Fluid/rock experiments on allanite alteration : Insigths on the mobilization of REE and HFSE during weathering

A. DENYS[1]*, A-L. AUZENDE[1], M.-L. DOAN[1], G. MONTES-HERNANDEZ[1], E. JANOTS[1]

[1]ISTerre, Université Grenoble Alpes, 38000 Grenoble, France (*correspondence: axel.denys@univ-grenoble-alpes.fr)

Allanite is an accessory mineral (epidote group), common in granitic rocks. It is considered, with monazite, as a main host of REE in the continental crust. Rock/fluid interactions are important processes for REE and HFSE (re-)mobilization, for example through the leaching of host minerals that can lead to ore deposits. The behavior of allanite during alteration is mainly described by direct observation in natural systems [1,2]. Surprisingly, the stability of allanite with fluids is experimentally poorly described. To fulfill this gap, we conduct fluid-induced alteration experiments on (1) a fresh granite from the External Crystalline Massifs of the French Alps, rich in allanite and titanite and (2) single crushed grains of allanite. A first type of experiment consists in fluid percolation through the granite thanks to an unique triaxial cell system. A controlled fluid (acidified pure water, pH = 4, by CO_2 dissolution) percolates through a cylinder (Ø = 20mm) of pre-fractured sample, under differential stress (σ_1 = 170bar, σ_3 = 80bar) at 180°C and is recovered at the exit of the cell. In a second and complementary set of experiments, pure allanite behavior is investigated. Teflon reactors are loaded with 200mg of crushed pure allanite (grain size around 20-50µm) together with 1.5mL of acidified pure water (by CO_2 dissolution) dopped with NaF. To follow the evolution of the reaction, we use a kinetic approach (15, 30, 45, 60 days). Temperature conditions range from 100°C to 200°C at saturated water vapor pressure. Pre- and post-experimental characterization of the sample use different methods as X-ray microtomography (internal fracture network), XRD, SEM, TEM, permeability measurements, and fluid are analyzed by ICP-MS. This two sets of preliminary experiments allow us to follow the petrophysical, mineralogical and geochemical evolution of minerals reactivity, especially allanite, under the first steps of alteration. The aims are to identify preferential ways of reaction (precipitation/dissolution, replacement) when deformation and fluid/rock interaction are coupled, and to characterize the resulting transfer of trace element.

[1] Wood & Ricketts (2000) *Canad.Min.* **38** : 81-100 [2] Poitrasson *et al.* (2002) *Contrib. Min.. Petrol*. **142**, 485-500.