peidae, Serranidae – Chalupová 2000) and glauconization of exfoliated foraminiferal tests (e.g., glaucony-rich layers near the Prosiek Valley). A small-scale intercalation of non-calcareous black shales with Globigerina Marls indicates a short pulses of carbonate productivity during the terminal Eocene fertility crisis. The fluctuations in productivity provide the evidence of climatic changes driven by precessional cyclicity (cf. Leszczynski 1997).

Early Oligocene is considered a time of catastrophic eutrophication of the West Carpathian basins, which culminated in mass expansion of diatoms (Menilite cherts in upper NP 23 – – Nagymarosy 2000). Early Rupelian sediments still reveal the cool-water influence, salinity decrease and semi-isolation, as indicated by wetzeliellacean dinoflagellates, diatom oozes, brackish nectonic fish and small gastropods. Higher in the section, the carbonate-free sequence reveals the first pulses of nannofossil blooms, characterized by reticulofenestrids of NP 23 Biozone (Tylawa-like limestones), which became flourished due to sea-level rising and renewed circulation. The TA4 supercycle tended toward to highest sea-level in time at of 32 Ma, which restored the Paratethyan circulation (Baldi 1984). Consequently, the CCPB became reoxygenated, which led to the increase in carbonate precipitation, productivity and fertility. The maximum flooding of this sequence falls into horizons of manganese layers, which represent a condensed section of the marine transgression. Successive formation of mud-rich deposits indicates a low-energy environment of highstand phase. Next supercycle TB1 was introduced by the Intra-Oligocene regression. It is in accordance with an abrupt sea-level fall at around 30 Ma (Mid-Oligocene Event), determined as a distinctive drop in sea-level during the major glaciation in Antartica and subsequent cooling in the Northern Hemisphere. At this time, the CCPB started to fill up by sand-rich submarine fans, as a frequency of related turbidite currents essentially increased during glaciation. The Late Oligocene regression in the CCPB is indicated by shallowing and decrease in salinity with appearance of braarudospherids in nannofossil associations and brackish dinoflagellates in phytoplankton. Therefore, the deposition of the Upper Oligocene submarine fans in the CCPB appears to have been forced by glacio-eustatic regression.

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Geochemistry and Composition of the Middle Devonian Srbsko Formation in Barrandian Area, Bohemian Massif: A Trench or Fore-Arc Strike-Slip Basin Fill with Material from Volcanic Arc of Continental Margin?

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Kukal and Jäger (1988) emphasised the tectonic significance of an abrupt termination of long-term, open-sea carbonate sedimentation in the Barrandian area. The deposition of Givetian Srbsko Formation was considered as a signal of Early Variscan orogenesis. The authors of the above mentioned paper made conclusions that these last sediments are distal turbidites and contains, besides fine-grained siliciclastic material also much of carbonate component. However, the prevailing meaning continued that Srbsko Formation is a normal siliciclastic wedge deposited in moderate depths, which might be best explained as a delta to pro-delta fan connected with uplifted and erosionally dissected continental margins. An uncertain range of medium depths was also suggested according to scattered occurrence of nine ichnofossil genera, incl. *Chondrites* and *Zoophycos* (Mikuláš and Pek 1996). An oblique collisional docking (Hladil et al. 1999) having been coupled with short-lived burial and consequent rapid exhumation (Hladil 1998; Mann et al. 1999) was recently suggested, but nothing was made for understanding provenance of this latest sedimentary material.

The major part of sediments in the Srbsko formation, having been studied in thin sections, contain an evident component of pelagic carbonate sediment in form of "pelagic ooze" which was partly dissolved during processes of compaction and lithification. Deformation of fossils indicates compaction ratios up to 7, on same places > 20. Small biomorphs are dacryoconarids (ecologic analogue of present pteropods) and radiolaria. Siliceous sponge spicules and rare echinoderm microfragments locally occur. Several horizons of fine-grained calciturbidites were found. The grains of upper-silt to fine-sand size are mostly derived from relatively fresh bioclastic material (crinoid tissues) which first had been collected in upper part of the slope and then transported in turbid gravitational flows. The distal turbidites contain also tiny recycled particles rejected from seafloor on the slope. Small clasts of ferrous hardgrounds in turbidite bypass zone are involved. The calciturbidite material mostly alternates the siliciclastic turbidites, so that independent and/or differentiated source is possible. The source is seen in young reefs, which were drowned as late as during the Early Givetian times. Lithoclastic grains of Eifelian limestones, both bahamites of islands and lime-mud calciturbidites of deep-sea basins are rare or absent. The first check of thin-sectioned laminites from the basal Kačák Member suggests the nature of rocks being strongly dissolved, organic-rich carbonates, but largely dissolved and silicified in profound (abyssal?) conditions.

The silicate clasts in turbidites are mostly angular/subangular grains of quartz and alkali (K and Na) feldspar. Occasional occurrence of basic (Ca) feldspar clasts has been found. The cathodoluminescence study did not reveal any significant differences between secondary luminescence of the individual generations of quartz grains. Angularity of many small quartz grains is remarkable, especially when many faces of grains are concave. Speculation about volcanic origin of this quartz seems to be reasonable. The luminescence of accessory minerals in fine-grained siltstone/sandstone turbidite was masked by bright, late diagenetical carbonate cement. Mineralogical diversity of heavy minerals is small, although their concentration is largely varia-

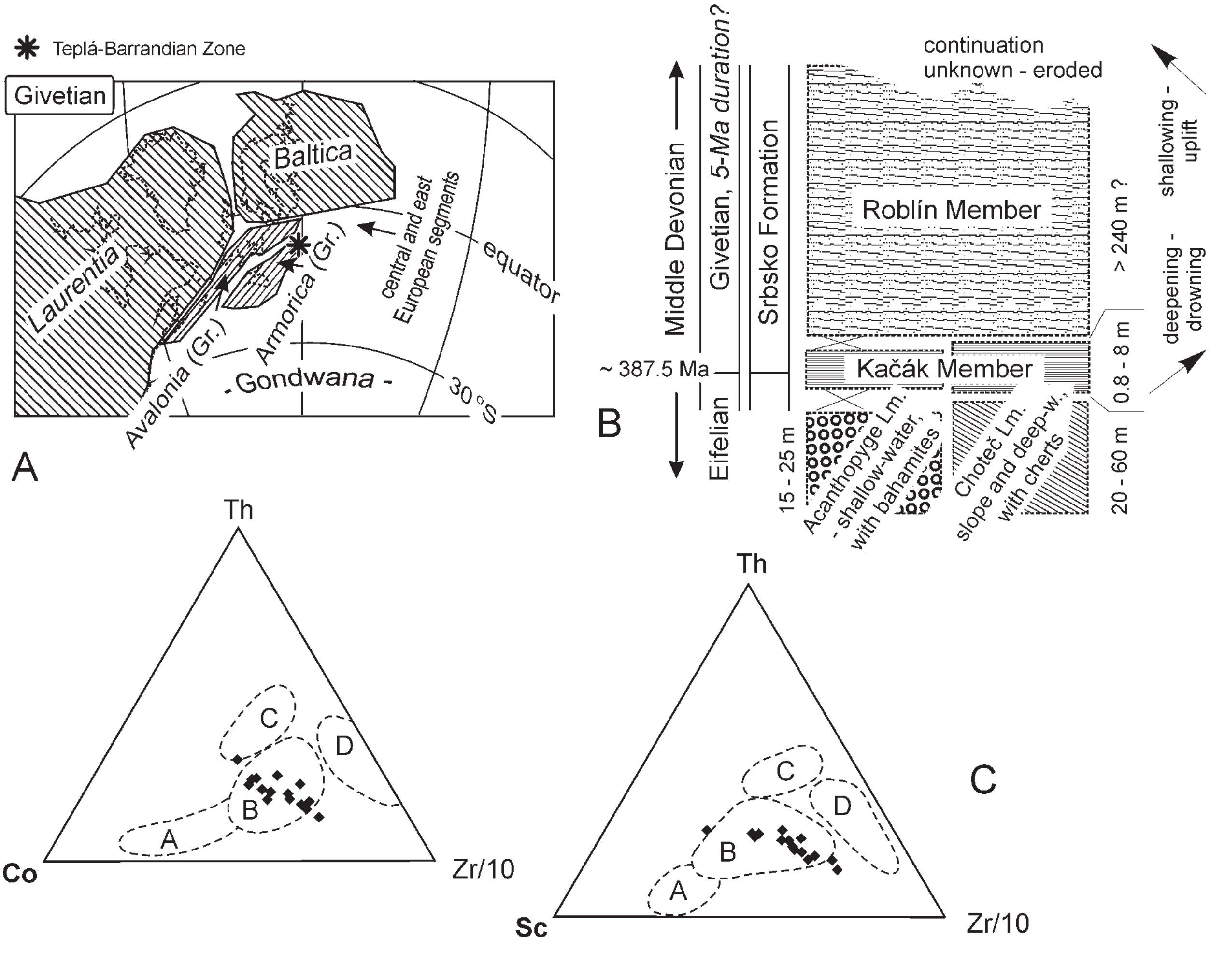

Fig. 1. A – Simplified Early Givetian palaeogeography, modified after Tait et al. (1997). Timing according to Tucker et al. (1997). Details of both Gondwana and blocks in the east are not shown due to unclear data about their shape and position. B – Stratigraphic chart, the Srbsko Formation covers both the Koněprusy shallow-water facies and deep-water facies (Eifelian, open-sea carbonate sediments). C – The Co-Th-Zr/10 and Sc-Th-Zr/10 discrimination diagrams for samples from Srbsko Formation. The position within the diagrams reflects the continental island arc-like (B) character of the tectonic setting during Givetian. A – ocean island arc; C – active continental margin; D – passive continental margin.

ble. Several populations of garnet and zircon, pyroxene, tourmaline, apatite, Fe-Ti oxides, spinel, Fe-sulphides, and rarely Mg-olivine and Mg-biotite occur. Zircon shapes are both idiomorphic and oval. The crystals of zircon are dipyramidal and long prismatic, being usually smaller than 100 µm. A geochronological study on these zircons is announced (ICP MS, Charles Univ., L. Strnad). So far, the instrument parameters and the acquisition settings, together with gas flows, Ar/He gas mixing and a variety of internal standards were tested in order to optimise the instrument performance and to suppress the mass bias and the laser-induced elemental fractionation of Pb and U.

The least mobile elements (such as Th, Zr, Hf, LREE, Nb, Ti and Sc) were used for tectonic-setting proxies made on whole-rock samples. Various tectonic setting discrimination diagrams (e.g. La-Sc-Th, Th-Sc-Zr/10 and Th-Co-Zr/10) were compiled and tested by Bhatia and Crook (1986). This technique seems to be a powerful and promptly applicable tool which is largely used for indication of source material (e.g. Patočka and Szczepański 1997). The data on rocks from the Srbsko Formation, when plotted, cluster within ranges typical for continental volcanic arc. Such conclusion is further supported by the bulk composition of the samples (U, Th, Pb, Ba, Sc and K/Rb, Rb/Sr, Ti/Zr, Zr/Th, Th/U ratios, with reference to data by Jakeš and White (1972) and Bhatia and Crook (1986). On the other hand, the values for Zr and LREE indicate rather standard continental sedimentary source. Possibly, the carriers of these Zr and REE contents are zircon and monazite, which could be recycled in sediments.

The combination of two different chemical signatures may therefore reflect the position of the sedimentary basin adjacent to a continental volcanic arc. Using the simple palaeographic models for relevant blocks (e.g. Tait et al. 1997), such continental volcanic arc would be reached by the Middle Devonian Barrandian (Armorican Group of lithospheric blocks waft in Rheic Ocean) at "Eastern Avalonia". Of course, there are also other possibilities of contacts, being particularly seen in unknown parts of W Brunovistulian Unit (covered by Moravian and Moldanubian Units in Late Carboniferous) or Saxothuringian Unit (with some little analogy in siliceous shales of Železné hory Area, E Bohemia). However, solution of this task requires more detailed data about pre-Carboniferous palaeogeography than available today.

The combination of all presently available indications (such as rapid pull in ocean abyss, basin fill containing volcanic arc material, non-sedimentary burial, rapid exhumation during Frasnian times and deformation of Barrandian beds comparable to accretionary prisms – cf. Taira et al. 1992) make hypotheses about the trench or fore-arc strike-slip basin environments more reasonable that considered during the previous years. The large "atoll"-shaped structure of Prague basin suggested by Galle et al. (1999) would be stripped at volcanic arc similarly to any arrived carbonate highs at Japanese arcs (cf. Konishi 1989).

Perhaps the most debatable aspect of the suggested theory lies in weak arguments in favour of large dimensions of this tectonosedimentary change. Process itself is now indicated, yet correct juxtaposition of relicts in this area has always proved difficult owing to the lack of reliable data on which links can be established. The main reason of these problems is seen in root destruction, strike-slip movements and deep erosion in Variscides (cf. Oncken 1997).

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Preliminary Data on the AMS Fabric in Salt Domes from the SW Part of Zagros Mts., Iran

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Salt diapirism has been studied intensively for many years, but the mechanisms and geometry of flow of salt diapirs are not yet satisfactorily resolved. Therefore, main objective of our study is detailed research of salt flow mechanics based on quantitative investigations of its internal structure (flow foliation, lineation, folds and microstructures). The area of Zagros was chosen for our study due to presence of about 150 salt extrusions. Hormuz salt of Upper Proterozoic to the Lower Cambrian age is composed of evaporites (multicoloured halite, lenses of anhydrite, dolomite, limestone and blocks of volcanic and sedimentary rocks of so-called Hormuz Formation) (Talbot and Alavi 1996). Original thickness of these evaporites was estimated as 1 km (Kent 1958), evaporites are presently covered by younger sedimentary formations up to 10 km in thickness. Salt diapirs extruded to various stratigraphic levels mostly in the hinge parts of mega folds, which affect Mesozoic and Tertiary formations. Strong planar fabric is developed in salt delineated by mesoscopic flow foliations mostly formed by alternations of coloured and pure salt strips. The colour of salt is due to variable presence of disseminated non-evaporite material (black – hematite, red – hematite ochre, green and purple – volcanic and sedimentary rocks). Thickness of individual layers of salt varies in conjunction with its grain size and dip of fabric across the dome. Coarse grained salt pegmatites (grain size from 3–10 cm) are developed, together with fine grained salt (ultra)mylonites (grain size in matrix about 1 mm, porphyroclasts up to several centimetres).

The anisotropy of magnetic susceptibility (AMS) of salt samples was measured by the KLY-3S Kappabridge in the laboratory of Agico Ltd. Brno. The mean susceptibility of salt ranges widely, from -11×10^{-6} to $+5 \times 10^{-2}$ [SI], due to character and quantity of dispersed magnetic particles among which hematite is obviously the main carrier of susceptibility. It is present in the form of flakes or less commonly as isometric grains.

We studied salt dome at Hormoz Island (Persian Gulf) with nearly circular shape and strongly concentric structure. Its structure can be divided into three main domains (see Fig. 1): central apical part of cupola (4 km in diameter, elevation 120–180 a.s.l), outer ring (thickness about 2 km, elevation max. 100 m a.s.l.) and peripheral zone. All domains exhibit different morphology, structure and also composition of evaporites in terms of amount of hematite. Dome is in its southern part surrounded by steeply inclined (80–60°) beds of limestones of Tertiary age.

The central dome shows flat foliation and radially spreading lineations in the apical part of cupola (about 20°), and towards the edge of the dome foliation and lineation become steeper, up to 80°. Here, central cupola passes to the outer ring, where folded zone is locally developed. Dip of foliation is subvertical and parallel to axial planes of numerous isoclinal flow folds. Going towards peripheral zone, which is probably developed only in the western part of the diapir, the foliation dips in opposite direction towards the core of the central cupola. The lineation becomes horizontal indicating lateral flow around main body of diapir. Mean susceptibility and the degree of anisotropy expressed by P parameter are low in the central part of the dome and both values increase towards periphery of the dome. The fabric symmetry characterised by T parameter show highly variable values in the central part and becomes oblate towards margin.

In conclusion, magnetic fabric in central part of the dome indicates symmetrical flow of material outwards, which passes to lateral compression in folded zone. For the southern part of the dome is distinctive lateral flow along the margin (see Figure 1). These results may reflect changing boundary conditions at the peripheral limits of diapiric structure.

The main but preliminary results of our research are as follows: (1) AMS is useful technique for fabric research of some salt domes where magnetic minerals are disseminated in salt; (3) measured magnetic foliation is in good agreement with mesoscopic flow foliation; in addition, magnetic lineation as well as magnetic fabric intensity and symmetry can be defined; (3) mean susceptibility is controlled by the amount and type of dispersed magnetic particles, e.g. in the Hormoz dome hematite is frequent.

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