Geophysical Research Abstracts
Vol. 16, EGU2014-7145, 2014
EGU General Assembly 2014

High spatial resolution dating of hydrothermal monazite from Alpine clefts

Emilie Janots (1), Edwin Gnos (2), Alfons Berger (3), and Martin Whitehouse (4)

(1) ISTerre, Grenoble, France (janotse@ujf-grenoble.fr), (2) Natural History Museum of Geneva, Switzerland , (3) Institute of geological Sciences, Bern, Switzerland, (4) Swedish Museum of Natural History, Stockholm, Sweden

Dating hydrothermal mineralization is challenging because most chronometers are commonly reset in open and multistage systems. Although monazite is rare in hydrothermal deposits, it is a very attractive mineral for dating mineralizations because it has a very robust isotopic system (U-Th-Pb) that is not affected by diffusion and hence retains the age of its precipitation. In the presence of an evolving or changing fluid, monazite crystallizes sporadically. Growth episodes are identifiable from zoning in trace element compositions (REE+Y, Th, U and Pb). Using high-spatial and mass resolution techniques, it is possible to date these distinct domains and to obtain the age of the successive mineralization stages. The aim of this study is to investigate the potential of monazite as chronometer and geochemical tracer of fluid mineralization via detailed characterization of natural monazite from Alpine clefts (Aar and Gotthard massifs, Switzerland and Tauern window, Austria). The objectives are two-fold: (1) Obtaining monazite growth ages and growth duration for different parts of the Alps and to link them with the local deformation and exhumation history, (2) trying to understand chemical and isotopic behaviour of the REE+Y, Th and U during monazite/fluid interaction. In monazite taken from Alpine clefts, SIMS U-Th-Pb dating yields U-Th-Pb ages with a resolution of 0.1-0.2 Ma. Although Th-Pb dating is normally preferred in order to limit the contribution of initial Pb or 206Pbexcess (due to 230Th disequilibrium), some monazite grains (or domains) have very low Th concentration and then U-Pb dating is required. Hydrothermal monazite grains are commonly zoned with domains showing extreme Th/U fractionation, which remains to be understood. Within a single grain, dating in the different domains enables to distinguish episodic growth stages separated by interval(s) generally <2Ma. Remarkably, monazite ages are systematically very close to zircon fission track ages in the different studied massifs, bringing new constrains on the role of deformation and fluid circulation during exhumation.