of Slánská hora Hill represents an extraordinary phosphorus anomaly among alkaline volcanic rocks of the Bohemian Massif (3.90-5.07 wt.% P_2O_5; 9.5-11.6 % of normative apatite). The olivine-poor nephelinite (melanephelinite) from the central part of the diatreme contains: (1) large hydroxyl-fluorapatite crystals (up to 1.8 mm in harzburgite microxenoliths - up to 2 mm in diameter), (2) partly melted individual hydroxyl-fluorapatite xenocrysts (0.05-0.8 mm) in matrix derived from disintegrated microxenoliths, (3) microcrystalline hydroxyl-chlorapatite inclusions (20-50 m in size) in silicates of the matrix and (4) apatite in matrix of the nephelinite dyke corresponding to hydroxyl-chlorapatite. The apatite cummulation in the rock may be related either to an extreme fractionation of the nephelinite-carbonatite magma or to an interaction of the apatite-rich ultramafic harzburgite microxenoliths originated from the metasomatised upper mantle. The compositional development of F, Cl (OH, CO_2, SO_3,) proportion in fluid phase during magmatic evolution of the diatreme reflected in the apatite structure in successive changes of hydroxyl-fluorapatite (1, 2) reflecting primary composition of the apatite from mantle xenoliths to hydroxyl-chlorapatite (3, 4) manifesting more significant influence of the parental magma. Charge balance in apatite is generally maintained by the coupled substitution of CO_3^{-2} and SiO_4^{-3} for PO_4^{-3}, however, excess charge may be subsequently adjusted by CO_3OH^{-3} partly accompanied by the REE in the Ca site.

Grants of the Ministry of the Environment

No. 4217: Stability of the sandstone Pravčice Arch (***J. Adamovič***)

Rockfall, selective weathering and erosion as well as rock crust formation are the potential hazards for future preservation of the Pravčice Arch. These processes are largely controlled by variations in sandstone lithology which are, in turn, defined by hydraulic conditions of sand deposition in the Late Cretaceous epeiric sea. The basement of the arch was found to be composed of fine- to medium-grained quartzose sandstones with TCB and sharp-based conglomerate beds up to 70 cm in thickness. The arch itself is represented by an interval of fine-grained sandstone with almost no sharp-based conglomerate beds passing upwards into coarse-grained sandstone with clinoforms. The roof of the arch is composed of rather monotonous medium-grained sandstone with occasional sharp-based, cross-bedded conglomerate beds up to 20 cm in thickness. Besides quartz pebbles, some of these beds also contain fragments of ferruginous crusts. The documented succession evidences progradation of the Jizera Formation clastic wedge during the Upper Turonian.

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9. Department of Stratigraphy and Palaeontology

Foreign Grants and Joint Projects

Joint Project of the University of Idaho, Moscow, USA and the Institute of Geology, Academy of Sciences, Prague

Late Devonian glaciation in western Gondwana (*P.E. Isaacson, University of Idaho, USA,* ***J. Bek*** *&* ***M. Vavrdová***)

The beginning of the main late Palaeozoic glaciation in Gondwana presents a good stratigraphic record in the western sector of the supercontinent, which was at high latitudes during the Devonian and part of the Carboniferous. Recent advances in the study of glacial marine deposits and their palaeoclimatic significance, together with the revised older (Late Devonian-Carboniferous) ages of several South American stratigraphic units previously considered to be Pennsylvanian, provide further evidence for the Late Devonian glaciation in the westernmost Gondwana (Bolivia and Peru). The age of strata with evidence for glaciation is constrained by invertebrate and palynomorph biostratigraphy. Late Palaeozoic glacial centres began to form during the Late Devonian in western Gondwana (northern South America), and shifted towards eastern Gondwana during the Carboniferous.

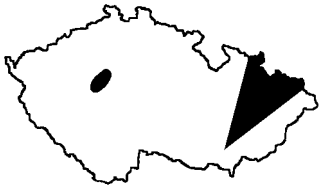
Joint project of the Institute of Geological Sciences, Polish Academy of Sciences, Warsaw and the Institute of Geology, Academy of Sciences, Prague

Comparison of the Tertiary Periphery Basins of the Bohemian Massif - between the Czech Republic and Poland (***M. Konzalová***)

Rich assemblage of microfossils was recognised in the clastic fluvial deposits overlying the productive complex in this part of the Ohře Rift. Several tens of taxa of lower and higher plants were recorded and evaluated. The taxa compositon, frequency of specimens and their accepted range in the European basins point to the Pliocene/Pleistocene age. The close comparable assemblage is known from the clastic fluvial deposits in the Kłodzko area (Poland). High proportion of fungal remains (including epiphytic and soil genera and species) indicates humid conditions and wet substrates.

Palaeontological Association of America, PALSIRP

Devonian system, sequences, basin fills and terranes: Mid-Palaeozoic of NGM – SLM marine passages exemplified on the structure of Bohemian Massif (***J. Hladil***)



Moravian, Silesian and Sudetic areas were investigated in larger Variscan context. Sequence of different tectonic settings show that the entire Devonian-Carboniferous Variscan history was more complex than usually considered. The Middle Devonian docking of Barrandian segments to Laurussian margins connotes end of a formerly vast Rheic Ocean. An idea

about very oblique contact with slightly consumed Gondwanan Plate segments in the north corresponds to an opposite spreading of the Middle Devonian siliciclastic cover on its carbonate basement (opposite – in comparison with Early Carboniferous Culm). Sedimentation of siliciclastic rocks was closely followed by detachment, uplift and subaerial exposure of substantial parts of Barrandian Palaeozoic basin fills. Concurrently with this closure of the Rheic Ocean, including extinction of volcanic arcs, a transtensional opening of new basins within the marginal part of Laurussia was very significant. Although these seas and oceans arose in distant back-arc position during the Emsian, their tectonic setting was subsequently reversed to foredeep-foreland, may be also hinterland or distal basins (characteristics by *J. Kalvoda*). Extension in these latter basins was compensated by underplating of cool margins with Early Palaeozoic relict basins under the thick and multiplicatively layered Moldanubian-Barrandian accretionary prisms. This Middle/Late Devonian change in tectonic settings was significant for history of the Bohemian Massif and developed to proper Late Variscan kinematics of the orogen, which was characterized by clockwise rotation of suspected terrane fragments with new slices of basin fills, Late Visean lateral extrusion, Early Namurian collision closure of Rhenish-type basins and probably Westfalian Moravian Shear Zone. Post-Variscan tectonics strongly influenced the shape of Moravian wedge, much more than formerly assumed. It can be exemplified by Permian faults and half-grabens, Mesozoic grabens, Tertiary inactive stacking of the Bohemian Massif (reflecting load of Alpine and Carpathian fronts) and Late Tertiary to Quaternary strike-slips and vertical movements.

International Geological Correlation Programmes, UNESCO.

IGCP Project No. 386, Response of the ocean/atmosphere system to past global changes – part Silurian-Devonian to Devonian-Carboniferous processes based on the data from Bohemian Massif *(project leader H. Strauss, Laboratory of Isotopes in Geology, Ruhr University of Bochum, and D.M. Banerjee, Department of Geology, University of Delhi, India, national representatives* ***J. Hladil*** *& J. Hladíková, Czech Geol. Institute, Prague)*

Dispersal of Emsian-Eifelian marine fauna and spores of continental plants were investigated on the background of palaeoenvironmental, particularly sedimentological and geochemical data (***J. Hladil, J. Bek****, J. Hladíková,* ***A. Galle****,* utilizing the expertises by *J. Kalvoda, I. Chlupáč and V. Havlíček*). Goals of the studies concentrated on hydrospheric /atmospheric circulation and palaeogeography. A first-order eustatic depression during the Pragian and Emsian caused separation of basins by submerged as well as subaerial barriers with concurrent reduction of the entire environmental system of shelf (incl. reefs). A ramp-slope complex replaced the previous system. Coral and brachiopod migration routes traced along continental shore and straits document direction of currents to the WSW. The faunas show “eastern” Early Devonian roots in Urals, Tian Shan and Sayan Alatau; their massive immigration to Rhenish basins was enabled as late as during the late Kačák sea-level rise and docking of the Barrandian segments. Exceptionally, the Mid-Emsian sea-level rise (Dalejan; warming, volcanic tuffs, incr. clay/ carbonate ratio) was reflected by diffusion of A. Boucot's Urals-region fauna into undifferentiated Ibarmaghian basins, Barrandian and Alpine precursors and partly also to Rhenish area. In fact, so-called mixed Bohemian-Rhenish faunas are faunas of intruding Urals communities (*V. Havlíček,* ***J. Hladi****l*). According to *H.-P. Schönlaub*, the submeridional migration of open-sea faunal groups may be realized in circular

circular domains of sea currents. Although direction of surface loops is unclear, a clockwise movement of deep-sea contour currents results from dispersal of Ibarmagian and/or Spanish corals. Spores of continental plants show a good zoning according to climatic belts: Russia and Arctic Canada – equatorial belt; Georgia, Ontario, Belgium, Germany and Barrandian – subtropical to moderate position; and Bolivia, Amazonia, Algeria and Libya – epipolar zone. In detail, a strong palaeogeographic/tectonic implication was suggested for Barrandian area and entire Bohemian Massif: the Ibarmagian marine benthics easy reached Barrandian seas, which were separated by a land barrier from south Laurussian plate segments during Emsian-Eifelian. However, this barrier was very close to Laurussia, because the influx of "northern" spores to marine sediments of the Barrandian area was very strong (wind from Old Red Continent).

IGCP Project No. 421, North Gondwanan Mid-Palaeozoic biodynamics – subproject Bohemian Massif and its European and world relationships *(project leader J.A. Talent, Centre for Ecostratigraphy and Palaeobiology, Macquarie University, North Ryde, N.S.W., Australia, and R. Feist, Institut des Sciences de l'Evolution, C.N.R.S. Montpellier, France, national representatives* ***J. Hladil****, J. Kříž, Czech Geol. Institute, Prague, Chlupáč, Faculty of Science, Charles University, Prague,* ***P. Štorch*** *& J. Kalvoda, Faculty of Science, Masaryk University, Brno)*

New analyses and comparisons of the Devonian faunal assemblages restore the ideas that the Pragian to Early Eifelian benthic associations were more endemic than during the Givetian and Early Frasnian. The primary cause of this difference is the first-order sea-level fluctuation since the Middle Givetian or Early Frasnian Devonian positions of sea-level may be about 150-200 m higher than during Pragian-Emsian and/or Famennian-Tournaisian. This eustatic fluctuation was considerably reflected by relief of epicontinental seas. Evolution of ecosystems strongly reflected Givetian-Frasnian flooding of continents and warming of climate. Massive and widespread precipitation of micrite, expansive evolution of reef ecosystem and rising abundance and diversity of continental plants are the most visible consequences. However, the proper eustatic-climatic maximum was characterised rather by unified, abundant but in respect to diversity depressed biota. Increased evolutionary rates and richly structured systems are typical mainly for Lochkovian, Eifelian and Frasnian times, i.e. after, before and again after the first-order sea-level maxima. The latter two diversifications were documented on reef ecosystems in Moravia. This general evolutionary-environmental background was suggested as a necessary correction tool for the case studies on evolutionary dynamics and interregional dispersal of the biota. The barriers of the Pragian-Emsian and Famennian-Tournaisian periods caused strong submeridional geostrophic currents, cf. the concepts by *P. Copper*. For example, occurrences of the brachiopod *Tropidoleptus* link the Pragian-Emsian of the Jeseníky Mountains with the Rhenish Massif, the Appalachians and Bolivia (*P.E. Isaacson, I. Chlupáč*), being probably accompanied by specific pleurodictyid corals following this route as well (*Y. Plusquellec,* ***J. Hladil***). Possible warm geostrophic current was derived in tropical Ural Ocean and extended to high latitudes of southern hemisphere.

Palaeontological Society (USA), International Research Project, Personal Award

Terrestrial bioerosion and its Recent and fossil ichnological consequences (***R. Mikuláš,*** *Harbor Branch Oceanographic Institution, Fort Pierce, Florida, USA in co-operation with R. Bromley, University of Copenhagen, Denmark*).

Numerous terrestrial bioerosive processes can lead to the formation of distinctive traces. These include: macro- and microbioerosion in wood, bones and shells; burrowing of some vertebrates in moderately lithified rocks; scraping of mammals; smoothing and polishing of limestone surfaces by mammals' locomotion; excavation by bees, wasps, and ants producing nesting and dwelling tunnels; dissolution of limestone surfaces by terrestrial snails; endolithic activity of fungi, algae, and lichens on subaerial rock surfaces; root corrosion etc. Quantitatively more important processes of biochemical weathering, biophysical erosion, and enlarging of cracks and fissures by the pressure of plant roots do not leave distinctive traces and therefore lie outside the ichnological realm. The fossil preservation of terrestrial bioerosive traces would be expected to be of uncommon occurrence. Nevertheless there are various possible means of preservation, such as rapid burial by volcanic material, by fluvial sediments, by travertine or tufa, by loess, "conservation" in caves, case hardening of surfaces of porous rocks, and preservation of subsoil traces below the fossil soil. The synecology of terrestrial bioerosion shows a similar picture as the synecology of marine borings: some structures are repeatedly colonised by squatters. In comparison with marine bioerosion, the terrestrial bioerosion differs mainly in the existence of subsoil bioerosion, and in a different taxonomical position of most of the tracemakers.

Kapchagay Geological Expedition, Kazakhstan

First record of a discoglossid anuran (Amphibia, Anura, Discoglossidae) from the Late Cretaceous of North-Eastern Aral Sea region, Kazakhstan (*E. G. Kordikova, Kapchagay Geological Expedition at Ministry of Geology and Natural Resources, Kazakhstan,* ***Z. Roček****, G. F. Gunnell, Museum of Palaeontology, University of Michigan, USA & P. D. Polly, The Natural History Museum, London, United Kingdom*)

The prooticooccipital of a discoglossid anuran from the Upper Cretaceous (Lower Santonian) Shakh-Shakh 10 locality, north-eastern Aral Sea region, Kazakhstan is described and compared with corresponding cranial elements published earlier from the early Cenomanian through Coniacian of the central Kyzylkum Desert. Although minor differences were found they cannot be used for taxonomic purposes and only assignment to the family Discoglossidae is possible. The specimen represents the latest Mesozoic record of the Discoglossidae in Central Asia.

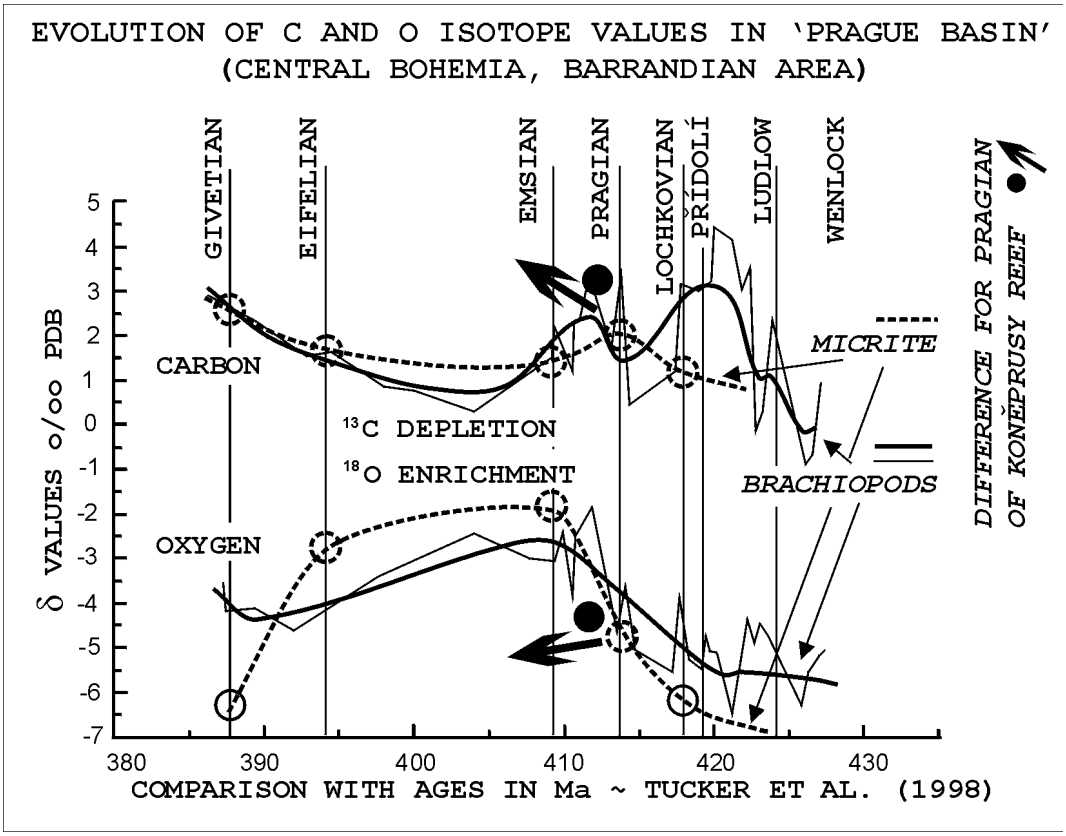


Fig: Comparison of isotope values between the 'micrite' and brachiopods.
Wenlock is characterised by the lowest $\delta^{13}C$ values (close to -1 ‰); on the other hand the highest $\delta^{13}C$ value (4.4‰) was found for Ludlow. This increase in $\delta^{13}C$ values was documented also in brachiopods from other sequences. Lochkovian and Pragian-show the $\delta^{13}C$ values close to 3 ‰; Emsian and Eifelian range between 1 and 2 ‰. Givetian shows restored $\delta^{13}C$ values (close to 2.5 ‰). Positive shift from Eifelian to Givetian is largely documented in the world. However, the $\delta^{13}C$ values 'do not directly copy' global sea level changes. Sea level from Wenlock to Přídolí dropped, but Eifelian/Givetian trend is clearly rising. With no doubts, a depression occurred during Pragian-Eifelian times. The proper reason of an inverted parity 'high $\delta^{13}C$ and lowstands' during the Silurian and Ordovician is not known in details, but it possibly corresponds to reduced terrestrial carbon reservoir.
An anomalous increase in the $\delta^{18}O$ values (up to -2.5‰ in brachiopods and -1.5‰ in micrite) is typical only for the Pragian and Emsian sediments in profounded basin on the north side Koněprusy. The Koněprusy area is different and shows normal ocean values of these times.
J. Hladil *and J. Hladíková*, Project GA CR No. 205/98/0454.

Grant Agency of the CR

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**, J. Hladíková, Czech Geol. Institute, Prague, **A. Galle**, J. Frýda, Czech Geol. Institute, Prague, **A. Langrová** & O. Janoušek, Czech Geol. Institute, Prague*)

C and O isotope analyses of relatively unaltered micrite components in the Devonian carbonates of the Barrandian area extended from the stage boundaries to parts of the whole section. High $\delta^{18}O$ values shifted up to -1.3 ‰ P.D.B. in Pragian, Emsian and early Eifelian limestones indicate that the basins corresponding to sediments in the centre of the Barrandian area were fairly isolated from the world ocean during those intervals, at least in lower parts of water column. These documents evoke an unpublished but significant ideas by *A. Galle* from 1993, that basins located north of Koněprusy are parts of "huge and locally deep, partly separated lagoon". Decrease and retrocession of the $\delta^{18}O$ values to common values of -4 to -7 ‰ may indicate end of this isolation, which corresponds to termination of the Eifelian. This unusual anomaly in composition of oxygen isotopes in the Barrandian area can be preliminarily assigned to this hypothetical "lagoon"; eustatic sea-level depression and elevation controlled start and cessation of this anomaly, respectively. Most of the data are based on micrite components and we do not know, whether the surplus of ^{18}O isotope reflects lateral supply of anomalous micrite or depends directly on the water composition in the depths of the basins. This duality is solved by isotope and chemical analyses of brachiopod shells, which are – as generally accepted – a relatively safe indicator of water composition. Fiber to wafer structures and extremely low CL-response qualified our new material for these purposes. According to preliminary tests, 80 samples from the Barrandian are up to required standard. In 1998, the EDX, EM, OM and CL routines for the preparation of samples, as well as the analytical technologies on Finnigan MAT 258-262 were refined and correlated with the Laboratory of Isotope Geology in Bochum (*J. Veizer, H. Strauss, P. Bruckschen, D. Buhl*). An excellent preservation of shells was particularly documented on *Procerulina procera* from the so-called coenitid reefs in Koněprusy quarries, but many spiriferids and atrypids also reach this quality. Good links of the data to brachiopod systematics and sedimentological-diagenetical parameters (*V. Havlíček, J. Hladil*, respectively) are advantages of the study. First results shows that local positive anomaly in $\delta^{18}O$ in micrite is reflected, to a certain extent, also by calcite of the brachiopod secondary layers.

No. 205/98/1347: Palaeobiogeography of Central European Variscides (***A. Galle, J. Hladil, P. Čejchan,** P. Isaacson, University of Idaho, Moscow, USA, **P. Pruner** & **L. Slavík**).*

The comparison of the faunal trees obtained - by means of PAUP programme - from Iberia, Barrandian and Thuringia brought surprising results: Iberian faunas differ from those of the Pragian of Barrandian and, on the contrary, Barrandian Pragian is close to the faunas of Pragian of Thuringia. It further confirms the opinion on the peri-Gondwanan origin of the Saxo-Thuringia. Differences between the respective peri-Gondwanan Iberian and Barrandian faunas are caused by different bathymetry, Barrandian faunas are shallow-water. Differences between Iberia and Barrandian can be caused also by an

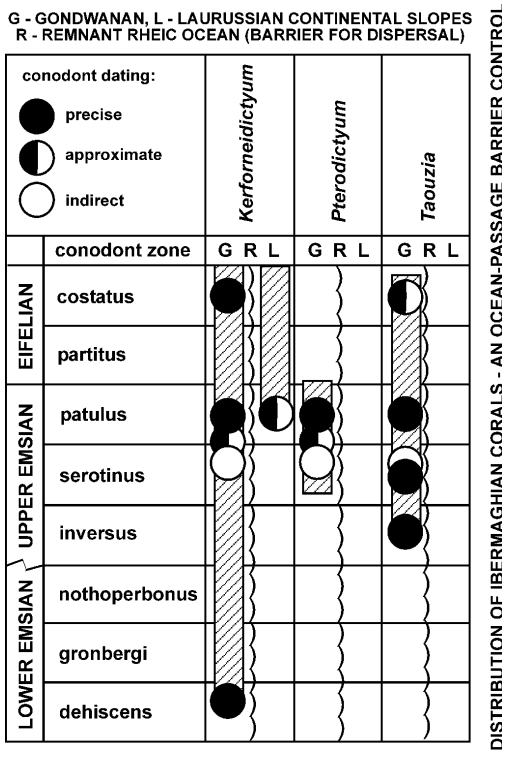


Fig: The Emsian coral fauna of Ibermaghian carbonate slopes connects areas like Morocco, Spain, Montagne Noire and Barrandian and crosses only with difficulty the remants of Rheic ocean passage. It is possible only due to strong barriers (currents and presence of island-arcs), because this passage was according to paleomagnetic data narrow.

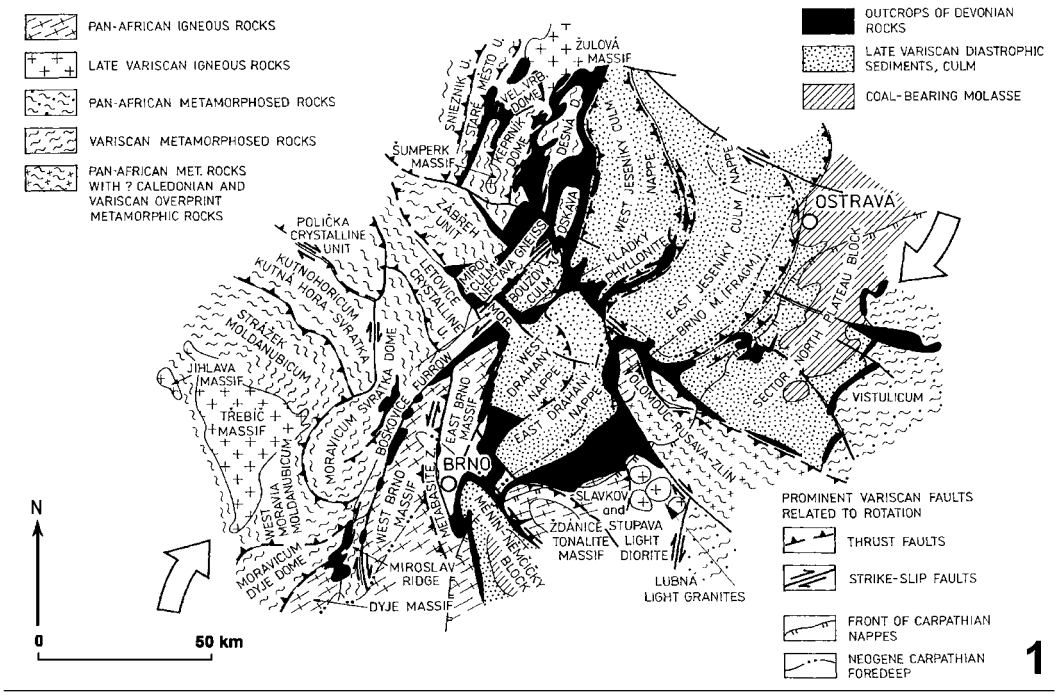
isolated sedimentation of some Iberian terranes, probably in the region of Ziegler´s Prototethys.

Iberian faunal and floral trees of Emsian form relatively homogeneous group separated from contemporaneous faunal and floral trees of Barrandian. Assemblage of the Daleje Shale is close to Iberian assemblages, as well as the assemblage of Petrovice (Moravia). The anomalous grouping is caused by bathymetry: Iberian localities as well as the Daleje and Petrovice shale were populated with assemblages of deeper water. It corresponds to the eustatic sea-level rise in the Emsian.

Eifelian is peculiar in disappearing of differences between peri-Gondwanan and Laurussian assemblages in the PAUP trees. Palaeogeographically close localities group still conspicuously, apparent is the closeness of Moravian localities (Konice, Čelechovice) to the localities of the Rhenish Slate Mountains (Dollendorf, Blankenberg), but some Laurussian localities (Horní Benešov, Ardennes, Rohr) are close to Gondwanan localities in Carnic Alps or Turkey. The separate position of the assemblage of Acanthopyge Limestone of the Koněprusy Area in Barrandian as well as its long distance from the assemblage of the Choteč Lst. of the same age is a notable anomaly in the Eifelian. We interpret the distance of Choteč and Acanthopyge Limestones by bathymetry when Choteč Lst. sedimented in deeper water. We tentatively moved the Acanthopyge Lst. into the Givetian time-slice as it shows clear Givetian characters although objectively - on basis of the conodont parastratigraphy - its age is Eifelian. In Givetian tree, the assemblage does not show any special position. It corresponds well to assumed migration of faunas from the East as well as to confirmed similarities to Ural and Sayan Mts.

Givetian tree gives impression of strong homogeneity, and differences between peri-Gondwanan and Laurussian assemblages are obliterated. It corresponds to large-scale tectonic shortening of the sedimentary space and to agile communication between respective communities, and/or to considerable eustatic sea-level rise.

The tree of the Frasnian is very homogeneous due to the cosmopolitan nature of its communities. The differences between peri-Gondwanan and Laurussian assemblages are not visible. Clustering of Polish localities (possible artifact?) is conspicuous. Polish localities differ from Moravian ones, indicating certain separation. Moravian assemblages fit well into the group of localities of Rhenish Slate Mts., Ardennes and Harz.



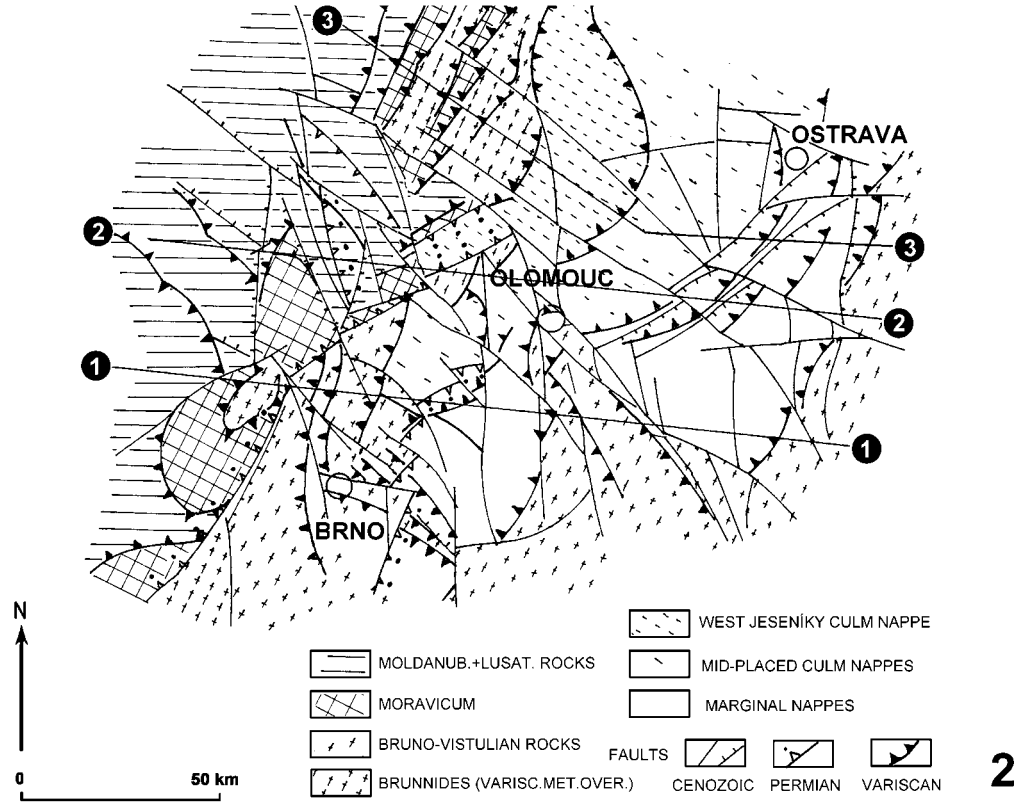
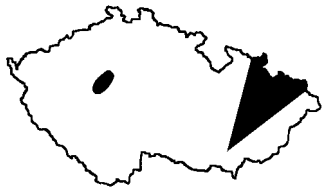


Fig: Two simplified geological maps of Moravia showing the Permian subcrops. They vizualize the results of facies, tectonic and paleomagnetic analyses of this part of the Variscan Orogen. 1 - A diagram where significant Variscan contacts and Devonian rocks have been stressed; 2 - another diagram where also young faults of Mesozoic and Cenozoic ages have been traced.
***J. Hladil** and R. Melichar*, Project GA CR No. 205/98/1347.

Grant Agency of the Academy of Sciences CR

No. A 3013809: Assessment of regional and eustatic sea-level changes at the Devonian carbonate platform bordering southeastern margin of the Bohemian Massif (***P. Bosák, J. Hladil, A. Galle, P. Čejchan****, K. Helešicová, Transgas, Brno, A. Těžký, Geofyzika, Brno et al.*)



Devonian sedimentary rates, hypsometric curves and water depths were quantified, taking the data, which are available at this stage of development of the disciplines. Vertically and laterally interconnected values were modified/tested for the best results with minimum error ranges. The qualitative arguments – common in geology - were “translated” to mean and limiting values. Feedback among vertically distributed data in sections with lateral relationships considerably reduced the previous error ranges from former 200-50 % to 30-10 %. The platform of the Moravian Karst basin was compared with other Devonian basins in the Bohemian Massif (transitional or slope and Tišnov basins in Moravia, Koněprusy and northeasterly-located parts of the Devonian basins in central Bohemia). Standard conodont zonation was used for assignment of the sedimentary records to time scale - in 70 % directly, in 30 % indirectly. Local sea-level changes were compared with calibrated global curve and vertical tectonic movements of the basin fundaments were plotted.

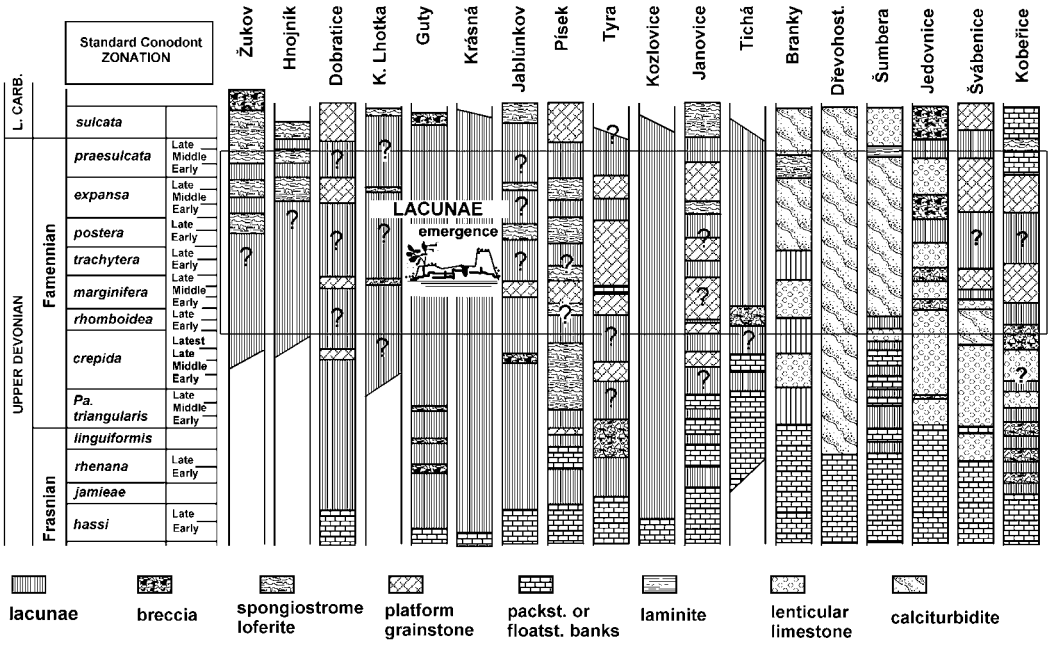


Fig: The global sea level fall corresponds to the latest Devonian and early Carboniferous glaciation on Gondwana. Similarly in Moravia, large parts of platforms distant from deep basin were affected by this regression of the sea. Emergence of platforms was localy accompanied by origin of paleokarst.

With the exception of a part of the Moravian Karst, the subsidence is not equal to the thickness of sediments, i.e. the "filling to sea-level" model is not working at whole. Low sedimentation rates are characteristic for other basins, where accumulation of the sediment lagged be-

hind the magnitude of sea-level changes by one or two decimal orders. Although the error ranges were considerably reduced, the published graphs are rather results of a modelling than "hard data". However, the calculated trend-lines are solid even being tested by marginal sets of the data; they are reliable. These trend-lines show continuous subsidence in three Moravian basins and continuous uplift in two Bohemian basins. Steeply rising gain of these vertical tectonic components accompanied - especially during the Late Devonian - by abrupt drops totally differs from any exponential, thermally controlled isostasis. The curves indicate transpression (Bohemia) and transtension (Moravia). This confirms a hypothesis that large parts of the Devonian NW-Gondwanan and SE-Laurussian marginal segments were influenced by regional tectonic strain, which intensified from Middle to Late Devonian.

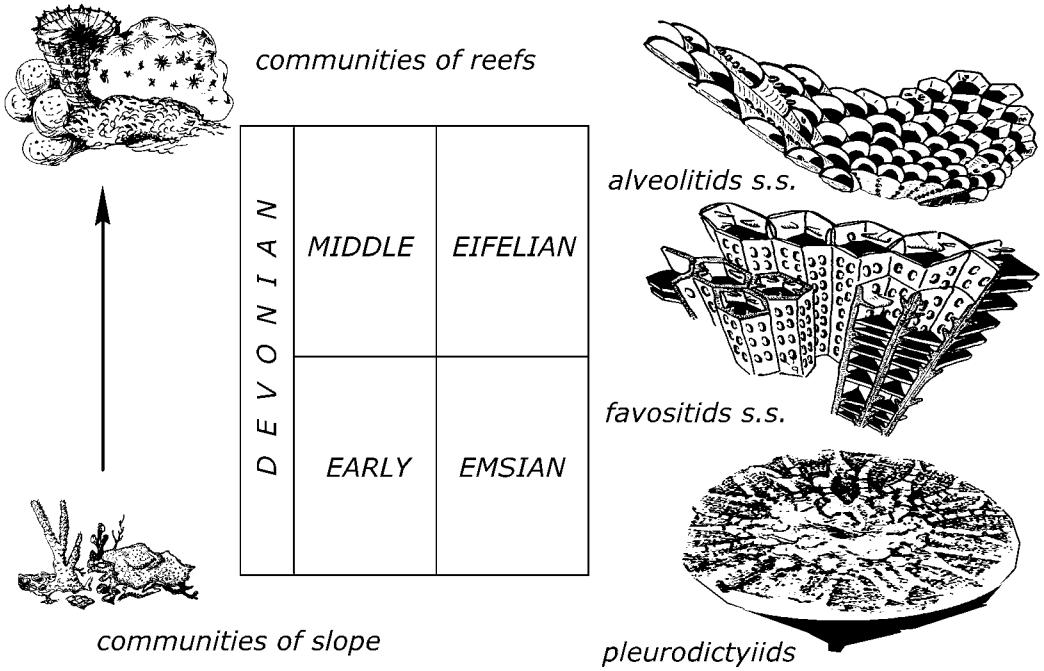


Fig: Evolution of coral communities in the late Early Devonian and early Middle Devonian seas between Gondwana and Laurussia shows a change from 'deep- and calm-water' communities on carbonate ramps and slopes to communities of 'reefs and carbonate platforms'. It corresponds to strong rise of the global seal level, which opened many equatorial sea communications that contributed to warming in the widening tropical belt.

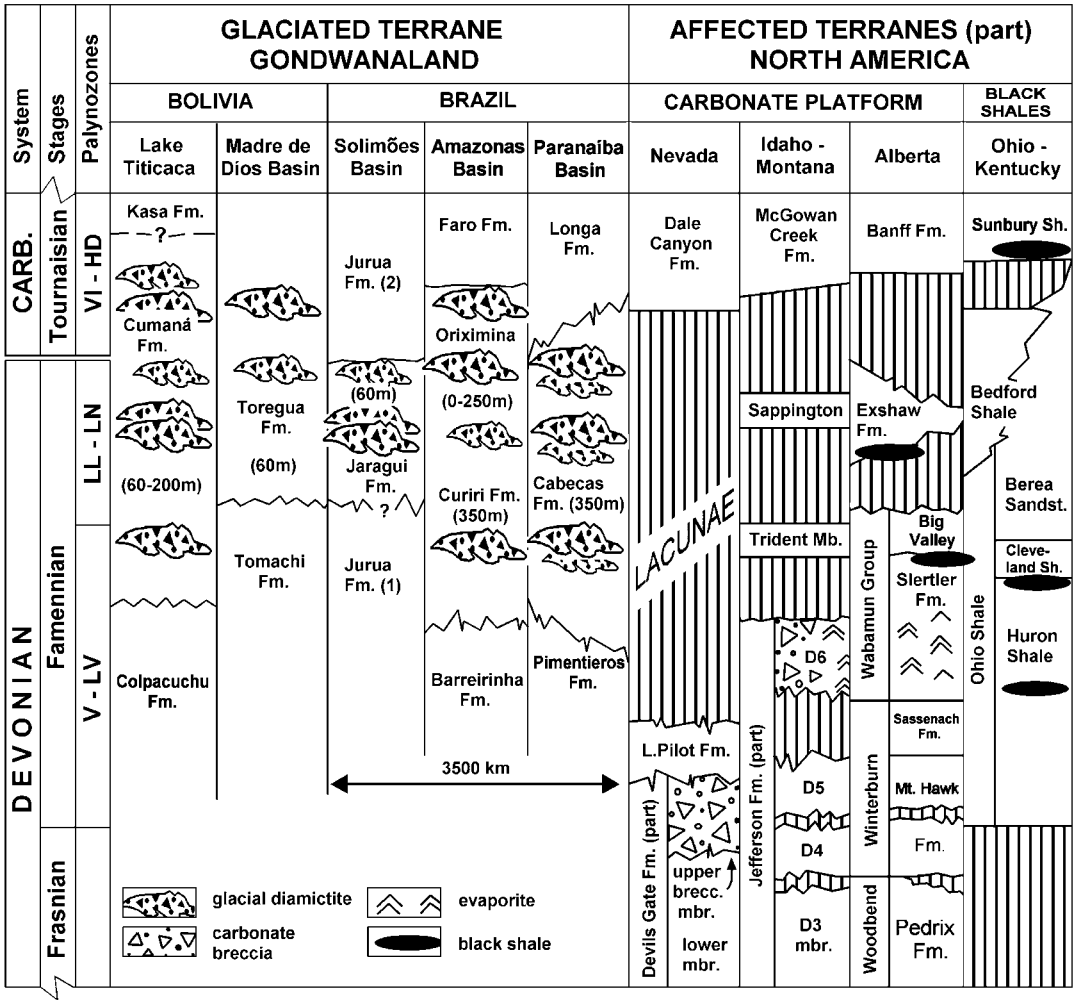


Fig: Palynological dating provided documents for the latest Devonian and early Carboniferous glaciation episodes on Gondwana. Note the correlation made for the sea level falls and corresponding lacunae in stratigraphical columns (North America - a part of the Devonian Laurussia continent).
P.E. Isaacson and ***J. Hladil***, Project GA ASCR No. A3013809.

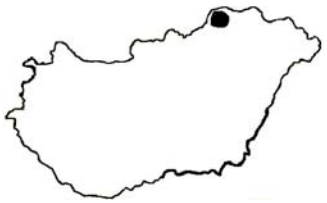
No. A 3013807: Hyolith-Epibiont Relationships: Taxonomy, Nature of Symbiosis, and Spatial/Temporal Distribution (***A. Galle*** *&* ***J. M. Malinky***)

A non-hyolithid benthos was studied to evaluate its epibionts compared to these in hyoliths. The only known locality from collection of Ing. Hanuš comes from St. Prokop Quarry (Lower Devonian, Pragian, Dvorce-Prokop Lst.), deposited in the Institute of Geology and Palaeontology, Charles University, Prague, yielded the following data:

Group	Number of specimens	With epibionts
Coelenterata	23	0
Brachiopoda	412	0
Bivalvia	118	0
Gastropoda	11	0
Cephalopoda	40	1
Hyolitha	509	132
Dacryoconarida	28	0
Ostracoda	4	0
Trilobita	42	0
Echinodermata	13557	57
Faunas indet.	5	0
Σ	**14749**	**190**

Epibionts were found in three groups (epibionts in trilobites are also known in literature but they were been observed in the material studied). Epibionts were studied in echinoderms, particularly crinoids, where in 13 557 specimens - mostly pluricolumnals - 57 epibionts of various systematic position were found, i.e., 0.4 %. Another group with epibionts are hyolithids where 132 epibionts were observed in 509 specimens, i.e., 26 %. Epibionts occur only in hyolithids, not orthothecids, as known in literature. Among hyolithids, epibionts are known only in *Pterygotheca* (386 specimens) and represented by only one species, *Hyostragulum mobile* (132 specimens), i.e., 34 %. Single specimen of epibiont in cephalopods (*Cycloceras*, 40 specimens) is close to, and probably congeneric with *Hyostragulum* (epibiotic cover 2.5 % but data are insufficient). Preference of epibionts to hyoliths is striking.

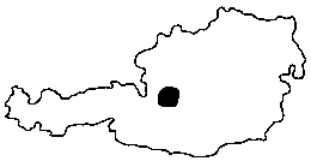
No. A6013701: Late Miocene Amphibia from Rudabánya, Hungary in context of evolution of European herpetofauna (***Z. Roček***)



The most abundant tailed amphibian in Rudabánya is *Mioproteus caucasicus*, a representative of the family Proteidae. Salamandridae are represented by *Chelotriton* which is morphologically close to the Late Oligocene articulated skeletons of *Chelotriton paradoxus* from Rott and Enspel (Germany), however, different in some significant anatomical features (e.g., morphology of the maxilla, type of sculpture, etc.). Another, not yet described salamandrid is represented by fragmentary maxillae, somewhat recalling those of contemporary *Salamandra* but more robust. This form was found also in the Sarmatian of Gritsev, Ukraine and will be described elsewhere. Two types of vertebrae nearly identical but different in size may indicate presence of two other salamandrid amphibians, from the *Brachycormus-Triturus* complex. Since precise taxonomic assignment of these forms can be exclusively based on cranial elements (too fragile for recovering from the sediment by washing methods), not on the vertebrae and other postcranial elements which are quite uniform, the more precise taxonomic assignment is not possible at the time being. Among anurans in Rudabánya the most common were palaeobatrachids. They are represented by several morphological types. It is difficult to decide whether this variation reflects ontogenetic or taxonomic differences. Another common anuran was the discoglossid *Latonia gigantea*. Besides, occurrence of another, smaller discoglossid is evidenced by rare ilia and praearticulars; the latter suggest that they belonged to *Bombina*. Ranids also occurred in Rudabánya, but were

less numerous than palaeobatrachids and *Latonia*. Size differences of ranid ilia may suggest that there were at least two forms in Rudabánya. Rather surprising is a rare occurrence of the pelobatids; only several ilia, humeri, and praearticulars represent these anurans in Rudabánya. The genus *Pelodytes* was recorded on the basis of a single ilium. Similarly, only two ilia suggest occurrence of the genus *Hyla*. In general, the Late Miocene amphibian fauna of Rudabánya involved taxa common in Europe since pre-Oligocene times (such as *Chelotriton* cf. *paradoxus,* Pelobatidae, *Pelodytes* sp., Palaeobatrachidae), the taxa which appeared only in the Miocene (e.g. *Latonia gigantea, Hyla* sp.), and those which appeared only in the Late Miocene and were widely distributed in eastern Europe but much less common in western part of the continent (e.g. *Mioproteus caucasicus*). *Bombina* was for the first time evidenced in co-existence with *Latonia* on the basis of other than postcranial elements. Rather surprising is the absence of the Bufonidae, common at other localities since the Early Miocene.

No. A 3013801/1998: Brachiopod fauna of the Kössen Beds (Uppermost Triassic) (***M.Siblík***)



The collecting of brachiopods of the Kössen Formation was focused on two areas: Gaissau near Hallein and Steinplatte near Waidring. The study of the brachiopod fauna of the reefal development of the Uppermost Triassic (Oberrhätkalk) on Steinplatte was quite recently finished and it can be now compared with that of basinal development - Kössen Beds fauna, where eleven brachiopod species were ascertained during new sampling. This is a little less than in the reefal facies. Former literature on Kössen Beds of Steinplatte mentioned *Rhaetina gregaria, Triadithyris gregariaeformis* and *"Rhynchonella" subrimosa,* which were not ascertained by the new sampling. On the other hand, leading Rhaetian species *Austrirhynchia cornigera* which was missing in old faunal lists, was found during new sampling at two localities. The field works in the Kössen Formation near Gaissau will continue in the future, so far an average Kössen brachiopod assemblage has been found there.

A comparative study of the Upper Triassic brachiopods (especially of very variable genus *Rhaetina*) from Gaisberg near Kirchberg i.T. enabled to distinguish a new species *Rhaetina tirolensis* sp.n.

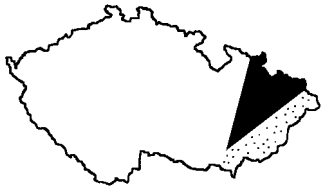
Grants of the Ministry of the Environment

Carbonate sediments of the Central Bohemian Proterozoic (*J. Pouba, V. Skoček et al., Faculty of Science, Charles University, Prague & **R. Mikuláš***)

Eight layers of carbonate sediments (clayey and quartzose limestones to calcareous siltstones) have been recognised in the outcrops of the Štěchovice Group at Jarov S of Prague. Mechanical sedimentary structures of these layers (i.e. parallel palaeolamination, convolute bedding, gradation features) point to their turbidite origin. The contrast in the composition and sedimentary textures between the carbonates and the surrounding shales gives a certainty that the carbonate enrichment is primary. Presence of larger ooids in the carbonates shows that the source area was probably in shallow water settings, which are not represented in the presently preserved sedimentary fill of the uppermost Proterozoic basin of the Barrandian area.

No. VaV/603/1/97: Geodynamic model of the contact between the Bohemian Massif and West Carpathian Mountains. (*O. Krejčí, P. Müller, J. Franců et al., Czech Geol. Institute, Brno,* ***J. Hladil*** *et al.*)

Subproject: Palaeozoic on the eastern margins of the Bohemian Massif *(**J. Hladil**)*



According to strict regulation concerning the releases of this project, which was part of the contract, the annotation deals only with overall topics and development of the methods. The detailed data with implications for oil and gas potential in this area are property of the client. The palaeogeographical subsurface maps of Palaeozoic formations, members and facies were largely completed and mostly up-dated according to present techniques in facies analysis, diagenetic modeling and re-interpretation of the well-logging. The object oriented files and numeric spreadsheets involve the information about 3-D geometry and quality of the rocks, especially in relationship to origin and presence of porosity. Special emphasis is given to re-investigation of the Macocha Formation and adjacent parts of underlying and overlying rocks. An extensive analysis was covered by calculation of parameters for diagenetic, so-called non-structure collectors. Several new approaches and techniques have been developed and applied: 1. Replacement of classical rock classification by more physically oriented parameters reflects a common failure in correlation between the classical descriptors and physical response of the rocks in well logs. Practically, only refined wackestone to rudstone progression, AAPG size categories of grains and cumulated contents of clay, oxidic, organic and quartz chalcedony sub-crystalline aggregates are utilisable. Newly introduced parameters are, for example: 1.1. DEF10-parameter, i.e. number of crystal defects, log10(n) of defects, standardised for 1 m, values up to 10^10 (accompanied with microscopic crazing, chaps, discontinuities visible in OM, TEM, SEM). 1.2. STY10-parameter, i.e. number of microstylolitic/dissolution seams, log10(n), standardised for 1m, values up to 10^10 (including larger dissolution on seams between crystals or on dislocations of crystal lattice, OM, TEM, SEM). 1.3. TH-parameter, i.e. the longest sub-horizontal trajectory on 95 %-frequence level (0 ±15 degree) in homogeneous mineral aggregates [micrometers]. 2. New development concerns also the probability of occurrence of the reef and carbonate platform sub-facies in cycles, if they are displayed in multi-layer or 3-D views. 2.1. Hypsometric and eustatic controls work within the framework determined by the tectono-sedimentary and ecological mosaics. 2.2. Leo Laporte model of palaeokarst remodeling on emerged reef banks works well at emersions above the amplitude of 50 m and duration of 1 Ma by slightly extensional or passive tectonic setting. 3. Studies on diagenetic tracing of sediment and fluid sources based on Fe isotopes were suspended owing to universal detection difficulties on spectrometers.

Industrial grants

Českomoravský cement a.s.: Facies, biofacies and structure of the Devonian limestones, Koněprusy area with respect to adjacent structures of the Barrandian area (***J. Hladil, P. Bosák, L. Slavík, A. Galle, J. Adamovič, M. Coubal,*** *A. May, Geologisches Institut und Museum, Universität Münster, Germany, R. Melichar, Faculty of Science, Masaryk University, Brno et al.*)

The Koněpusy Limestone (Pragian) of the Zlatý Kůň Hill near village of Koněprusy yielded a new species of rugose coral peculiar in its non-parricidal intracalicinal increase. Offset begins as the gap in the parent corallite wall filled with the tabulae with their both ends resting on the tabula below, and thus resembling the single series of horseshoe dissepiments. Horseshoes do not develop in

the interseptal chambers but rather they interrupt the septa. Later on, the dimensions of the offset increase and it diverges from the parent corallite. Normal tabulae develop after an increase of the offset´s diameter in the offset while horseshoes sometimes can fill surviving gap in the marginarium. The coral resembles the genus *Farabophyllum* Lavrusevich, 1971, from the Lower Emsian of Tadzhikistan, Central Asia and Victoria, Australia.

Subproject: Contributions to Early Devonian palaeogeography based on stromatoporoids from Koněprusy (***J. Hladil**, A. May, Geologisches Institut und Museum, Universität Münster, Germany*)

Early Devonian palaeobiogeography of benthic faunas, particularly stromatoporoids, is – according to retrieval of the data from world – very unclear. Pragian stromatoporoids and the relevant facies as well, make a significant complication being absent from many key-places, for example from the eastern U.S.A. From this primary absence it could be hypothesised (*C. Stock*) that refugium for stromatoporoids during this break in eastern American continuity must be somewhere on adjacent continental margins, for example on parts of European Variscan precursors. Especially, the Cantabrian Mountains in Spain, Armorican Massif in France or Prague Basin in Czech Republic were considered in respect to this role. Recently, this assumption was tested by comparison of up-dated list of stromatoporoids from Koněprusy with other regions. The eastern American stromatoporoid assemblages from Lochkovian and Emsian – the Pragian is mostly within a stratigraphic lacuna due to sub-aerial exposure and erosion – are characteristic by presence of *Habrostroma* and absence of Actinostromatida. In contrast, *Habrostroma* is completely missing in Koněprusy Limestones and Actinostromatida are fairly rich, being represented mostly by *Plectostroma* species. This strong difference suggests that the Pragian basin was probably never acting like a refugium for the eastern American stromatoporoids. Occurrences of the Old World genera like *Schistodictyon, Stromatoporella, Parallelopora* or *Atopostroma* do not show any significant links on species level as well. Material from Koněprusy suggests that refugium for the Appalachian stromatoporoids must be located much closer than in the Variscan Europe.

Subproject: Investigation of exploited limestones in quarries of the Velkolom Čertovy schody (***J. Hladil, P. Bosák & L. Slavík***)

Exploitation of limestone proceeded particularly in the Quarry-East. Prevailing rock type is represented by gray but coarse detrital limestone. Composite fans of sediment are 2 to10 m thick and consist of bio- and lithoclasts of extremely varying composition, size and roundness of particles. Micrite is accessory, <10 %, accumulated only in lenses or layers of dm-thickness. These sediments are similar to ordinary slides of accumulated debris at the foot of the former cliffs or highs, i.e. debris with fluxoturbiditic and olistholitic objects, reworked and transported at a short distance, but two differences are typical: First, whitish nodules of solenoporacean algae are commonly redistributed in these fans They are otherwise typical for stratigraphically higher ramps at a middle distance from the Zlatý kůň Hill or fills of some cavities directly in the Pragian reef cap of the Zlatý kůň Hill. Second, carbonate pebbles are locally very abundant. These pebbles well rounded, pitted, spherical or disk- and rod-

shaped; 2-25 cm large, consist of lagoonal packstones/grainstones lithified in sub-aerial conditions, incl. vadose silt and “chalkified” alterations. Composition of pebbles is similar to populations found in 1992 in limestone-conglomerate channel fills. The newly documented assemblages of pebbles are derived either from reworked lag material from the mentioned SSW-directed pebbly grooves or directly from the pebbly beach at the emerged limestone cliffs in unknown north (separated by the Očkov Overthrust).

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10. Department of Exogenic Geology and Geochemistry

Foreign Grants and Joint Projects

Czech-US Joint Programme ”KONTAKT” (Ministry of Education, Youth and Sports)

No. ME 147: The dynamics of the biogeochemistry of beryllium (Be) (*principal investigator J. Veselý, Czech Geol. Institute, Prague, co-investigator in GLI:* ***P. Skřivan****. Collaborating researchers:* ***L. Minařík, O. Kvídová, J. Martínek, I. Dobešová, A. Žigová*** *&* ***M. Burian***)

Quantification of the beryllium pools and collection of data concerning the Be fluxes in forested experimental catchments, were the main task of the Czech part of the Project whose leading idea is to develop, what happens inside the ”black boxes” of the biogeochemical cycle of beryllium. The study was accomplished through the field study in an experimental catchment of ”Lesní potok” in the Kostelec nad Černými Lesy region, 30 km SE of Prague. Samples of bulk precipitation, beech- and spruce throughfall, and surface stream were collected monthly and analysed for the content of Be, Al, F^-, SO_4^{2-}, and H^+ ions. Annual fluxes of these elements/ions, expressed in $\mu g.m^{-2}.year^{-1}$ are shown in the following Table:

Fluxes of elements/ions expressed in mass per 1m^2 of soil per year

flux	locality	Be/μg	Al/μg	F^-/mg	SO_4^{2-}/mg
bulk precipitation	Truba	11,0	50,0	28,2	2765
bulk precipitation	Arboretum	12,4	37,2	---	----
surface water	LP6	76,03	12,4	73,57	7744
beech throughfall (V)	LP6	26,1	----	35,5	2240
beech throughfall (G)	LP6	15,5	----	----	----
spruce throughfall (V)	LP7	22,2	38,3	65,58	7014
spruce throughfall (G)	LP7	11,7	----	----	----

Measured and computed values of the annual surface water discharge (20.35 $l.m^{-2}$) are very low with respect to the input of water through precipitation (598.4 $l.m^{-2}$), which indicates considerable discharge through the subsurface water. Actual beryllium loss through total discharge should then be much higher than the value presented in the above-presented Table (76.03 $\mu g\ Be.m^{-2}.\ year^{-1}$).

Pools of beryllium in the bedrock (the Říčany type monzogranite and Jevany type syenogranite), in corresponding soil horizons, and in the organic matter of the forest vegetation were evaluated on the basis of determined analytical concentrations of Be in these types of

material. Rock-forming minerals of the parent rocks were examined to evaluate the main beryllium-bearing mineral phase. Mean content of Be in both types of the parent rock is 13 and 7 ppm, respectively. Highest accumulation of Be (14.8 ppm) was found in the plagioclase. Content of Be in the soil profile was found to be steadily increasing with depth, which corresponds to its origin and to the effect of the acid atmospheric precipitation. Beryllium content in the beech wood, bark and leaves (dry weight) is 21 ppb, 68 ppb, and 350 ppb, respectively. Computed preliminary results of the Be cycling in the model catchment of Lesní potok show steady release of the element from the system. The process is accelerated by the acid atmospheric precipitation and the beryllium loss is supplemented by its depletion in soil and weathered rock.

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

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

Thermal and subsidence history of the deepest borehole in the Barrandian basin – Tobolka 1 – has been investigated by means of analysis of organic matter reflectance. Time-temperature evolution of the section was then simulated through an advanced PDI computer-aided basin modelling software.

It was found that silty and shaly lithologies of Devonian age contain unidentified organic particles with random reflectance (R_r) of 1.35-2.05 %. The data do not show any systematic trend with depth. In Silurian sediments, the graptolite zooclasts are the major organic maceral type. Graptolite reflectance increases with depth from 1.35 to 1.74 % over 450 m. In Ordovician samples, fragments of chitinozoans and unspecified organic matter (R_r = 2.27-3.91 %) were recorded along with the particles of redeposited metaanthracite to graphite.

Using PDI computer programme the physical properties of rocks, temperature distribution and organic maturity in the section were calculated and the simulated reflectance data were calibrated by the actual R_r values measured. A number of alternative scenarios of heat flow, eroded units and accumulation rates were tested. Based on simulation results, two subsidence and thermal models of the borehole appear to represent the most likely solutions:

1. In the first model, the heat flow was adjusted at 75 $mW.m^{-2}$ through the Palaeozoic. The model assumes deposition of hypothetical Middle to Upper Devonian sedimentary or tectonic units (up to 1,800 m thick) which caused maximum burial and heating during the Upper Devonian. During the Late Devonian, tectonic overthrusting occurred that was responsible for the erosion of these inferred units. Subsequent deposition of the Upper Carboniferous to Permian sequence up to 1,200 m thick did not affect substantially the thermal experience of Lower Palaeozoic rocks.

2. The second model assumes 65 $mW.m^{-2}$ heat flow through the Ordovician to Devonian that was followed by elevated 85 $mW.m^{-2}$ heat flow during the Carboniferous to Permian. The model simulates deposition of 500 m of the Srbsko Fm., subsequent erosion, and deposition of 1,400 m of the Permo-Carboniferous sediments. The maximum heating occurred during the Autunian that was followed by erosion and overthrusting in the Late Permian or Mesozoic.

The research is now in progress to obtain independent time-temperature data from apatite fission track analysis (AFTA) and to compare the data with those based on organic maturity and computer modelling.

Czech-US Scientific-technical Programme (Ministry of Education Youth and Sports)

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

Oriented samples from the sedimentary profiles in Kůlna Cave and additional charcoal samples from Spirálka Cave were collected in the Moravian Karst. At the Michigan Technological University, an anisotropy of magnetic susceptibility (AMS) and remanent magnetisation measurements were made on oriented samples from the Kůlna Cave to determine if a sedimentary flow fabric was present in these sediments and whether they recorded the Blake event. These measurements were augmented by X-ray diffraction and microanalyses of heavy minerals to determine the source area and the possible mode of transportation of these cave sediments. Radiometric dating of bones and flowstone from the Kůlna Cave and a charcoal from the Holštejn Cave helped to further constrain the age of these clastic sediments. Palynological analyses of organic-rich layers in Spirálka Cave and Holštejn Cave are currently underway to determine whether these layers are related. Petrographic study of a flowstone from Svážná studna Cave was made to determine the correlation between annual cave calcite growth and seasonal temperature and precipitation variations.

A stalagmite from the Holštejn Cave originated during Late Glacial and Holocene period was prepared for stable isotope analyses and radiometric dating. These analyses will yield data for reconstruction of climatic change on Pleistocene/Holocene boundary.

Grant Agency of the CR

No 205/98/703: The development of the deep slope movements in neovolcanic rocks of České středohoří Mts. (*J. Rybář, Institute of Rock Structure and Mechanics, Academy of Sciences, Prague & **V. Cílek***)

The seemingly uniform large landslide at Čeřeniště close to Litoměřice is according to a new geological analysis a complex phenomenon of several - at least 4-6 individual lava flows divided by intercalations of Tertiary sedimentary rocks. The contact metamorphism affected kaolinitic claystones, diatom muds and thin layers of silt sediments and changed the sedimentary rocks covering the uneven surface of former lava flows into brick red rocks with autochthonous augite crystals and a relict of former root systems. Thus the landslide should be considered as multi-phase phenomenon of several layers represented by individual flows sliding down on unevenly developed sedimentary cover of different contact metamorphism.

No. 526/96/1041: Impact of the soil cover erodibility on the surface water contamination (*principal investigator M. Janeček, VÚMOP Prague – Zbraslav, **P. Skřivan** co-investigator in GLI. Collaborating researchers: **O. Kvídová**, **I. Dobešová** & **M. Burian***)

Changes in distribution of As, Cd, Cu, Pb, and Zn between the solution and particulate matter of the run-off with time were studied in dependence on pH of the model system. Fine fraction of three types of the run-off was employed in the laboratory experiments. The type A was prepared in a laboratory from soil extremely contaminated by trace metals. The other two types were collected in the field, both from uncontaminated regions: the type B from acidic soil, and C from soil with higher buffering capacity. Laboratory experiments were arranged to cover the time span of equilibration of 1 and 2 weeks, respectively. Experiments with heavily contaminated particulate matter were characterised with fast initial step of equilibration resulting in high concentration of elements in solution, which was followed by further gradual and slow increase of their dissolved forms with time. Higher content of dissolved forms of elements was found in suspensions with higher pH value. On the other hand, experiments with the uncontaminated run-off types confirmed the significance of fine soil fraction to fix reactive dissolved forms of contaminants in surface waters. Experiments also proved the significance of Fe- and Mn- hydrated oxides for the fixation of trace elements in surface waters.

Grant Agency of the Academy of Sciences CR

No. A3013603: Biogeochemical cycles of trace elements, their sources and redistribution in a catchment with granitic bedrock: a model study (*principal investigator P. Skřivan in the Faculty of Forestry of the Czech Agricultural University, Prague, responsible person in GLI **J. Martínek**. Collaborating researchers: **L. Minařík**, **P. Skřivan**, **I. Dobešová**, **O. Kvídová**, **M. Burian** & **A. Žigová***)

The geochemistry of rare-earth elements (REE) and yttrium as a selected group of less common trace elements has been studied in 1998 in the soil profile derived from a biotite granite in the area of "Lesní potok" catchment near Říčany (Central Bohemia, the Czech Republic). The comparison of the variation in the REE and Y concentrations in the individual zones of the profile shows that total content of lanthanides depends on the grain size of the soil material. The horizons abundant in clay fraction (Gr_1, Gr_2) contain 5 times more REE's than those with a predominance of silt and sand (G_0, Gr_3). The chondrite - normalised soil La - Lu pattern is similar in all profile zones and it behaves as an almost smooth function of the REE ionic radii, or their atomic numbers, respectively. The bulk content of lanthanides in soil is higher than that in the local partly weathered boulders of the parent rocks (syeno- and monzogranite). The content of acid soluble forms of REE (the portion of elements soluble in 0.1 M HNO_3) increases from the umbric horizon A towards the bottom of the profile. Our results indicate that the mobile part of REE is leached and transported to the lower part of the profile by acidic atmospheric precipitation. The REE distribution pattern of surface- and subsurface waters draining the terrain of the catchment confirms this consideration.

No. A3012703: Thermal History of Sedimentary Basins of the Czech Republic and its Relationship to Tectonic Processes (*J. Šafanda, Institute of Geophysics, Academy of Sciences, **V. Suchý**, I. Sýkorová, Institute of Rock Structure and Mechanics, Academy of Sciences, Prague & M. Stejskal, Institute of Chemical Technology, Prague*)

Tectonic deformations were responsible for the origin of an extensive set of post-Variscan fractures that cut across the Lower Palaeozoic limestones of the Barrandian Basin. Fractures were cemented by three successive generations of calcite cements that were investigated by means of stable isotope and fluid inclusion analysis.

The two oldest cement generations were represented by intensely tectonically deformed Fe-rich calcite that graded into a later phase of less deformed Fe-rich and Fe-poor calcite.

Fluid inclusion data indicate that precipitation of the vein cements occurred at $\leq$70 ^{o}C. Analysis of the reflectivity of vein bitumen and deformation fabrics in calcite, however, show that some of the cements probably experienced higher temperatures (as high as 200-250 ^{o}C) that were reached after the crystallisation. It is assumed that this inferred thermal event was due to the influence of hot fluids that may have locally migrated through the veins during tectonic deformations.

The fluids that precipitated vein calcite were H_2O – NaCl solutions of variable salinity (0 – 8.9 eq. wt% NaCl) often containing a small admixture of liquid petroleum hydrocarbons. In some vein calcite samples, the inclusions of highly saline fluids (up to 22.4 eq. wt% NaCl) were occasionally also recorded that appear to be associated with sulphides, bitumen, and saddle dolomite and fluorite cements. The calculated $\delta^{18}O$ values of the ambient fluids (-3.4 % to +3.7 % SMOW) are interpreted to indicate precipitation of vein cements from deeply circulating meteoric water that may have partly mixed with deeper basinal fluids.

Schematic presentation of typical microscopic features of some Barrandian calcite veins:

Fig A: Calcite- and bitumen-filled vein from the Lochkov Limestone, Radotín. Diameter of the circular field of view is approximately 7 mm. Note the presence of saddle-shaped dolomite crystals (Dol) along the vein margin and the intensely corroded calcite grains “floating” within the bitumen (shown in black)

Fig B: Calcite- and quartz-filled vein from the Kopanina Formation, Kosov quarry, Beroun County. Diameter of the circle is about 5 mm. Note that the vein cuts through all the cements in the bioclastic limestone and the late-stage tectonic stylolites. Black particles embedded within the vein calcite are solid bitumens.

The luminescence and stable isotope characteristics of the latest generation of vein calcite are different from those of stage 1 a 2 calcite and are assumed to reflect precipitation at lower temperature, from shallower meteoric fluids.

The north-south-striking Barrandian calcite veins probably belong to a major fracture zone, 10 to 20 km wide that cuts across the territory of the Czech Republic. It is likely that a complex multistage record of events encountered in the veins can be explained as a result of repeated episodes of fluid migration that have probably occurred along these lineaments since the Variscan Orogeny.

Grants of the Ministry of the Environment

VaV 610/2/96-56/03/15: The establishment of the unified network of protected geological sites at Mělník, Mladá Boleslav and Praha-západ districts (***V. Cílek***)

The Czech Geological Institute listed about 30 geological sites intended for protection in three Central Bohemian districts. This number was almost doubled by new research. All sites were visited and divided into several categories of protection:

National nature reserves. The only locality was proposed to fall into this category - Závist close to Zbraslav with one of the largest European Celtic oppidum, natural forest, contacts of Proterozoic and Ordovician units and complex geomorphology.

Nature reserves or nature monuments. Three sites should be protected within this category - the underground “opuka” chambers in Vehlovice close to Mělník, Dvořák Rocks in Carboniferous arkoses close to Nelahozeves and the upper part of Radotín Valley with a number of important geological outcrops, palaeontological sites and karst phenomena. However, at least four other sites have the value of nature monument: (1) Černolice rocks formed by Ordovician quartzite; (2) System of Kazín and Humenská - the rocky meander of the Berounka River with archaeological sites, important outcrops in the Letná Formation and natural oak forest; (3) abris and rock tower in the Jizera Formation close to Strážiště in Mladá Boleslav district, and (4) the upper part of Skalský (Strenický) potok Creek between Kokořínsko and Skalsko CHKO.

Important landscape features. More than forty natural objects such as Davle Quarry, Lečice meander, Požáry Quarry, Skalka and Babka quartzite outcrops, and other were proposed to be listed this category of protected objects.

Industrial grants

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

Concentrations and fluxes of 10 ions and 11 selected minor and trace elements are the object of study of various forms of atmospheric precipitation in the area of the Velkolom Čertovy schody Quarry, in the Koněprusy region (Bohemian Karst). The aim of the study is to determine sources of the monitored chemical components in relation to activities in the quarry. The second hydrological year of monitoring was finished during 1998. On the basis of the preliminary results, enhanced deposition of components connected with lime exploitation and

its processing is documented. Concentrations of the hazardous elements and compounds, nevertheless, are not significantly higher than the values common in Central Bohemia.

Českomoravský cement a.s.: Quarry reclamation: principles, methods and future perspectives (***V. Cílek***)

The problems of quarry reclamation were extensively studied and the methods and guidelines for the reclamation were proposed both to the directors of lime and cement plants of Central Europe (through Cembureau of the European Union) and to the Czech Ministry of the Environment. The morphological adaptation is the most important of the revitalisation project. The quarry reclamation will pay increasingly important role in the lime and cement industry of the Central Europe. The attitudes of public sphere and state administration to the opening of new mines will to a large degree depend on the successful reclamation of the old quarries. Several important principles are gradually making their way into environmental consciousness:

1. The concern should know how the mining area will look after the exhaustion of the deposit before it opens a new pit.
2. The scientific, especially geological evaluation of the quarry will provide the basic guidance for further morphological adaptations.

3. The reclamation should be subsequent - it saves money for the concern and time for the nature.

4. The aesthetic incorporation of a quarry into the landscape is a job for landscape architect.

5. The spontaneous biological reclamation should be preferred.

Českomoravský cement a.s.: Geological salvage research in the area of the Velkolom Čertovy schody Quarry (***V. Suchý*** *& A. Zeman, Prague*)

The origin of caverns and caves associated with hydrothermal calcite veins was investigated in the area of the Quarry. From the integration of field, petrographical and geochemical data it follows that most of corrosive cavities and caves developed in the area under study can be coined as *hydrothermal karst.*

Based on detailed observations in the Velkolom Čertovy schody Quarry and elsewhere in the Beroun District, an attempt was made to elaborate a genetic model for the origin of caves in the Bohemian Karst.

Most of the caves in the Bohemian Karst bear little or no relation to the modern topography or surficial hydrology. The epikarst is poorly developed, with solution sinkholes and vadose solution conduits being rare. On the other hand, many caves clearly tend to be spatially linked to sub-vertical, generally north-south-trending veins mineralised with coarsely crystalline calcite, chalcedonic silica and Mn-oxides. Hydrothermal origin of the veins has already been established by means of independent geochemical study (see also Grant AS CR A3012703 by V. Suchý, this volume).

The caves and caverns are developed both inside the calcite veins and in immediate limestone host rocks. Steep subvertical caves that originated as corrosive enlargements of tectonic fractures or veins appear to be predominant. Large domes and sub-horizontal passages

are comparatively rare and occur chiefly along lithological boundaries. The morphology of large caverns and caves indicates activity by uprising corrosive fluids with only minor modifications by vadose erosion later. Cupola-form (convection) cavities up to 1-2 m in diameter and circular ceiling dissolution pockets are commonly present. Ramifying dendritic pattern is less common but many branch passages terminate in circular pockets.

Most of the caves virtually lack any internal speleothems, having the wall rocks intensely corroded and locally disintegrated into loose carbonate sand. Exotic encrustations are developed only in some caves. They include dark brown to black Mn-Fe-rich crusts overlain by white pisolitic sinters that consist of alternation of calcite and quartz laminae. These precipitates are interpreted as hydrothermal products. Later generations of spelean carbonates include coarsely-crystalline yellow columar calcite and a variety of flowstone and dripstone sinters that are assumed to reflect gradual decay of a hydrothermal system and its transition into a cold-water shallow meteoric karst.

Within the karstified sequence, cave morphology and its speleothems tend to exhibit a vertical zoning. Large caves with exotic sinters are often developed in the upper part of the sequence whereas sub-vertical caverns and shafts coated with coarsely crystalline calcite spar appear to be concentrated at lower levels.

The origin of caves is interpreted as hydrothermal or hydrothermal-geochemical because of its close relationship to hydrothermal calcite veins, typical cave morphology and exotic internal mineralisation.

The work is now in progress to establish the age of the calcite veins and associated caves by means of indirect palaeomagnetic and absolute age dating (U-Th, radiocarbon) methods.

Českomoravský cement a.s.: Soils of the Koněprusy region (***A. Žigová***)

The structure of the Koněprusy region was studied using a macromorphological method. The soil units and horizons are classified according the Morphogenetic Soil Classification System and the World Reference Base for Soil Resources. The recent soil prevailed in the soil cover of the Koněprusy region. These soils correspond to the last cycle of pedogenesis of the Holocene. Lithic leptosol is dominant and rendzic leptosol is the minor soil units in protected area of the Zlatý kůň Hill. An opposite situation appears in agricultural soil cover. Eutric cambisols are developed only in the north and in the north-eastern part of the Koněprusy region.

Other Projects

FRVŠ No. G 0081/1998: Evaluation of biogenic and anthropogenic impacts on the cycles of selected ecologically important elements in the environment (*principal investigator P. Skřivan in the Faculty of Forestry of the Czech Agricultural University, responsible person in GLI O. Gottstein. Collaborating researchers:* ***P. Skřivan*** *&* ***M. Burian***)

The aim of the monitoring of content and fluxes of As, Be, Cd, Cu, Pb, and Zn in surface water, bulk precipitation, beech- and spruce throughfall in two distinct areas with differing bedrock (the Říčany granite and the devonian calcites) was to obtain sets of the data suitable for the construction of ”black box” models of the element-cycling in the environment. Quantitative mass balances of the

elements in the experimental catchment of the Lesní potok (region of Kostelec nad Černými lesy, 30 km SE of Prague) have shown following principal characteristics of the elements: Cu, Pb, and Zn are elements with low mobility in the soil profile and they are accumulated in the forest soil. On the other hand, Be is gradually washed out from soil by the acid atmospheric precipitation, as its output through the surface- and subsurface stream exceeds its input through the bulk precipitation by more than one order. Root uptake of the essential elements Cu and Zn by the forest vegetation (beech - *Fagus sylvatica L.*) is high and the elements are incorporated in wood, bark and assimilation organs of the trees. Cu, Zn and Cd are enriched in throughfall by the washout and ion-exchange of these anions which are present in the assimilation organs for H^+ ions of the acid atmospheric precipitation. Litterfall is an important flux of Zn, Cu, Cd, and Be and it closes the internal circle of these elements in a forest ecosystem.

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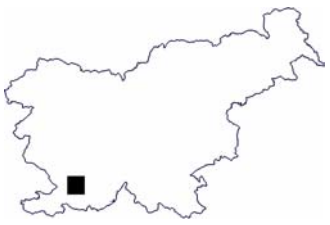
11. Department of Palaeomagnetism

Foreign Grants and Joint Projects

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

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



Palaeomagnetic and magnetostratigraphic investigations carried out on 122 oriented laboratory speciments of clay, sand, limestones and flysch rocks yield data concerning basic magnetic properties and identification of palaeomagnetic directions. Generally, the AF demagnetisation procedure was more effective than the thermal one due to phase changes of magnetically active minerals during thermal treatment. For each sample Zijderveld diagram was constructed and data measured 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 low unblocking temperature. Viscous and magnetically very soft properties are typical for the A-components represent up to 90 % or even more of the natural remanent magnetisation. The harder B-components were clearly revealed by AF procedure within the intervals of 200 - 250 up to 300 –1,000 Oe.

Palaeomagnetic data inferred from samples collected from a cross-section in SW Slovenia indicate that, by means of alternating field of demagnetisation, data suitable for multi-component analysis of remanence may be reliably derived and palaeomagnetic directions tested. Magnetostratigraphic investigations obtained for three cross-sections defined normal and reverse polarity magnetozones. Magnetostratigraphic data along the Divača profile show two narrow normal magnetozones detected in the lower part of reverse palaeomagnetic directions of the profile.

Magnetostratigraphic investigations obtained for three cross-sections defined normal and reverse polarity magnetozones and shows the correlation between the profiles at Divaški Jama

and Trhlovca Cave. According to standard Pliocene-Pleistocene geomagnetic polarity time scale the narrow normal magnetozones probably correlates with the Jaramillo subchron (0.90 to 0.97 Ma) of the Matuyama chron. Magnetostratigraphic data along the Divača profile detected, two narrow normal and one reverse magnetozones in the long reverse polarity zone. Two narrow normal magnetozones probably correlate with Olduvai or Reunion subchrons of the Matuyama chron. Data indicate that caves of the Classical Karst are much older than supposed earlier. Magnetostratigraphic results from Divača profile could open the problem of Messinian speleogensis connected with sea-level fall within the Mediterranean basin.

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 & J. Slepičková***)

Magnetostratigraphic profile at the locality of Brodno near Žilina, NW Slovakia, including limestones at the Tithonian/Berriasian boundary, proved to be exceptional among the hitherto studied analogous J/K profiles within the Tethyan realm due to its geophysical as well as palaeontological characteristics. Favourable physical properties of the limestones investigated and low-energy sedimentation in a basin were essential pre-requisites to guarantee a reliable inference of normal and reverse polarity subchrons from M21r to M17r. In the range of subchrons M20n and M19n the profile has the character of a high-resolution profile. In this range, the frequency of oriented samples collected was so high that an almost continuous record of magnetic and palaeomagnetic parameters was obtained especially for the critical intervals containing boundaries of strata with N-R and R-N palaeomagnetic polarities. The summary magnetostratigraphic profile at Brodno yields moduli of natural remanent magnetisation (J_n), values of volume magnetic susceptibility of samples in natural state (k_n), palaeomagnetic declination D_p and inclination I_p (of C-components inferred by multi-component analysis of remanence). Values of angular deflection of the direction of C-components of remanence from the mean direction are given in the next column. Resulting normal and reverse subchrons are drawn in the last column also including two reverse subchrons detected in the zones M20n and M19n and proposed to be named the Kysuca Subchron and the Brodno Subchron, respectively. Palaeomagnetic data are correlated with the distribution of calpionellid taxa. A precise determination of the position of significant biostratigraphic horizons relative to global magnetic polarity time scale is the fundamental prerequisite for any progress in the correlation of different biostratigraphic charts. In the Brodno section, this aim was achieved with high precision in calpionellids but only due to the precise determination of the positions of the individual palaeomagnetic zones. The base of the subchron M19r practically coincides with an important and marked calpionellid event – the appearance of *Calpionella grandalpina* Nagy, i.e. the base of the standard calpionellid Intermedia Subzone. This bioevent lies at an identical position relative to the palaeomagnetic time-scale also in the sections of Štramberk and the Bosso Valley. The reverse Kysuca and Brodno Subzones were marked on the outcrop at Brodno by aluminium cylinders 1 inch in diameter, stamped „Kysuca“ and „Brodno“, so that the results of the magnetostratigraphic profile could be used in future sampling by other workers.

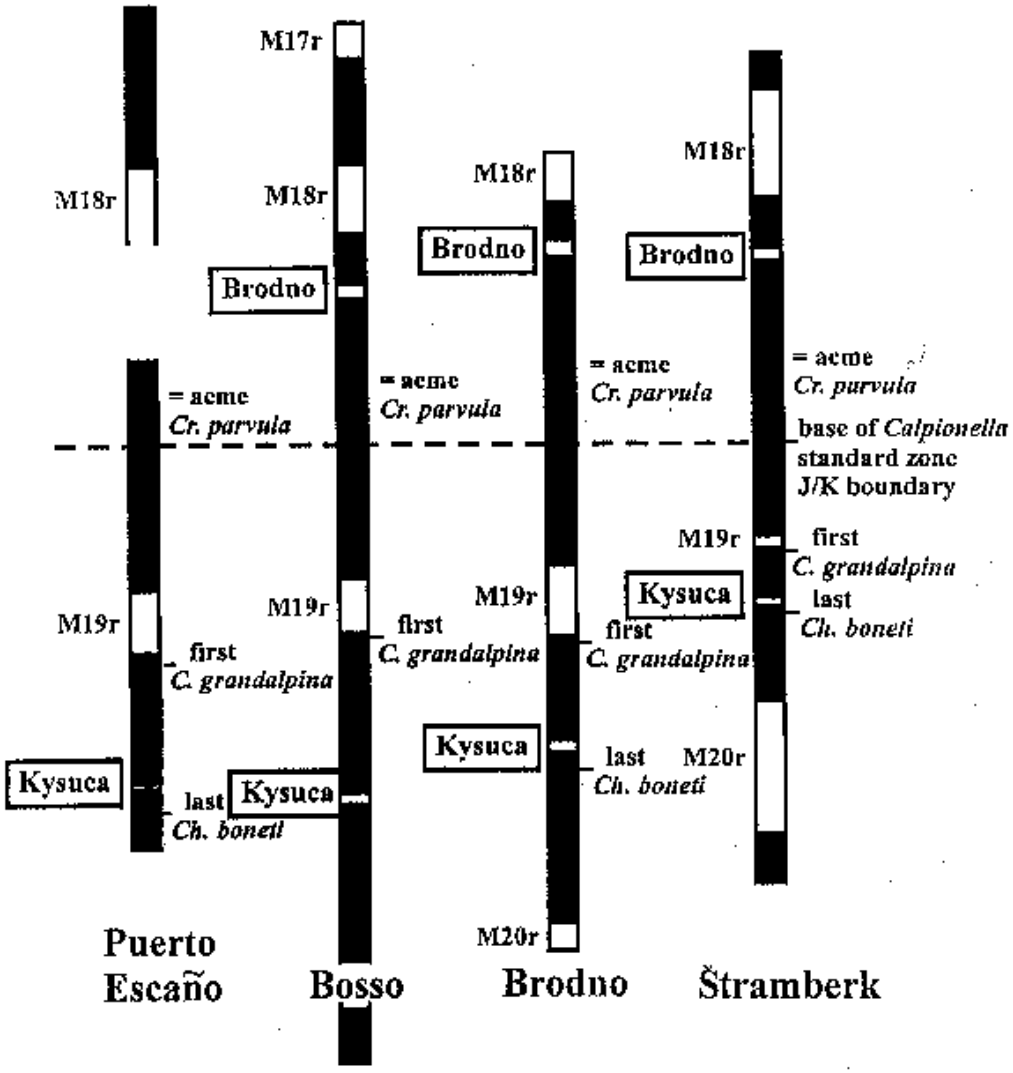


Fig: Correlation of magnetozones and magnetosubzones („Kysuca“ and „Brodno“ Subzones) with calpionellid events.

The section in the Bosso Valley, Umbria, central Italy, was synoptically investigated by *W. Lowrie* and *J.E.T. Channell* already in 1984. The present authors resolved to subject the lowermost 40 m of this section to a high-resolution magnetostratigraphic and micropalaeontological study (in collaboration with the Italian specialists, *F. Cecca, G. Nardi* and *M. Piscitello*). Laboratory studies and interpretations of this detailed section are presently in the final stage, in the range of the subchrons M20n to M17r. Two reverse polarity subchrons precisely corresponding to the Kysuca Subzone in M20n and the Brodno Subchron in M19n in the Brodno near Žilina profile were also detected in the Bosso Valley section.

The section at Puerto Escaňo, Province of Córdoba, S Spain, aimed at a detailed magnetostratigraphic investigation across the J/K boundary strata was selected due to extremely favourable physical properties of limestones and concomitant presence of calpionellids and ammonites. The study is carried out in collaboration with Spanish specialists *F. Olóriz, J.M.*

Tavera. Preliminary laboratory investigations of palaeomagnetic properties indicate that this profile will be the third continental profile in the Tethyan realm suitable for mutual correlation of magnetozones, magnetosubzones and palaeontological data.

Grant Agency of the Academy of Sciences CR

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

Palaeomagnetic investigations were carried out on the Middle Devonian to the Early Carboniferous sediments in the Jeseník Mts. and in the Moravian-Silesian region. Pilot samples were collected from 24 localities – 85 samples (in the vicinity of Vrbno, Světla, Anenský vrch, Suchá Rudná, Kozov, Ptení, Stínava, Kobeřice, Náměšť na Hané, Luleč, Mokrá, Šošůvka and Bedřichov), detailed sampling was done on two localities – 30 samples (Jesenec and Slavoňov). The principal object of the investigation was to find localities of rocks with properties suitable for palaeomagnetic analyses, and hence for derivation of palaeotectonic and palaeogeographic reconstructions. The laboratory specimens were subjected to progressive thermal demagnetisation using of the MAVACS apparatus. The samples from Jesenec were tested using the Thellier method and the samples from Slavoňov were investigated for the stability spectrum of componets of NRM.

The results presented in this article are preliminary dealing with pilot samples only. The Variscan overprint components were found in pilot samples from the localities Ptení 1 (greywackes, E. Carboniferous), Křtiny (siltstones, Early Carboniferous) and Šošůvka (greywackes, E. Carboniferous). The principal carrier of the magnetisation is pyrrhotite. The primary magnetic components of the Devonian age were found in rocks from the localities Ptení 2 (limestone and basalt, Devonian), Stínava (tuffite, Devonian), Bedřichov (limestone, M. Devonian) and Lesní lom near Brno (limestones, Middle Devonian). The carriers of the magnetisation are titanomagnetite (Ptení 2), haematite (Stínava), titanomagnetite (Bedřichov) and pyrrhotite + titanomagnetite (Lesní lom). The Devonian rocks prove palaeotectonic rotation. The samples from other pilot localities represent rocks with properties not suitable for palaeomagnetic investigations. Samples from all these localities are under laboratory investigations with the aim to verify their applicability to palaeomagnetic studies.

The primary (palaeomagnetic) magnetisation 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. The carrier of the secondary magnetisation is pyrrhotite, the carrier of primary magnetisation in some rock samples is haematite. The computed palaeogeographic latitude is 13,48 ^{o}S. The rocks prove palaeotectonic rotation being similar to that derived on rocks from the Moravian Karst, approx. 120^{o} clockwise.

The secondary magnetic components of the Variscan age were found in rocks from Jesenec (limestone). The samples from the locality of Jesenec were investigated using Thellier method. The overprint magnetisation components of the Early Permian age on this locality show thermoremanent origin. It was possible to determine the ratio of the ancient to present geomagnetic field intensity for the E. Permian (k = 0,52 ±0,14).

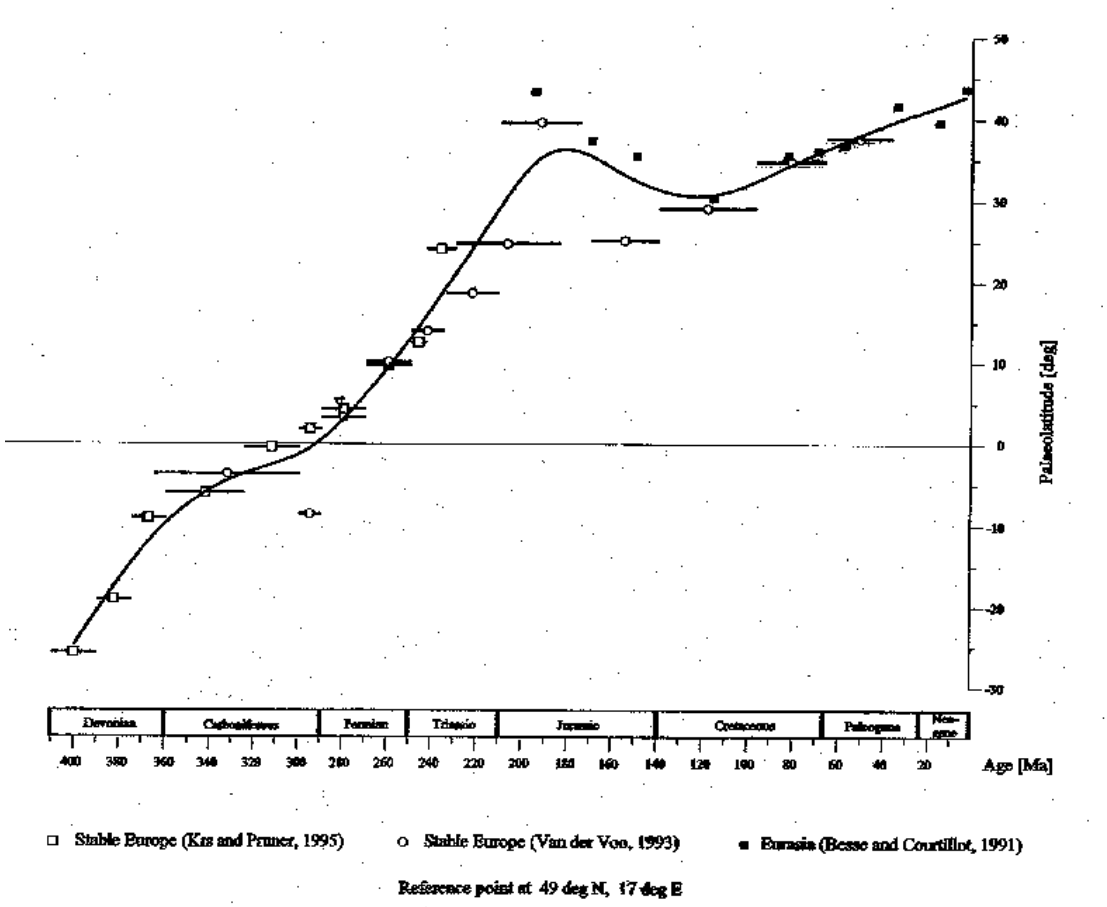
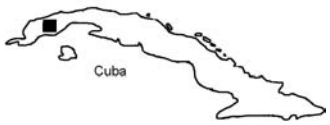


Fig: Bohemian Massif: palaeolatitudes extrapolated from different sources, recalculated to a single reference point. Full line indicates the course of mean palaeolatitude values.

Other Projects

Grant Agency of the Charles University

No. 169/1998/B GEO/PrF: High resolution magnetostratigraphy of the Jurassic/Cretaceous boundary in the Tethyan Realm (Cuba). *(M. Kobr, Faculty of Science, Charles University, Prague,* ***V. Houša, P. Pruner, J. Slepičková****, J. R. Sánchez, CEINPET, La Habana, Cuba, J. Pérez, Universidad de Havana & M. Fundora, IGA, La Habana, Cuba)*



The important section of Hacienda el Americano in Cuba, where calpionellids occur together with association of ammonites, lies unfortunately in closed military zone. Therefore, samples were taken from another profile of J/K boundary strata – Majagua in the area of Cinco Pesos – Cirro Redondo in Sierra del Rosario, western Cuba. Pilot samples (103) for palaeomagnetism and 101 samples for calpionellids are under laboratory processing.

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12. Programme of Advancements in Scientific Research in Key Directions

(12a) K1-012-601 Project No. 5: Geophysical processes and structure of the Earth (with special reference to 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***)

Bohemian Massif (BM) is the most extensive exposed relict of Variscan Orogen in central Europe. According to the present knowledge, it originated through multiple accretion of peri-Gondwanan fragments (terranes) with the continent of Baltica or, more exactly, Laurussia (i.e., with Fennosarmatia). Yet before the accretion, these fragments underwent a complicated geological history including (even repeated) interactions. The suture zone formed by the accretion of peri-Gondwanan fragments with Fennosarmatia was complexly modified by Late Variscan shear faulting, frequently resulting in juxtaposition of previously widely separated blocks. The study of the original relationships between these elements and the history of their evolutions is the principal subject of study in the BM within the present project.

The Upper Devonian (370 Ma) collision between the Teplá-Barrandian (= Bohemian), Saxo-Thuringian and Moldanubian terranes resulted in the uplift of an extensive flat elevation in the Bohemian region. However, as early as in the uppermost Devonian (360 Ma), the elevation was subject to a gravitational collapse, being tilted to the east. Large areas of the underlying thickened mantle lithosphere subsequently subsided into the asthenosphere (350 Ma). This process resulted in (1) rapid isostatic uplift and exhumation of highly metamorphosed Moldanubian and Saxothuringian blocks; (2) a considerable increase in heat flow in the lower and middle crust (especially in the Moldanubicum), and (3) anatexis and intrusion of melts, partly mantle-derived. Relatively cold Bohemicum subsided into the weakened basement and, following the Central Bohemian Shear Zone, was emplaced between relatively “hot” regions of Moldanubicum and Saxothuringicum.

Thermobarometry of rocks of the Kdyně basic massif indicates a slow cooling or a high depth of its emplacement (11 to 14 km) relative to other plutonic complexes of the Bohemicum, thereby evidencing a much more rapid uplift of this crustal segment, which was moreover tilted to the north. The tilting probably resulted from the tension exerted by the ascent of the Moldanubicum during the Variscan Orogeny.

Upper Proterozoic volcanic and subvolcanic complex of the Jílové Belt is a complex of the island-arc type. According to the newly acquired or revised data on the trace element and REE chemistry, this complex consists of two, geochemically different volcanic associations: tholeiitic and calc-alkaline (depleted in K).

Crystalline complexes of the southern margin of the Krkonoše-Jizera terrane were subjected to Variscan polyphase metamorphism. The sequence of tectonometamorphic events can be traced on the basis of Ar-Ar method applied on separated phengites: (1) 360 Ma - the end of subduction metamorphism in blueschist facies; (2) 345 Ma - retrogression in greenschist facies or lower amphibolite facies (associated with Lower Carboniferous tectonism and magmatism); (3) 325-320 Ma - late Variscan shear deformation, and (4) 314-313 Ma – the upper limit of the period of magmatism and metamorphism including late-tectonic emplacement of the Krkonoše granite. Local differences in the intensities of phases (1) through (4) reflected the northwesterly spread of the orogenic wedge as documented by inverse metamorphic struc-

ture (from chlorite zone in the NW to garnet zone in the E) and inverted stratigraphic succession (several early Palaeozoic crustal slices are thrust over Upper Devonian to Early Carboniferous units).

Železný Brod Complex is one of a series of Lower Palaeozoic volcanic complexes along the eastern and southern margins of the Krkonoše-Jizera terrane. These complexes represent uppermost allochthonous slices within the Variscan architecture of the Krkonoše-Jizera terrane. Geochronological evidence from the Eastern Krkonoše complex dates the earliest volcanic activity to the Cambrian/Ordovician boundary. According to palaeontological finds from the Železný Brod Complex, this activity lasted till the Silurian to Devonian. Time succession and distribution of the individual geochemical types of volcanics reflect the evolution of a Lower Palaeozoic intracontinental rift showing linear propagation from the complexes of the eastern Krkonoše Mts. (where it reached the most advanced extension, i.e. the stage of oceanic crust formation) to the Železný Brod Complex. The end of volcanic activity and sedimentation preceded here the onset of blueschist metamorphism associated with the subduction of oceanic lithosphere of the Eastern Krkonoše Complexes (?) terminating at ca. 360 Ma. The first stages of subduction can be identified with the Early Variscan diastrophism marking the end of sedimentation in the Barrandian area in the Lower Givetian (375-380 Ma). The above mentioned timing of tectonic history and the parallel geochemical history of volcanites indicate a possible affinity between the Teplá-Barrandian and Krkonoše-Jizera terranes.

A comparative study of oolitic limestones of the eastern Krkonoše Mts. (Rýchory Mts.) and their fossil contents in particular with analogous sediments from the Leipzig area put their Upper Devonian or Carboniferous age in dispute. The analyses of their lithology and faunal content (Archaeocyathida, Trilobita?) indicate with high probability the originally Cambrian age for these carbonate rocks.

Micropalaeontological study of the silicites (metalydites) of the Krkonoše-Jizera Unit showed the presence of strongly P-T-altered fossils. These were determined as unicellular marine microplankton, graptolite siculae and chitinozoans, sporomorphs of terrestrial origin are rare. Acritarchs of spheromorph and nethromorph types (genera *Iroistella*, *Domasia*, *Neoverihachyum*) indicate Upper Silurian to Lower Devonian age. The occurrence of mazuelloids ranks the studied rocks to the Rhine facies of Siluro-Devonian successions deposited north of the marginal rims of the supercontinent of Gondwana and south of the continental megafacies of Laurussia.

The results of palaeomagnetic studies from the region of Bohemian Massif were recalculated to palaeolatitudes and palaeomagnetic declinations relative to the Barrandian area. Mean values of palaeolatitudinal drift (with respect to geological time) can be inferred for the period of Upper Silurian to Quaternary. Latitudinal drift magnitude of ca. 2 cm/year was determined for the period of Middle Devonian to Lower Carboniferous, increasing from 3 cm/year to ca. 4 cm/year during the Lower Permian to Lower Triassic.

INDIVIDUAL RESULTS

Recognizing the Palaeozoic basin attributes from the Variscan terrane segments (***J. Hladil***)

Non-metamorphic ooidal dolostones, which form boudins and lithons in strongly metamorphosed crystalline limestones of Rýchory (*J. Don,* ***F. Patočka****,* an active Vaněk quarry in Dolní Albeřice, Suchý Důl) represent an attractive subject of continued studies. Independently on the theories about the emplacement and differences in metamorphism, two facts are very interesting.

These rocks represent fragments from several ten to several tens of meters thick, exclusively oolitic and dolomitised sediments. Oolitic sediments and particularly so thick accumulations were never described from the Late Silurian and Early Devonian, but – in the Palaeozoic era – they are very typical for the Late Devonian and Early Carboniferous times (neighbourhood of Třinec, NT-4) and/or Cambrian (boreholes in Leipzig area). New analysis of the sporadic fossils show, that the best preserved fragment which was formerly compared with Late Devonian tube-shaped receptaculitids from China or Germany lacks some diagnostic features. Four independent revisions believe that this specimen is a Cambrian archaeocyathid. The first one who emphasised this solution was *P. Kraft*, and comparison of the documents from Albeřice and Leipzig area (***J. Hladil**, O. Elicki, M. Hubačík*) show a great similarity – nearly identity – of the rocks and scattered skeletal relicts from both sites. A crucial expertise was provided by *F. Debrene*, who considers this fossil an archaeocyathid, in spite of her well-known accuracy and prudence in interpretations. Study of a new shell, coll. *V. Kachlík*, show composition and microfabric, which corresponds to trilobite or related carapaces. Microstructure is relativelly well-preserved, being not damaged by young calcite crystals. Aragonite chips of other problematic shells were dissolved and replaced by mosaics of calcite crystals (?bivalves). If this revision is confirmed and generally accepted, the possible Barrandian affinity of this segment in Rýchory Mts. is rather problematic, because massive occurrence of oolitic carbonates is too exotic for terrane segments of this type.

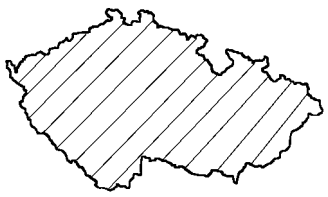
Investigation of the Lečice Member of the Barrandian Upper Proterozoic (***M. Konzalová***)

The samples of the Lečice Member were processed and studied in the acid resistant residues. - Only sphaerical vesicles, residues after the *Cyanophytes* or *Chlorophytes* (green algae) have been found in the positive case. They could be assigned to *Leiosphaeridia* sp., *Micrhystridium* sp. (larger-sized forms of the from-genus) and *Palaeocryptidium cayeuxi* Defl. *Leiosphaeridia* div. sp. are ranging from Neoproterozoic to Cambrian and upwards, as well as div. sp. of *Micrhystridium*. *Palaeocryptidium/Sphaerocongregus* belong to the widely distributed *Cyanophytes* and fit well to the Neoproterozoic assemblage corroborated by the filamentous cyanophytes found in the oolitic rock in the same area. Neither *Prismatomorphs* (599-530 Ma) nor *Pteromorphs* (530-549 Ma) have been recorded there up to now. The “assemblage“ is common in the Neoproterozoic rocks.

Palaeozoic evolution of the Bohemian Massif terranes integrated into the history of the European Variscides (***M. Konzalová***)

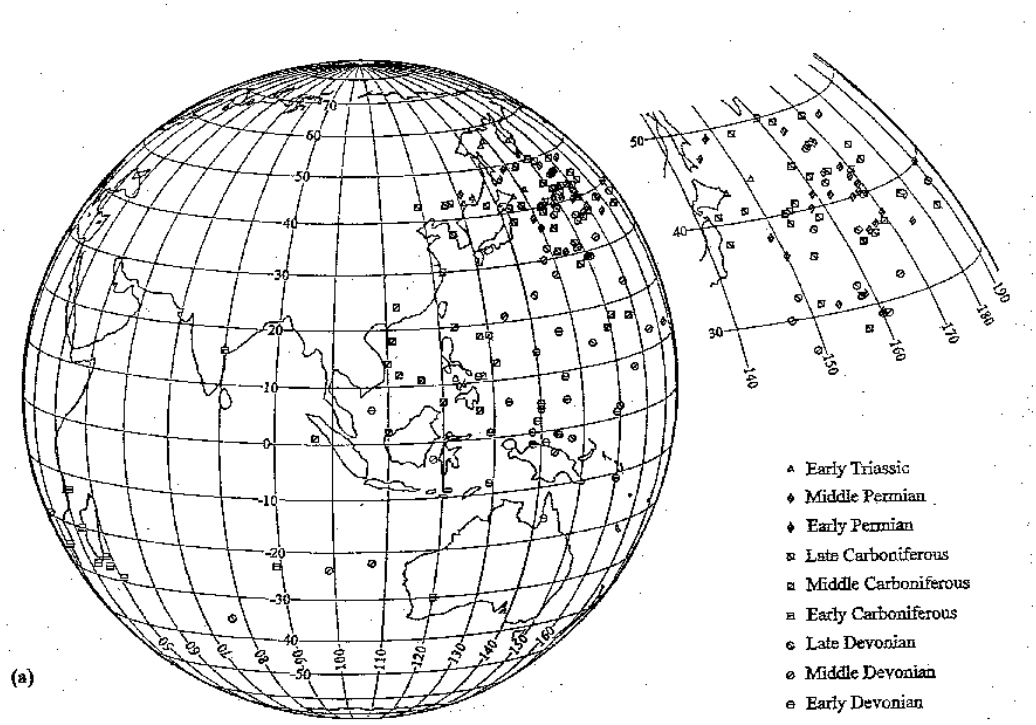
The planktonic marine microfossils (*Mazuelloidea)* were determined from the crystalline complex of the south-eastern part of the East Bohemian crystalline (area of Vysoké nad Jizerou). Finds can be compared with the Silurian finds in the Barrandian (especially within the Rastrites linnaei graptolite Biozone), and with the Late Silurian specimens of Carnic Alps in Austria. Finds from the Armorican Palaeozoic (Vendée, France) show the same type of detailed morphology and preservation. The stratigraphic range of the plankters is known from the Ordovician up to the Devonian, with the acme of occurrence in the Silurian.

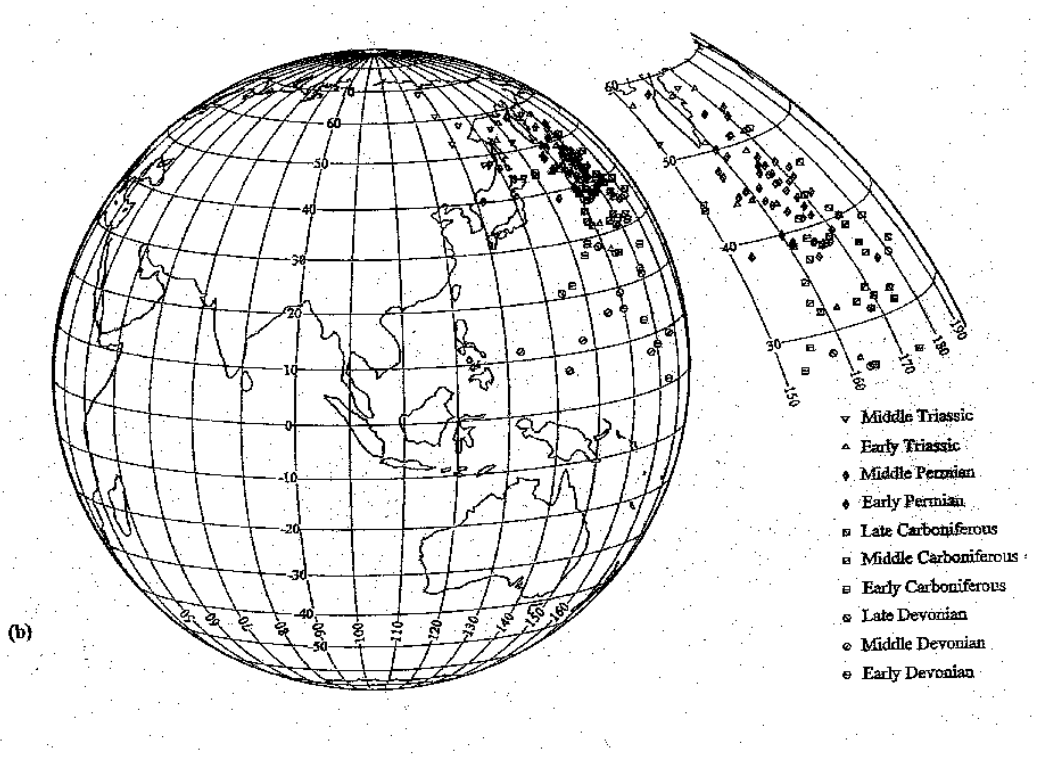
Palaeomagnetic investigations aimed at global-tectonic interpretations, palaeogeography of Palaeozoic rocks and Variscides in Europe (***M. Krs, P. Pruner, D. Venhodová, O. Man & J. Slepičková***)



Palaeotectonic deformations associated with the Variscan Orogen in Europe represent the starting point for the interpretation of palaeomagnetic data of the pre-Variscan formations. Numerous palaeomagnetic data were accumulated during more than last thirty years. Especially the Early Permian, Late Carboniferous formations from different furrows and basins within the Bohemian Massif, Devonian formations from the Barrandian area and the Moravian Zone as well as Cambrian volcanics and sediments from the Barrandian area yielded abundance of palaeomagnetic results. Lesser volume of data is available for the Ordovician and Silurian rocks. Model interpretations of horizontal palaeotectonic rotations contributed considerably to more precise understanding of the origin of scatter and/or specific distribution of Variscan and pre-Variscan palaeomagnetic pole positions. It has been shown that a noticeable similarity exists in model interpretations of horizontal palaeotectonic rotations in the Variscan and Alpine orogenic belts. These rotations undoubtedly result from collision of rock formations (smaller blocks) in the Alpine and Variscan orogenic belts.

All derived palaeomagnetic data form the Bohemian Massif were recalculated into palaeogeographic latitudes and palaeomagnetic declinations related to a reference point in the Barrandian (φ = 50° N, λ = 14 °E). The interpretation of the newly presented results was carried out in the context of data derived for Europe by different authors. Averaged values of palaeolatitudinal drift were calculated respecting their dependence on geological time was constructed. According to this analysis, reliable data exist from the Late Silurian to the Quaternary. In the period of the Middle Devonian to Late Carboniferous, the latitudinal drift is around 2 cm.y^{-1}, while from the Early Permian to the Early Triassic the drift increases from 3 cm.y^{-1} up to around 4 cm.y^{-1}. The determination of palaeolatitudinal drift in the period from the Late Cambrian to the Ordovician needs further investigations.





Petrography of the Zábřeh Crystalline Unit: a review (***M. Němečková**, P. Hanžl & J. Babůrek, Czech Geol. Institute, Brno*)

The Zábřeh Crystalline Unit (ZCU) is the metamorphosed volcano-sedimentary complex situated on the NE margin of the Bohemian Massif. The supposed gradual increase in the metamorphic grade from the S to N in the ZCU was not fully confirmed by recent data. It is possible to distinguish some relatively independent parts of the ZCU from the viewpoint of lithology and character of the metamorphism.

The southern part is formed by phyllites containing abundant intercalations of amphibolites in places with ultramafic rocks. The acid metavolcanic and metadiorite bodies are rare. The metabasites metamorphosed in the conditions of the granulite facies are exposed together with garnet phyllonites in the low-grade metapelites and metagreywackes in the southernmost part of the ZCU. The metabasites are accompanied by thin layers of strongly mylonitized marbles.

The northern part is composed of quartzite gneisses containing intercalations of quartzites and metarhyolites, biotite gneisses with garnet and sillimanite, augen gneisses and migmatites with bodies of amphibolites. The concordant bodies of tonalites are common mostly in the northern part of the ZCU.

The described northern and southern parts are separated along the valley of the Moravská Sázava River by the independent narrow belt of flysch-like metasediments characterised by presence of abundant porphyroblasts of biotite. The belt contains a horizon of schists with staurolite, which indicates metamorphic conditions of the lower amphibolite facies.

New mineral assemblages in gneisses, tonalites (chlorite) and amphibolites (chlorite, epidote) accompanied by brittle to ductile deformation are products of destabilisation during the retro-

grade metamorphism in the greenschist facies conditions. Indicators of the retrograde metamorphism have not been observed in metasediments from the southern part of the ZCU.

Tectonometamorphic evolution along the Variscan terrane boundary at the nothern termination of the Boskovice Furrow (***M. Němečková**, P. Hanžl & J. Babůrek, Czech Geol. Institute, Brno*)

Small crystalline blocks are exposed as equivalents of the Moravicum along the branching of the marginal fault of the Permian Boskovice Furrow between the towns of Jevíčko and Mohelnice (Central Moravia). The northernmost of these units is the Svinov-Vranová crystalline unit (SVU) exposed as a narrow NE-SW oriented wedge-shaped slice separating the Viséan flysch sequence of the Moravosilesian Zone on the SE from the Moldanubian Zone in the NW which is represented by the Zábřeh Crystalline Unit (ZCU) with the Mírov complex (weakly metamorphosed flysch-like sequence of the Givetian to Carboniferrous age). This contact was described as a Moldanubian or Vacetín Thrust by earlier authors.

It is possible to correlate the SVU with Olešnice Group of the Moravicum according to lithology (garnet mica-schist with intercalations of amphibolites, marbles, and graphitic rocks). The relationship of small-scale structures and mineral assemblages document the SVU polyphase evolution. Relics of mineral association garnet-biotite-sillimanite and garnet zoning (characterised in some grains by increments of MgO abundances from the centers towards rims) indicate the older metamorphic phase of amphibolite facies conditions. The temperature of about 600 ^{o}C was estimated using the hornblende-garnet thermometr. The S-shape inclusions in garnet are common in sections perpendicular to the N-S-oriented stretching lineation and may be correlated with this metamorphic phase. The younger retrogressive metamorphic phase in greenschist facies conditions is connected with the development of N-S-oriented structures and is accompanied by non-penetrative phyllonitisation of the rocks.

The metamorphic conditions in the southern part of the ZCU differ from conditions in the adjacent SVU. Relics of high-grade amphibolites (T = 730-740 ^{o}C, P = 10-11 kbar) were found in the low grade rocks - phyllites and metagreywackes. The rocks of the southern part of the ZCU were imbricated together with overlying Mírov complex during the N-vergent oblique thrusting along the western margin of the SVU.

The SVU contacts were strongly reworked by brittle-ductile mylonitic zones developed along the anastamousing strike-slip faults balancing the northern termination of the marginal fault of the Boskovice Furrow. A narrow strip of the strongly cataclased Devonian(?) limestones separated the SVU from the Culm. It was dredged from the Brunovistulian cover in the footwall when these units were brought nearer to each other along the faults.

Petrology and geochemistry of the polyphase granite intrusions in the Krušné hory batholith eastern part (***J.K. Novák & E. Pivec***)

The last of the main stages of tectonomagmatic evolution in the eastern part of the Smrčiny-Krušné hory Mts. anticlinorium is the polyphase intrusion of the Younger Intrusive Complex (YIC). The biotite syenogranite of the 1st sequence and altered zinnwaldite granites of the 2nd sequence - both Late Palaeozoic in age - intruded at subvolcanic level. In some cases they form minor bodies such as the Cínovec/Zinnwald, Krupka-Preisselberg, Altenberg and Sachsenhöhe units, which occur in the Teplice-Altenberg caldera. The dominant Teplice Rhyolite Complex, consisting of ignimbrites with syenogranite porphyry and felsic dyke sys-

tems as well as sedimentary intercalation, represents the most widespread volcanic complex in Eastern Krušné hory Mts. All volcanic rocks are of rhyolitic or trachyrhyolitic composition and their brittle deformation is of great significance at the location of the ascent paths of thermal waters in Teplice Spa, the subrecent fluorite mineralisation as well as during emplacement of the foidite dyke rocks.

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 were carried out on the Middle Devonian to the Early Carboniferous sediments in the Moravian-Silesian region with the aim to find localities in which properties of rocks are suitable for palaeomagnetic analyses, and hence for derivation of palaeotectonic and palaeogeographic reconstructions. The laboratory specimens were subjected to progressive thermal demagnetisation by means of the MAVACS apparatus. The samples from Jesenec were tested using the Thellier method and the samples from Slavoňov were investigated for the stability spectrum of NRM components.

The Variscan overprint components were found in numerous pilot samples. Primary magnetic componets of the Devonian age were found at some of the localities. Secondary magnetic components of the Variscan age could be detected, too.

High-resolution graptolite stratigraphy and correlation of selected Lower Silurian sequences of the Peri-Gondwanan Europe (***P. Štorch***)

A monograph describing well preserved middle Llandovery graptolite fauna of the leptotheca and convolutus biozones, comprising 60 species and subspecies from Svatý Jiří near Tmaň, was submitted for print. The leptotheca Biozone was introduced in the Silurian graptolite zonal scheme of the Barrandian area in place of the lower part of the convolutus Biozone of former classifications. A dominance of uniserial rastritid forms (both species and specimen abundance) was documented by quantitative analysis of bulk samples. Seven new species and one new genus were erected, 23 taxa were recorded for the first time in Bohemia. The fauna is closely related to the middle Llandovery graptoloid faunas of Baltoscandinavian area.

Graptolite-rich Lower Silurian black-shale formations of Bohemia, Spain, Portugal, Italy (Sardinia), and Germany has been correlated. Namely Spanish sections and graptolite faunas from Central Iberian Zone, Western Iberian Cordillera, and Asturia-Leon Zone have been studied with regard to the elaboration of the field trip guide book for the Sixth International Graptolite Conference and SSS Field meeting in Spain. Several biozones of the late Llandovery and early Wenlock (lapworthi, insectus, centrifugus, murchisoni biozones) have been described for the first time in the Iberian Peninsula. There the deeper-shelf faunas closely resemble graptolite faunas of Bohemia (Barrandian area) and even southern Scandinavia. On the other hand, shallow shelf areas of the Iberian lower Silurian yield rather different assemblages: some elements are common containing graptolite assemblages of epicratonic and intracratonic basins of North Africa. Different bathymetry of the individual areas may likely explain the complicate elaboration and application of the joint zonal scheme in faunal differences. The true biogeographical differences appear to be unlikely within the peri-Gondwanan

Europe. In the world-wide scale the existence of the two principal palaeobiogeographical provinces has been suggested.

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

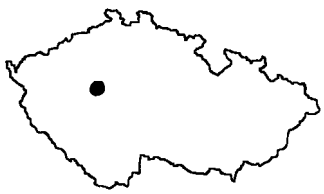
Subproject: Dynamics of lithospheric processes (***V. Suchý, Š. Eckhardtová, J. Fiala, J. Filip, A. Galle, J. Hladil, V. Houša, M. Konzalová, M. Lachmanová, R. Mikuláš, J. K. Novák, L. Peza, P. Pruner, M. Svobodová, P. Štorch, M. Vavrdová & J. Žítt***)

INDIVIDUAL RESULTS

Relicts of sedimentary fabric and fossils in slightly metamorphosed rocks (***J. Hladil***)

Investigation of slightly metamorphosed Devonian sediments in the Moravian-Silesian area yields a series of partial results. For example, *J. Bábek* extracted carbonate pebbles from the lower part of the Mohelnice Formation, in the road cut near Studená Loučka (neighbourhood of Mohelnice). Thin fragments of skeletal branches alternatively accumulated in sedimentary laminae were identified as *Couvinianella* cf. *sartenaeri* Mamet et Preat 1992 (***J. Hladil**, A. May*). Occurrences of these and similar udoteacean-gymnocodiacean algae (*Couvinianella, Givetianella* and *Pseudopalaeoporella*) are typical for Middle Devonian sediments in central and southern parts of the Dinant Massif in Belgium as well as southern parts of the Rhenish Massif in Germany. Branches are 1.5-2.0 mm thick and display discontinuous axial cavities. Although the slightly metamorphosed limestone is light grey, chambers in algal tissue have abundant clay and oxidic mineral inclusions, including highly degraded kerogen. The presence of these algae contrasts with content of abraded crinoid columnals and possible chips of stachyodid skeletal tissues; they are clearly allochthonous. Original sediment was interpreted as a proximal calciturbidite. Original content of micrite and crinoidal debris may resemble the slope carbonates from the Konice area, but the abundance of algae corresponds to basins like Rýmařov (*Pseudopalaeoporella*), Tišnov or hypothetical unknown sources on the W of the Moravian precursors. Another new information concerns fragmentary relicts of Devonian limestones at Vitošov near Zábřeh, NW Moravia. Revision of the thin sections available from the quarry on the Vitošov hill resulted in finding of two sections, where slightly metamorphic limestones displays older, sedimentary lamination and numerous styliolinid (tentaculitoid) shells *(**J. Hladil**, R. Morávek)*. Alternating coarse- and fine-grained laminae with abundant pelagic styliolinids are very typical – for example – for sediments of basin slope in the area of Konice. Occurrence of this basinal type of the sediment at Vitošov is very significant, because most of other metamorphosed carbonates in this isoclinally folded and stacked tectonic fragment show shallow water structures, incl. shadows after branched stromatoporoids, bulbs of *Pseudoactinodictyon dartingtoniense* and probably anhydrite replaced by carbonate. A tectonically shortened section from shoals to basin slope can be suggested on the basis of these data.

Study of the Cenozoic fluvial deposits in caves of the Bohemian Kast (***J. Kadlec***)



Preliminary survey and documentation of Cenozoic fluvial deposits preserved in the area of the Bohemian Karst were carried out. The geophysical surveying (ground penetrating radar, very low frequency method) was applied for investigation of underlying fluvial sediments, bedrock morphology below calcareous tufa accumula-

tion and detection of karst spring resurgence in Svatý Jan pod Skalou. A junction of the Kačák Canyon and Propadlá voda Valley has the character of a hanging valley with a step 8 to 10 m high. Karst springs are situated at fault intersections. The morphological situation together with the position of springs controlled the deposition of tufa.

Ichnological record of past environments in the Bohemian Massif (***R. Mikuláš***)

Attention has been paid to the ichnological research of the late Palaeozoic and Tertiary coal-bearing sequences. In the sediments of the Carboniferous to Permian fluvial and limnic basins of the Bohemian Massif, the following patterns of ichnofabric were preliminarily recognised: (1) primarily non-bioturbated sediments; (2) sediments with "illegible" bioturbation; (3) "large *Planolites* Ichnofabric"; (4) *Palaeophycus - Planolites* Ichnofabric; (5) alternation of *Planolites-Palaeophycus-Unisulcus* Ichnofabric with root traces; (6) *Planolites montanus* Ichnofabric; (7) claystones with well-preserved surface traces and no surface bioturbation, and (8) sandstones and siltstones with vertebrate tracks. As more data are needed especially from the stored cores, distribution of these patterns in the individual basins remains unclear.

Figure description: Images of the eight recognised ichnofabric patterns. Approximately natural size. A. primarily non-bioturbated sediments; B. sediments with "invisible" or "illegible" bioturbation; C. "large Planolites" Ichnofabric; D. "Palaeophycus -Planolites" Ichnofabric; E. alteration of "Planolites-Palaeophycus-Unisulcus" Ichnofabric with root traces; F. Planolites montanus Ichnofabric; G. Claystones with well-preserved fine surface traces and no subsurface bioturbation; H. sandstones and siltstones with vertebrate traces.

A new kind of fossil behaviour record, i.e. traces probably made by insect larvae in stone fruits of the Miocene hackberry, *Celtis lacunosa,* were described as *Lamniporichnus vulgaris* igen. et isp. nov. They were found at the locality of Merkur-North in Most (North Bohemian) Basin. The newly proposed ichnogenus comprises borings in those wooden parts of fruits which contain a hollow filled with non-xylic digestible tissue (stones, nuts). The borings consist of a short cylindrical tunnel joining the stone (nut) surface and a natural hollow inside the xylic body. In comparison, the ichnogenus *Carporichnus* Genise, 1995 represents a longitudinal central cavity and a radial tunnel both made by the tracemaker. Less favourably preserved material of *Celtis* sp. from the Pleistocene fill of karst cavities at Vitošov (northern Moravia) provided also finds of presumable insect borings.

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

Palaeomagnetic investigations of the Middle Devonian to the Early Carboniferous rocks collected from the Moravian-Silesian region were extended to laboratory studies. Since the palaeotectonic deformations in form of palaeotectonic rotations around vertical axis and palaeogeographical latitudes derived from palaeomagnetism of the Devonian rocks both in the Moravian Zone and in the Barrandian area are relively well known today, efforts were concentrated on the study of palaeomagnetic parameters of the Early Carboniferous rocks from the Moravian-Silesian region. New Early Carboniferous data were derived, well supporting the Late Carboniferous results previously derived on rocks from different furrows and basins in the Bohemian Massif.

Mean palaeomagnetic pole positions previously published for rocks from the Carpathian Flysch Belt were reinterpreted in order to study the tectonic evolution of the Western Carpathian arc in a more detail. For that reason, virtual pole positions were calculated from the data

published in the original papers, palaeomagnetic declinations were demonstrated with the aim to study palaeotectonic deformations within respective units, such as the Dukla Unit (E.-M. Eocene, E Slovakia), Magura Unit (Eocene, N Slovakia, Orava), Biele Karpaty Unit (L. Palaeocene, E Moravia), Biele Karpaty Unit (L. Senonian, W Slovakia), Silesian Unit (M. Cretaceous, NE Moravia) and Silesian Unit (E. Cretaceous, NE Moravia). Distribution of virtual pole positions clearly indicates palaeotectonic rotations around vertical axis even within small segments of the above-mentioned tectonic units. Of special interest are tectonic units located close to the contact between the Bohemian Massif and the Western Carpathians. A considerable part of the Biele Karpaty Mts is deposited horizontally or sub-horizontally. Distribution of respective virtual pole positions derived on rocks of Late Palaeocene and Late Senonian age evidence pronounced counterclockwise palaeotectonic rotation. Similar phenomena were observed in the Silesian Unit. Palaeomagnetic declinations derived on red claystones of Cenomanian to Early Turonian age from eight localities show palaeotectonic counterclockwise differential rotations. Calculated palaeomagnetic and virtual pole positions follow with reasonable approximation the theoretical paths of palaeotectonic rotations calculated for palaeomagnetic inclinations I_p = 45° and I_p = 55°. Similar palaeotectonic deformations were derived on eleven outcrops of teschenite rocks. The palaeomagnetic directions for respective localities (sites) and the mean directions calculated for all the analysed teschenite rocks indicate very clear differential palaeotectonic rotations from outcrop to outcrop and also a pronounced counter-clockwise rotation of the whole Silesian Unit. Counter-clockwise palaeotectonic rotations in the Carpathian Flysch Belt due to Alpine tectonics are in contrast to the clockwise palaeotectonic rotations of the Variscan and pre-Variscan rock formations in the Bohemian Massif.

Holocene fluvial sediments of the Labe flood plain (***E. Růžičková***)

Studies were aimed at the overbank sediments along the course between cities of Lysá n.L. and Mělník. Variability of these sediments (grain-size composition, mineralogical composition as well as their thickness) has been caused by several factors:

- intensity of influence of tributaries
- underlying sediments and bedrock
- discharge changes caused by climatic variability in local and global scale
- anthropogenic influence

Overbank sediments of the higher flood plain terrace were studied in detail. Geochemical characteristics of samples from hand-drilled holes at Ostrá (near Lysá nad Labem) proved the admixture of volcanic ash at 1 m depth (Nb<7 ppm, Y = 15 to 25 ppm, Yr = 177 to 235 ppm).

According to transport processes 5 main groups of colluvial deposits are described:

1. gravitational deposits (transport by down falling, no other factor is involved)
2. gravitational slide deposits (rather fast transport by water activity)
3. gravitational creep deposits (transport under cryogenic conditions)
4. gravitational flow deposits (very fast transport in water-saturated conditions)
5. wash sediments (transport by rainwater)

Taphonomy and palaeoecology of selected groups of invertebrates (Echinodermata, Bivalvia) in the Late Cretaceous sequences (Bohemian Cretaceous Basin): Rocky coast facies of the Unhošť-Tursko High (late Cenomanian-early Turonian, Bohemian Cretaceous Basin) *(**J. Žítt**, O. Nekvasilová, L. Hradecká, Czech Geol. Institute, Prague, M. Svobodová & B. Záruba, National Museum, Prague)*

A study of the Late Cretaceous rocky coast deposits of the Unhošť-Tursko High lying to NW of Prague was undertaken. Based on the record of the rocky bottom characters, overlying sediments, phosphates, distribution of foraminifers, palynomorphs and macrofaunal taphocoenoses, two sedimentary settings each with its own phosphogenesis have been distinguished. The phosphogenic products are in part reworked and redeposited into younger beds. The older setting is represented by conglomerate in which the taphocoenosis with *Gisilina*? *rudolphi-Goniopygus* cf. *menardi* occurs. Parts of two sections (Předboj and Černovičky) characterized by this taphocoenosis belong to the *Metoicoceras geslinianum* zone and are discussed in more detail. The younger setting is probably of the early Turonian age. Both phosphogenic episodes and subsequent development of strata are correlated with the updip succession of the Pecínov Member and the Bílá Hora Formation in the Pecínov Quarry. The palaeoenvironments of principal intervals were briefly discussed to elucidate problems of phosphogenesis and distribution of faunal remains.

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

Subproject: Climatic oscillation and environmental changes of the recent geological past (***V. Cílek, J. Kadlec, V. Ložek, J. Martínek, & A. Žigová***)

INDIVIDUAL RESULTS:

(a) The influence of climatic and anthropic factors on ecosystems. Special attention was paid to Pleistocene climates (loess research, 1) and to the environmental changes in Holocene established on the basis of interdisciplinary research of the sandstone phenomenon - mostly the sedimentary fills of sandstone abris in northern Bohemia (2):

Loess research:

A detailed analysis of mineral fractions from 13 individual loess-palaeosol layers of Dolní Věstonice Brickyard section (international stratigraphical point) provided new data on source area and pedogenic processes of the late glacial cycle. The loessification is a complex process associated with different processes of chemical weathering:

- the most important process during which loess is formed from a mere accumulation of dust is impregnation and hardening of the clay bridges between individual silt grains by carbonate or complex Si-Al hydroxides
- principal part of calcium carbonate in loess is not derived from clastic fraction but from some other mechanisms such as rainfall, marine aerosol or ground water. The dissolution and precipitation of calcite is common within loess and leads to different forms of calcite - impregnations of clay minerals, dusty chalk calcite, authigenic calcite.
- dolomite formation, metasomatic exchange of chalk dusty calcite by Fe-hydroxides, release of Si-Al hydroxides of allophane type in loess and formation of Al- and Fe-Al phosphates and Al-hydroxide in palaeosols was observed.
- gypsum microconcretions and salt efflorescences indicate salt weathering to take place within loess strata

The most important source area of Dolní Věstonice loess strata is located on weathered outcrops of crystalline complexes of Moravian-Bohemian Highland. About 80 % of silt fraction comes from the area of less than 100 km from the site. The silt was carried by winds of the SW-NW direction, but some other directions (N, NE) are indicated by presence of rounded zircons and some other minerals.

Holocene research

Fifteen new Mesolithic sites were found during last six year research in the northern part of Kokořínsko Protected Landscape Area known as the Polomené hory Upland. Seven rockshelters were searched in 1998 in detail by one or several pits about 2 by 3 m and up to 2.4 m deep. The complex stratigraphy where usually two striking (and several diffused) Mesolithic layers, Neolithic horizon, Late Bronze horizon and Medieval-Modern horizons are present was discovered. The total thickness of Mesolithic strata may reach up to 1.3 m. The sandstone rockshelters are characterised by different mode of fossilisation – they are much drier and contain calcareous (former burnt bone horizon) intercalation, thus the relatively abundant malacofauna, rare bone industry and numerous bones of up to 24 vertebrate species are sometimes present. The synthetic approach using radiocarbon data (between 6,500 and 9,000 y BP), malacostratigraphy, vertebraete analysis, sedimentology and mineralogy, floral macrorelicts, artifact analysis etc. is carried to obtain the complex palaeoenvironmental and cultural data (seasonal migrations, hunting activities, hazelnut collecting, architecture). Three human Mesolithic teeth were discovered during 1998 season and surprisingly preserved Neolithic Punctuated Bowl with rich geometric ornamentation including simplified praying figure was unearthed. The research is carried together with Institute of Archaeology, Academy of Science, Prague and the Museum in Česká Lípa. From the point of the natural science the most important result is the recognition of a major environmental crisis (deforestation, erosion event, environmental change) happening some 3,000 y ago which is well documented by faunal assemblages.

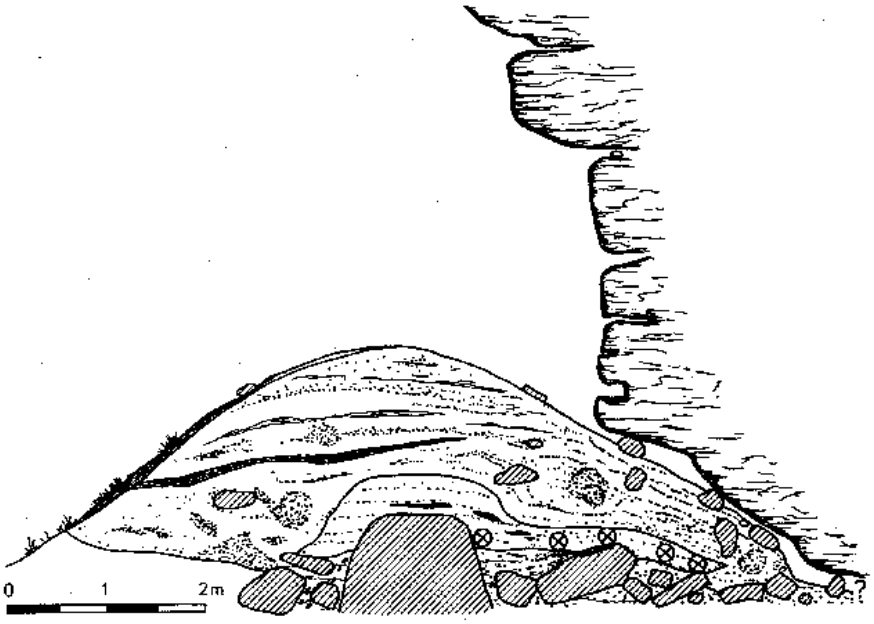

Fig: The profile through Holocene sediments under sandstone rockshelter in Northern Bohemia. The Mesolithic artefacts are indicated by crossed circles.

(b) Research of Quaternary fluvial deposits (***J. Kadlec***)

Documentation of profiles in Quaternary fluvial deposits exposed in northern and central part of the Czech Republic was made. The sedimentary structures, lithology and source areas of fluvial sediments were studied to extend knowledge on hydraulic conditions, which controlled the deposition. The facies changes on the transition between glacio-fluvial and fluvial were documented.

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

Soil of the group terrae calcis (terra fusca, terra rossa) occur especially in calcareous regions of the Mediterranean Sea. They are preserved as relic soils on the peneplain of the Bohemian Massif. They considerably differ from Holocene soils. Essential characteristics of terrae calcis indicate a development under the past climatic and environmental conditions. The terra fusca soil is developed at Přední Kobyla in the south-western part of the Protected Landscape Area approximately 5.5 km to the S of Beroun. The area is completely forested now. The result of conventional analysis showed that only final stage of the pedogenesis has been preserved. The individual pedogenetic development stages were studied by soil micromorphology method and by the analysis of clay minerals. Soil cover was formed on residuum of the Koněprusy Limestones with colluvial and aeolian deposits. The majority of the grain-size fractions <0,01 mm and <0,001 mm of the soil is composed of kaolinite, illite and quartz. Preservation and distribution of feldspars reflect the process of strong weathering. Kaolinite prevails among clay minerals. These relict soils can be classified as a illimerized brown earthified terra fusca with a slight indication of pseudogleyisation. Soil cover of the Přední Kobyla site is of polygenetic character.

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13. Organisation of conferences and scientific meetings

Conferences and Symposia organised in 1998

3rd meeting of the Czech Tectonic Studies Group *(Česká tektonická skupina)*, Malá Úpa, April 15-19, 1998. The field trip to Krkonoše and Kaczawa Mts. located in a region which is of key significance for unravelling the evolution of the Variscan Orogeny in Central Europe (***M. Svojtka*** *- in cooperation with J. Cháb, Czech Geol. Institute, Prague, K. Schulmann, Z. Venera, Faculty of Sciences, Charles University, P. Hanžl, Czech Geol. Institute, Brno, P. Mixa, Czech Geol. Institute, Jeseník,* ***J. Hladil****,* ***F. Patočka****, R. Kryza, P. Alexandrowski & S. Mazur, University of Wroclaw, Poland*).

The Final Session of the IGCP No. 369/2a Comparative evolution of Peritethyan rift basins (*Project leaders: W. Cavazza, A. Robertson, P. Ziegler*). Subproject 2a Magmatism and rift basin evolution: Peritethyan region (*Subproject leader I. Bilik, National representative:* ***J. Ulrych***) in Liblice Chateau, Scientific Centre of the Academy of Sciences of the Czech Republic, September 7-11 1998. The Organising Committee: ***J. Ulrych*** *- convener, M. Růžička, V. Cajz, Czech Geol. Institute, Praha - chairman,* ***J. Filip*** *- treasurer,* ***P. Bosák****,* ***J. Adamovič, J.K. Novák, J. Pavková, J. Forman, L. Slavík,*** *E. Jelínek, D. Matějka, Faculty of Sciences, Charles University, Prague, P. Pazdernik, Friedrich-Alexander University, Nürnberg-Erlangen, Germany, A. Přichystal, Faculty of Science, Masaryk University, Brno & F. Fediuk, Geohelp, Praha.*

The Institute of Geology of the Academy of Sciences hosted the Final session of the IGCP No. 369/2a. More than 40 scientists from 10 countries working in the Subproject took part in this session. Two days excursion route was directed to the main volcanic areas of the Bohemian Massif the České středohoří Mts., Lužické hory Mts. and Ralská pahorkatina Highland. The Excursion Guide (59 pp.) and Abstracts (34 pp.) and Index was published (printed by courtesy of the Czech Geological Institute, Prague).

The workshop was dealing with volcanism in rift basin regions, focused on conditions governing and controlling magma genesis. Lectures were focused mostly on problems of Permo-Carboniferous and Cenozoic magmatism of the Central European Volcanic Province (H. *Sorensen* - invited lecture). However, fundamental contributions originated from both classical riftogenous volcanic regions of the world (E Africa - *F.E. Lloyd,* Arabian Peninsula, Iberian Peninsula) and newly studied areas such as the Dobrogea Rift. Theoretical consideration on repetition of episodic rift magmatism in the context of global dynamics was presented by *D.K. Bailey*. Exceptional attention was paid to incipient Upper Cretaceous and riftogenic Cenozoic volcanism of the Bohemian Massif (a review by *J. Ulrych*) and riftogenic volcanism of Western Carpathians. Special interest enjoyed mineralogy of the upper mantle region beneath the Bohemian Massif (*L.G. Medaris*), volcanostratigraphy of the České středohoří Mts. and the Quaternary volcanism in W Bohemia. Limited number of the Excursion Guides and Abstracts are still available (ulrych@gli.cas.cz).

Conferences and Symposia under preparation

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

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14. Publication activity of the Institute of Geology

In 1998, the Institute of Geology edited two issues of **GeoLines**, a series of monographs and mono-thematic volumes of extended conference abstracts.

Each number is thematically consistent, containing several papers on joint topic or, preferably, one large paper or monograph.

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 organised and/or co-organised by the Institute of Geology are preferred. The papers are subject to reviews.

1998

GeoLines 6 (1998), 88 pp., 26 text figs., 4 tabs.

Abstracts of Contributions and Excursion Guide to the 3rd Meeting of the Czech Tectonic Studies Group (Česká tektonická skupina), associated to the Czech Geological Society held at Malá Úpa on April 15-19, 1999. *Martin* ***SVOJTKA***, Editor.

Contents:

Pavel ***HANŽL****, Helena* ***GILÍKOVÁ****, Jaromír* ***LEICHMAN*** *&* *Kristýna* ***BURIÁNKOVÁ:*** Structural Profile through the Southern Part of the Svratka Dome (Moravicum)

Josef ***HAVÍŘ:*** Post-Variscan Deformation in Some Sedimentary Units on the Eastern Margin of the Bohemian Massif

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EXCURSION GUIDE

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Stanislaw ***MAZUR:*** **Stop 1** Eastern Margin of the Karkonosze-Izera Massif. Deformation Associated with Extensional Collapse in Quartz-muscovite Schists near the Okraj Pass

Stanislav ***MAZUR:*** **Stop 2** Eastern Margin of the Karkonosze-Izera Massif. Extensional Structures Superposed upon Thrust Related Deformations in the Kowary Gneiss at Kowary Górne

Ryszard ***KRYZA:*** **Stop 3** Diabase Sills in Ordovician(?) Slates, Blueschist Facies Metamorphism (Kaczawa Mts, Świerzawa Unit) at Wojcieszów Dolny

Ryszard ***KRYZA:*** **Stop 4** Cambrian?-Ordovician Pillowed Basalts, Primary Volcanic Structures, Bedding/Cleavage Relationships (Kaczawa Mts, Świerzawa Unit) at Okole Hill

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František ***PATOČKA*** *&* *Jindřich* ***HLADIL:*** **Introduction to the Field Trip (Second Day):** An Outline of the East Krkonoše Mts. Crystalline Sequence Geology

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Jindřich ***HLADIL:*** **Stop 7** Limestone Quarry near Dolní Albeřice

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GeoLines 7 (1998), 178 pp., 105 text figs., 19 tabs.

Pavel ***BOSÁK,*** *Josef* ***JAROŠ,*** *Jiří* ***SPUDIL,*** *Petr* ***SULOVSKÝ*** *&* *Vladimír* ***VÁCLAVEK:*** Salt Plugs in the Eastern Zagros, Iran: Results of Regional Geological Reconnaissance.

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

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***** publications in journals with impact factor

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16. Financial Report

(given in thousands Czech Crowns)

A. INCOMES

1. From the annual budget of the Academy of Sciences CR
   12 522
2. From the Grant Agency of the Acad. Sci. (accepted research projects)
   1 908
3. From the Grant Agency CR (accepted research projects)
   691
4. From the internal research projects of the Acad. Sci.
   3 200
5. From other state sources (ministry of Environment, etc.)
   1 000
6. Applied research
   150
7. Investments (for laboratory facilities)
   2 441

TOTAL INCOMES
21 912

B. EXPENSES

1. Scientific staff - wages, medical insurance
   9 610
2. Research and scientific acticites
   4 968
3. Administration and technical staff - admin.expenses,wages,medical insurance
   3 257
4. General expenses (postage shipping, maintenance of buildings, energies, transport, office supplies, miscellaneous, etc)

1 066

5. Library (subscriptions etc.)

450

5. Editional activites (Geolines, Annual Report)
   120
6. Investments (for laboratory facilities)
   2 441

TOTAL EXPENSES
21 912