has orange luminescence without growth zones. Younger population (light orange CL) crosses the older one (dark orange CL) in form of tiny veinlets.

REE in fluorite
Total content of REE in analyzed fluorites varies between 46 and 273 ppm. REE chondrite-normalized patterns differ at single localities (flat curve without any anomaly and LREE enrichment at Tetčice, a well-balanced curve and a strong positive Eu anomaly at Rakšte). However, both total content and distribution of REE correspond well with those of surrounding rocks. The level of REE fractionation (in the Tb/Ca vs. Tb/La plot) indicate hydrothermal origin of all studied fluorites.

Fluid inclusions
Primary and primary-secondary fluid inclusions have been studied in fluorites. Inclusions are always two-phase (type L+V), with 2-5 vol. % of vapour phase. Homogenization temperatures range between 83 and 165 °C. Inclusions completely freeze at temperatures from -29 to -47 °C. Eutectic temperatures around -20 °C indicate presence of NaCl-H2O fluid. Last ice crystal melts between 0.0 and -2.6 °C, so the given range for Tm values corresponds to the very low salinity of the trapped solution (between 0 and 4.3 wt. % NaCl eq.). Distribution of the measured data in the Th/salinity plot indicate mixing of more saline and warmer fluid with less saline and cooler one. In fluid inclusion is further probably present small amount of CO2. Fluid inclusions in associated minerals exhibit, actually, the same fluid characteristics as those in fluorites.

Stable isotopes
Isotopic composition of C and O was determined in calcites from Tetčice. The δ13C and δ18O values vary between -6.7/-9.9 % and -7.5/-15.0 % PDB, respectively. Calculated carbon isotopic composition of the parent fluid is around -11 % PDB. Source of carbon was probably in the host rocks, but some admixture of organic carbon cannot be excluded. Calculated δ18O values of the fluid ranging between 0 and -7.5 % SMOW are typical of meteoric water.

Conclusion
The investigated mineral associations precipitated from low-saline fluids at temperatures of 80–150 °C. These fluids were probably shallow-circulating meteoric waters. Components of mineralizing fluids have been extracted from the host rocks as is documented by REE in fluorites or by carbon isotopes in calcites. The studied fluorite mineralization from the Brno massif could be compared with the Tertiary fluorite mineralization described from the North Bohemia region (Teplíčka, Jílové u Děčína, Žák et al. 1990).

Reference

Accretionary Type Metamorphism in the Meliata Unit (Western Carpathians, Slovakia)

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The blueschist belt of the Meliata unit, formed during the mid-Jurassic (165–170 Ma) high-pressure metamorphism of continental margin and oceanic sequences, occurs south of the Gemericum in east Slovakia. Besides isolated slices overthrusting the basement units to the north, the high-P/T metamorphic rocks are preserved within very low-grade sedimentary sequences, consisting of slates, metasandstones, -siltstones and locally, evaporites. The metasedimentary melange has been traditionally assumed as an unmetamorphosed series (Meliata series s.s.). The evaporite-bearing formations, which were locally found both in the Slovak and Hungarian territories, played an important role in the structural deformation of the Meliata accretionary wedge.

Recent studies on the Meliata unit have been mostly related to petrology of ophiolites and blueschists (Faryad 1995; Mazoli and Vozarova 1997; Ivan and Kronome 1995 and references therein and Horváth 2000). By contrast, little attention has been devoted to their mélangé matrix (Árkai and Kovács 1986). The present work provides some new results on the very low-grade rocks of the Meliata unit. Sedimentary rocks, some of them mixed also with very fine-grained, altered basic volcanoclastic material, were collected from four localities (Meliata, Držkovce, Rožňavské Bystré and Hačava).

Si contents of white K-micas vary between 3.1 and 3.6, the FM values between 0.05 and 0.55, the total RVI contents between 2 and 2.2 a.p.f.u. The total interlayer charge is predominantly 0.8–0.9 a.p.f.u., the Na/(Na+K) ratio scatters between 0 and 0.1, both parameters being characteristic of very low-grade micas. From the Hačava locality dark marly slate samples contain white micas corresponding to paragonite and phengite with Si content between 3.30–3.35 a.p.f.u. Paragonite was found as core in relatively coarse-grained phengite crystals. Some volcanic rocks, which are in tectonic position with marble, have albite, chlorite and early blueschist facies phylites, which underwent strong retrogression and mylonitization. They contain relics of chloritoid and pseudomorphs after glaucophane. High-Si phengite is rimmed by medium to low-Si muscovite. In chlorites the diotriothedral (suditoic) substitution plays a subordinate but significant role, in addition to the FeMg2+ and Tschermak’s substi-
tions. The octahedral vacancy of chlorites together with the celadonite content of white K-micas prove elevated pressure.

Ililite and chlorite crystallinity indices rather homogeneous, medium- to high-T anchizonal metamorphic conditions, with slight increase of grade (temperature) from Meliata through Držkovce to Hačava. This trend is supported also by the chlo-

rite-Al” geothermometry that has provided maximal tempera-

ture values of 300, 340 and 350 °C for the Meliata, Držkovce

and Hačava slates, respectively. The retrogression of the green-

schist facies phylites from Rožňavské Bystré occurred also in

anchizonal circumstances.

Qualitative white K-mica b geobarometry shows medium,

transitional medium-high pressure type metamorphism at the lo-

calities of Meliata and Roznavske Bystre. White K-mica ave-

rages from Držkovce and Hacava may suggest transitional low-

medium pressure, although the disturbing effect of paragonite

content can not be ruled out. As a consequence, moderate vari-

ations in P/T ratio seem to be probable in the very low-grade

sequences. These results suggest a diverse range of metamor-

phic conditions reflecting complex structural mixing of meta-

morphic components at shallower levels.

Differences in burial pressure estimates and inferred geo-

thermal gradients occur between the various localities of the

slate-chert-basalt-turbidite sequence. Metamorphism of these

rocks occurred at shallow levels closer to the toe of the accre-

tionary complex. Although temporal relations are not well con-

strained, the evolution of these terranes is consistent with for-

mation within a single convergent-margin system. The K-Ar ages

obtained on the white K-mica-rich <2µm grain-size fraction

samples scatter between 178 and 115 Ma. Considering the clo-

sure temperature of these fine-grained micas and the eventual

effect of inherited, detrital micas, the age interval of very low-

grade metamorphism of the Meliata unit may be between c. 150

and 115 Ma, i.e., between the Middle Jurassic blueschist facies

event of the Meliata unit and the Upper Cretaceous low to low-

-intermediate pressure type very low-grade metamorphism of

the Bükkiáum. The deformed matrix material of the Meliata

melange formed at lower temperatures and lower pressures, on

the order of 250–350 °C and 3–6 kbar. The mélangé contains a

diverse assemblage of tectonic blocks that formed under a range of P-T conditions, including those of the blueschist,

pumpellyite-actinolite and greenschist facies.

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Fluid Compositions in High-grade Rocks: An Example from

the Lapis Lazuli Deposits at Sare Sang, Afghanistan

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The world known lapis-lazuli deposit at Sare Sang in Hindukoo-

sh occurs within high-grade metamorphic rocks (Sare Sange

Series) which are part of Precambrian South Badakhshan block

(NE Afghanistan). The primary volcano-sedimentary sequences of

the Sare Sange Series were intercalated by carbonates and prob-

ably by evaporites. P-T conditions estimates based on min-

eral assemblages in whiteschists (Schreyer and Abraham 1976)

and in metapelites and metabasites (Faryad 1999) reached triple

peak P-T conditions were estimated using scapolite-bearing re-

actions. Halogens and S are involved in the following minerals:

F (apatite, biotite, amphibole, titanite, clinohumite), Cl (scap-

olite, sodalite, biotite, amphibole, apatite) and S (haüyne, lazur-

ite, scapolite, pyrite and pyrrhotite). Blaise and Cesbron (1966)

reported the presence of gypsum and galena, associated with
calcite and sodalite. With the exception of accessory pyrrhotite,

pentlandite and some scapolites, the S-bearing minerals origi-

nated during retrogression and metasomatism. Partitioning of F

and Cl between coexisting phases was calculated for

apatite-biotite (log(X F/XOH, log(X Cl/XOH)). Fluorapatite is present in
calc-silicates, but metabasites contain chlorapatite. Cl is prefe-