Experimental constraints on lithium diffusion and isotope fractionation in water-bearing magmatic systems

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Existing experimental data on lithium diffusion is limited to anhydrous systems and predominantly atmospheric pressures (see review in [1]). Here we investigate the more natural cases of watersaturated melts at the pressure-temperature range of the upper crust. Secondary ion mass spectrometry (SIMS) analyses of experimental run products on the Los Posos rhyolitic melt from [2] indicate that elemental lithium diffuses faster than the stable isotopes ⁶Li and ⁷Li can equilibrate (Fig. 1).



and elemental Li diffusion observations are likely to be sensitive to timescales relevant for short-lived magmatic processes (seconds to weeks) in the shallow crust, such as magma ascent. This may be especially true in the presence of water, as heavier ⁷Li dominantly partitions into the fluid phase [3], and could be important for interpreting degassing processes. A series of water-saturated intramelt diffusion-couple experiments at pressures \leq 300 MPa and temperatures from 900-1200°C are currently in progress.

[1] Zhang *et al.* (2010) *RiMG* **72**, 311-408, [2] Stanton (1990) *Ph.D. thesis*, Arizona State Univ., [3] Millot *et al.* (2010) *GCA* **74**, 1852-1871.