Academy of Sciences of the Czech Republic

Geological Institute Annual Report 1996

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July 1997

Academy of Sciences of the Czech Republic

Geological Institute
Annual Report 1996

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Editorial Note: The report is based on contributions of individual authors; content and scientific quality of contributions is on responsibility of respective author(s).
The report was compiled by J. Krhovský and finaly edited by P. Bosák.
English version was checked kindly by J. Malinky.
Final proofs were carefully made by Mrs. J. Čadková.

1. General Information

The Geological Institute of the Academy of Sciences of the Czech Republic (abbrev. GLI AS CR) concentrates on research activities in the principal branches of the geological sciences. The principal research areas most developed in the Institute are as follows:

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

The research potential of the Institute is divided into 8 units:

Scientific departments

1. Endogenic geology
2. Paleontology
3. Exogenic geology and geochemistry
4. Paleomagnetism
5. Sedimentology and stratigraphy

Service units

1. Service Laboratory of Physical methods
2. Service Laboratory of Chemical methods (canceled September 1996)
3. Information Center (Library and Computer Network)

The scientific concept of the Geological Institute and the evaluation of its results are the responsibility of the Scientific Council that includes both the internal and external members. Besides research, 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 prominent scientific results in the public media.

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2. Connections

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3. Principal Administrative Changes in 1996

During 1996, a new Director of the Institute was elected. Several researchers left the Institute for other Academy Institutes. At the same time approximately the same number of specialists joined the Institute from different institutions. Several specialists retired to pension (see Staff News).

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4. Staff (as of December 31, 1996)

Management

RNDr. Pavel Bosák, CSc.	Director of the Institute
Ing. Ottomar Gottstein, CSc.	Deputy Director
RNDr. Jan Krhovský, CSc.	Chairman of the Scientific Council

Head Office:

František Bobek (*technical service*)
Josef Brožek (*photographer*)
Ing. Jana Čadková (*assistant to the Director*)
RNDr. Petr Čejchan (*computer specialist*)
Ing. Miroslav Fridrich, CSc. (*computer specialist*)
Karel Jeřábek (*garage attendant, driver*)
Jaroslav Kratochvíl (*technical service*)
Petr Vachalovský (*technical service*)

Scientific departments

Department of Endogenic Geology

Scientific Staff:

RNDr. František Patočka, CSc. - Head of the Department (*petrology, geochemistry*)
Ing. Jiří Fiala, CSc. (*structural geology, metamorphic petrology*)
RNDr. Miloš Lang, CSc. (*igneous petrology, mineralogy*)
prom. geol. Jiří Novák (*petrology*)
RNDr. Edvín Pivec, CSc. (*igneous petrology and mineralogy*)
Mgr. Martin Svojtka (*geochronology*)
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*)

Department of Paleontology

Scientific Staff:

prom. geol. Arnošt Galle, CSc. - Head of the Department (*Devonian corals*)
RNDr. Jiří Bek (*Devonian and Carboniferous spores*)
RNDr. Petr Čejchan (*paleoecology*)
RNDr. Václav Houša, CSc. (*Jurassic and Cretaceous stratigraphy, calpionellids and ammonoids*)
RNDr. Magda Konzalová, CSc. (*Proterozoic, Early Paleozoic, Jurassic, Cretaceous and Tertiary palynology*)
RNDr. Miroslav Krůta, CSc. (*Early Paleozoic ostracodes*)
RNDr. Radek Mikuláš, CSc. (*ichnofossils*)
Doc. RNDr. Luftulla H. Peza, DrSc. (*Mesozoic molluscs*)

Doc. RNDr. Zbyněk Roček, DrSc. (*Origin and evolution of the Amphibia, Tertiary Anura and Sauria*)
RNDr. Miloš Siblík, CSc. (*Mesozoic brachiopods*)
RNDr. Marcela Svobodová, CSc. (*Cretaceous palynology*)
RNDr. Milada Vavrdová, CSc. (*Proterozoic, Paleozoic and Mesozoic palynology and plankton*)

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*)
Ing. Ottomar Gottstein, CSc. (*geochemistry of granitic and metamorphic rocks*)
Ing. Olga Kvídová, CSc. (*exogenic and environmental geochemistry*)
RNDr. Vojen Ložek, DrSc. (*Quaternary geology, malacozoology*)
Ing. Jaroslav Martínek (*geochemistry*)
Ing. Luděk Minařík, CSc. (*geochemistry*)
RNDr. Eliška Růžičková (*petrology, Quaternary geology*)
Doc. Ing. Petr Skřivan, CSc. (*exogenic and environmental geochemistry*)
RNDr. Antonín Zeman, CSc. (*exogenic geology*)
RNDr. Anna Žigová, CSc. (*pedology, paleosoils*)

Technical Staff:
Jaroslava Bednářová (*editorial services*)
RNDr. Miloš Burian (*chemical analyst*)
Ing. Irena Dobešová (*maternal leave*)
Miroslav Karlík (*technician*)
Jana Krejčová (*technician*)
Jana Macháčková (*secretary of the department, technician*)

Department of Paleomagnetism
Scientific Staff:
Ing. Petr Pruner, CSc. - Head of the Department (*geophysics, paleomagnetism*)
Ing. Miroslav Krs, CSc. (*geophysics, paleomagnetism*)
prom.fyz. Otakar Man, CSc. (*geophysics*)
Mgr. Jana Slepičková (*geophysics*)
RNDr. Daniela Venhodová (*petrophysics*)

Technical Staff:
Otto Čejchan (*mineralogical laboratory methods*)
Jana Drahotová (*technician*)
Věra Havlíková (*technician*)

Department of Sedimentology and Stratigraphy
Scientific Staff:
Ing. Václav Suchý, CSc. - Head of the Department (*sedimentology and basin analysis*)
Mgr. Šárka Eckhardtová (*organic petrography and sedimentology*)
RNDr. Jindřich Hladil, CSc. (*Devonian stratigraphy and reefs*)
RNDr. Jan Krhovský, CSc. (*Upper Cretaceous and Cainozoic stratigraphy, calcareous nannofossils and foraminifers*)
Marie Lachmanová, B.Sc.(*sedimentology*)
RNDr. Karel Melka, CSc. (*XRD analyst*)
RNDr. Petr Štorch, CSc. (*Ordovician and Silurian stratigraphy, graptolites*)
RNDr. Jiří Žítt, CSc. (*Cretaceous and Tertiary paleoecology and sedimentology, echinoids and crinoids*)
Technical Staff:
Jana Macháčková (*secretary of the department, technician*)

Professional Departments

Service Laboratory of Physical Methods

Ing. Anna Langrová - Head of the Laboratory (*microprobe and scanning microscope analyst*)
Jiří Dobrovolný (*XRD analyst*)
Jaroslava Jabůrková (*preparing of thin sections*)
Ivana Konopáčová (*preparing of thin sections*)
Milena Kozumplíková (*microprobe and scanning microscope operator*)

Information Centre and Library

RNDr. Helena Purkyňová - Head of the Department (*librarian*)
PhDr. Liliana Peza (*librarian*)

Economical Department

Ing. Ottomar Gottstein, CSc. - Head of the Department
Antonín Čejka (*technical service*)
Michael Dytrt (*telephonist*)
Svatava Jandeková (*personnel section*)
Ludmila Jilichová (*telephonist*)
Jana Klímová (*accountant*)
Lenka Staňková (*accountant*)

Scientific Council

RNDr. Jan Krhovský, CSc. Chairman since May (Geological Institute AS CR)
RNDr. František Patočka, CSc., Chairman till May (Geological Institute AS CR)
RNDr. Václav Cílek, CSc. Vice-Chairman (Geological Institute AS CR)
Prof. RNDr. Vladimír Bouška, DrSc. (Faculty of Sciences, Charles University)
Prof. RNDr. Petr Čepek, CSc. (Faculty of Sciences, Charles University)
RNDr. Jan Cháb, CSc. (Czech Geological Survey)
prom. geol. Arnošt Galle, CSc. (Geological Institute AS CR)
RNDr. Miroslav Krůta, CSc. (Geological Institute AS CR)
Doc. RNDr. Zdeněk Kukal, DrSc. (Czech Geological Survey)
Ing. Petr Pruner, CSc. (Geological Institute AS CR)
Doc. RNDr. Jaromír Ulrych, CSc. (Geological Institute AS CR)

Foreign consultants

Prof. Petr Černý (University of Manitoba, Winnipeg, Canada)
Prof. Jaroslav Dostál (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., Mag.	MSc
RNDr., PhDr.	no equiv.
CSc.	PhD
DrSc.	DSc
doc.	Assoc. Prof.

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5. Staff News

January

Jan. 31 Mrs. H. Grebíková
left the Institute

February

Feb. 15 RNDr. K. Melka, CSc.
joined the Institute

Feb. 17 RNDr. H. Purkyňová
returned after her maternal leave

March

March 31 Mr. P. Kohák (technician)
left the Institute

April

April 1 Mrs. J. Krejčová (technician)
joined the Institute

April 1 Mr. G. Hašek (technician)
joined the Institute

April 1 Doc. RNDr. J. Ulrych, CSc.
joined the Institute

April 1 Mrs. J. Jabůrková (preparation of thin sections)
took up maternal leave

April 1 RNDr. R. Mikuláš, CSc.
took up one year scientific scholarship of The Royal Society, London at the University of Liverpool

April 24 Mr. G. Hašek
left the Institute

April 30 Mrs. V. Frimlová (accountant)
left the Institute

May

May 1 Mrs. V. Horálková (technician)
joined the Institute

May 22 New Scientific Council was elected.

June

June 30 RNDr. O. Nekvasilová, CSc.
retired to pension

August

Aug. 1 Ing. J. Martínek
joined the Dept. of Exogenic Geology and Geochemistry

September

Sept. 1 RNDr. P. Čejchan
joined the Dept. of Paleontology

Sept. 1 Mgr. J. Slepičková
joined the Dept. of Paleomagnetism

Sept. 15 Ing. Chalupský, Mrs. M. Malá and Mgr. J. Švec
left for the Institute of the Rock Structures and Mechanics AS CR

Sept. 16 Mrs. L. Staňková (accountant)
jointed the Institute

Sept. 30 RNDr. V. Houša, CSc.
finished in the function of the Director of the Institute

October

Oct. 1 RNDr. P. Bosák, CSc.
appointed as the Director of the Institute

Oct. 1 Bc. M. Lachmanová

joined the Dept. of Stratigraphy and Sedimentology
Oct. 30 Mrs. V. Horálková
left the Institute
Oct. 31 Ing. M. Hříbal
left for the Institute of the Rock Structures and Mechanics AS CR

December
Dec. 1 Prof. John Malinky, PhD
joined the Institute
Dec. 31 Mr. M. Dytrt (telephonists)
left the Institute

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6. Undergraduate and Postgraduate Education

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

Bosák P.: *Karstology and Paleokarstology.* Postgraduate course, Faculty of Sciences, Prague.
Cílek V.: *Landscape and Culture.* Summer session course, Simon Fraser University, Vancouver, Canada.
Cílek V.: *Landscape, ecology, culture and language.* Summer school course, Northwestern University, Evanston, Chicago.
Cílek V.: *Sandstone phenomenon.* Field course, Institute of the fundamentals of learning, Pedagogical Faculty, Charles University.
Cílek V.: *Gaia and ecology.* Undergraduate course, Institute of the fundamentals of learning, Pedagogical Faculty, Charles University.
Hladil J.: *Origin of carbonate rocks*. Undergraduate and postgraduate special courses, Faculty of Sciences, Masaryk University, Brno.
Houša V.: *Taxonomy and nomenclatorics*. Undergraduate course, Faculty of Sciences, Charles University, Prague.
Houša V.: *Paleobiogeography.* Undergraduate course, Faculty of Sciences, Charles University, Prague.
Krhovský J.: *Mass extinctions*. Undergraduate course, Faculty of Sciences, Charles University, Prague.
Krhovský J. & Roček Z.: *Evolution of the Global Ecosystem.* Postgraduate course, Faculty of Sciences, Charles University, Prague.
Krs M. & Pruner P.: *Paleomagnetism and paleogeography of the Variscan formations of the Bohemian Massif, comparison with other European Regions*. Undergraduate course, Faculty of Sciences, Charles University, Prague.
Pruner P.: *Paleomagnetism and paleogeography of Mongolia from the Carboniferous to the Cretaceous*. Undergraduate course, Faculty of Sciences, Charles University, Prague.
Ložek V.: *Development of the Nature during the Quaternary Era.* - Undergraduate course, Faculty of Sciences, Charles Univeristy, Prague.
Roček Z.: *Evolution of vertebrates*. Undergraduate course, Faculty of Sciences, Charles University, Prague.
Roček Z.: *System of fossil vertebrates*. Undergraduate course, Faculty of Sciences, Charles University, Prague.
Skřivan P.: *Environmental chemistry.* Undergraduate course, Faculty of Forestry, Czech Agricultural University, Prague.
Štorch P.: *Principles and methods of stratigraphy*. Undergraduate course. Faculty of Sciences, Charles University, Prague
Ulrych J.: *Methods of mineralogical investigation.* Undergraduate course, Faculty of Sciences, Charles University, Prague.
Ulrych J.: *Interpretations of mineralogical data.* Undergraduate course, Faculty of Sciences, Charles University, Prague.

Ulrych J. & Matějka D.: *Geochemistry of volcanites of the Bohemian Massif.* Undergraduate course, Faculty of Sciences, Charles University, Prague.
Zeman A.: *Geology and Pedology.* Undergraduate course, Pedagogic Faculty, West Bohemian University, Plzeň.
Žigová A.: *Geographic distribution of soils and protection of soil resources in the Czech Republic.* Undergraduate course, Faculty of Sciences, Charles University, Prague.

Supervision in Undergraduate Studies

M. Dvořáková, Faculty of Forestry, Czech Agricultural University, Prague *(supervisor P. Skřivan)*
J. Hlaváč, Faculty of Sciences, Charles University, Prague *(supervisor V. Ložek)*
P.Jarošová, Faculty of Forestry, Czech Agricultural University, Prague *(supervisor P. Skřivan)*
J. Laurin, Faculty of Sciences, Charles University, Prague (*scientific consultant R. Mikuláš*)
J. Samek, Faculty of Forestry, Czech Agricultural University, Prague *(supervisor P. Skřivan)*
L. Sedláčková, Department of zoology, Faculty of Sciences, Masaryk University, Brno (*supervisor Z. Roček)*
L. Slavík, Faculty of Sciences, Masaryk University, Brno *(supervisor J. Hladil)*
J. Slepičková, Faculty of Sciences, Charles University, Prague (*supervisor P. Pruner*)
P. Špaček, Faculty of Sciences, Masaryk University, Brno *(supervisor J. Hladil)*
N. Stanišová, Institute of Chemical Technology, Prague *(scientific consultant V. Suchý)*
R. Štorc, Faculty of Sciences, Charles University, Prague (*scientific consultant J. Žítt*)
J. Vejvalka, Faculty of Sciences, Charles University, Prague (*supervisor Z. Roček)*
P. Zajíc, Faculty of Forestry, Czech Agricultural University, Prague *(supervisor P. Skřivan)*
R. Zuzka, Faculty of Sciences, Charles University, Prague *(supervisor J. Fiala)*

Supervision in Postgraduate Studies

RNDr. J. Bek, Geological Institute AS CR, Prague *(supervisor M. Vavrdová)*
Mgr. Š. Eckhardtová, Geological Institute AS CR, Prague (*supervisor V. Suchý)*
RNDr. B. Hamršmíd, Moravské naftové doly a.s., Hodonín *(supervisor J. Krhovský)*
Mgr. L. Juřičková, Faculty of Sciences, Charles University, Prague *(supervisor V.Ložek)*
RNDr. J. Kvaček, National Museum, Prague *(scientific consultant M. Konzalová)*
Mgr. L. Motl, Schola Humanitas Litvínov - Faculty of Forestry, Czech Agricultural University, Prague *(supervisor P. Skřivan)*
Ing. J. Sedláčková, Institute of Chemical Technology, Prague *(scientific consultant V. Suchý)*
Mgr. J. Slepičková, Faculty of Sciences, Charles University, Prague (*co-supervisor P. Pruner).*
RNDr. M. Streitová, Faculty of Sciences, Masaryk University, Brno *(supervisor J. Hladil)*
RNDr. E. Střelcová, Czech Geological Survey, Branch Brno and Masaryk University, Brno *(scientific consultant V. Suchý)*
Mgr. R. Štorc, Faculty of Sciences, Charles University, Prague (*scientific consultant J. Žítt*)
Mgr. M. Vach, Institute of Applied Ecology, Faculty of Forestry, Czech Agricultural University, Prague *(supervisor P. Skřivan)*
RNDr. Miloš Vater, Zoological Institute of the Slovak Academy of Sciences, Bratislava (*supervisor Z. Roček)*

RNDr. F. Patočka was the member of the Board of Postgraduate Studies on Geology, Faculty of Sciences, Charles University, Prague.

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7. Department of Endogenic Geology

Foreign Grants and Joint Projects

Joint projects of 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-Barrandean area (Bilanzierung und Modellierung eines angekippten Krustenprofils von der Anchizone bis zur Amphibolitfazies, W-Rand Teplá-Barrandium (*G. Zulauf and G. Kleinschmidt, Geologisch-Paläontologisches Institut Johann-Wolfgang-Goethe-Universität Frankfurt a. M., FRG , **J. Fiala** & **Z. Vejnar***)
The Late Paleozoic evolution of the Teplá-Barrandian unit has been interpreted as a consequence of the Variscan gravitational and rheological plateau-collapse.
The transtension kinematics in Cadomian basement of the Teplá-Barrandian in the Cambrian led to exhumation of deeper crustal levels and tilting of metamorphic isograd surfaces. An intensive Cambrian supracrustal plutonism (Teplá and Domažlice crystalline complexes) and volcanism (Barrandian syncline) occurred contemporaneously with this transtension. The Mid-Cambrian marine sediments point to complete dissection of the original Cadomian relief. Starting probably in the Silurian at the N-edge of Teplá-Barrandian, an active continental margin evolved. After closing of an intervening ocean in the Devonian the attenuated Saxothuringian continental crust was subducted under the Teplá-Barrandian one. Thereafter, in the Carboniferous the substantially thickened continental crust was subjected to gravitational collapse and tectonic denudation of the roof pendant. A recent analogue of this configuration can be found in Himalayan orogen. The Teplá-Barrandian in this model represents probably a Late Devonian to Early Carboniferous Tibet-Plateau.

(2) Structural and kinematic evolution of the Central Bohemia Shear zone (CBS) between Klatovy and Rittstein (Strukturelle und kinematische Entwicklung der Zentralböhmischen Scherzone (CBS) zwischen Klatovy und Rittsteig (*G. Zulauf, G. Kleinschmidt and D. Scheuvens, Geologisch-Paläontologisches Institut Johann-Wolfgang-Goethe-Universität Frankfurt a. M., FRG, **J. Fiala** & **Z. Vejnar***)
The Teplá-Barrandian/Moldanubian *s.s.* boundary is characterized by the intrusion of large felsic (Bor, Babylon, Nýrsko, Klatovy) and small mafic (Mutěnín, Drahotín) plutons, which were emplaced in a shear zone during ductile shearing. The NNW-SSE trend of the 35 km long Bor pluton is parallel to that of the West Bohemian shear zone (WBS). Near Neukirchen, the WBS bends sharply towards the WSW-ENE and continues as the Central Bohemian shear zone (CBS), which is intruded mainly by the Klatovy granitoid type of the Central Bohemian Pluton. An attempt has been made to date the fault-related plutons, in order to constrain the age of the tectonic activity along shear zones.
For all analysed granitoids of the WBS and CBS the discordant U-Pb zircon data result from a combination of different amounts of inherited lead from various sources and (sub) recent lead loss. From these reasons almost relatively wide ranges can be only defined for the time of granitoid intrusions. For the Bor pluton this range is between 315 and 332 Ma, for the Babylon granite between 320 and 345 Ma. For the Klatovy granitoid the range can be defined between 335 and 357 Ma, which is in good agreement with K/Ar cooling age of biotite at 339±10 Ma obtained from the same sample. A similar but slightly higher range of 342 and 361 Ma was obtained from zircons of the Nýrsko granitoid, giving the biotite K/Ar cooling age of 342±8 Ma.

(3) Magmatic and metamorphic evolution of Early Paleozoic plutonites in a coherent crustal section at the southwestern margins of the Teplá-Barrandean area (Magmatische und metamorphe Entwicklung frühpaläozoischer Plutonite in einem kohärenten Krustenprofil am SW-Rand des Teplá-Barrandiums (*P. Blümel, Institut für Mineralogie der Technische Hochschule Darmstadt, G. Zulauf, Geologisch-Paläontologisches Institut Johann-Wolfgang-Goethe-Universität Frankfurt a. M., **J. Fiala, Z Vejnar** & J. Babůrek, Czech Geological Surwey, Prague*)
A range of plutons was intruded in the Early Paleozoic into the Cadomian basement in the SW part of the Teplá-Barrandian. The intrusive complex was thickened, metamorphosed and tilted to the E in the course of the Variscan orogeny. An opportunity is given to study a coherent 35 km long crustal section reaching, regarding the intrusion level, from lower and middle crust (coronitic gabbro at Neukirchen) to upper crust (granodiorite of Stod). Gradients or discontinuities in relation to depths of intrusions and Variscan tectonometamorphic overprints will be studied with the aid of petrologic, geothermobarometric and structural investigations of plutonic rocks as well as of their contact aureoles along the mentioned tilted section.

International Geological Correlation Programs, UNESCO

IGCP Project No. 369: Comparative Evolution of Peri-Tethyan Rift Basins. Subproject 2a

Magmatism and Rift Basins Evolution: Peri-Tethyan Region

(a) Age related contrasting alkaline volcanic series in North Bohemia (***J. Ulrych*** & ***E. Pivec***)

The Upper Cretaceous - Tertiary volcanism of the north-eastern part of the Ohře (Eger) rift in northern Bohemia displays characteristic features of two intraplate magmatic series. An older (79-50 Ma) unimodal ultramafic ultra-alkaline (olivine melilitite to olivine nephelinite) series which represents the precursor of rifting occurs exclusively in external blocks of the Ohře rift. A younger (40-18 Ma) bimodal (basanite-phonolite) rock series of alkaline character predominates in the internal blocks of the rift. The later series is characteristic of the highly-volcanic active rifts. In the central part of the Ohře rift, in the České středohoří Mts., there is a mildly alkaline bimodal basanite-trachyte association. Enrichment of the ultramafic series in incompatible elements (Rb, REE, Y, U, Th, Zr, Hf, Nb, Ta, P) could be explained by low degree partial melting of a metasomatically enriched mantle source and/or steady zone refining process of magma generation. Further enrichment during the postmagmatic process within the high level crustal reservoir source is likely. The $^{87}Sr/^{86}Sr$ (0.70327 - 0.70366) and $^{143}Nd/^{144}Nd$ (0.51267 - 0.51287) ratios of the (ultra)mafic rocks of both magmatic series are similar and close to those of HIMU OIB. Highly evolved phonolites, which originated by low-pressure crustal fractionation of the parental basanitic magma were affected by some crustal contamination ($^{87}Sr/^{86}Sr$ = 0.70431 - 0.70534). The additional gains of a lithophile element in phonolites are most probable. The volcanic association of the Ohře rift is comparable with classic areas of bimodal alkaline volcanism, such as in Hegau, Rhön and the East African Rift.

(b) The Podhorní vrch volcano: volcanological and geochemical characteristics (***J. Ulrych*** & ***E. Pivec***)

Podhorní vrch volcano (15 - 12 Ma), situated near Mariánské Lázně spa in western Bohemia, belongs to the Miocene-Pliocene volcanism of the Bohemian Massif. The volcano occurs spatially associated with the tectonic zone striking NNW - SSE pertaining to the Neogene Domažlice - Cheb Graben. All its volcanic products have an olivine nephelinite composition. On the basis of geochemical criteria they could be considered as undifferentiated products of mantle origin (Mg-value = 71-74 Cr > 500, Ni > 250, Co > 50, Sc > 30 ppm; presence of lherzolite xenoliths). Strontium ($^{87}Sr/^{86}$ Sr = 0.7035) and neodymium ($^{143}Nd/^{144}Nd$ = 0.51286) isotope composition suggests a mantle origin as well. High contents of selected incompatible elements (U = 1.7-5.2, Th = 9.3-15.9 REE = 320-460 ppm, LaN/LaN = 29-54) are most characteristic. Coarse- to medium- and fine-grained segregations of ijolite to turjaite composition in the parental olivine nephelinite are presented by the nepheline + melilite/(leucite + sanidine) + diopside/fassaite - aegirine ± sodalite, titanian magnetite, fluor-hydroxyapatite mineral paragenesis. Origin of the segregations is associated with the late-magmatic stage concentrating alkalies (Na), trace incompatible elements (REE, U, Th, Nb, Ta, P) and volatile components (F, Cl, H_2S). The segregations are characterised by the low contents of Si, Al and K and higher concentrations of Ca in comparison with that from classical localities (Maiches and Löbauer Berge, Germany). This composition has been reflected in the crystallisation of melilite, instead of leucite and sanidine.

Grant Agency of the Czech Republic

No. 205/95/0149 - The influence of postmagmatic processes on the mineralogical and petrochemical composition of granitoids within Krušné hory - Smrčiny anticlinorium (*M. Štemprok, Faculty of Sciences, Charles University, Prague,* ***E. Pivec, J.K. Novák*** & ***M. Lang***)

The study was focused on granites of the younger intrusive complex in the Karlovy Vary Massif formed by two-mica granites classified as alkali-feldspar granites. Some parts of these rocks show a high stage of postmagmatic autometamorphism and are close to Li-granites. They are composed of feldspars, quartz, dark and white micas, topaz, tourmaline, clay minerals in pseudomorphs (mixture of kaolinit and dickite) after older feldspars next to younger ones, and cassiterite and zircon as accessories. These porous rocks have a higher content of LiO_2 (about 0.10 wt.%). Dark micas in these zones are strongly affected by postmagmatic processes and correspond in the core to siderophyllite with the rim to zinnwaldite. This suggests that the Li-mica granites in the Krušné hory area are not products of extreme differentiation of biotite granites but the results of metasomatic processes or melting of earlier formed granites similar to the Cornubian batholith.

The chemical data set concerning to granites of the Krušné hory Mts. Batholith was statistically treated to show evident differences in bulk phosphorus content between both the Eastern and Western plutons. Whereas the Eastern pluton is a classic example of the P-low

subtype, the granites of the Western pluton are commonly enriched above the theoretical apatite solubility curves. Additional investigation was focused on phosphorus content in feldspars. Compositional granite characteristics of the Western pluton show affinities with post-collisional setting (e.g. Cornubian batholith), and those of the Eastern pluton with anorogenic setting (similar to Transbaikalia and Nigeria). Authors suggest that difference has not been caused by different conditions of the crystallization path, but by the amount of phosphorus in the melt derived from the protolith. In the Krušné hory Mts. the role of phosphorus does not appear to be as decisive for ore productivity as shot of fluorine and/or boron.

No. 205/94/0687 - Isotopic study of accessory minerals from deformed granitoid rocks of the Moldanubian Zone in the Bohemian Massif (*J. Košler, Charles University, Prague, K. Vokurka, Czech Geological Survey, Prague &* ***M. Svojtka***)
The largest orthogneiss body in the Moldanubian zone of the southern Bohemia near Stráž forms a NE-trending elongated lens (ca 15 km^2) tectonically intercalated with the surrounding biotite-cordierite paragneisses of the Monotonous Group, for which a Late Proterozoic maximum age of deposition has been established on the basis of U-Pb detrital zircon data (Kröner et al. l988). The Stráž orthogneiss has a zonal fabric with the most deformed outer parts and the central part containing relics corresponding to a metagranite, suggesting the rock had an igneous protolith. Intrusive origin of orthogneiss is also indicated by strong migmatitization in the surrounding paragneisses, the intensity of which increases near the paragneiss/orthogneiss boundary. The orthogneisses and the surrounding paragneisses share a common dominant NE to NNE trending foliation which is parallel to the orthogneiss margins.
For U-Pb isotopic study of zircons a sample of orthogneiss was collected 0.3 km NW of Lásenice. Backscattered electron study has revealed fine oscillatory zoning in most of the studied grains. Zircons from the Stráž orthogneiss show a considerable scatter in their U-Pb isotopic compositions. Three zircon size fractions plot on different discordias and form a cluster of data points near 420 Ma in the concordia diagram. Two of the three size/morphological fractions plot above the concordia, indicating strong disturbance of their U-Pb systems, probably associated with U-loss or different initial Pb proportions. In addition, two positively discordant samples have the highest common lead contents and the grains have high content of apatite inclusions. Composition of short prisms (53-85 mm) plots well above the composition of the zircon size fractions, near 500 Ma. As the 53-85 mm size fraction is dominated by short prisms, the composition of air-abraded 53-85 mm short prisms effectively corresponds to that of air-abraded 53-85 mm size fraction. The two fractions define a discordia with an upper intercept at 552$\pm$11 Ma. The lower intercept (near 0 Ma) indicates a recent Pb-loss. Both the euhedral shape and fine oscillatory zoning are indicative of magmatic crystallization of studied zircon grains and, accordingly, the 552 Ma upper intercept age is interpreted as representing an Early Cambrian magmatic crystallization of the Stráž orthogneiss protolith.

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A 3111601 Geochemical development of volcanic complex from the central part of the České středohoří Mts. (***J. Ulrych, M. Lang, F. Patočka*** *&* ***J.K. Novák***)
The Roztoky intrusive center is formed by the diatreme filled by trachytic breccia. Subvolcanic monzodiorite, essexites and sodalite syenites bodies and more than 1,000 almost radially arranged dykes, occurring in the neighbourhood of the centre. Differentiation series of essexite - monzodiorite - sodalite syenite (DI = 46-65) and linked dyke series of alkali basalt s.l. - camptonite/monchiquite - gauteite - trachyte/phonolite - nepheline syenite porphyry/tinguaite - rhyolite (DI = 26-91) were recognized. Fractional crystallization of an alkali basalt parental magma in a high level crustal chamber gave rise to the rock series. The presence of cumulates of kaersutite/diopside composition in sodalite syenite confirm this assumption. The $^{87}Sr/^{86}Sr$ data yielded values in the range of 0.70366 to 0.70837 and support a mantle magma origin, however, with substantial crustal contamination.

A 313410 - Petrology and geochemistry of the Tertiary volcanics from the Mariánské Lázně spa region (***E. Pivec*** *&* ***M. Lang***)
The petrology and geochemistry of the olivine nephelinite from the Podhorní vrch area (15-12 Ma) were studied in conjunction with lherzolite inclusions and “doleritic” exsolutions close to ijolite with mineral association clinopyroxene-melilite/leucite, sanidine+sodalite, olivine

magnetite and apatite. Based on geochemical criteria these rocks could be considered as undifferentiated products of mantle origin (Mg # = 71-74, Cr>500, Ni>250, Co>50, Sc>30 ppm; presence of lherzolite xenoliths). The products of felsic magmas in the studied area presented by the series trachybasalte - basaltic trachyandesite - trachyandesite - trachyte - rhyolite (between 11.4 and 12.9 Ma) represent the continuation of the olivine nephelinite above. Authors on the basis of geochemical criteria defined these rocks as distinctive comagmatic series (with a specific geochemical features e.g. anomalous Mn content in minerals, occurrence of sulfur etc.) All geochemical data, minor and REE elements, K/Rb values etc. proved a crustal contamination of trachytes and cognate rocks, i.e. series from trachybasalt to rhyolite; the last rock is unknown so far in this area.

A 3013610 - The development of the Early Paleozoic volcanic complexes of the West Sudetes: the Železný Brod as an example (***F. Patočka**, M. Fajst, Charles University, Prague, **J. Ulrych** & **M. Vavrdová***)

(a) Geochemistry and ^{40}Ar-^{39}Ar dating of metamorphisms in the Variscan High Pressure Terranes of the Rýchory Mts. (W Sudetes, Bohemian Massif): paleotectonic significance (*H. Maluski, Université Montpellier 2, France and **F. Patočka***)

The mafic metavolcanics (blueschists and greenschists) of the Rýchory Mts. crystalline complex (West Sudetes) underwent sea-floor hydrothermal alteration (spilitization?). The metabasite geochemistry (trace element and REE abundances especially) indicates that the protolith was comparable in composition with (1) tholeiitic to transitional ocean-floor basalts and (2) transitional and alkaline intra-oceanic island basalts.

Two main metamorphic events affected the metabasites. In an earlier HP-LT metamorphic event the rocks experienced blueschist facies metamorphism. The HP-LT metamorphism was followed by a greenschist facies overprint. The results of the ^{40}Ar-^{39}Ar geochronology on phengites from the Rýchory Mts. mafic blueschists date the end of the earlier metamorphism at 360 Ma. Around 340 Ma the greenschist metamorphic event followed.

The elongated bodies of mafic metavolcanics are situated within the prominent NNE-SSW trending Leszczyniec shear zone following the Rýchory Mts. and Rudawy Janowickie Mts. Both the geochemical affinities and the blueschist facies metamorphism of the metabasites suggest that this shear zone evolved from the Variscan suture dividing western and central terranes of the West Sudetes. According to the radiometric age of the HP-LT metamorphism termination, the terranes accreted in Famennian.

A considerable time-span between the origin of the metabasite protolith and the blueschist metamorphism may indicate a long-lasting consummation of a large oceanic plate between Gondwana and Laurussia, possibly accompanied by terrane accretion prior to the Variscan orogeny.

(b) The possible affinites of metasedimentary sequences of the central West Sudetes based on microfossil record (***M. Vavrdová***)

Metacherts from the Radčice Group (Ještěd Mountains) yielded poorly preserved, but abundant and varied fossil organic remains (chitinozoans, graptolite sicules, melanosclerites, nematoclasts and acritarchs). Despite the poor preservation of recovered microfosils, influenced by a metamorphic alteration, preliminary biostratigraphical assessment points to the Silurian age of samples from the Kryštofovo údolí Valley. Filamentous nematoclasts were provisionally assigned to pterobranchids, known from silicites (chalcedonites) and erratic boulders from the Baltic region.

Grants of the Charles University, Prague

RUK No. 3239 Application of apatite crystal chemistry to interpretation of genesis of volcanic rocks (*D. Matějka, Charles University, Prague, **J. Ulrych** & P. Pazdernik, Erlangen University, FRG*)

Contents of P_2O_5 vary in volcanic rocks of the České středohoří Mts. in the range 0.01 - 4.13 wt.% (0.01 - 0.6 wt.% in the trachyte - phonolite series). These contents correspond to the 0.025 - 10.5 vol.% of apatite. More than 98 wt.% of P_2O_5 is concentrated in apatites (fluorapatites). However, phosphates as goyazite, crandallite, gorceixite and florencite were also found in the volcanic rocks in minor amounts, too (Pazdernik 1997). P_2O_5 contents correlate negatively with the acidity of the host rock and positively with the temperature of its

crystallization. Substitution of SiO_4 – P_2O_5 groups is reversible, both in silicates (olivine - feldspar) and phosphates (apatite).

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8. Department of Paleontology

Foreign Grants and Joint Projects

Joint project of URA-CNRS 1761, Université Paris 6, France and GLI AS CR

Les amphibiens du Tertiaire européen. Evolution, paléobiogéographie, paléoécologie (*J.-C. Rage, Université Paris 6, Paris, France &* ***Z. Roček***)
A complete review of the Mesozoic and Tertiary anuran taxa of Europe was compiled, with comments on their taxonomic assignment and geographic distribution. The review was submitted as chapters „Relationships of Mesozoic anurans“ and „Tertiary Anura of Europe“ to be published in H. Heatwole & R. Carroll (Eds.): Amphibian Biology, Vol. 4 - Paleontology. Surrey Beatty & Sons.

International Geological Correlation Program, UNESCO

IGCP Project No. 335: Biotic Recoveries from Mass Extinctions (*Project leader D. Erwin, Smithsonian Institution*)
Subproject - Restoring gradients from fossil communities: a graph theory approach (***P. Čejchan***)
A series of ancient seafloors colonized by diverse organisms has been documented from the Upper Devonian rocks of the Western Mokrá Quarry. Situated in the southern tectonic closure of the Moravian Karst, the Frasnian-Fammenian shallow carbonate ramps exhibit both Rhenish and Ukrainian affinities. Reconstructions of paleo-sea floor horizons resulted in a series of 28 quadrants sufficient for further evaluation. Eighty-five taxa involved were scritinized for abundance, occupied area, skeletal mass production and biomass production. The aim of the study was to determine whether the observed sequence of quadrants can be distinguished from a random one, and to discover any possible unidimensional gradient as a latent control. Monte Carlo situations and a graph theoretical approach were applied. Although the raw data seemed chaotic, the simulations demonstrated the observed sequence is not random. A significant influence of a hidden control is thus suggested. Fifteen characteristics of quadrants (e.g. diversity, number of taxa, vertical stratification of community, number of patches) were utilized for final interpretation. The gradient reconstructed by TSP algorithm reveals a significant crisis within the uppermost Part of the *Amphipora*-bearing limestone.

Grant Agency of the Czech Republic

No. 205/94/1321 - Carboniferous spores of plant groups Lycophyte, Sphenophyte and Pterophyte (***J. Bek***)
About 2,000 samples were collected and evaluated from various fertile parts of Carboniferous plants from the collection of the National Museum in Prague during last three years. Research was concentrated on the spores from fructifications of three main plant groups - *Lycopsida, Sphenopida* and *Pteropsida*.
Cones of the genus *Lepidostrobus* (Brogniart) Brack-Hanes & Thomas produced only miospores of the genus *Lycospora* (Ibrahim) Schopf, Wilson & Bentall. One cone produced only one lycospore species (with one exception - *Lepidostrobus cernuus*) in all its parts (basal, middle and apical) and it seems that these cones rippened at the same time. Miospores belonging to the nine dispersed lycospores species were isolated from eight cone types of the genus *Lepidostrobus*.

Parent plant	Miospores
Lepidostrobus crassus Němejc	*Lycospora parva* Kosanke
Lepidostrobus haslingdenensis Thomas & Dytko	*Lycospora noctuina* Butterworth & Williams

Lepidostrobus lycopoditis O. Feistmantel	*Lycospora rotunda* Bharadwaj
Lepidostrobus stephanicus Němejc	*Lycospora punctata* Kosanke
Lepidostrobus cernuus (Sternberg) Němejc	*Lycospora* cf. *brevis* Bharadwaj *Lycospora* cf. *pseudoannulata* Kosanke
Lepidostrobus cf. Sternbergii Corda	*Lycospora* cf. *pusilla* (Ibrahim) Schopf, Wilson & Bentall
Lepidostrobus sp. A	*Lycospora subjuga* Bharadwaj
Lepidostrobus sp. B	*Lycospora microgranulata* Bharadwaj

Only a few of studied cones were heterosporous, which means that they produced male (miospores) as well as female (megaspores) reproductive organs. All of these cones are referred to the genus *Flemingites* (Carruthers) Brack-Hanes & Thomas.
Fertile part of the genus *Sporangiostrobus* Bode (family uncertain but of lycopod affinity) contained spores belonging to thirteen dispersed species (until this time) of two genera - *Densosporites* (Berry) Butterworth, Jansonius, Smith & Staplin and *Cristatisporites* (Potonie & Kremp) Staplin & Jansonius. Most of these fertile branches contains only miospores, a few were bisporangiate with megaspores of the *Superbisporites* type. These fertile branches probably rippened gradually from the basal to the apical parts and produced miospores with a relatively large morphological variability.

Parent plant	Miospores
Sporangiostrobus feistmantelii (Feistmantel) Němejc	*Densosporites* cf. *spinifer* Hoffmeister, Staplin & Malloy *Densosporites spinifer* Hoffmeister, Staplin & Malloy *Densosporites granulosus* Kosanke *Densosporites lobatus* Kosanke *Densosporites sphaerotriangularis* Kosanke *Densosporites glandulosus* Kosanke *Densosporites pseudoannulatus* Butterworth & Williams *Densosporites anulatus* (Loose) Smith & Butterworth *Densosporites gracilis* Smith & Butterworth *Cristatisporites* cf. *saarensis* Bharadwaj *Cristatisporites saarensis* Bharadwaj *Cristatisporites solaris* (Balme) Potonié & Kremp *Cristatisporites indignabundus* (Loose) Potonié & Kremp

cones of genera *Macrostachya* Schimper*, Calamostachys* Schimper and *Paleostachya* Weiss contained miospores and megaspores belonging to various dispersed species of the genus *Calamospora* Schopf, Wilson & Bentall. The most common are spores belonging to the dispersed species *Calamospora breviradiata* Kosanke, *C. hartungiana* Schopf, Wilson & Bentall, *C. laevigata* (Ibrahim) Schopf, Wilson & Bentall, *C. liquida* Kosanke, *C. microrugosa* (Ibrahim) Schopf, Wilson & Bentall, *C. mutabilis* (Loose) Schopf, Wilson & Bentall, *C. pallida* (Loose) Schopf, Wilson & Bentall, *C. parva* Guennel, *C. pedata* Kosanke and *C. straminea* Wilson & Kosanke. It is very difficult to distinguish single sphenopsid cones based on their spore content because all calamospores species are very similar and their classification is based on less important morphological features influenced by fossilisation and by stage of their preservation.
A few fertile fronds of some pteropsid plants contained miospores belonging to various species of dispersed genera *Laevigatosporites* (Ibrahim) Schopf, Wilson & Bentall*, Latosporites* Potonié & Kremp, *Leiotriletes* (Naumova) Potonié & Kremp*, Punctatosporites* Ibrahim*, Cyclogranisporites* Potonié & Kremp and *Raistrickia* Schopf, Wilson & Bentall.

No. 205/96/0066 Morphologic reaction of a model species during the extinction-recovery of an ecosystem (*Caliapora battersbyi*) (***P. Čejchan*** & ***J. Hladil***)
The morphological variability of this species slowly but continuously decreased during the entire stratigraphic interval of the Givetian stage (Moravian Karst and adjoined eastern Moravian subsurface). This decrease in variability has been documented as the raw data, and as on the calculations which reflect the probabilistic or heuristic corrections. In individual peaks and depressions, the variability is well-correlated with the age of the colonies. Some exceptions to this correlation occur, but they are limited only to the earliest and latest periods of the Givetian. Good, but locally imperfect correlation was documented also for exposure to mechanical factors. With respect to the diversity of the attendant corallomorphs, the variability is fairly independent. The relationship to biological attack shows an evident negative

correlation during, approximately, the earliest two thirds of the species´ history (populations M1-M18), whereas the final part possesses a slightly positive correlation(!). A slight positive correlation also exists in regard to the density of the population. Investigation of morphological patterns within the matrices indicate that some levels in particular during recovery from these depressions exhibit a special "<"-shaped feature; that means: a) encrusting and branched deviations in corallum shape; b) thin and upwards shifted couples of squamulae including some irregularities in positioning; c) larger spacing of tabulae. This morphological complex resembles an alveolitid "archetype" of the coral, which have been already deduced from atavistic feature as they emerged during the stages of intense stress and malformation (a paper which is in print, Fossil VII. Cnidaria Conference, Madrid). At the beginning, the decrease in morphological variability was in relationship to the evolution "of a stabilized stage in morphology" (a time interval after a half of the history of this species; times of the highest species abundance). The next decrease in variability could correspond to step-wise crises which cut the marginal representatives of the populations. However, the late populations did not always meet these conditions for reduced variability and these late stages of the decrease in variability were probably controlled by genetic constraints.

No. 205/93/0001 - Neoteny and paedomorphosis as evolutionary factors in Tertiary Amphibia. Evidence from paleontological and developmental data (***Z. Roček***)
The Tertiary Amphibia of Europe include some forms which are related to contemporary species but in which adults are much more ossified. When various developmental stages of a single taxon are documented in the fossil record, the cranial structures of adults of contemporary species correspond to earlier developmental stages of Tertiary forms; the postcranial skeleton is not affected. The phenomenon is exemplified by a common European Tertiary anuran *Latonia* (Discoglossidae); the cranial elements of subadults of *Latonia* correspond to those in adults of contemporary *Discoglossus*. Similar relations may be found between the Tertiary salamandrid *Chelotriton* and the contemporary *Tylototriton* and *Echinotriton*, and even between two Tertiary forms, *Chelotriton* and the Late Oligocene *Brachycormus*. Comparison revealed that the final pair differ not only in degree of their ossification but also in that *Brachycormus* retained ossified branchial apparatus, suggesting a shift towards neoteny. Since disappearance of heavily ossified forms and their substitution by forms ossified to a lesser degree correspond to periods of climatic deterioration in the Late Oligocene and Pleistocene, it is apparent that abbreviation of somatic development played a significant role in surviving these unfavourable periods.
[Accepted abstract for the Fifth International Congress of Vertebrate Morphology to be held 12 - 17 July 1997 in Bristol, U.K.; the abstract will be published in Journal of Morphology (New York)]

No. 205/94/0579 - The Bohemian Ordovician as a stratigraphic standard for the Mediterranean Region (*J. Kraft, Regional Museum of Rokycany,* ***R. Mikuláš, M. Vavrdová, M. Krůta, P. Štorch*** *and others*)
The aim of the project is an international correlation of the central Bohemian Ordovician within the framework of the peri-Gondwanan Europe, and to promote this sequence for the international stratigraphic standard for the Mediterranean region. Critical revisions of fossils and lithology of particular formations, stratigraphic evaluations of fauna and flora, and a paleogeographic study (i.e. inserting the studied region into the overall picture of Europe in the Ordovician) will be undertaken.
In 1996 R. Mikuláš studied ichnofossils of the Klabava Formation and of the Barrandian Ordovician, ferrolites and he revised the ichnogenera *Curvolithus* and *Pragichnus.* The stratigraphic distribution of the brachiopod genus *Aegironema* was studied along with the boundary section of the Vinice and Zahořany Formations. P. Štorch published a revision of the Late Ordovician graptolite *G. bohemicus* - a junior synonym of *N. persculptus.* The review on biostratigraphical dating of the Late Ordovician glacio-marine diamictites of the peri-Gondwanan Europe is under preparation. M. Vavrdová sampled the so far poorly known parts of the Barrandean Ordovician succession (especially the Letná Formation). The taxonomic revision of the acritarch genus *Multiplicisphaeridium* was submitted for publication; another paper contained a review of the palaeogeographic distribution of the Ordovician acritarchs. Morphologically distinctive species of acritarchs such as *Coryphidium bohemicum* and *Arbusculidium filamentosum* were utilised for the definition of distribution pattern of unicellular marine phytoplankton in the Early and Late Ordovician time interval. Provincialism of Early Ordovician acritarchs was demonstrated by the newly defined Coryphidium bohemicum

Bioprovince within the peri-Gondwanan sedimentary sequences. M. Krůta completed his studies of the evolution and biogeographical relationships between ostracode faunas of the Barrandian and Baltoscandinavia.

No. 205/96/0156 - Brachiopod fauna of the Lowermost Liassic in Northern Calcareous Alps (***M. Siblík***)
Detailed samplings at some Hettangian localities of the Northern Calcareous Alps yielded an abundant and varied brachiopod fauna. This contrasts with the generally accepted statement about the relative impoverishment of the lowermost Liassic brachiopod faunas in the Alpine chain. Localities such as Breitenberg with dominant terebratulids in marly sediments, Saubachgraben (Osternhorn Group), Hochleitengraben near Gaissau, and the Adnet quarries should be mentioned in this connection. Subsequent collecting in the Adnet area increased our knowledge of Middle-Upper Hettangian brachiopod assemblage which contains 25 species. Rhynchonellids prevail there in number, while spiriferinid species (*Liospiriferina*) are poorly represented. Recrystallization of the interiors of most shells made study of the internal characters and thus the revision of the generic affiliations of some species impossible. Results of the study of the Adnet brachiopod fauna will be published in the Jb. Geol. Bundesanst. Wien (l997).

No. 205/94/1744 - Global and regional factors, causing the relative sea-level changes and their influence on basin sediments and paleoenvironment (*D. Uličný, Charles University, Prague, S. Čech, Czech Geological Survey, Prague, J. Kvaček,* ***M. Svobodová*** *&* *L. Špičáková*)
The aim of the research of the last year of the project is the determination of the relative ages of isolated fossiliferous localities in the Bohemian Cretaceous Basin and recognition of their paleoenvironment.
Depositional conditions, fluvial sedimentation and the first records of the marine incursion were studied at three localities: Horoušany, Slaný and Brník. Sedimentological, palynological and macrofloristic investigations of the basal claystones emphasized the environmental differences between flora, new paleoclimatological results of the fluvial sedimentation and age of single localities. The fluvial style of the Horoušany was small shoal of a meandering river. The environment at the time of deposition was characterized by humid swampy vegetation contrary to the locality Slaný, where the palynospectra were composed predominantly of xerophytic vegetation. The oldest deposits (lower part of the Middle Cenomanian), from the palynological point of view, seem to be those of the Slaný and Brník localities. Many very small representatives of the angiosperm group, such as *Tricolpites minutus, Tricolpites parvulus* etc. have been recorded in the fluvial and brackish sequences. No triporate angiosperm pollen of the Normapolles Group has been found.

Grant Agency of the Academy of Sciences CR

A 313409 - Paleobiogeography of the Central European Variscides: Statistical evaluation of the assemblage similarities (***A. Galle, P.Čejchan*** *&* ***J. Hladil***)
The PAUP program was used to order in a hierarchy the similarities of the faunas of Devonian localities of European Variscides. For practical reasons, the time-slices used were as long as stages, and were characterized with genera. Respective faunal lists were extracted from the literature usually not older than 1980 and, when possible, confirmed by our own study or by consulting with respective specialist. This is the reason for the absence of some areas, particularly those from the former USSR.
The comparison of the Lochkovian assemblages did not yield any results because of inadequate data.
Comparison of the faunas of the Pragian of the Iberian Peninsula, Barrandian and Thuringia revealed that Iberian faunas differ from those of Barrandian, while Barrandian faunas are similar to those of Thuringia. It seems to confirm the peri-Gondwanan origin of the Saxo-Thuringian terrane as well as the sedimentation on both Barrandian and Saxo-Thuringian terranes near each other. Differences between the peri-Gondwanan Iberian and Barrandian faunas were caused by bathymetric differences and/or by Proto-Tethyan origin of Iberian terranes.
The Emsian localities in the Barrandian, Iberian Peninsula, and Moravia were studied. Iberian assemblages form a relatively homogeneous cluster separated from Barrandian

assemblages. The position of the Dalejan assemblage is notably similar to the Iberian assemblages as well as to the Moravian assemblage. It is, in our opinion, caused by bathymetry. This is supported also by the known Emsian eustatic sea-level rise.
Eifelian localities of Barrandian, Moravia, Rhenish Slate Mountains (RSG), Ardennes, Carnic Alps, Iberian Peninsula, and Turkey were also examined. Diminishing differences between the peri-Gondwanan and Laurussian assemblages is a characteristic of the Eifelian. Paleogeographically close Iberian localities still cluster together, Moravian and RSG localities are close to each other, but, on the other hand, Laurussian Horní Benešov, Ardennes, and Rohr in RSG are close to the peri-Gondwanan Carnic Alps and Turkey.
In the Eifelian, the separate position of the Acanthopyge Limestone and its distance from the Choteč Limestone is interesting. We explain differences in the Acanthopyge and Choteč assemblages by different bathymetry, though the position of the Acanthopyge Lst. assemblage is less clear. The fauna shows clear Givetian affinity the age based on conodont parastratigraphy is Eifelian; we provisionally placed the assemblage discussed into Givetian. There, the Acanthopyge Lst. assemblage does not show any peculiar position. It seems to confirm the migration of “Givetian-type” faunas into peri-Gondwanan Barrandian from the east as early as the Eifelian.
Givetian assemblages of Laurussian RSG and Ardennes, N France, Moravia, Harz, and Holy Cross Mts., and peri-Gondwanan Barrandian, Iberian Peninsula, Carnic Alps, and Turkey have also been studied. Although most of the localities studied are Laurussian, the differences between peri-Gondwanan and Laurussian assemblages disappeared. It corresponds with the tectonic shortening of the sedimentary basins and extensive communication among respective assemblages. It is also confirmed by known sea-level rise in Givetian.
Among Frasnian localities, the Laurussian ones predominate: RSG, Ardennes, N France, Harz, Moravia, and several Polish localities. The localities of the Iberian Peninsula are originally peri-Gondwanan. The occurrences cluster homogeneously on the resulting graphic trees due to the cosmopolitan nature of the assemblages, and the differences between peri-Gondwanan and Laurussian assemblages can not be traced. Clustering of Polish localities is conspicuous and can be an artifact. Their separation from the Moravian assemblages seems to confirm a certain degree of separation among Moravia and Poland during Frasnian. Moravian assemblages fit well into the group of RSG, Ardennes, and Harz. Iberian localities are statistically distant from each other due to the cosmopolitan nature of the Frasnian assemblages and their respective small differences.
Famennian localities have not been evaluated because of scarcity of data.

A 3013606 - Carnian spiriferid brachiopods of the Slovak Karst and Northern Calcareous Alps (***M. Siblík***)
Carnian spiriferid brachiopods coming from the Slovak Karst are the only major group of Upper Triassic brachiopods in that area that have not been studied in detail, despite their common occurrence. The marked external variability is characteristic *of Laballa suessi* (Zugmayer), known well from the Koessen Beds. Its occurrence in the Carnian of the Slovak Karst is thus surprising but this was already mentioned by Pearson (1977). The present study confirmed the external identity of the Slovak material with Zugmayer’s species, but at the same time the study of the internal characters of the Carpathian specimens proved an affiliation with *Laballa*. The very similar *"Cyrtina"(Laballa) ambigua*, based on 2 specimens from Silická Brezová, was described by Balogh (1940). Considering the extremely large external variability of *L. suessi*, the existence of "ambigua" as a good species seems unclear at present. Possible synonymy will require the comparison with Balogh´s type specimens deposited in Budapest. *"Spiriferina" halobiarum* Bittner, common especially in the Ostré vršky hill on the Plešivec Plateau, is usually affiliated with *Mentzelioides* Dagys. Evidence of this attribution should be proved in the Carpathian material as this species occurs only rarely in the Alps.

Organized Conferences and Symposia

Organization of the Final IGCP-335 Conference, Recoveries '97 Prague (***P. Čejchan & J. Hladil***)
The IGCP Project 335 aims to be a platform for the study of survival and recovery of the biosphere, and restructuring of global environments, following mass extinctions. The final meeting of the UNESCO IGCP Project 335 "Biotic Recoveries from Mass Exctinctions" will be held on September 12-14, 1997 at Prague, Czech Republic. The conference is held under the

auspices of the Geological Institute, Academy of Sciences, and is organized by *P. Čejchan* & *J. Hladil*. It will take place at the new IKEM Conference Building, Vídeňská 800, Prague 4. The conference is devoted to ecosystem restructuring after major ecosystem collapses during the history of the Earth (including the recent). Numerous extinction events were followed by recoveries and origination of new ecosystems. This significant transformation could be realized in numerous ways. The meeting should bring together paleobiologists, paleontologists, biologists, ecologists, systems theorists, and other persons that are interested in the topic.

The project outlines are:

(1) to study patterns of extinction/survivorship of organisms during the mass extinction events;

(2) to analyze the evolutionary and ecological strategies that allowed clades and communities to survive and initiate subsequent biotic recoveries;

(3) to study the structure of the deep-crisis ecosystem;

(4) to elucidate the recovery initiation mechanisms;

(5) to find the time, space and functional patterns of the recovery;

(6) to refine the data and tools for this discipline;

(7) to develop general models by means of comparison of individual global crises in Earth's history;

(8) to apply these (predictive) models to better understanding the modern environmental and biodiversity crises.

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9. Department of Exogenic Geology and Geochemistry

Foreign Grants and Joint Projects

International Geological Correlation Program, UNESCO

IGCP Project No. 384: Impact and extraterrestrial spherules and stratigraphic boundaries (*V. Bouška - Faculty of Sciences, Charles University, Prague, R. Sláma - National Museum, Prague,* ***V. Cílek*** *&* ***J. Krhovský***)

During the first year of research, a nearly complete bibliography of Czech and Russian studies from the area of former Czechoslovakia was summarized for the Debrecen meeting. The field research was concentrated towards searching for cosmic or terrestrial spherules in Devonian limestones of Bohemian and especially in the Moravian Karst where the Famenian-Frasnian boundary was studied. The latter has been considered by some authors to be impact-controlled. The insoluble relicts of the samples well biostratigraphically dated by conodonts were used for the study but no cosmic material has been found.

Pole-Equator-Pole III, PAGES, UNESCO (*F. Gasse, Leader of the group, University of Paris, France,* ***V. Cílek*** *national co-ordinator*)

The general aim of the PEP III profile is to cover the last glacial cycle (with special emphasis on the last 2,000 years) in paleoclimate profile Greenland-Scandinavia-Central Europe-Mediterranean-Africa-Antarctica. The Czech part of the project concentrates on climate synthesis. This is achieved by summarizing all relevant published data for the area of Czech Republic and nearby regions, and by filling the temporal and special gaps. Since the general funding of PEP III project is low the research is conducted by means of local grant support (e.g. see project „Dry climatic phases in the Middle Holocene“ in this volume).

Joint project of the U.S. Peace Corps, Management of the Landscape Protected Area of the Slovak Karst, and GLI AS CR

The Nature protection and Management of Silica Intermittent Lake (*Main co-ordinator - B. Kaliser, U.S. Peace Corps in Slovak Karst Environmental Office,* ***V. Cílek*** *- expertise*)

The project aimed for the understanding of lake level changes (the lake became completely dry in 1995) in Silica, Slovakian Karst Biosphere Reserve. The 27 open pits revealed a variety of Holocene sediments which together with detailed karstic research of the nearby karst

terrain lead to new data on karst hydrology and lake level dynamics. A new detailed plan of the lake management was invented and the main results published.

Grant agency of the Czech Republic

No. 205/95/1392 - Dry climatic phases in the Middle Holocene - correlation of isotopic and biostratigraphic methods (*J. Hladíková, Czech Geological Survey, Prague,* ***V. Cílek*** *&* ***V. Ložek***)
Dry climatic oscillations in the Epiatlantic and Subboreal represent the most important Holocene climate change. These changes are well recorded in accumulations of calcareous tufa deposited by karst resurgences. A calcareous tufa mound, about 40,000 m^3 in volume, was deposited in Svatý Jan pod Skalou in the Bohemian Karst. The spring is characterized by discharge close to 20 $l.s^{-1}$ and a virtually constant temperature of 11.3-11.6°C which indicates a large and deep groundwater reservoir. The middle part of the tufa complex is developed as 13 m thick strata covering the Middle Holocene approximately from 8,000 - 2,500 years B.P. The tufa body was studied by several independent methods. The dating was performed on the basis of malacostratigraphy, archaeology, AMS radiocarbon dating of charcoals, radiocarbon and U-Th series dating of carbonate.The paleoclimatological and paleoenvironmental analyses were conducted by biostratigraphical and stable isotopes methods. For the first time, the oxygen isotopes paleoclimatic curve was constructed for the larger part of Bohemian Holocene displaying not only a series of temperature oscillations but important similarities with the Greenland Camp Century ice record.

No. 205/95/0841 - Structural and textural characteristics of the main genetic types of clastic Quaternary sediments in the Czech Republic (***E. Růžičková, A. Zeman*** *&* *M. Růžička, Czech Geological Survey, Prague*)
Complex research of glacial deposits was completed both in the field and by cameral methods. Rare flow till was documented together with typical lodgement till in one of the southernmost localities of glacial sediments at Blahutovice. Thin section studies (applied for the first time in Quaternary sediments in the Czech Republic) showed massive structures of lodgement till with more or less preferred orientation of elongated sand clasts. Parallel bedding expressed by intercalation of finer and coarser grained layers is characteristic for subglacial melt out tills.
Coluvial sediments were studied over a large area. They posses many different structural and textural features depending on the processes of their origin (gravitation, solifluction, run-off etc.). Their grain-size distribution depends mostly on the source material (character of weathered products), the structural features resulted from the environmental conditions and processes of transport and sedimentation. Different types of sediments were documented in the field, some details were studied using thin section of samples.
In the succession between typical eolian sediments (loess) and coluvial deposits many transitional facies are recognised starting with debris containing an admixture of eolian silt to loess with scattered clasts cumulated sometimes into more or loess continuous layers. Structures of some layers within loess complexes indicate run-off processes during their deposition.
Fluvial sediments represent a very important genetic group. Gravels and sands of river-bed facies were studied in numerous sections in terraces of the Labe River and its tributaries. Some of our finds indicate a much more complicated construction of terrace bodies than was believed (periglacial phenomena, interlayers of laminated overbank muds - both proving interruption in sediments).

No. 205/96/0011 - Geochemical, biological, and anthropogenic mobilization factors of selected minor and trace elements in the course of the rock weathering (***P. Skřivan****, D. Fottová, Czech Geological Survey, Prague,* ***M. Burian, O. Kvídová, L. Minařík*** *&* ***J.K. Novák***)

Chemical weathering of silicic and mafic rocks, and of the separated biotite phase was simulated through leaching experiments in acid solutions at room temperature. The course of weathering was verified by the modal analyses of the studied rocks and by chemical analyses of their individual minerals. Results indicate that highly mobilized Cu and especially the toxic Cd may cause a potential environmental risk during chemical weathering under acidic conditions, if no complexation reactions with soil organic matter occur. To compare the significance of the main mobilization factors (abiotic, biotic and anthropogenic) of the studied

elements during the course of rock weathering, the chemical composition of the bulk atmospheric precipitation, beech/hornbeam- and spruce throughfall, and surface discharge was determined throughout the year in the Lesní potok catchment area. In accordance with the aims of the project, a new type of throughfall collector was developed and tested. The collector was found to eliminate all malfunctions of the hitherto employed collector types. The collected set of chemical data represents an essential basis for the evaluation of mass-balances of the individual elements in the studied system. Present results show that the metabolic activity of the forest tree vegetation represents an extremely important mobilization factor for manganese. This discovery was confirmed by the vertical distribution of Mn in forest soils (in a beech forest stand on granitic bedrock). To compare the mobility of studied elements, and to evaluate the impact of the tree vegetation on their mobility in regions with different kind of bedrock, an experimental landscape with contrasting underlying rock (carbonate rocks of the Bohemian Karst) has been selected and equipped with the appropriate devices for the study of the chemistry of bulk precipitation and throughfall.

No. 526/96/1041 - The effect of soil cover erodibility on surface water contamination (*M. Janeček, Research Institute for Soil and Water Conservation, Prague,* ***P. Skřivan, O. Gottstein*** & ***M. Burian***)
The chemical aspects of the research subject (the course of interaction of suspended matter with surface water) were studied in the model system involving the artificial rainwater and the runoff of heavily contaminated (with extremely high concentration of Pb, Sb, Zn, and Cd) soil, obtained during the experiments carried on in the Mini Rainfall Simulator Eijkelkamp.
Composition of the artificial rainwater (AR) was evaluated to correspond to the mean concentration of selected principal components (Na, K, Ca, Mg, Fe, HN^{4+}, SO_4^{2-}, NO^{3-} a Cl^-) obtained throughout the bulk precipitation sampling in the Černokostelecko region since 1993. The pH of the AR containing the suspended soil particles was then appropriately modified with a mixture of H_2SO_4 and HNO_3 (6:5) acids. The liquid and solid phases were separated after selected equilibration time through centrifugation and membrane filtration and resulting pH was determined. The studied time span of the equilibration of individual samples was chosen within 10 min. and 15 days. The liquid samples were stabilised with diluted HNO_3 and they have been subjected to AAS analysis for the content of selected trace elements (As, Cd, Cu, Fe, Mn, Pb, Zn, complete results are so far not available).

No. 404/94/0604 - Settlement and development of the Holocene flood plain of the Labe River between Nymburk and Mělník (*D. Dreslerová, Archaeological Institute AS CR &* ***A. Zeman***)
The study of the Holocene Labe River flood plain dynamics was finished in 1996. In the middle course of the Labe River flood plain the occurrence of three levels was confirmed, two flood plain terraces (higher and lower) and the present flood plain. These three levels provide evidence for the existence of three periods when the river reached graded profile which means that the river neither erodes nor accumulates.
The *higher flood plain terrace* represents a remnant of an Early Holocene flood plain of the Labe River; its surface lies 4 m above the present river level. The age of these sediments was dated by means of radiocarbon and varies from 9,490 to 10,370 years B.P. Remnants of abandoned meanders on its surface are very typical. At the locality Kozly, the filling of these meanders was dated 8,800 years B.P.
The *lower flood plain terrace* represents a part of the Labe River flood plain. This terrace is composed of two layers. Accumulation of the lower layer started 7,700 - 8,500 years B.P. The surface of this accumulation was colonized in Neolithic. During the Neolithic this surface was suddenly buried by gravel and sand deposition. This materials formed the top of lower flood plain terrace and from Eneoliothic was colonised.
The *recent flood plain* is the narrowest one in comparison with former parts of the Labe River flood-plain. This very frequently flooded area is covered with fluvial looms. Numerous oxbow lakes occur on its surface and the water communicates with the water of the Labe River bed.

Grant Agency of the Academy of Sciences of CR

A 3013603 - Biogeochemical cycles of trace elements, their sources and redistribution in a catchment with granitic bedrock: a model study (***P. Skřivan****, J. Bendl, Analytika s. s r.o. Prague,* ***M. Burian, O. Gottstein, O. Kvídová*** & ***L. Minařík***)
The aim of this study is to determine the content and speciation of several less common trace elements in the abiotic and biotic compartments of a model landscape (catchment-area) and

to evaluate their main biogeochemical fluxes. The study takes the advantage of employing the unique analytical procedure (ICP-MS), which enables to determine a broad spectrum of elements (both essential, indifferent, and environmentally hazardous, such as Cs, In, Mo, Rb, REE, Sb, Se, Tl, U, V, W, Zr, etc.), sometimes in extremely low concentrations.
The content and flux of the elements has been studied in the basement rock (Říčany Massif), soils, bulk atmospheric precipitation, beech/hornbeam and spruce throughfall and surface water of the experimental catchment-area "Lesní potok". The impact of acid atmospheric precipitation and of the metabolic activity of forest trees on the elements mobilization has been studied through their distribution (and temporal changes in the distribution) in soil profiles and through the mass balance of their fluxes in the experimental catchment-area.

Grants of the Ministry of Environment

Quaternary geology and malacozoology of Podyjí National Park (***V. Ložek*** *&* ***V. Cílek***)
A small monograph (80 pp.) summarised the fossil and the modern malacozoology research of this important and only recently opened area around the Dyje Valley (frontier zone between the Czech Republic and Austria). The most important results were described in the former annotations. The 1996 activities concentrated on the preparation of the monograph.

Molluscs of the Protected Landscape Area Labské pískovce (***V. Ložek***)
The plan of unifying Czech and German „Elbe Sandstones" frontier area into one large National Park (NP) lead to detailed malacozoological research of about the same scope and purpose as the NP Podyjí research. About 70 sites have been so far searched and analyzed and the total number of localities should exceed 100 so precise environmental evaluation is emerging.

Standard massif activity and the weathering of Pravčice Sandstone Arch (*J. Zvelebil, Institute of the Rock Structure and Mechanics, ASCR, Prague &* ***V. Cílek***)
The program is focused on understanding the standard massif activity: i.e. the movement of the Arch as measured at six places by J. Zvelebil, and rock crust formation and salt destruction studied by V. Cílek. Two antagonistic processes seem to play the most important role in sandstone relief formation: (a) - surface hardening and the origin of rock crusts. Endocrusts or interior crusts originated along the sandstone surface by cementation of silica or less commonly of ferruginous crusts and some salts. It may be an ancient or quite modern phenomenon. Exocrusts or exterior crusts originate on the surface of sandstone mostly as ferric infiltrations on the walls of tectonic fissures and they are mostly of Tertiary age. The isolated rock pillars and towers owe their shape mostly to the protective secondary hardening. The minute globulae of opal were frequently found in castellated rocks of Česká Lípa, Kokořín and Labské pískovce regions; (b) The antagonistic mechanism to surface hardening is represented by salt weathering. The acid rains attack cement of the quartzose sandstones to produce gypsum, K-Al sulphates and variety of other salts such as ammonium nitrate of possible microbial origin and anthropogene salts - chlorides, phosphates and others ones. Most of salts are destructive. They behave in three basic destructive modes: (I) - salt efflorescens and subflorescences attack the several mm thick layer of stone and they cause peeling off small scales or individual grains; (II) - salt blisters attack and often totally decompose 3-5 mm thick outer layer, and (III) - salt subflorescences developed under rock crust may cause peeling off pieces of rock several kilograms heavy.
The opal and salts are components of the same solutions percolating in rock massif. Their precipitation at the ends of capillary water pathways may cause both - the hardening and the destruction as well. However the most frequent case is rock hardening and rock crust evolution. The evolving crust is subsequently perforated and complex microrelief with numerous small cavities often develops behind the crust

Industrial grants

Cement Bohemia Praha a.s.- Beroun. - Geological salvage research in the area of the Čertovy schody Quarry (***A. Zeman*** *&* ***V. Suchý***)
Present mining activities for limestone in the Čertovy schody Quarry (Koněprusy area, Beroun District) in the western part of the Bohemian Karst have revealed a number of steep, almost vertical depressions that penetrate several dozen metres into Devonian carbonate sequences. These features resembling solution pipes appear to follow presumably older, south-north-

oriented thick mineral veins filled with hydrothermal coarse-grained calcite. Most of the depressions are of circular cross section and about 10 metres or more in diameter. Sedimentary fill of the cavities is locally well stratified and includes Tertiary clastics and Cenomanian marine sediments (glauconitic sandstones and Turonian marlstones occurring at approx. 450 metres a.s.l.). Further down the hollows, thick brown and reddish clay and sandy sediments of uncertain age occur that reach several dozen metres in thickness. Our findings have two-fold geological importance: (1) The Upper Cretaceous deposits have been found in the central part of the Bohemian Karst, following earlier reports by Kukla, Zelenka and other investigators, which, in turn, increases our knowledge about the paleogeography of the Upper Cretaceous period in the area studied; (2) There is a thick sequence of sediments of unknown age present beneath the Upper Cretaceous sedimentary cover that may be of Lower Cretaceous or older age. If so, this sequence may clearly serve as a powerful potential source of geological information with respect to the pre-Cretaceous history of the Bohemian Massif which, so far, has largely been obscured due to the lack of sedimentary record of that age. Our present activities concentrate on the exact dating of these sediments and the relationship of solution depressions to the adjacent hydrothermal veins.

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10. Department of Paleomagnetism

Foreign Grants and Joint Projects

National Museum of Natural History, Leiden (sponsored by The Netherlands Oil Company)

MAGNETOARGOS - Magnetostratigraphic Investigations of Early Cretaceous Limestone Beds, The Río Argos Area, Provincia Murcia, SE Spain (***M. Krs, V. Houša, P. Pruner, D. Venhodová, O. Man,*** *J. M. Parés*, *Barcelona, Spain & Ph. J. Hoedemaeker*, *Leiden, The Netherlands*)

Magnetostratigraphic results derived for the Jurassic/Cretaceous boundary strata at Brodno near Žilina (Western Carpathians, Slovakia) were the basis for extending similar high-resolution studies to next localities in the Tethyan realm. Two localities were selected for investigations, in the Río Argos area (Subbetics, SE Spain) and in the Bosso Valley (Umbria, central Italy). Altogether 361 oriented hand samples were collected from the Early Cretaceous limestone beds in the Río Argos area during 1995. All these samples were systematically investigated by means of paleomagnetic and magnetomineralogical methods. Two Reports were prepared. It has been clearly proved that the carrier of remanent magnetization in the limestone samples is magnetite with an unblocking temperature less that 540 - 560°C showing three components of remanence. Similar properties are shown by numerous Mesozoic limestone samples from other localities in the Tethyan realm, which are generally suitable for derivation of magnetostratigraphic scales. However, detailed magnetomineralogical and multi-component analysis studies led to an unexpected finding that the limestone beds from the Río Argos were either totally demagnetized during the Neogene (with post-tectonic remanence) or partially demagnetized during the folding process (with syn-tectonic remanence). The results obtained are useful for the methodology of the next magnetostratigraphic investigations of limestone beds in other localities in the Tethyan realm. Consequently, a publication with methodological findings is under preparation. However, the authors were able to find a substitute locality suitable for high-resolution magnetostratigraphy across the Jurassic/Cretaceous boundary strata at Carcabuey (S. Spain). Pilot samples from Carcabuey show extremely suitable properties for derivation of paleomagnetic directions (precise Zijderveld diagrams, accurate separation of secondary and primary components of remanence, good paleontological records based on ammonites and calpionellids). In addition to the above studies, laboratory investigations of samples from the Bosso Valley were partly investigated in 1996. The Project MAGNETOARGOS was sponsored by The Netherlands Oil Company (due to courtesy of Dr. Ph. J. Hoedemaeker).

Joint project of Geological Survey of the Slovak Republic, Bratislava and GLI AS CR

Deep structure and geodynamic model of the Western Carpathians, paleomagnetic investigations 1996 (***P. Pruner***, ***M. Krs, O. Man, J. Slepičková*** & ***D. Venhodová***)

Basic paleomagnetic data were derived from pilot samples collected from the Tatricum, Manín and Križna units spanning the Triassic, Jurassic and Cretaceous periods. Dr. M. Rakús from the Geological Survey of the Slovak Republic, Bratislava took part in the field collection of hand samples, from which laboratory specimens were prepared for detailed paleomagnetic and petromagnetic studies. Respective remanence components were separated by means of the multi-component analysis after application of progressive thermal demagnetization procedures. Phase changes of magnetically active minerals were also investigated during laboratory thermal treatments. Preliminary data indicated localities suitable for next detailed paleomagnetic investigations. The localities with rocks with normal and reverse paleomagnetic directions in particular are the primary targets for next investigations.

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11. Department of Sedimentology and Stratigraphy

Foreign Grants and Joint Projects

Deutsche Forschungsgemeinschaft, Bonn.

Reef limestone of Koněprusy (Lower Devonian, Czech Republic), with special emphasis on bryozoa and algae. (Die Koněprusy Riff-Kalke (Unterdevon, C.R.) unter besonderer Berücksichtigung der Bryozoen und Algen) (*G. Flajs, Rhein-Wesfälische Technische Hochschule, H. Hüssner, Geologisches Institut, Universität Frankfurt a.M., FRG &* ***J. Hladil***)
The joint studies corroborate the existing pilot data in two directions: First, the bryozoan debris dominated by thin fragments of fenestellids represents 30-45% of the bioclasts in the entire skeletal accumulation which underlyies the proper Koněprusy reef (Zlatý kůň Hill). The bryozoan component is also significant for the reef body itself, although its percentage volumes considerably fluctuate along the horizontal sections. Second, the occurrence of algae is limited to the late stages of the Pragian sedimentation. The algae are abundant almost exclusively in the upper part of the reef, or adjacent facies (passages with multidirectional cross-bedding, platform, algal bioherms rims). They were never abundant in the lower part of the Koněprusy Pragian limestone. Based on the biofacies data, the Zlatý kůň reef was exposed towards the south/south-east, whereas the opposite end of the section displays features of a backreef. The facies below the Koněprusy reef display a transgressive "climbing" towards the north-west. The true reef stage must be assigned only to the Middle/Late Pragian levels when the aggradation of the buildup reached the contact with the sea-level: abundance of algae; the reef terraces and pebbles in the eastern part of the Quarry West (Čertovy schody) or in the northern part of the Quarry East. The lithology of these pebbles (subaerally altered lagoonal packstone) indicates an emerged atoll-lagoon as a source. However, the shape of this lagoon is unknown because this source area lies below the Očkov overthrust). It also means that this reef is not directly rooted in the sequence boundary between the Kotýs and Koněprusy limestones but its base rests on the older crinoidal-bryozoan grainstone/rudstone. Regression of the shore-line back towards the south-east is indicated by the latest stages of the Pragian reef facies.

Stromatoporoids (demosponges) of the Koněprusy reef, Lower Devonian, Czech Republic (Die Stromatoporoidenfauna der Koněprusy Riff-Kalke, Unterdevon, C.R.) (*A. May, Universität Münster, FRG &* ***J. Hladil***)
The rocks and cements in thin-sections of the Barrande-Počta collection (National Museum of Prague) were investigated for a revision of the former stratigraphical classification. Only the following taxa originated from the Koněprusy Limestone (Pragian): three representatives of the genus *Stromatopora* (*S. latens* Počta, *S. compta* P. and *S. florida* Novák, sensu Počta), two representatives of the genus *Clathrodictyon* (*C. neglectum* Počta and *C. subtile* P.), and one species of the genus *Actinostroma* (*A. contextum* Barrande). On the other hand, the common and true actinostromid species *A. frustrulum* is seen evidently in some specimens from the Eifelian. Although they were labeled as Plešivec, in recent terminology the material points to other sites which lie on the Kobyla Hill. Of course, this actinostromid differs from the representatives of the genus *Plectostroma* which dominate the rocks of Preissler and Jirásek quarries on the w. slope of the Kobyla Hill. *Actinostroma vastum*, which is also labeled as

Plešivec, is embedded in red limestone of compactite type (with *Syringaxon*, *Cladopora*, *Cupressocrinites*, and *Gasterocommma*). Both the lithology and biota correspond either to the very Late Pragian of so-called "upper Vinařice facies" or early fills of the Suchomasty limestone within the neptunian dykes (Emsian). This stromatoporoid is only imitating the morphology of actinostromids. The thin sections with the label *Stromatopora columnaris* are mostly representatives of the genus *Salairella*, and this material includes at least two species which originate definitely from the Acanthopyge limestone (Eifelian). *Clathrodictyon clarum* P., from Plešivec also, grew in close commensalism with other organisms, e.g. worms (*Helicosalpinx*, *Trypanopora*) and tabulate corals (*Caunopora*-type). This common commensalism as well as the surrounding rock and appearance of the cements makes assignment to Pragian very doubtful (probably Eifelian). Field work in the Koněprusy area provided the new data about the distribution of stromatoporoids (in process): Over 90% of their occurrences are limited by the reef of Zlatý kůň Hill, about 5% are scattered on the adjoined platform, margins, or within the pinnacle coenitid reefs, and only rare occurrences are in the older facies of the Koněprusy Limestone. The actinostromids (2-3 species) and stromatoporoids (3-5) species are dominant on the reef, whereas the clathrodictyids with common ?*Stromatoporella* (about 4 species) occupied the deeper niches.

Joint research of the Mineralogical and Petrographical Institut, University of Basel, Switzerland and the GLI AS CR

Vitrinite reflectance and shear-induced graphitization in orogenic belts (*M. Frey, University Basel, Switzerland &* ***V. Suchý***)
Vitrinite reflectance (VR) is an important indicator of incipient metamorphism and it has been generally assumed that temperature and, to a lesser degree, time are the two main variables. The potential role of stress on VR remains, however, much less clear and is addressed in the present study.
In the Kadersteg area, N of Lake Oeschinen (central Switzerland), four different Helvetic tectonic nappe units are outcropping, comprising mainly limestones, marls and greywackes of Mesozoic and Lower Tertiary age. VR (R_r, R_{max}, R_{min}) and illite crystallinity (IC) were identified from a very steep section at elevations between 1 700 and 2 900 m a.s.l. In general, R_r, R_{max} and IC increase from tectonically higher to lower units, i.e. from upper diagenetic (2-3 to 4-5% R_r) to upper anchizonal conditions (3-4 to 5-6% R_{max}).
Many samples contain, in addition to coaly fragments, abundant semigraphitized and graphitized particles that appear to be of authigenic origin. “Transitional matter” shows R_{max} values ranging from 7 to about 11% and R_{min} of 1.3-3.4% ; “optical graphite” shows R_{max} of about 15-16% and R_{min} of 1.6-1.8%. There is good textural evidence that tectonic deformation has played a major role in the development of these strongly coalified particles. The first tiny needle-like crystals of graphitic material occur within narrow shear zones transecting the rock matrix. The beginning of graphite formation parallels the onset of plastic deformation and dynamic recrystallization of quartz. Strongly elevated vitrinite reflectance (R_{max}) and bireflectance values are found near thrust planes, where microscopic observation on quartz grain morphology indicates an increase in strain intensity. It is suggested that frictional heating associated with thin shear zones was responsible for the formation of authigenic graphite in the Kandersteg samples.
Our results indicate that an intimate association of different types of apparently authigenic organic matters with contrasting reflectivities is probably a common feature of many intensively deformed subgreenschist and greenschist-facies sediments. Vitrinite grains in one single rock sample may exhibit highly contrasting reflectivity values and thermal experience due to the local influence of frictional heat. This implies that vitrinite-based paleogeothermometry in strongly deformed sediments of high thermal maturity requires careful separation of coexisting types of vitrinitic particles.

Peri-Tethys Programm

Cenozoic paleogeographic map series of the northern Peritethys area (*Co-ordinator: J. Meulenkamp, University of Utrecht, the Netherlands, national co-ordinators: K. Holzová, Charles University, Prague,* ***J. Krhovský*** *&* ***M. Konzalová***)
Drafts of seven paleogeographic maps of Peri-Tethys area were prepared for Ypresian, Lutetian, Late Rupelian, Early Burdigalian, Langhian, Tortonian and Pliocene at the meeting in Bratislava.

Origin and distribution of the Oligocene „Menilite facies“ in basins along the East European margin (*Co-ordinator: M. Kováč, Faculty of Sciences, University of J.A. Komenius, Bratislava, Slovak Republic, national co-ordinator:* ***J. Krhovský***)
Aim of the project was the environmental modelling of the origin and distribution of siliceous laminites in the Lower Oligocene sequences along the continental margin through integrated paleontological, sedimentological, geochemical and paleomagnetic studies. Inferred model of siliceous laminites origin is based on several findings: (1) biogenic origin of silica (diatoms, silicoflagellates, ebridians, cysts of archaeomonads, spicules of siliceous sponges); (2) blooms of siliceous phytoplankton reflect increase in productivity probably due to seasonal upwellings of the deep waters accumulated in the partly isolated marginal basins of early stages of the Paratethys, and (3) good preservation of silica point to low dissolution rate in deposits rich in organic matter accumulated in semi-locked basins. Slightly acid chemistry pertinent to silica preservation may be, on the other hand, the cause of the absence of calcareous microfossils in Menilite facies. The second cause may be primary, a competition with opportunistic siliceous phytoplankton. Accumulations of diatoms are concentrated at intervals of eustatic highstand and may represent the drier phase of the long eccentricity orbital cycle.

Faculty Research Grant Programs, Earth Sciences, State University of New York, Oneonta

Sequence stratigraphy of Upper Silurian through Middle Devonian strata in the international stratotype areas of Bohemia, Czech Republic: Phase 1 - Pragian and Lower Emsian (*J.R. Ebert, State University of New York, Oneonta,* ***J. Hladil*** *&* ***P. Čejchan***)
The upper part of the Lochkov Formation displays coarsening upwards (turbidites to tempestites); the regularity of cycles is progressively disordered. The Koneprusy elevation displays an example of a very late Lochkovian downlap which is accompanied by the occurrence of intertidal sediments and hardgrounds. The pre-woschmidti lowstands mark a sequence boundary with truncation (type 2). The onset of deposition of the Praha Formation, subsequent to the base-"la" shallowing of Johnson et al. (1985), is characterized by skeletal debris on the elevations and wide-spread lime-mud deposits in depressions. Thinning and fining in the outskirts of the sequence corresponds to *sulcata*-peaks of the sea level rise. After the *kindlei*-peaks, the rest of the Pragian is characterized by thickening of the alodapic banks in the basin, but development of the ammonitico rosso facies on the emerging elevations and numerous gaps and truncations on the elevation (Koněprusy). The large depression in sea level height between the *pireneae* to early *gronbergi* zones resulted in a distinct unconformity. The elevated parts were emerged and truncated, whereas the slopes indicate condensed sedimentation which was truncated by channelized debris flow (Kaplička). The distinct base of the Zlíchov Formation is not a result of a partial sea-level maximum of the *gronbergi* zone, but it reflects mainly the tectonic changes of the sea floor (the early Emsian directions of the sedimentary transport, to the W, differ from the Pragian ones, to the SE). The Zlichov Formation represents an upward thinning and fining sequence which is disappeared within the middle Emsian Dalejan Shale. The Mid-Emsian Daleje Event (Walliser 1995) is related to a singular highstand peak. The symmetric cycles of early Třebotov Limestones, e.g. separated lime-mudstone beds round the "I-b/I-c" eustatic intervals, contrast with the imperfect rhythmicities that prevailed concurrently with the disappearance of the shale. The Choteč Event is pronounced, similarly to other Devonian events, by strong sea level fall-and-rise anomalies. The progradding of thick turbidite and tempestite beds marks mainly the basal parts of the Choteč Limestones (Suchý 1990); the continuation is characterized by thinning upwards, which ends by fine cyclic structures rich in silica (radiolarians and sponges; the late "I-c" sea level rise. The end of the Eifelian (*kockelianus* zone) is marked by rising disturbances in cyclic stratification. After the very significant sea level fall-and-rise anomalies of the Kačák Event, the tectonic changes in the basin caused the covering of the former carbonate ramp-to-slope area by pro-delta siliciclastic sediments. The observed stacking and sequence markers are compared with the Appalachian foredeep.

International Geological Correlation Programs, UNESCO

IGCP Project No. 326: Oligocene-Miocene transition in the Northern hemisphere (*Co-ordinator M.A. Akhmet'iev, Russian Academy of Sciences, Moscow, Russia, national co-ordinator* ***J. Krhovský***)

Material for the biostratigraphic and eventostratigraphic correlations were collected in Oligocene to Lower Miocene sequences in the Romanian Eastern Carpathians and Transylvania, Lower and Upper Austria. Facies changes around the basal Šitbořice and basal Ždánice-Hustopeče events were recognized as sequence boundaries corresponding to the 3rd order eustatic sea-level falls. Responses to the circulation changes driven by paleogeographic evolution, sea-level fluctuations and climatic oscillations are traceble in all studied areas of the Paratethys.

IGCP Project No. 335: Biotic Recoveries from Mass Extinctions (*Project leader D. Erwin, Czech representative **J. Hladil***)

- An attempt to define the ecological concept of refugia using basic system deliberation (***J. Hladil & P. Čejchan***)

Refugia conditions are fairly different from those that dominate diversified ecosystems but the former concept that conditions in refugia are simply worse is misleading. Precisely defined, they need not be worse or better but simply different. The ultimate conditions encompass the absolute limits of organic adaptive capability. The refugia conditions cannot be equal to conditions of thrifty systems or ultimate conditions but they must have some advantages, at least in survival probability (nutrition and reproduction). Usually, the total sum of utilizable biologic nutrients in the refugium is the same or bigger than those that were accessible in structures thrifty systems. Possible refugium-taking strategies are: (i) shift to environment just below the ultimate limits; (ii) taking the so-called super-tramp strategy; (iii) minimizing metabolism and preference for omnivorous sustenance, and (iv) utilizing unstable zones within the zone of medium-high environmental stress. This survival is realized, for example by: (i) appearance of new, in-crisis activated strategies, and (ii) neighbouring with refugium allowing the passive diffusion. Some characteristics aided in overcoming the crisis. They are, for example: (i) less nutrient requirements and/or less selectivity for nutrient sources, and (ii) short reproduction, so-called ***r*** strategy. Briefly we can say that some organisms are successive in crisis environments; this success depends on the capacity to migrate, survive and then emigrate to other regions. Are the refugia physically outlined or not? When they lack any physical boundaries they are part of an internal exchange within the system. Such phenomena are to be conceptualized separately and they need another label. The concept of refugia can be effective only when a real system of natural refugia can be demonstrated. From the stand-point of refuge quality, two types of refugia can be distinguished: large and stable reservoirs, e.g. the deep ocean (stable refugia) and zonal and quickly changing boundaries of systems (stationary refugia).

- Cascade of causally linked effects of rapid glaciation-deglaciation events: A possible cause of non-selectivity of mass extinctions (***J. Krhovský & P. Čejchan***)

Absence of selectivity during mass extinctions in the marine realm is regarded as an artificial feature appearing when a mass extinction is examined as a singular event without any inner structure. The cascade of causally linked effects of rapid glaciation-deglaciation event, as a model of mass extinction killing mechanism, may explain both the stepwise pattern of mass extinctions and the broad ecological spectrum of their victims. The coupling of glaciation and rapid deglaciation can lead to a decline of thermophilous organisms during the glaciation period and the disappearance of many stenohaline pelagic and benthic aerobic organisms during environmental perturbances at the time of rapid deglaciation. They further broaden the ecological spectrum of the organisms wiped out. Mechanisms of rapid glaciation and deglaciation are discussed in detail. Abrupt onset and termination of volcanic production of sulfate aerosols are considered as one of the possible ultimate causations of the cascade of environmental changes.

IGCP Project No. 325: Correlation of paleogeography with phosphorites and associated authigenic minerals (*Project leader J. Lucas, University of L. Pasteur, Strasburg, France*)

- Phosphate occurrences in the rocky-coast facies (Cenomanian-Turonian boundary interval, Bohemian Cretaceous Basin) (***J. Žítt***)

Phosphatic crusts, microstromatolites, invertebrate coprolites, and ichthyolites occur in the Kaňk Member of the Peruc-Korycany Formation and in the Bílá Hora Formation of the Bohemian Cretaceous Basin. The study of phosphate microstructures, geological position, paleontological content and distribution provided the material for a partial paleoenvironmental reconstruction of the studied time-interval. The sites of phosphate crust formation were supplied by suspended mud particles deposited even on steep to subvertical bottom rocky

substrates. Early diagenetic phosphogenic environments of the bottom muddy depositional sites (i.e. below the water-sediment interface) suffered frequent small-scale disturbances causing the recycling of organic remains.

Grant Agency of the Academy of Sciences CR

A 3013503 - High-resolution graptolite stratigraphy and correlation of the selected Lower Silurian sequences of the Peri-Gondwanan Europe (***P. Štorch***)
Based on the large amount of biostratigraphical data from Bohemia, Spain, Portugal, Italy (Sardinia), and some data from Germany, France (Corsica) and Austria (Carnic Alps), a standard graptolite biozonal scheme of the Lower Silurian of peri-Gondwanan Europe is being elaborated. Spanish sections especially and graptolite faunas from the Central Iberian Zone, Western Iberian Cordillera, and Asturia-Leon Zone were studied during the second year of the project. Several biozones of the late Llandovery and early Wenlock (*lapworthi, insectus, centrifugus, murchisoni*) have been recorded for the first time in the Iberian Peninsula. In general, the graptolite faunas of deeper shelf areas closely resemble graptolite faunas of Bohemia (Barrandian area). On the other hand, shallow shelf areas of the Iberian lower Silurian yield considerably different assemblages. Faunal differences which complicate elaboration and application of the joint zonal scheme may be likely explained by different bathymetry of the individual areas. The true biogeographical differences appear to be unlikely within the peri-Gondwanan Europe.
The basal Silurian *ascends- acuminatus* Biozone of the peri-Gondwanan Europe was analyzed and reviewed. In the world-wide scale the existence of the two principal paleobiogeographical provinces was suggested in this time interval.
The Lower Silurian graptolite faunas and biozonation of the Yangtze Platform were studied during the author´s visit to China. Detailed correlation with peri-Gondwanan Europe and a review on biogeographical faunal differences are under preparation.

Grant Agency of the Czech Republic

No. 205/95/1516 - Biotic crises and post-crisis recoveries recorded by Bohemian Silurian graptolite faunas (***P. Štorch***)
Graptolite records and stratigraphic-range charts utilized in the earlier analysis of the Silurian graptolite dynamics in Bohemia (Štorch 1995) were completed with the addition of new data. Current research was primarily focused on the Lower Silurian sequence which allows a more detailed approach, and on global correlation of extinction and speciation rates and diversity curves. The Bohemian data were plotted in local Lower Silurian graptolite zonal chart, being composed by 27 biozones. Each of the biozones were further subdivided into the lower and upper parts respectively. Thus 54 reference stratigraphical intervals were recognized to locate fluctuations in graptolite diversity as precisely as possible. The Czech biozones were correlated with the generalized zonal chart employed by the Subcomission on Silurian Stratigraphy in order to obtain a reasonably precise correlation with local zonal charts used in widely separated territories around the world.
Six graptolite mass extinctions have been recorded from the base of the Silurian System to the top of Wenlock Series. A new mass extinction event was identified at the top of the *acuminatus* Biozone. Although the extinctions are of different magnitude, in every case less than 50% taxa survived the top of the reference interval. The data have not been callibrated with respect to zonal duration. The six Lower Silurian graptolite mass extinctions, as well as another three in the Late Silurian, are prominent, and wide-spread around the world; they can not be artifacts of the methodology. At least six of the nine crises are well correlatable with the most significant drops in global sea-level. On the other hand, the mid-Aeronian, basal Telychian, upper Telychian and basal Homerian highs in graptolite diversity correspond with periods of relatively high stand of sea-level.
New results were presented at 2nd International Symposium on the Silurian System, Rochester, N.Y. (Štorch 1996) and by several lectures. Some papers which deal with graptolite systematics were submitted (e.g. Loydell & Štorch, in press), some other are in progress (Štorch, a monograph on graptolites of the *convolutus* Biozone).The paper reviewing

the graptolite record from different palaeocontinents to reveal actual global trends and changes in graptolite diversity is under preparation (Melchin, Štorch and Koren).

Industrial grants

Cement Bohemia Praha a.s., Beroun. - Geological salvage investigation of carbonates in the Devonian reef of the quarried area Čertovy schody, with emphasis on biofacies/facies and stratigraphy of the Koněprusy Limestone (*Project leader **J. Hladil**, members L. Slavík, Masaryk University, Brno, **P. Čejchan,** & **A. Galle***)

The quarries of the Koněprusy area provides a unique view of Pragian biostratigraphy, where the transitional facies between the pelagos and benthos in particular have been studied. Twenty two lithological-biological facies have been defined and subsequently placed in an idealized stratigraphical column, they are: 1. breccia with Lochkovian clasts; 2. red crinoidal debris with rhynchonellid brachiopods (the lower Vinařice facies); 3. embryonal mud mounds, with stromatactis structures; 4. crinoidal facies with "roots" of big crinoids; 5. crinoid-bryozoan limestone, slides, thick homogeneous deposits; 6. crinoid-bryozoan limestone, bars and multidirectional cross-bedding; 7. bryozoan "deep water" biostromes and bioherms; 8. crinoid-bryozoan-coral "black" facies, pigmented clasts, increase in content of P, C, and Si; 9. coarse bioclastic sediments, dolomitization and recrystallization, stocks and lenses, rich in P, C, Si, Mg, S and Fe; 10. limestone conglomerate, lagoonal rocks in pebbles; 11. marine cave and fissure fills, micrite and coquina of trilobite carapaces; 12. algal bioherms, *Renalcis*, *Frutexites*; 13. rudstone with abraded corals and pebbles (light-coloured; the Voskopa facies); 14. in-situ accumulations of giant fore-reef shells, the Plešivec facies; 15. Solenoporaceae-bearing, crinoid-bryozoan-algal-coral facies of platform; 16. Slided and fissured crinoid-bryozoan-algal facies of the platform margin (giant bothryoid cements in cavities); 17. cephalopod lime-mud with big orthoconic cephalopods and ostracods; 18. *Coenites-Procerulina* pinnacle reefs; 19. coral-stromatolite-stromatoporid block reef structure; 20. reef terraces, branched coralla facies; 21. lagoonal facies with onkoids, lime-mudstone to grainstone; 22. red, intraclastic and bioclastic grainstone, large shells of bivalves and rostoconchs (the upper Vinařice facies). At the base of the Koněprusy Limestones, a gap in stratigraphical record has been documented, which corresponds to the global lowstand in *pesavis* Zone. The missing record of the *pesavis* Z. has been documented also on flanks of the elevation (Tmaň). The upper sequence boundary was set at the end of the *kindlei* Z. and was definetely developed during the *pireneae* Z. The entire sequence of the Koněprusy Limestone is well-corresponding with the Sandberg's eustatic cycle Ia; the sedimentary record in the central part of the Koněprusy elevation represents only the highest Ia-highstand peaks, ?middle part of the *kindlei* Z. The setting of the Koněprusy buildup was based on: the Ia-cycle sea level maxima were lower that the maxima before and after the Pragian, and the Late Lochkovian tectonic elevation along a pennate, dextral-transpression fault.

Cement and Lime Company Mokrá a.s., Brno-Mokrá. - Determination of visible technological markers and biostratigraphy of the Late Devonian limestone formations in Mokrá (***J. Hladil, P. Čejchan** & **A. Galle***)

Twenty-eight colonization surfaces have been reconstructed and four overall ecological parameters, diversity, biomass production, coverage, and patchiness/uniformity of the sea floor have been studied.

A significant correlation marker was exactly placed to the critical decrease after re-introduction of the gradient values from the TSP series. This marker can be easily traced in the quarry by groups of white syringoporid corals which are covered by clayey brachiopod coquina of greenish color. The main theoretical results concern the patterns of ecosystem recovery: *Recovery - reconstruction of a similar ecosystem:* (1) Coincident peaks of both benthic diversity and associated biomass production are typical. After the crisis, an increase in diversity preceded the overall growth of biomass; (2) The uniformity and coverage displayed similar evolution. However, the trends to utilize all of the possible surface appeared with a slight delay. The latter process was pronounced just after the decay of the mosaic structure (benthos), and (3) The intensive crises of the end of the Frasnian caused decrease in all parameters, i.e. diversity, biomass, coverage and uniformity. Offset of decreases in the evolution of individual parameters can be formulated by the following hypothesis: (a) first signal of recovery after the post-crisis depletion is a slight rise in diversity; (b) this first diversity increase was still related to isolated patches and mosaic structures, whereas the uniformity of the carpet rose rather later, and (c) trends to higher coverage and increase in biomass

productivity continued the recovery process. *Recovery - origination of an entirely different ecosystem:* (1) Fatal extinction of relict corallomorph assemblage was characterized during a "pre-extinction peak of diversity". Three trends were typical: rapid decrease in biomass production + decay in structures in favor of rising uniformity + attempts to spread in thin mottled films over the all accessible surface. This configuration signalizes a serious jeopardy of the ecosystem, and (2) A couple of divergent trends, i.e. decrease in biomass production vs. increase in coverage, and decrease in taxonomical diversity vs. increase in uniformity of plane-geometry of cover are related to the fatal crisis. This end crisis of Mokrá bears on a critical reduction of recovery sources, as well as change of conditions in the Horákov Bay.

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12. Program of Advancements in the Scientific Research in the Key Directions of Science persued at the Academy of Sciences CR

(12a) K1-012-601 Project No. 5: Geophysical processes and structure of the Earth (Bohemian Massif namely)
Subproject: Paleozoic evolution of the Bohemian Massif terranes integrated into the history of the European Variscides (***F. Patočka, J. Fiala, A. Galle, J. Hladil, M. Konzalová, M. Krs, M. Krůta, O. Man, J.K. Novák, P. Pruner, J. Slepičková, M. Svojtka, P. Štorch, J. Ulrych, M. Vavrdová, D. Venhodová, Z. Vejnar*** & ***J. Waldhauserová****)*

PRINCIPAL RESULTS:
The Bohemian Massif is an integral part of the suture zone of the European Variscan Belt. The zone, where formerly independent terranes were amalgamated throughout the Early Paleozoic, was transformed into the Variscan orogen during the Early Carboniferous by collision of the Laurussia and Gondwana supercontinents. In the earliest Paleozoic some terranes of the Bohemian Massif (e.g. Barrandian and Saxothuringian Zone) belonged to Gondwana as the fossil communities and paleomagnetic data interpretations indicate. A large-scale extension and fragmentation of the Gondwana northern margin is documented by Cambro-Ordovician intrusives and bimodal volcanics of the Teplá-Barrandian Zone and West Sudetes. The Moravo-Silesian Zone was a peri-Laurussian terrane. The initial differences between faunas, characterizing peri-Gondwanan and peri-Laurussian terranes of the Bohemian Massif in the earliest Paleozoic, disappeared in the Devonian due to gradual convergence of both supercontinents. The terrane convergence resulted in subduction of the attenuated Saxothuringian lithosphere below the northern margin of the Teplá-Barrandian Zone. Individual terranes performed clockwise rotations (of 80° to 140°) prior and during the accretion processes. The waning of subduction and final disappearance of oceanic lithosphere (separating the individual terranes) towards the end of Devonian is indicated by 360 Ma old HP-LT metamorphism of the oceanic crust related basalts of possibly Ordovician age in the West Sudetes. The collision of Gondwana and Laurussia plates significantly narrowed the Moravo-Silesian Zone in the Carboniferous.

IMPORTANT INDIVIDUAL RESULTS:
(a) Variscan terranes: The facies disjunctions among the segments of basin fill in Moravian and Barrandian Devonian, with the respect to metamorphic terranes of Ještěd and Rýchory Mountains, Moravian Shear Zone, a.o. (***J. Hladil***)
The study results in a correlation of facies and basin fills (***J. Hladil****, J. Otava, Czech Geological Survey, Brno*), terrane geology and deformation *(P. Orel, Czech Geological Survey, Brno, R. Melichar, Masaryk University, Brno*), and paleomagnetism (***M. Krs, P. Pruner***). Conclusions are as follows: (1) Facies: The facies disjunctions of the Moravian Devonian belts run the magnitude of n×100 km. These tectonically individualized facies belts represent different parts of the Devonian extension basin of Rhenish-type. The trans-European continuity (and former sub-rectinilinear/sub-latitudinal course) of the distinct Devonian belts corroborates a very strong narrowing and clockwise rotation of the Moravian Devonian belts. The entire concavity of these belts exceeds 90° and the differing clockwise rotations of the Devonian rocks in slices widely fluctuated (80-160°; comparison between the facies pattern after deformation and model facies arrangement for the Devonian); (2)

Structures: The arrangement of segmented Variscan nappe structures suggest an extreme narrowing of the Moravian Zone. The W part of Moravia was pushed towards the north and the E part towards the south. The rheologically individualised zones rotated with dispersal about 80-140° clockwise finishing during the Late Carboniferous times. The 40 km-wide Moravian Shear Zone (along the Boskovice Furrow) is a very young Variscan feature. Strong rotation of the central and eastern Moravia was connected with rotation of the neighbouring Moravian, Moldanubian and Czech Cadomian terranes; the Czech Cadomian terrane with its Barrandian Palaeozoic cover was presumably cut from the former continuation of the Saxonia-Thuringia in the south-east being rotated clockwise and consequently pushed against the latter area; (3) Paleomagnetic data: The Devonian rocks of the Moravian Karst belt yielded the succession of the remanent magnetization components which clearly indicate their clockwise rotation. The total rotation related to the present reference net ranges along the interval of 105-134° clockwise (the difference from the Devonian remanence, the C-component). With regard to the Devonian-stable-Europe reference net, the paleotectonic rotations within the Moravian Zone are of the order of 65-94° clockwise.

(b) Metasediments of Variscan and pre-Variscan complexes of the Bohemian Massif (***M. Konzalová***)
A rest of small multicellular organisms have been revealed in the Kutná Hora crystalline complex. together with products of microbial communities and microfossils, partly mineralized, partly preserved as organic matter in various degree of alteration.

(c) Palaeomagnetic investigations aimed at global-tectonic interpretations and palaeogeography of Variscan and pre-Variscan formations in Europe (***M. Krs, P. Pruner, O. Man, J. Slepičková & D. Venhodová***)
In 1996, the palaeomagnetic investigations were entirely concentrated on the Devonian rocks in the Barrandian area. Pilot hand samples (n = 45) of the Devonian limestone were collected from the localities of Koněprusy, Hostim, Quarry Prastav, U dubu sedmi bratří, Zlíchov and Branická skála. Detailed palaeomagnetic and petromagnetic data were derived for all the samples collected, respective remanence components were separated by means of the multi-component analysis (using J.L. Kirschvink's method). The samples of the Devonian limestones from the localities of Hostim, U dubu sedmi bratří, Quarry Prastav and Branická skála showed suitable palaeomagnetic properties; consequently, the next samples were collected from the above localities. Preliminary results indicate that the derived virtual-pole positions fall within the theoretical model illustrating palaeotectonic rotations for rocks older than the Carboniferous, values of palaeotectonic rotations differ from locality to locality. However, palaeogeographic reconstructions will require additional collections of oriented samples for detailed palaeomagnetic investigations.

(d) Palaeomagnetic investigations of formations close to the contact zone between the Bohemian Massif and the Western Carpathians (***P. Pruner, M. Krs, O. Man, J. Slepičková & D. Venhodová***)
Palaeomagnetic investigations were focused on Devonian and Carboniferous rocks from the Moravian Zone. Oriented pilot samples of rocks of different origin (limestones, greywackes, siltstones, shales) were collected from the localities of Jevíčko, Vitošov, Mohelnice, Jesenec, Újezd near Boskovice and Slavoňov. The main task of the work was to select sites with suitable palaeomagnetic properties so that sets of samples would be enlarged for next palaeogeographic reconstructions based on mean palaeomagnetic data. From the original set of samples of 49, only 24 were found suitable for palaeomagnetic investigations. Despite a small set of data, the newly derived values of palaeomagnetic declination and inclination for the localities of Mohelnice and Slavoňov are in agreement with previously derived Devonian directions, virtual pole positions for the localities of Jesenec and Vitošov are in agreement with those of the Early Carboniferous. Additional samples have to be collected with the aim to enlarge data sets needed for more precise derivation of R. Fisher's statistics values (semi-vertical angle of the confidence cone, precision parameter at the 95% probability level, e.g.).

(12b) K1-042-603 Project No. 6: Atmospheric and lithospheric processes with special reference to the territory of the Czech Republic
Sub-project: Dynamics of lithospheric processes (***V. Suchý, J. Bek, P. Čejchan, A. Galle, Š. Eckhardtová, J. Fiala, V. Houša, J. Hladil, M. Konzalová, J. Krhovský, M. Krs, M. Krůta,***

M. Lachmanová, R. Mikuláš, J.K.Novák, O. Nekvasilová, L. Peza, Z. Roček, M. Svobodová Z. Vejnar & J. Žítt)

IMPORTANT INDIVIDUAL RESULTS:

(a) Organic microfacies of Barrandian Lower Paleozoic (***Š. Eckhardtová, V. Suchý****, I. Sýkorová, Institute of Rock Structures and Mechanics AS CR & P. Dobeš, Czech Geological Survey, Prague*)

In the Barrandian basin a thick sequence of graptolite-rich Silurian black shales was protruded by bed-parallel basaltic sills that caused an extensive contact alteration of enclosing sediments. The degree of shale alteration was examined by means of graptolite reflectance measurements. R_0 % values of graptolite cortex gradually increase from 0.7% R_0 in the adjacent unaltered shale up to 2.0% R_0 characteristic of samples immediately close to the intrusive body. From Barker and Pawlelicz´s (1986) equation it follows that these reflectances correspond to the maximum temperatures of 74°C and 280°C, respectively. Basaltic sills themselves are crosscut by a number of small ptygmatic veinlets that are filled with calcite, quartz, chlorite, analcite and prehnite. Solid brittle bitumen (R_0=1,07%) and yellowish waxy substances are also present in some veins. Fluid inclusion research on quartz crystals separated from the veinlets reveals the presence of abundant brightly blue- and yellow-fluorescing primary liquid inclusions which are likely composed of light oils. Homogenisation temperatures of the inclusions (T_{hom}) vary between 57°C and 150°C, with the most values between 80 and 100°C.

We believe, that higher hydrocarbons entrapped in vein minerals represent petroleum-like products which were generated essentially "instantaneously" with respect to geological time when basaltic sills intruded into organic-rich sediments. This process may have been similar to the present-day generation of hydrothermal petroleum from immature organic matter as in has been observed in Guayamas Basin and elsewhere.

(b) The prograde metamorphic series of the Teplá Crystalline Complex and the Zone of Erbendorf-Vohenstrauß - a geochemical and Sr-Nd isotopic comparison (***J. Fiala,*** *F. Henjes-Kunst, Bundesanstalt f. Geologie u. Rohstoffe, Hannover, H. Müller-Sigmund, Institut f. Mineralogie, Petrologie u. Geochemie, Universität Freiburg &* ***Z. Vejnar***)

Recent geodynamic models for the crystalline basement in the W part of the Bohemian Massif mostly assume a tectonometamorphic equivalence between the Teplá Crystalline Complex (TCC) and the Zone of Erbendorf-Vohenstrauß (ZEV). Current studies investigate whether the correlation of TCC and ZEV is also true for the geochemistry and Sr-Nd isotopic characteristics of their sedimentary protoliths.

Major elements relations indicate that the sedimentary protoliths for TCC sequence consisted of immature (pelitic) greywackes. In appropriate projections all TCC samples lie within the variation range of ZEV paragneisses. Major and trace elements patterns of both units are best comparable with those of recent sediments from continental island arc (CIA) setting. In comparison with average upper continental crust (UCC) in general, highly incompatible elements are less enriched and highly compatible elements are less depleted in both units. Special minima in relation to UCC in the case of Ca, Sr, Nb and Cu and one maximum in the case of V were observed. This is also in accordance with the assumption of a CIA-type setting lacking geochemically evolved continental detritus.

REE spectra in general are similar to those of post-Archean shales with LREE enriched, smooth patterns and negative Eu anomalies. Several samples from the lower metamorphic part of the TCC, however display a distinct positive Ce anomaly with the other LREE less enriched. This feature is attributed to LREE leaching under oxidising conditions during sedimentation while Ce^{4+} remains in the sediment. This samples gave also higher Sm-Nd model ages (T_{DM}=1.8-2.0 Ga), while all others yielded lower model ages of 1.1-1.5 Ga. Sr_i for all samples was fairly constant and compatible with the assumption of a dominance of detritus which is isotopically not highly evolved.

Geochemical and isotopic characteristics of the TCC very closely resemble those observed in the ZEV paragneisses. This evidence indicates that both units were coevally deposited and share either the same or at least a compositionally similar source region.

(c) Paleoenvironmental interpretations of early Oligocene palynomorphs of the Pouzdřany Formation (***M. Konzalová***)

In the upper part of the Pouzdřany Formation and the lower part of the Uherčice Formation (South Moravia) the changes in the composition of organic-walled microfossil content occured,

namely within the biozone NP 22. The section is characterized by common laminated deposits. The short time intervals display different associations of vascular plant pollen derived from land and also different assemblages of phytoplankton. Only Pinaceae, inclusive *Picea*, *Tsuga,* and *Cedrus,* were found almost in all fossiliferous portions of sections. At several levels the existence of shore swamp communities of Taxodiaceae and Cupressaceae were recorded along with the communities of drier fagaceous forest with common represented Juglandaceae (*Engelhardtia*). The admixture of the so called Arctotertiary elements reaches up to 3% only. Nevertheless, the whole composition of the communities demonstrates the trend of gradual lowering of temperature. Also the record of key fossil *Boehlensipollis hohli* W.Kr. is worthy of mention for these communities. The taxa of phytoplankton show a prevailing offshore condition; the littoral forms (*Tasmanites, Homotryblium, Crassosphaera*) occur rarely. Besides littoral and offshore communities, the taxa with euryhaline *Wetzeliella* that tolerate estuarine conditions and occurs often with *Pediastrum* were identified. *Pediastrum* was recorded within the layers with freshwater diatoms and within the non calcareous clay at the base of the Uherčice Formation. Within one portion of the Pouzdřany marl, the higher frequency of angiosperm pollen, low frequency of organic-walled phytoplankton and rich association of calcareous plankton with species tolerate to lower salinity (*Braarudosphaera bigelowii, Dictyococcites ornatus*) were recorded. This demonstrated the short-duration outwash and input of terrigenous material into the marine basin; these facts were also demonstrated in two other portion of sections. Also the rich fuzinite corroborate this periods of probable lower salinity.

(d) Ichnological record of paleogeographical and climatic changes in the Bohemian Massif (***R. Mikuláš***)

The progress in ichnology (i.e. the study of fossil and recent traces) in past decades has shown that most of the sedimentary processes and events are recorded also by trace fossils. The proposed ichnological research is directed toward the sedimentary units of the Bohemian Massif with particular emphasis on the solution of paleogeographical and climatic problems.
(1) Recent and subrecent surfaces of Czech castellated sandstone rocks and hardened sandstone clasts in Quaternary sandy taluses provided cylindrical tunnels representing bees' nests. This phenomenon might contribute to knowledge of Quaternary climatic changes; (2) Some biogenic structures from the Peruc Member (nonmarine Upper Cretaceous, Bohemian Cretaceous Basin) have been reinterpreted. The grooves and ridges on fossil leaves have been recognized as representing traces of burrowing organisms which originated in soft sediment near plant remains lying on the lake floor or buried in the substrate. The leaves functioned in the sediment at the time of burrowing and/or during a compaction of the substrate as distinctive laminar bodies with specific physical characteristics, and therefore they enabled the preservation of some aspects of ichnofabric otherwise invisible in the surrounding rock. Therefore the knowledge of the ichnological content of the Peruc Member has been improved; moreover, this phenomenon has no published analogies abroad.

(e) Petrological research of the diatreme in Teplice - Šanov spa (***J.K. Novák***)

As an independent volcanic body, the Miocene breccia pipe occurring in close proximity of the Horský thermal spring (NE part of the Teplice-Šanov spa) was studied. Granulation breccia was split into fragments corresponding to both highly weathered olivine basalt (white in colour) and vitric alkali basalt. The weathered basaltic fragments showing green pseudomorphs after olivine contains a well-crystallized, mixed-layer kaolinite/smectite as the dominant mineral, dark volcanic fragments are decomposed to beidellite smectite only. Rhyolite, rhyolitic ignimbrite, granite porphyry, metagranite, silicite, and marlstone are allochtogenous fragments. The laboratory investigations and the obtained data provide to evidence of repeated eruption on the chimney body. The sedimentary sequences exposed in the surroundings of the locality are predominantly composed of the Upper Cretaceous marlstones and limestones, including silicified basal conglomerate.

(f) *Diptyxis* Oppenheim (Nerineacea, Gastropoda) from the Lower Cretaceous of Albania. On the distribution of *Diptyxis* (***L. Peza***)

A short overview of the gastropod genus *Diptyxis* Oppenheim and its palaeogeographic distribution was given. Three species, including two new ones were studied and described: *D. lutickei* (Blanckenhorn), *D. munellae* n. sp. and *D. mirditae* n. sp. These species originated from the Barremian-Aptian deposits of the northern part of the Mirdita zone, Munella Mountain and Lura Region (Northeast Albania). They were reported for the first time from the Balkan

Peninsula.

(g) *Adaptyxis* n. gen. (Nerineacea, Gastropoda) from the Mirdita Zone of Albania (***L. Peza***)
A new genus and two new species of nerineids (Gastropoda) are described from the Lower Cretaceous deposits of the Mirdita zone, South Albania. *Adaptyxis* n. gen., and new species *Adaptyxis lavdaris* n. sp. and *Adaptyxis carinatus* n. sp. are studied and correlated with other nerineid genera and species. The fossil material originated from the Barremian-Aptian conglomerates and sandstones of the Buzemadhe Hill west from the town of Korca, south part of the Mirdita zone (Albania).

(h) Assemblages of amphibians in European Tertiary: Paleogeographic deduction (***Z. Roček***)
- An overview of the anuran fossil record (*B. Sanchiz, Museo nacional de ciencias naturales, Madrid, Spain &* ***Z. Roček***)
A general overview of the known anuran fossil record is presented, with an emphasis on diversity and extinct groups. The fossil record is analyzed for all anurans at the family level, and palaeontological minimal ages are inferred. Most of the record can be referred to extant families, but a few exceptions remain: the South American Jurassic *Vieraella* and *Notobatrachus*, the Asiatic Cretaceous *Gobiates* and the holarctic palaeobatrachids are especially discussed in this regard. However, the real evolutionary pattern appears to include a few examples of extinct diversifications within the order Anura, unless this merely derives from sampling bias of the known fossil record. Diversity in the past has not proven to be higher than today, and it seems to have been growing very slowly through time. At least 10 Jurassic and Lower Cretaceous sites (dated>100 Ma) are known where multiple anuran remains have been recovered. In all these localities, one or a few anuran species were detected per site, but in no case have more than two very closely related genera been found. More diverse assemblages, including more than one family, are presently known only from the Upper Cretaceous and later. We consider the example of Europe, with a fairly rich fossil record, clearly documenting the role of addition, by means of transcontinental migration and minor speciation events, in the development of present anuran biodiversity. Finally, consideration is given to the relationships of the Palaeobatrachidae. This extinct family, known from the Upper Cretaceous to the Plio-Pleistocene boundary (roughly 66 to 1.6 Ma) can be considered the sister-group and ecological equivalent to the living Pipidae.

(i) Microfossils of bituminous diatomites at the Kundratice lokality in the České středohoří Mts. (***M. Konzalová***)
Two different assemblages of microfossils were found within the bituminous diatomites and tuffaceous diatomites at Kundratice locality (Jesuitengraben in Engelhardt) that differs in composition of identifiable organic components and microfossils.
The lower level of diatomites, rich in bituminous matter is composed of algal organic detritus at different stages of decomposition and contain closely packed pollen exines of terrestrial and aquatic plants (e.g. *Nymphaeapollenites*). The low admixture of arctotertiary pollen is the characteristic feature of this community. In contrast, they are richly represented in the woodland recorded in pollen within the clayey sediments of the upper level. The change of environment along with change of plant communities is well demonstrated.

(j) Basin analysis and thermal history of the Barrandian terrane (***V. Suchý***)
It was found that carbonate and shale sequences of the Barrandian Lower Paleozoic basin contain abundant bed-normal, north-south-trending calcite veins of syn- to post-tectonic nature. The veins are filled with massive calcite, dolomite, chalcedonic silica, minor sulphides and a variety of manganese minerals. Fluid inclusion measurements on calcite samples indicate precipitation of the veins from $NaCl$-$CaCl_2$-$MgCl_2$ brines of variable salinity, at 55-120°C. Field observations show that the process of veining and vein calcite precipitation was associated with an extensive dissolution of enclosing carbonate sequences. In particular, unusual subvertical cavities of cylindrical shape link spatially to the calcite veins at some places. It has been suggested that these cavities that are often filled with (pre)Upper Cretaceous sediments may represent the “dissolution pipes” from which the carbonate was removed by circulating hydrothermal solutions. Structural analysis reveals that NS-trending calcite veins control the occurrence of many caves in Barrandian carbonate sequences. Hydrothermal origin of at least some caves in the area appears to be also supported by a common occurrence of so-called “Koněprusy rosettes”. These represent unusual, cauliflower-shaped speleothems composed of alternating layers of chalcedonic silica and carbonate that

precipitated on the walls of some Barrandian caves. The "Koněprusy rosettes" may have originated from warm mineralized solutions in a way similar to the hydrothermal siliceous geyserites or "Carlsbad popcorn" to which they are strikingly similar.
These observations provide for the evidence that the sedimentary sequences of the Barrandian basin were extensively altered by warm fluids that were responsible for hydrothermal veining, dissolution of carbonate rocks and caves formation. A work is in progress to investigate the origin of the fluids, their evolution in time and space and the timing of individual hydrothermal events.

(k) Biostratigraphy of clayey accumulations in the Štramberk Limestone (Plaňava Formation) (***M. Svobodová***)
The Štramberk limestone bodies (Tithonian) near Štramberk contain lithologically different rocks of the Lower Cretaceous age. Claystones and marls of different colours from brown, grey to dark grey contain more or less well preserved plant microfossils, marine microplankton, chitinous linings of foraminifers and scolecodonts.
The most interesting palynomorph association was found in Š 91, where stratigraphically important dinoflagellates - *Batioladinium longicornutum, Muderongia staurota* and others were found, which can confirm the Hauterivian age of the studied deposits. No angiosperm pollen were observed.

(l) The Devonian/Carboniferous boundary in Northern Bolivia (***M. Vavrdová***)
60 samples from two boreholes situated in Northern Bolivia, Manuripi X-1 and Pando X-1 were processed with the aim of a stratigraphical and paleoecological assessment. Latest Silurian, Early Devonian, Frasnian and Famennian assemblages of acritarchs, miospores and chitinozoans were distinguished. Affinities to coeval palynological associations from South America, Northern Africa and Western America suggest plate-tectonic interaction between western Gondwana and eastern Laurentia during the Devonian.

(m) Taphonomy and paleoecology of selected groups of invertebrates (Crinoidea, Echinoidea, Brachiopoda, Bivalvia) in the Upper Cretaceous sequences. Importance for the sedimentary environment and its changes (***J. Žítt, L. Peza*** & ***O. Nekvasilová***)
Comatulid crinoids were studied from the point of view of distribution of isolated skeletal elements in sections of the Kaňk Member and Bílá Hora Formation in the rocky-coast facies. Taphonomic features of *Remesimetra* and *Semiometra* in the Velim section indicate increased rate of burial regardless of lithology and C_{org} content in the rock (uppermost Kaňk Member and lowermost Bílá Hora Fm.) and absence of mechanical wear (relatively low-energy environment). Comatulid event was traced on the base of the Bílá Hora Fm. in the eastern part of the study area.
Study of echinoid decorticated spines revealed that decortication is not taphonomic but rather diagenetic process of dissolution and disintegration of the surficial stereom layer.
Taphonomy of the thecideid brachiopods from the shallow-water environments of the world is so far little known. The Bohemian species (genera *Praelacazella*, *Eothecidellina, Thecidiopsis*) seem to be very susceptible to mechanical wear. Not only both brachial and also strong pedicle valves are very fragile and their occurrence, together with still articulated shells, sugests an environment of low agitation and rapid burial. The same is proved by overgrown small bioclasts. In situ findings document that all types of solid substrates were suitable for these cementing species.
Study of rudist bivalves from the Předboj, Radim, Plaňany, and Velim localities shows only about 3 species to be represented, indicating the Upper Cenomanian age of sections.

(n) Paleozoic metasediments of the Bohemian Massif, selected objects at the transition between the Variscan internal and external belts (***J. Hladil***)
Ch. Pin (*CNRS - Blaise Pascal Univ., Clermont-Ferrand, France*) and *F. Patočka* discovered oolite rocks embedded in metamorphozed marble of the Rýchory Mountains, in the low-grade metamorphozed Poniklá Group (Suchý Důl, Dolní Albeřice). The metamorphic history and structure of both carbonate rocks were investigated in detail (*J. Hladil, A. Galle, G. Dieken, W. Rottke*). Originally, three possibilities were tested: (1) fills in karstified relief; (2) fills in subsurface hydrothermal chambers, and (3) tectonic detachment and emplacement in a newly formed pile of slices. The data show that the third of the previous assumptions is right. *Different metamorphic history:* As shown in Cl-luminescence, the replacement of ooids by dolomite happened in 3 major phases, with saddle dolomite as the latest. Subsequent

changes on the carbonate of particles, former cement and low-metamorphic aggregates shows retrograde features, e.g. replacement by calcite, grain/size diminution (finally again in deep vadose circulation - Cl-bright fills, channels and rims along the corroded aggregates). Assumed depth of burial could reach about 10 km. The marble has another history: According to relict structures, this marble was formerly a dark gray corallomorph-bearing packstone (?Givetian), its dolomite-calcite mosaic was equilibrated in higher p-T conditions of ductile zone (about 20 km). Later retro-grade events were reflected by depletion in dolomite, with granulation of the crystals. *Structures and metasomatism:* The lithons and boudines of the oolite rock are on the faults. However, the metamorphic banding of the marble copy the shape of the oolitic segments; if not deflected, the metamorphic banding of marbles corresponds to extremely elongated isoclinal folds. Brittle deformation prevails in the internal parts of the oolite blocks whereas the margins are mostly rounded, schistose, with wrinkles and folds. Contact between the oolite and marble is often masked by hydrothermal alteration, i.e. quartz-calcite-sulfate veins. The massive quartz metasomatosis gluttonizes more the oolite than the marble. Thus, this metasomatism affected the tectonically embedded boudines “in place”; this metasomatosis was post-kinematic. In addition, the alternated carbonate bodies of marble and oolite rock have been obliquely amputated by a thrust over which with a retrograde, wrinkled phyllonite occurs. Age of this thrust represents the upper limit of the processes described above. Indications by fossils (?*Receptaculites* cf. *guilinensis* Yu.), facies (massive oolite depositions) and isotopes (Sr, *F. Patočka*) favor a Famennian age of this oolitic carbonate, approximately 365-355 Ma.

(o) Tithonian and Berriasian calpionellid associations (***V. Houša***)
The goal of the present project is to recognize general changes in calpionellid associations in Jurassic/Cretaceous boundary strata, to study them in detail with the objective of recognizing main changes, to establish their exact stratigraphic position in terms of the magnetostratigraphic zones and other scales of biostratigraphic zonation, especially the ammonite zonation, and to correlate them to different distant localities in the Tethyan region. Finally, the calibrated magnetostratigraphic scale will be compared with the magnetostratigraphic scale of the J/C boundary strata in the Boreal region with the goal of correlating them exactly, and with them correlating exactly the biostratigraphic scales in both regions.
In the last year pilot samples were taken and studied from the classic locality of J/C boundary strata in the Bosso Valley (Umbria, Italy) together with pilot samples for magnetostratigraphic investigations. The approximate position of the principal events in calpionellid associations and boundaries of magnetostratigraphic zones in this profile was established. Obviously biostratigraphic events appear independently of magnetostratigraphic events. Nevertheless in one case an exact coincidence exists between one important event in calpionellid evolution (i.e. appearance of *Calpionella grandalpina*) and the base of reverse magnetozone M-19. This coincidence of both events was seen in all studied localities, especially in Brodno (West Carpathians), Bosso (Italy) and Rio Argos (Murcía, Spain). In Rio Argos area pilot samples were taken and studied from the Tithonian part of the profile „Z“ near Caravaca and several proof samples (also for magnetostratigraphy) from Tithonian part of profile by the J/C boundary beds in Carcabuey (Granada, Spain).

(p) Cephalopod limestones of the Barrandian basin (Silurian), Czech Republic: Sedimentary environments and stratigraphic significance (***V Suchý., J. Krhovský & Š. Eckhardtová***)
Sedimentological and taphonomical aspects of Silurian cephalopod limestones in the classical Barrandian area in Bohemia were studied. Cephalopod limestone levels are here developed in upper Wenlock (*T. testis* Biozone), in lowermost Ludlow (*C. colonus* Biozone), in Middle Ludlow (*M. fritchi linearis* Biozone), in uppermost Ludlow (*M. fragmentalis* Biozone), in lowermost Přídolí (*M. parultimus* Biozone), and in uppermost Přídolí (*M. transgrediens* Biozone).
Individual cephalopod horizons or “banks”, in which cephalopod shells are the dominant rock-forming constituent with some bivalves and brachiopods occasionally present, appear to have originated from a series of repeated gravity flows ranging from debris flows to turbidites. Field observations indicate that most of bioclastic material originally accumulated on former submarine highs which were drowned volcanic seamounts, with cephalopod primary accumulations on top. We think that some part of the shells may have floated for some time to allow postmortal accumulation by surface currents along shorelines or on the flat tops of

submerged volcanoes. From these shallow-water locations cephalopod shells, along with other bioclasts, have been subsequently redeposited by gravity flows into deeper-water environments. Although decisive evidence is lacking, from the sedimentological context it appears likely that much of inferred gravity transport was in fact triggered during major storms that episodically influenced Barrandian shelf.
In proximal facies, bedding-parallel sheet cracks, neptunian dykes, slump folds and a variety of graded beds have been recognized in some sections and attest to mass movements down slope. On the slopes of submarine volcanic highs cephalopod sediments moved downhill to produce debris flow and turbiditic graded beds that were deposited in relatively deeper-water basinal setting on the foot of slope or below the seamounts.
Resedimented concentrations of cephalopod shells build the uppermost parts of several transgressive-regressive, coarsening-upward sequences which typically prograde into the basinal setting. At least two of these cephalopod limestone-terminated sequences (in uppermost Ludlow and in uppermost Přídolí) appear to be the result of eustatic fluctuations rather than local or regional epeirogeny. The distribution of cephalopod beds in Barrandian stratigraphic record generally reflects periods of sea level falls. It is suggested that eustatically controlled horizons of resedimented cephalopod shells can serve as a correlative tool to some other Lower Palaeozoic sedimentary basins.

(12c) K1-017-602 Project No. 22: The influence of climate and antropogenic factors on biosphere and geosphere
Subproject: Climatical oscillations and environmental changes of the recent geological past (***V. Cílek*** & ***A. Žigová***)
The project concentrates on the study on climatical and environmental changes on three basic hierarchical levels:
(a) the first and the most important level concerns the climate of the last 2,000 years. E. Růžičková and A. Zeman conducted with cooperation of the Archaeological Institute a detailed research of the Labe floodplain and the history of human settlements in response to different hydrological regimes.
(b) the second hierarchical level concerns Late Glacial and the Holocene. The most important environmental factor for the area of Czech Republic are considered to be the waves of continental climate bringing not only harsh winters but periods of drought lasting 100-500 years especially in Subboreal of the Middle Holocene. The paleoclimate curve based on C, O stable isotopes for the 8,000-2,500 B.P. was for the first time obtained for the area of the Czech Republic (tufa mound in Svatý Jan pod Skalou, Bohemian Karst, Prague region). An even older profile in nearby Švarcava covering Early Holocene would prolong the OXY curve for the missing 2,000 years. Limited data exist on time-span 0 - 1,000 years A.D.
(c) the third level is represented by the last glacial cycle some 10-120 ka ago studied on loess profiles of Central Bohemia and Southern Moravia as part of international projects (PEP III and others).

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13. Organization of conferences and scientific meetings

P. Skřivan: Workshop SCOPE "Global Changes and Essential Elements Cycling in the Environment", September 17-18, 1996, Geological Institute AS CR, Praha.

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14. Publication activity of the Geological Institute

In 1996, the Geological Institute edited the third volume of ***Geolines***, a new series of monographs and monothematic volumes of extended conference abstracts published by the Geological Institute of the Academy of Sciences of the Czech Republic.
Articles in English on primary research in any field of geology (geochemistry, geophysics, petrology, stratigraphy, paleontology etc.) will be considered. Each number is thematically consistent, containing several papers on joint topic or, preferably, one large paper or monograph. More comprehensive systematic and regional descriptions of wider interest will be

appreciated. Monothematic volumes of extended abstracts from specialised workshops and conferences will be considered as well.
Only original papers will be accepted which have not been published previously nor currently submitted for publication elsewhere.
The journal accepts papers within their respective sectors of science without national limitations or preferences. However, in case of extended abstracts, the conferences and workshops organized and/or co-organized by the Geological Institute will be preferred. The papers are subject to reviews. 25 offprints of each paper will be provided free of charge.

1996

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15. Publication activity of the members of the Geological Institute

15a) Published papers in 1996

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Financial Report

(given in thousands of Czech Crowns)

A. INCOMES		
1. From the annual budget of the Academy of Sciences CR		10,443
2. From the Grant Agency of the Acad. Sci. (accepted research projects)		713
3. From the Grant Agency CR (accepted research projects)		1,082
4. From the internal research projects of the Academy of Sciences CR		2,540
5. From other governmental sources		479
6. Applied research		167
7. Investments (for laboratory facilities)	3,041	
TOTAL INCOMES		**18,465**

B. EXPENSES		
1. Scientific staff - wages, social and medical insurance	7,232	
2. Research and scientific activities		3,196
3. Administration and technical staff - social and medical insurance		4,209
4. General expenses (mail, maintenance of buildings, energies, transport, office supplies, miscellaneous)		351
5. Library (subscriptions, etc.)		436
6. Investments (for laboratory facilities)		3,041
TOTAL EXPENSES		**18,465**