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Conditions of kyanite formation from fluid in an alpine shear zone

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Hydrothermally formed quartz-kyanite rocks from the WSW-ENE-striking Greiner shear zone (Pfitscher Joch, Italy) on the south-western border of Tauern window were investigated in order to reconstruct conditions and processes of kyanite formation from metamorphic fluids. It is known from experiments that kyanite does not precipitate spontaneously from a qz-saturated, Al-rich fluid in spite of p-T conditions well inside the thermodynamic stability field of kyanite. Natural samples where kyanite nucleates spontaneously from fluid were investigated in order to understand what factors may control inhibition of nucleation in experiments.
The Greiner shear zone cuts a variety of metasedimentary (metapelites, -psammites) units of the lower Schieferhülle, which lie between two distinct Zentralgneis units (Tuxer gneiss core in the north, Zillertaler gneiss core in the south). At the Pfitscher Joch near to the Rotbachlspitze (2897 m), the shear zone intersects the tectonic contact between the Schieferhülle metasediments and the Zillertaler gneiss in an acute angle. A number of segregations (up to 1m in diameter) composed mainly of quartz, feldspar and tourmaline are found along strike in the most silica-rich sheared stratigraphic layers.
Besides kyanite and quartz the vein rocks show a range of other refractory mineral phases, especially pyrophyllite, rutile and zircon. Minor amounts of xenotime and monazite represent the REE carrier in these rocks. Growth textures indicate simultaneous crystallization of quartz, kyanite, rutile and zircon, whereas pyrophyllite may represent alteration processes in a later stage during obduction of the rocks. Additionally, in some samples muscovite and tourmaline were observed. The potassium and boron supply is likely provided by the metapelite or gneiss units adjacent to the shear zone. In the metapelites tourmaline is most abundant in the vicinity of the shear zone, suggesting migration of boron-rich fluids either to or from the shear zone.
The range of the crystallization temperature of the veins will be reconstructed using the known thermometers that refer to quartz, rutile and zircon mineral chemistry. Tourmaline chemistry is used to monitor fluid composition during tourmaline growth.