

## Solubility of F-Cl-apatites in KCl-H<sub>2</sub>O brines at 800°C and 1 GPa

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Chloride-rich brines are increasingly recognized as playing an important role in high P-T metamorphic and magmatic systems [1]. The origins of these saline, multicomponent fluids are still debated, but experimental evidence suggests that regardless of their origin they are important agents of rock alteration and mass transfer wherever they occur. Apatite (Ca<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>(OH, F, Cl)) is a ubiquitous accessory mineral in many crustal rocks that is widely used to evaluate petrogenetic processes [2] and is also particularly suitable for assessing the role of fluids at high pressures and temperatures, where metasomatic activity is important but poorly understood. Apatite is an important host for LREE, F, and Cl and thus can be used to monitor elemental mass transfer in high P-T settings. Therefore the determination of its solubility in geologic fluids is of utmost geochemical importance. To this end, we have investigated the influence KCl-H<sub>2</sub>O aqueous fluids on the solubility behaviour of synthetic F-apatite, synthetic Cl-apatite, and natural Durango F-apatite at 800°C and 1.0 GPa using 3 mm diameter/1cm long Pt capsules arc welded shut and the piston-cylinder apparatus (NaCl setup, cylindrical graphite oven). The experimental results indicate a strong increase in apatite solubility for aqueous fluids with a moderate KCl mole fraction ( $X_{\text{KCl}}$ ). Synthetic F-apatite and synthetic Cl-apatite dissolve congruently. Their solubility increases from 19 and 37 ppm in pure H<sub>2</sub>O to 1917 and 2487 ppm, respectively, at  $X_{\text{KCl}} = 0.4$ . Natural Durango F-apatite dissolves incongruently at  $X_{\text{KCl}} < 0.2$  to monazite + fluid and congruently at  $X_{\text{KCl}} > 0.2$ . The solubility behaviour of both apatites with increasing  $X_{\text{KCl}}$  indicates the participation of H<sub>2</sub>O in the dissolution reaction. In contrast to the NaCl-H<sub>2</sub>O system investigated by Antignano & Manning (2008) [3], apatite solubilities in the system KCl-H<sub>2</sub>O are considerably lower.

[1] Newton, R.C., Manning, C.E. (2010): *Geofluids*, **10**, 58-72.

[2] Spear, F.S., Pyle, J.M. (2002): *Rev. Mineral. Geoch.*, **48**, 293-335 [3] Antignano, A., Manning, C. (2008): *Chem. Geol.*, **251**, 112-119