Li in plagioclase: Investigating its rapid diffusion and potential as geospeedometer

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Elemental and isotopic studies with Li as a geochemical tracer for source components and potential tool for geospeedometry have proliferated in recent years. Indeed, the abundance and isotopic fractionation of Li, alongside its rather rapid diffusivity especially in plagioclase, remain topics of interest and importance. In volcanic systems, such Li data may demonstrate processes and timescales that lead up to the extrusion of magma.

To further understand Li diffusion in (and out of) plagioclase, we analyse exceptionally large crystals using the SIMS, to be confirmed by other methods. Our current results involve a heating experiment on a 2cm-long plagioclase phenocryst from a lava flow in Luzon, Philippines. The crystal, partly surrounded by groundmass, was heated in an oven first at 500°C, then at 800°C, both for an interval of 30 hours. Li, Be, B and δ^7Li analyses were undertaken before the experiment and after each heating. The Li concentration profile prior to heating, with values that decrease from core to rim, had a range of 12-29 μg/g. After each heating, a general drop of 2-5 μg/g was observed. The profile however, was rendered more irregular and the outermost rim displayed an unmistakeable increase in Li content after heating at 500°C. Surprisingly, the δ^7Li profile did not show any significant modification.

Preliminary as it was, the experiment showed that Li does diffuse within the range of temperatures in a matter of days. How this experiment may be refined, e.g. to constrain the effects of Li escaping into the air, define how it leaves the plagioclase to diffuse into different phases of the matrix, or estimate how fast at which temperature the diffusion occurs, is a matter of continued consideration. Moreover, corroborative analyses, time calculations and diffusion modelling are needed to better interpret our existing data.

Uranium minerals from a Portuguese Variscan granite and its hydrothermal alteration

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Electron microscopy images, X-ray maps and electron microprobe analyses were carried out on uraninite, coffinite, (meta)saleeite, thorite, xenotime, monazite and apatite from unaltered and altered Variscan peraluminous granite and related hydrothermal brecciated uranium-quartz veins. Uraninite occurs mainly in the unaltered granite [1], is rare in the altered granite and was not found in the mineralized quartz veins. Uraninite from the altered granite is fractured and hydrated, has the radioactive damage halos filled with late mineral phases, and its analytical totals are lower than in the uraninite from the unaltered granite. The alteration zones are poorer in U than the unaltered zones and some uraninite crystals are replaced by coffinite, which results from uraninite alteration and only in the altered granite. Its U content ranges between 65.0 wt.% UO_2 in the rims to 84.0 wt.% UO_2 in the cores of crystals. Thorite was found in all the granite samples and its composition is variable from 0.5 to 10.4 wt.% UO_2, with the low UO_2 contents in fractured crystal zones. Secondary thorite replaces apatite and monazite. Monazite from the altered granite is vacuolated, replaces apatite, and is replaced by secondary thorite. In the altered granite, xenotime is zoned, with cores richer in U than rims. Apatite from the altered granite is dissolved and has lower U and P contents than apatite from unaltered granite.

[1] Cabral Pinto MMS *et al*. (2008) Geochemistry of U-bearing minerals from the Vale de Abrutiga uranium mine area, Central Portugal N. *Jb. Miner. Abh* **185/2,** 183-198