Hydrothermal fluid evolution in the fracture network of the Baksa Gneiss Complex, Pannonian Basin, Hungary

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Introduction. Investigation the fracture systems of rock bodies are very important in many aspects, and as example in fluid mining, geothermics or nuclear waste deposition. Our study area is the Baksa Complex that is a polymetamorphic basement complex and is located in the SW part of the Pannonian Basin. The Baksa-2 prospecting borehole explored the formations of the Complex in 1200 m thickness. The explored metamorphic rock body is built by metapelites – gneiss and mica schist – with amphibolite marble and dolomite-marble intercalations. Aplite intrusions are numerously found in the rock body. The aim of this study is the accurate analysis of the fracture infillings that are found in the fractured metamorphic complex. We try to differentiate the brittle deformation events and define the relative sequence of the fracture filling minerals. On the other hand we try to determine the evolution of paleofluids by analyzing of fluid inclusions trapped in fracture filling minerals.

Results. The investigated veins of the Baksa Complex belong to the same group according to their mineral paragenesis and succession. The ideal sequence of the veins is *ep* ± *czo* ± *di* + *ab* + *kfs* + *chl* ± *prh* ± *py/sp* + *cc* (Fig. 1.). Mineral chemical data of the vein filling minerals suggest origin under low *p-T* conditions. The decrease of Al^{3+}/Fe^{3+} ratio from core to rim in the epidote crystals indicates formation of this mineral during decreasing temperature. Chlorites accompanied by epidote show significant decreasing of Al^{III}/Si^{IV} from core to rim in individual crystals which also support the assumption of temperature decreasing during formation (Cathelineau 1985). Chlorite geothermometry give a 160-320 °C range for this crystallization process. The almost pure cogenetic alkali feldspars give a possibility to estimate the formation temperature of this feldspar assemblage by two feldspar thermometry (Nekvasil and Burnham 1987; Whitney and Stormer 1977). The results suggest precipitation of feldspars occurred between 270 and 330°C at lower than 200 MPa.

Traces of two significantly different fluid types can be identified in the inclusions of diopside, epidote and calcite phases. Type I occurs in primary liquid dominant (L+V) inclusions of diopside, epidote and as early primary inclusions of calcite. The T_h values are 280-360°C in diopside and 180-330°C in epidote while 130-200 °C in calcite. T_m (ice) varies within a -0.2 to -2°C range corresponds to 0.5 – 3.0 eq. mass% NaCl salinity in diopside and epidote while between -2 and -4°C correspond to 3-6 eq. mass% NaCl salinity in early primary inclusions of calcite. Type II fluid can be found in secondary inclusions in epidote and diopside and in later primary inclusions of calcite. These inclusions are liquid dominant L+V type aqueous inclusions. The T_h values are varying between 135 and 200C in epidote and diopside and between 75 and 125°C in calcite. Hydrohalite crystals occurred in these inclusions during freezing experiments indicate presence of dissolved NaCl in the fluid. Eutectic temperatures (T_e) vary between -60 and -50°C indicating a minor amount of Ca^{2+} and/or Mg^{2+} ions in the fluid beside the NaCl. The T_m (ice) values are very similar in each mineral. They vary between -14 and -25°C that indicate salinity from 18 to 25 eq. mass.% NaCl.

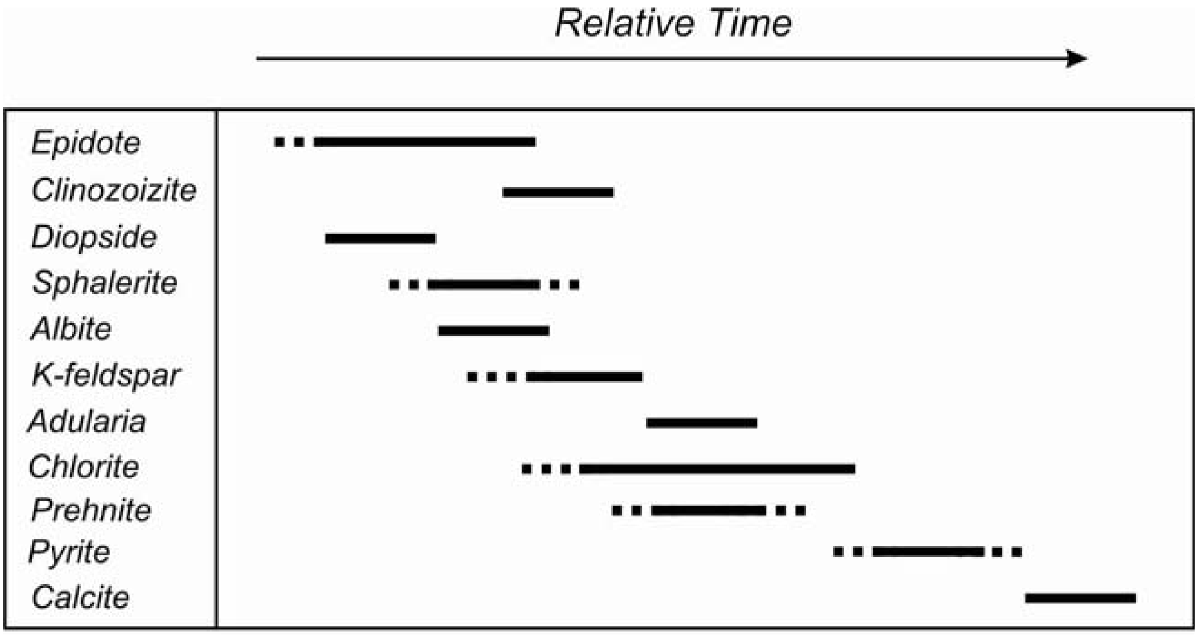

Fig. 1. Relative mineral sequence of the investigated fracture infillings

The observed mineral assemblage related to a propylitic alteration caused by a cooling hydrothermal fluid circulated in the fractures of the complex. The first stage of this alteration was characterized by a low salinity aqueous fluid while in the second stage high salinity fluid became predominant. The lower T_h values and the presence of Ca^{2+} and Mg^{2+} in this fluid suggest the possibility of communication between the hydrothermal fluid and hypersaline sedimentary brine originated from the overlying sediments.

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