

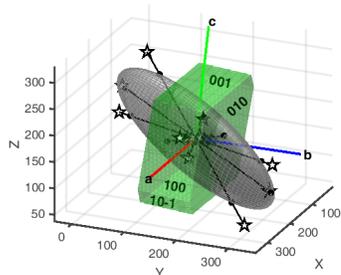
## Mg diffusion in labradorite at hydrous magmatic conditions

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Diffusion of Mg in plagioclase underpins a popular geospeedometer, but the value of  $D_{\text{Mg}}^{\text{plag}}$  is poorly constrained. Published values, obtained from anhydrous experiments performed on crystallographically oriented crystals, vary by 5 orders of magnitude. We present results of a novel experiment aimed at assessing  $D_{\text{Mg}}^{\text{plag}}$  under hydrous conditions relevant to the magmatic systems underlying arc volcanoes. The combined effects of H<sub>2</sub>O-saturation, elevated pressure, and magmatic  $f\text{O}_2$  on  $D_{\text{Mg}}^{\text{plag}}$  at 900 °C and 125 MPa were investigated using An<sub>66</sub> plagioclase. Partial dissolution of the input labradorite occurred, but mass balance and thermodynamic arguments suggest that the driving force for dissolution was low, and that equilibrium was approached during the 42-day duration. Mg concentration profiles measured via electron microprobe are well fit by a 1-D diffusion model, which yields diffusivities that are anisotropic and up to ~100 times larger than any previously reported. The fast diffusion direction is approximately  $[-1 \ -3 \ 1]$ . The presence of substantial H<sub>2</sub>O, good interfacial contact with liquid surroundings, and potentially dissolution itself, may act to enhance Mg diffusion in our experiment. Our work underscores the importance of examining diffusion in all directions, not just those along crystallographic axes, and it suggests that  $D_{\text{Mg}}^{\text{plag}}$  may be higher in arc settings than previously thought.



**Figure 1.** Ellipsoid (grey) representing the anisotropy of  $D_{\text{Mg}}^{\text{plag}}$  with respect to a simple plagioclase crystal (green).