Diffusivities of Redox-Sensitive Elements in Basalt vs. oxygen fugacity determined by LA-ICP-MS.

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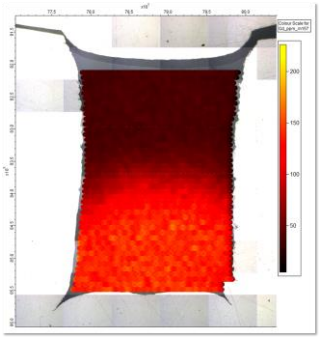
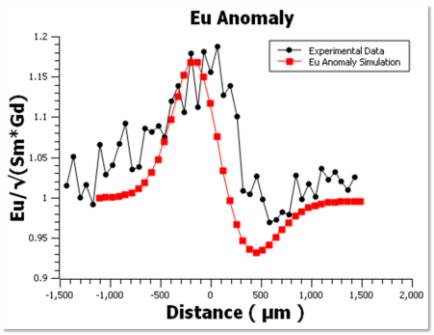
Several diffusion experiments were conducted in a piston cylinder device across a range of oxygen fugacities (FMQ-3 FMQ-1.2, FMQ+6) at 1 GPa and 1300 C. This was done to explore the effects of oxygen fugacity (fO_2) on diffusivity of redox sensitive trace elements. This allows investigation of how these elements diffuse across the fO_2 range encountered in different reservoirs on planets and moons in our solar system. The University of Rochester LA-ICP-MS system was used for analysis of samples. Analyses were conducted using an Agilent 7900 quadrupole mass spectrometer connected to a Photon Machines 193 nm G2 laser ablation (LA) system equipped with a HelEx 2-volume sample chamber. Spots used were 35 µm circles spaced at 65 µm intervals. Laser fluence was 7.81 J/cm^2 with a rep rate of 10 Hz. The iolite software package was used to reduce data collected from laser ablation analysis of experiments with Si-29 used as the internal standard isotope. Iolite's global fit module was used to simultaneously fit elements' diffusivities in each experiment while keeping the Matano interface constant. Elements analysed include V, Nb, W, Mo, La, Ce, Pr, Sm, Eu, Gd, Ta, and W.





Figures 1(left) and 2(right): Figure 1 is a laser ablation generated map of Gadolinum concentration in a diffusion experiment run for 80 minutes with an oxygen fugacity buffered at FMQ-3. Figure 2 is a simulated Europium anomaly (red line) using the diffusivities acquired from a 40 minute molybdenum capsule experiment. The black line is the experimental Europium anomaly from the same run as analyzed by a LA-ICP-MS spot traverse.

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