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The Carbonatization of Blastomylonites – an Example from the Oskava Block, Jeseníky Mts.

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The Oskava block is a 15 km long and up to 4 km wide, NNE-SSW oriented tectonic slice of the Cadomian basement of the Desná paraautochton. The block is formed by metagranites and blastomylonites cutted by sporadic metadoleritic dykes. The rocks are inhomogenously mylonitised due to late Carboniferous event of the Variscan orogeny and retrogressively metamorphosed under the greenschist facies conditions. The blastomylonites originated from middle- to coarse-grained granites to trondhjemites, their chemical composition is calc-alcaline, peraluminous and shows a volcanic-arc affinity (Hanžl et al. 2000).

The occurrences of gold mineralization were discovered in metagranites of the Oskava block, hosted by steeply plunging quartz-calcite-arsenopyrite veins parallel to the later regional subvertical axial cleavage S_3 (Mixa et al. 1990).

Intense pervasive and fissural post-magmatic hydrothermal alterations occur in metagranites and blastomylonites. Albitization, sericitization and carbonatization are most common features of the alteration related to mylonitization. Microscopy, microprobe analysis and cathodoluminiscence illustrates that these alterations are due to replacing plagioclase porphyroclasts by albite, white mica and to a lesser extent by prehnite. Most of An component forms epidote and perhaps Fe-Mg carbonate. Albitization of K-feldspars is common, K substituted by Na forms muscovite (´sericite´) through hydrating reaction. Secondary chlorite is formed by breakdown of biotite.

Using microscopy, microprobe analysis and isotope geochemistry two main groups of carbonates in altered rocks and veins were distinguished.

1) Young quartz-calcite veins, veinlets and aggregates with the thickness up to several centimetres are formed by pure calcite containing common limonitic pigment and rarely hematite and Mg-chamosite. Quartz crystalises as idiomorphic columnar crystals with rhombs on its tips. According to Dobeš (1990) fluid inclusions restricted to young qtz-cc veins are hydrous, marked by low salinities (5–13 wt% NaCl equiv.), homogenized to the liquid phase between 117–194 °C.
2) The carbonates of dolomite-ankerite group occur as a widespread impregnation between rock-forming minerals, abundant inclusions in albites and fillings of hairlike fissures in feldspars and crossing the phyllosilicates concentrated on S-foliations as well.

The chemism of these carbonates varies in a wide range from ankerite to ferroan dolomite, with relatively homogenous sum of Fe+Mg cca 22 % but with a wide range of Fe–Mg substitution (Fe 7–23 wt % and Mg 4–13 wt %). The content of MnO is 1,42 % avg. The presence of heavy carbonates is also detected by increasing density, ranges from 2,725 to 2,811 g/cm^3 compared to density 2,665 g/cm^3 in an ordinary granite (Chlupáčová 1990).

The carbonates of dolomite-ankerite group represent evidently the older alteration stage with higher temperatures perhaps connected with breakdown of plagioclases and their albitization. According to Dobeš (1990) at least three generations of fluid inclusions from the older generations of quartz-carbonate veins are related to a more concentrated aqueous fluids (H2O > CO2 >> CH4). As for the salts, besides NaCl, they contain $CaCl_2$ and perhaps $MgCl_2$ as well. Fluid inclusion microthermometry indicates that inclusions homogenize to vapor within the range of 210 to 349 °C. The pressures estimated through the intersection of the isochores vary between 0,7–1,6 kb.

The isotopic composition of C in the carbonates of dolomite-ankerite group vary from delta^{13}C –8,3 to –10,2 ‰ PDB, the value of delta^{18}O range between +10,8 and +13,8 ‰ SMOW. The calcites from young veins have delta^{13}C values of –4,9 to –8,4 ‰ PDB and delta^{18}O values of +18,8 to +22,4 ‰ SMOW. Assuming the temperature of ank-dol carbonate fluid ranging between 350–400 °C and the temperature of calcite veins up to 200 °C we are able to calculate (according to Robinson, 1975) the composition of delta^{13}C in hydrothermal fluids to be −6 to −8 ‰ PDB – the same for both types of fluids. This interval is typical for crustal rocks and also restricts the Devonian sedimentary carbonates in the vicinity of the Oskava block from beiing the prevailing source of carbon in the hydrothermal fluids.

The calculated delta^{18}O values (according to O´Neil et al. 1969) range between +8 to +10 ‰ SMOW for dolomites and ankerites and +10 to +12 ‰ SMOW for calcites. Most probably these values reflect the formation of water of metamorphic origin.

The similar hydrothermal fluid values of delta^{13}C a delta^{18}O from which both calcite and ankerite/dolomite originated, show the same source of carbon and water for these fluids. This indicates that carbonates of both types might have originated from the same fluid the temperature of which was decreasing.