CONTINUOUS GROWTH STAGES OF MINERALS IN AN ALPINE CLEFT OF THE GLOCKNER NAPPE SYSTEM (TAUERN WINDOW, EASTERN ALPS)

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A large Alpine cleft was discovered 2012 in the Glocknerwand near Hoffmanspitze at 12° 41'06,2" E, 47° 04'53,0" N, 3575m sea level. The cleft mineralization hosts in prasinite interlayered by calcschists and consists of early quartz mobilisates (milky quartz) followed by large crystals of smoky quartz, covered by adularia+hematite+chlorite and finished by two calcite generations, a first rhombohedral and a late scalenohedral.

Fluid Inclusions (FIs) have been investigated from a quartz layer in prasinite host, milky quartz, smoky quartz and calcite. In prasinite quartz, aqueous FIs with additional solid inclusions like albite, rutile and magnesite, characterized by Raman spectroscopy, occur. FIs with eutectic temperatures (T_e) around -28°C homogenize to the liquid phase between 250-270°C. Data are in close relation to primary FIs with negative crystal shapes in smoky quartz with homogenization temperatures (T_h) between 248-272°C, showing some lower T_e around -22.0°C that is indicative for a dominant H_2O-NaCl±KCl±$MgCl_2$ system. Based on last ice melting temperatures (T_m) around -1.0°C, lowest salinities are observed. Rhombohedral calcite shows two groups of FIs, an early primary generation of negative rhombohedral shape with T_h from 240 to 250°C followed by a second generation of irregular shaped FIs arranged as clusters with T_h from 110 to 160°C. This second generation is related to latest crack healing (necking down) and associated with the growth of late scalenohedral calcite. Late stage fluid system is characterized by decreasing T_e around -40 to -45°C indicative for a more complex system like H_2O-NaCl-$MgCl_2$±$CaCl_2$. Total salinities are <3 mass% with NaCl/$MgCl_2$ = 0.7/0.3.

Considering fluid inclusion density isochores of all studied FIs, an increased geothermal gradient (≥45°C/km) is required as previously suggested for the metasediments of the Glockner Nappe System (e.g. DACHS, 1990). This high temperature evolutionary path is the effect of isothermal decompression from peak conditions (ca. 7kb/500°C) down to <2kb/~300°C, representing growth conditions of early mineral phases like smoky quartz and rhombohedral calcite. Late fluid overprint is linked to scalenohedral calcite growth and fluid re-equilibration in milky quartz as an effect of fracturing under isobaric cooling conditions near shallow (ca. 3km) crustal levels.

DACHS, E. (1990): J. Metamorphic. Geol., 8, 217-230.