long line coinciding with the Libědice Fault. Southeasterly drops in bases of Upper Pliocene sediments by 5 and 10 m can be observed along lines parallel to the Střezov Fault between Droužkovice and Hrušovany; 3. normal faults forming small grabens (Fig. 1) documented in a sand-pit in Upper Pliocene sand and gravel terrace at Vysočany with vertical displacement of 0.3–1.5 m. The faults strike E–W to WNW–ESE, reach to the underlying Lower Miocene sediments but do not deform the overlying younger-type loess. Slickensides measured in loess of older type in the same sand-pit indicate SSW–NNE extension.

The most striking evidence of post-Pliocene deformation was observed on the Hořenice Fault Zone transverse to the Střezov Fault in the Erdbrand Gorge NW of Poláky. The gorge is drained east, to the Ohře River (Nechranice Res.). Clay-dominated sediments of the Most Formation with burnt coal seams are deformed by easterly dipping reverse faults with drag folds and younger, westerly dipping normal faults. Senses of movements on this zone relative to present-day topography exclude their gravitational origin.

The oldest stress field was responsible for left-lateral strike-slip movements on N-S-striking faults (Fig. 2A). Its characteristics, as interpreted from the different generations of superimposed striae, are very close to those of phase δ (NNW–SSE compression). A younger stress field (ENE–WSW compression) was responsible for the formation of reverse faults dipping east (W part of the gorge) or west (E part) and extensive drag folding (Fig. 2B). The youngest recorded stress field relates to normal movements on faults dipping mostly west (Fig. 2C). Its calculated parameters indicate approx. ENE–WSW minimum principal stress.

Some fault zones with striae pertaining to the younger compressional phase and the subsequent tensional phase enclose lenses of fluvial gravels containing pebbles of quartz, basaltic rocks (up to 25 cm large), tuffs, granulites and orthogneisses. These pebbles are derived from the Ohře River terraces of Upper Pliocene to Middle Pleistocene age.

The phenomena documented from the SW part of the MB point to the identification of two post-Pliocene stress fields of tectonic origin: an older ENE–WSW compression and a younger NNE–SSW to ENE–WSW extension, which were responsible for movements on the order of first metres.

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What Happened to Quartz from the Izera Gneisses? A Possible Scenario

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Numerous theoretical, experimental and field studies have shown that the quartz c-axis CPO depends primarily on temperature and kinematic framework of the deformation. Temperature governs the active slip systems, manifested as charateristic maxima on the CPO pole figures, while kinematic framework is responsible for their symmetry. Thus, it can be expected that CPOs from rocks deformed in the rotational regime should exhibit asymmetric habit.

This is, however, not the case when the crystalline rocks from the northern part of the Izera-Karkonosze Block (IKB) are considered. Mica-schists and orthogneisses deformed during Variscan sequence of non-coaxial tectonic events yield quartz c-axis CPO with dominantly orthorhombic symmetry. Most of the pole figures (in stereographic projection) display strong maxima III (at circumference of the stereonet), located symmetrically with respect to the foliation and stretching lineation. Sometimes weak joining girdles form Type I or Type II crossed girdles or small circles. Few diagrams display the expected asymmetric girdles and some are unreadable.

The discrepancy between asymmetric rock fabrics and its symmetric quartz c-axis CPO can be explained by a number of reasons: strain partitioning, domainal fabric/texture, multiple deformation mechanisms and overprint by late deformation. In case of the IKB rocks, the following evidence supports the late overprint model:

- lack of relationship between lithology, grain size, intensity of deformation and the type of quartz c-axis CPO;
- occurrence of asymmetrical intensities of the maxima and/or relicts of asymmetric joining girdles in some diagrams;
- structures commonly observed on outcrops such as: folds, boudins, conjugate kink-band sets, tension gashes, reverse and thrust faults, pointing to tectonic event with generally coaxial, with respect to the IKB shear zones, geometry.

The structures listed above were formed during regional N ? S compression, in the lower greenschist facies temperature conditions and below. Strong alteration of rocks, abundance of quartz veins and fluid inclusions indicate high water activity during the deformation, which could have enhanced the hydrolitic weakening of quartz.

Thus, the symmetric quartz c-axes CPO are interpreted as resulting from overprinting of older, asymmetric patterns (still recognizable in relicts) by younger ones, originated during late strain increment. The temperature was too low to affect the fabric elements such as kinematic indicators, but high enough to reorientate the quartz CPO.

Contrasting Types of Paleofluids in Volcano-Sedimentary Complex of the Barrandian Upper Proterozoic

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The contribution summarizes fluid inclusion study of three localities in the Barrandian Upper Proterozoic rocks that underwent different sedimentary, diagenetic and metamorphic development. The rocks are mostly anchimetamorphosed or low-grade metamorphosed.

1. Příbram locality (60 km SSW of Prague)

Lithological variability and the presence of cherts and oolitic limestones is typical for the Upper Proterozoic rocks in "Second Slate Belt" N of the town of Příbram. Two and three-phase H_2O-rich, H_2S-rich and mixed inclusions were measured in recrystallized calcite with distinct but undeformed lamellas in oolitic limestone. The recrystallization of calcite is probably connected with hydrothermal fluid mobilization during diagenesis (Žák et al., in prep.).

H_2S-rich inclusions homogenized to liquid between 72 and 87 °C (D = 0.51 to 0.625 g/cm^3). H_2O-H_2S inclusions have variable liquid to vapor ratio of 0.1 to 0.5 and represent the mechanical mixture of H_2O-rich and H_2S-rich phase. The melting of solid H_2S was observed at -87.3 to -87.5 °C, close to triple point of H_2S (-82.9 °C). H_2S homogenized to liquid between 73 and 85 °C (D = 0.52 to 0.62 g/cm^3). Water-rich inclusions have consistent liquid to vapor ratio of about 0.9. Homogenization temperatures were measured between 185 and 200 °C, salinity is about 2.4 wt.% NaCl equiv.

All the types of inclusions are believed to be trapped contemporaneously under conditions of heterogeneous environment of partial immiscibility between liquid-rich H_2O-rich inclusions and vapor-rich H_2S-rich inclusions. The rough estimation of PT conditions of trapping of inclusions is of about 200 °C and 13 MPa.

2. Mítov locality (30 km SE of Plzeň)

Submarine volcanic and volcaniclastic rocks together with sedimentary rocks of this area underwent submarine basalt-sediment-water interaction. Fluid inclusions were studied in bitumen-rich inter-pillow fillings of pillow lavas of spilitized basaltic andesites (Dobeš and Dubessy 1995).

Primary inclusions in calcite of concentric texture growing on lava pillows contain water solution with low salinity (c < 10 wt.% NaCl equiv.) and Th between 225 and 315 °C. The majority of the inter-pillow matter is formed by dark-coloured quartz and coarse-grained calcite with H_2O-rich or CH_4-rich inclusions or mixed inclusions. Methane (D = 0.162 to 0.363 g/cm^3) contains about 3 mol.% CO_2 and 1 mol.% of $N_2 + H_2S$. H_2O-rich inclusions have low salinity between 1 and 7 wt.% NaCl equiv. and Th in the interval of 135–207 °C.

The inclusions are believed to be trapped under the conditions of immiscibility of water solution and methane in heterogeneous environment at temperatures of ≤ 200 °C and pressures of 50 to 100 MPa.

3. Hromnice locality (20 km NNE of Plzeň)

Fluid inclusions were measured in syn-metamorphic quartz and carbonate veinlets bearing grainy pyrite, and Zn, Ni, Cu, and Mo sulfide mineralization. The veinlets are hosted by black shales (Pašava et al. 1996).

H_2O-CO_2 inclusions have variable liquid to vapor ratio and contain 8 to 58 mol.% CO_2, with the density of CO_2 equal to 0.605 to 0.870 g/cm^3. The melting temperatures of CO_2 ($TmCO_2$ = -57.5 to -61.6 °C) are lower than the triple point of CO_2 (-56.6 °C) and indicate the presence of additional gas components (CH_4, N_2). The total Th range of fluid inclusions with LVR of about 0.8 is 270 to 312 °C and the salinity of water solution varies from 1.0 to 4.0 wt.% NaCl equiv. Inclusions syngenetic with the H_2O-CO_2 type seem to be those filled with CO_2 only. The density of CO_2 is 0.665 to 0.920 g/cm^3 and $TmCO_2$ is equal to -57.7 to -60.8 °C.

The wide range of compositions and volume fractions, as well as the variable densities of CO_2, show that the inclusions are the result of heterogeneous trapping of two originally unrelated fluids under the conditions of partial mixing of CO_2-rich and H_2O-rich fluid (T < 350 °C and P not exceeding 240 MPa).

In conclusion, despite of the relatively different PT conditions of trapping of inclusions from the individual localities, all the fluid inclusions were trapped at heterogeneous environment under the conditions of immiscibility of water-rich and gas-rich phase. On the other hand, the types of gases trapped in inclusions reflect diverse facies-lithogenetic environment, as indicated by other geological and geochemical observations. H_2S-rich inclusions in carbonate rocks close to Příbram are characteristic of relatively shallow diagenetic environment, CH_4-rich inclusions from Mítov correspond to reducing environment of sub-sea floor metamorphism, and finally, quartz-carbonate veins with CO_2-bearing inclusions from Hromnice formed during late metamorphic processes.

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