# F, REE, Zr, Hf, Nb,Ta, Sn, Mo and W partitioning between titanite and felsic melt

HAIHAO GUO[1], VINVENT VAN HINSBERG[1]

[1] Department of Earth and Planetary Sciences, McGill University, Montreal, Quebec H3A 0E8, Canada. Email: haihao.guo@mcgill.ca

Titanite [$CaTi_{1-x}Al_xSiO_4(O, OH_x, F_x)$] is a common accessory mineral in igneous, and low to high grade metamorphic rocks. Due to the lattice site charges and dimensions of titanite, it can incorporate elevated amounts of rare earth elements (REE), high field strength elements (HFSE), U, Th, Sn, Mo and W. As a result, titanite has become a significant mineral for U-Pb geochronology, Zr-in-titanite thermobarometry and as a compositional petrogenetic indicator. These applications critically depend on a detailed understanding of the element partitioning behavior of titanite. In this study, we experimentally investigate the partitioning of elements between titanite and silicate melts.

Fluorine is an important halogen in granites and rhyolites, and fluorine-bearing felsic rocks are frequently associated with Li, Sn–W and Ta–Nb ore deposits. Fluorine also plays a profound role in determining melt properties and, therewith, magma evolution. It can promote extreme degrees of melt fractionation by lowering the magma's solidus and viscosity. Fluorine also elevates the solubility of the REE and HFSE in melts and fluids by formation of F-species.Thus, fluorine facilitates residual melt extraction and melt accumulation in magma chambers, and greatly impacts the fractionation of the REE and HFSE.

We present new data for patitioning coefficients of F, REE, Zr, Hf, Nb, Ta, Sn, Mo and W between titanite and felsic melt. The results are based on experiments performed in rapid quench cold seal pressure vessels at 700-900 ℃, 2 kbar and oxygen fugacities ranging from FMQ (fayalite–magnetite –quartz) - 0.8 log units to FMQ + 5.1. We find that the patitioning coeficcients vary as a function of temperature, melt composition (ASI-aluminum saturated index) and oxygen fugacity ($fO_2$). Our results can be applied to use titanite as an indicator mineral for tracing the F, REE, Zr, Hf, Nb, Ta, Sn, Mo and W concentrations of felsic intrusions during differentiation.