Li-isotopic evidence for fluid exsolution and remobilisation of REE-HFSE in peralkaline Siwana granite

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The peralkaline Siwana granite of the Neoproterozoic Malani Igneous Suite in western India hosts a diverse suite of rare earth elements (REE) and high field strength elements (HFSE)-bearing minerals formed during magmatic to post magmatic evolution of the granite body. Extensive fluid-induced deuteric to hydrothermal alteration led to the partial breakdown and re-equilibration of primary igneous minerals and remobilization and redistribution of precursor REE and HFSE minerals.

In this study, Li isotopes were measured in-situ on magmatic and deuteric/hydrothermal zones of coexisting clinopyroxene and amphibole using LA-MC-ICPMS. The early magmatic hedenbergite furnish δ^7Li of 20.4±3.2‰ while the late-magmatic aegirine have δ^7Li of 8.6±2.6 to –16.7±0.65‰. Hydrothermal aegirine rims have heavier δ^7Li of 24.6±0.8‰. Amphiboles display a similar Li-isotopic trend with early magmatic richterite having δ^7Li of 18.5±0.65‰ and late magmatic riebeckite-arfvedsonite having lighter δ^7Li of –3.5±1.4‰. Hydrothermal arfvedsonites replacing the magmatic amphiboles have much heavier δ^7Li of 29±0.8‰ to 33.3±0.7‰. The trend of decreasing δ^7Li in the magmatic pyroxenes and amphiboles can be explained to be due to progressive degassing and exsolution of ^{7}Li-rich fluids from the peralkaline magmas during low-pressure vapour-saturated crystallization [1]. The hydrothermal minerals crystallized from the exsolved fluids which explains their heavier Li isotopic compositions. The hydrothermal amphiboles are characterized by high F, Cl, and Pb. The Cl-rich exsolved fluids were responsible for the mobilization of the REE and HFSE as chloride complexes while F assisted the re-precipitation of hydrothermal REE minerals [2].

[1] Vlastélic et al. (2011) *Chem. Geol.* **284**, 26–34 [2] Migdisov et al. (2016) *Chem. Geol.* **439**, 13–42.