

Trace elements in olivines as probes of parental melt compositions in the western rift of East Africa

S.F. FOLEY¹, D.E. JACOB¹ AND H.ST.C. O'NEILL²

¹Earth System Science Research Centre and Institute for Geosciences, University of Mainz, Germany (foley@uni-mainz.de, jacobd@uni-mainz.de)

²Research School of Earth Sciences, Australian National University, Canberra, ACT 0200, Australia

Olivine is commonly the earliest abundant phase crystallizing in mafic igneous rocks, and therefore has the potential to record information about unfractionated melts. Distinguishing liquidus olivines from crystals with other origins is particularly important for MgO-rich rocks such as picrites, kimberlites, and olivine lamproites, for which the proportion of primary igneous olivines is debated. Olivine phenocrysts in ugandite (16-22wt% MgO) and leucite basanite from the western branch of the East African Rift [1] have been analyzed for up to 34 trace elements by Laser-ICP-MS with detection limits as low as 1ppb.

Trace element concentrations are remarkably uniform between large and small phenocrysts; leucite basanites (Mg# 59) have higher D_{Ca} and D_{Al} , and less fractionated LREE/HREE than MgO-rich ugandites (Mg# 75-80). Zonation is seen in elements with cation charges from 5+ to 2+ (P, Ti, Zr, Cr, Al, Sc, V, Cu, Mn, Ni) and may correlate with Ti and Al, but not P. Some early phenocryst cores have high Li or Ni, low Mn, or enrichments in many trace elements, whereas xenocrysts have exceptionally low Na, Cr, Ti, V and Co. Partition coefficients for Ni are 31-35, less than in lamproites [2], with which they demonstrate correlations with K_2O , K_2O/Al_2O_3 and K_2O/Na_2O in melt, but none with SiO_2 content or Mg#. D-values for Cr, Mn and Co overlap with those of basalts, whereas those for Sc (0.011-0.018), Zn (0.44-0.49) and Ga (0.006-0.007) are lower. V/Sc indicates $fO_2 = \Delta FMQ - 0.54$ to $+1.38$ at the time of olivine crystallization.

A comparison of point analyses and line scans shows that line scan analyses are contaminated in Al, Ca, Cu, Ga, Sr, Zr, Nb, La and Ce, elements that are also concentrated in microcracks between subgrains, indicating smearing out during polishing, and demonstrating that large spot analyses produce the best results.

[1] Rosenthal *et al.* (2009) *Earth Planet. Sci. Lett.* **284**, 236–248. [2] Foley & Jenner (2004) *Lithos* **75**, 19–38.

Reactions of accessory minerals during sub-solidus alteration of granitic rocks by As-rich fluids

H.-J. FÖRSTER¹, M. ONDREJKA^{2*} AND P. UHER³

¹Deutsches GeoForschungsZentrum-GFZ, Section Reservoir Technologies, D-14473 Potsdam, Germany

²Dept. of Mineralogy and Petrology, Comenius Univ., Mlynská dolina G, 842 15 Bratislava, Slovak Republic (*correspondence: mondrejka@fns.uniba.sk)

³Dept. of Mineral Deposits, Comenius Univ., Mlynská dolina G, 842 15 Bratislava, Slovak Republic

In small zones in the apical part of the Zinnwald/Cínovec granite cupola (Germany/Czech Republic), consisting of highly evolved, weakly peraluminous topaz–albite–Li mica leucogranites of A-type affiliation, various As-bearing accessory minerals were identified. This assemblage includes REE arsenates [arsenoflorencite-(Ce), chernovite-(Y), hydrated chernovite-(Y)–xenotime-(Y) solid solutions] and As-bearing silicates (thorite, coffinite, zircon). Accompanying minerals comprise As-poor REE fluorocarbonates [bastnäsite-(Ce), synchysite-(Ce), synchysite-(Y)], fluocerite-(Ce), and As-free ferrocolumbite. Arsenoflorencite-(Ce) contains low to moderate concentrations of P, Pb, and Sr (4.0–8.3 wt% SrO), reflecting substitution of florencite, arsenoflorencite, goyazite, and kintoreite components. Relative to published data, chernovite-(Y) from this location is the most REE-rich yet recorded, with up to 0.51 *apfu* REE substituting for Y. Thorite, coffinite, and zircon accommodated maximum concentrations of As of 14.4, 5.3, and 1.3 wt% As_2O_5 , respectively. Most of these minerals display variably kinked REE_{CN} pattern, reflecting the lanthanide tetrad effect. Formation of the As-rich minerals appears confined to zones, where the granite became infiltrated by post-magmatic, probably hydrothermal As-rich fluids. A tentative model is provided which tries to explain the origin of these minerals by dissolution–reprecipitation and alteration of pre-existing granitic accessory minerals. Our observations corroborate the results of previous studies demonstrating that As-bearing fluids are susceptible to dissolve and severely alter primary and secondary REE–Y–Th–U–Zr minerals.

This work was supported by the Slovak Research and Development Agency under contract No. APVV-0557-06 and APVV-0279-07.