

Rates of Li diffusion in garnet: Coupled transport of Li and Y+REEs

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ABSTRACT

Numerical simulation of stranded diffusion profiles in partially resorbed garnet crystals from the aureole of the Makhavinekh Lake Pluton (Labrador, Canada) yields quantitative rates of intracrystalline diffusion for Li in garnet. Diffusion coefficients for Li at 700–900 °C and 0.53 GPa are 0.5–1.5 log₁₀ units lower than those for divalent cations in the same samples, and match those for Y and Yb. This correspondence likely stems from coupled substitution of Li and Y (or REE) ions in the garnet structure: the requirement of local electroneutrality limits Li mobility to be no faster than that of Y+REEs. Because of this coupling, Li zoning in garnet is retained to comparatively high temperatures, making garnet a valuable monitor of the behavior of Li in deep crustal systems.

Keywords: Lithium, yttrium, REEs, garnet, intracrystalline diffusion, coupled substitution