

EGU2020-8886

<https://doi.org/10.5194/egusphere-egu2020-8886>

EGU General Assembly 2020

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## Plagioclase as a witness of syn-eruptive degassing in rhyolitic magmas

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Lithium (Li) is one of the fastest diffusing elements in most geological media and so has the potential to provide information about processes occurring on timescales too short to be captured by other proxies. These processes may be of fundamental importance both in terms of understanding what happens during explosive volcanism and for defining where lithium, an element of increasing economic importance, ends up. To investigate the fate of Li, we studied in detail the 1.30 Ma Mesa Falls Tuff (MFT) from the Yellowstone volcanic field (USA). MFT is a typical rhyolite of the Yellowstone system containing an anhydrous mineral assemblage of sanidine, quartz, plagioclase, clinopyroxene, fayalite, orthopyroxene and accessory phases. We focussed on plagioclase crystals that have a strong gradient in Li contents from cores at ~25 ppm to rims with ~5 ppm. This notable decrease in Li abundance is decoupled from changes in other major and trace elements.  $\delta^7\text{Li}$  values measured by fs-LA-MC-ICPMS in the plagioclase crystals reveal that cores are about 5 ‰ lower than rims. Taken together, the Li abundance and isotopic data make a compelling case for the plagioclase attempting to react to a sudden change in Li abundance in the surrounding melt. Diffusion modelling of these gradients indicates that this sudden Li drop in the melt occurred over timescales of tens of minutes prior to quenching. The volatile behaviour of Li implied by this result finds support in Li concentrations measured in quartz-hosted melt inclusions that reach 400 ppm while groundmass glass Li contents are much lower (36-55 ppm). While equilibrium fractionation of stable isotopes is minimised at high temperatures, the large-magnitude, rapid loss of lithium from the melt phase may allow kinetic isotopic fractionation to occur, as recorded in the plagioclase crystals. With glass / groundmass both volumetrically dominant and the main repository of Li in virtually all volcanic deposits, further consideration of how syn-eruptive processes may affect the bulk Li identity of a sample is warranted.