Tectono-metamorphic significance of aluminosilicates-bearing quartz veins in the Central Alps

ALLAZ Julien[1], MAEDER Xavier[2] and VANNAY Jean-Claude[3]

[1] Inst. Geol., Uni. Bern, 3012 Bern, Switzerland, jallaz@geo.unibe.ch, URL: www.geo.unibe.ch/people/allaz/

[2] Inst. Geow., Johannes Gutenberg Uni., 55099 Mainz, Germany, maederx@uni-mainz.de

[3] Inst. Miner. and Geochem., Uni. Lausanne, 1015 Lausanne, Switzerland, jean-claude.vannay@img.unil.ch

Aluminosilicates-bearing quartz veins are observed in high-grade metamorphic gneisses of several orogens. Such veins testify to migration of aqueous fluids in deep crustal environments, but their significance is still poorly understood. We combined structural analysis, thermobarometry and oxygen isotope geochemistry to constrain the evolution of kyanite and/or andalusite-bearing quartz veins from the amphibolite facies metapelites of the Simano Nappe, in the Central Alps of Switzerland. The Simano Nappe records a complex polyphase tectonic evolution associated with nappe stacking during the Tertiary Alpine collision. The second regional deformation phase D2 is responsible for the main penetrative schistosity and mineral lineation, formed during top-to-the-N thrusting. During the next stage of deformation (D3 phase), the aluminosilicates-bearing veins formed as a consequence of crystallisation in tension gashes, between boudins, as well as along shear bands associated with top-to-the-N shearing. The D2+D3 deformations are coeval with the Early Miocene metamorphic peak, characterized by kyanite+staurolite+garnet bearing assemblages in metapelites. Multiple equilibria thermobarometry constrains peak P-T conditions in these rocks at 630±20 °C and 9±1 kbar (c. 30 km depth), in good agreement with oxygen isotope thermometry indicating isotopic equilibration of quartz+kyanite pairs at 670±50°C. For the aluminosilicates-bearing quartz veins, quartz+kyanite pairs yielded temperatures at 645±20°C, confirming that these veins formed near the metamorphic peak in deep crustal levels. Quartz and kyanite from both the veins and surrounding metapelites have comparable isotopic compositions, indicating a local remobilization of SiO_2 and Al_2O_3 by metamorphic fluids. Andalusite is lacking in the host rocks, but it is common in the quartz veins, often as pseudomorphs after kyanite. For andalusite to be stable at T_{max}, P_{gashes} must have been substantially < $P_{lithostatic}$. Another explanation consistent with structural observations would imply the inheritance of the isotopic ratio of kyanite during the polymorphic transformation to andalusite after T_{max}. These results emphasize that aluminosilicates-bearing quartz veins can provide relevant information on the metamorphic evolution and on the elusive metamorphic fluids in deep crustal environments.