Resolving water sources in Icelandic basalts: insights from hydrogen isotopes

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A recent melt inclusion study, largely focused on material associated with the proto-Iceland plume at Baffin Island, revealed exceptionally negative δD values (down to –218‰), suggesting tapping of primordial water sources via the Iceland plume [1]. Limited hydrogen isotope data of basalts are available from Iceland and current datasets are restricted to highly degassed subaerial lava flows, providing limited insights into the importance of the inferred water reservoir in the Icelandic mantle today.

We report new water elemental abundance and hydrogen isotope data for a suite of geochemically well-characterized subglacial and subaerial basaltic glasses from Iceland using SIMS and TC/EA-IRMS, respectively. To better characterize the δD composition of the hydrated Iceland crust, we also report δD values for several drill cuttings. Water contents in the basaltic glasses vary from 0.07 to 1.0 wt.%. Preliminary δD values of the glasses span a wide range from -125 to -73‰, with no obvious spatial control, whereas the drill cuttings δD values appear dominated by local groundwater source.

Consideration of δD-H_2O/Ce relationships, allows us to identify samples with modified δD values, for example due to degassing, and δD-$^3He/^4He$ relationships facilitate identification of possible primordial water sources. Interestingly, high-$^3He/^4He$ glasses from central and south Iceland display lower δD values than expected for the depleted MORB mantle. Comparison of this dataset to indicators of recycled components will allow us to investigate water sources in the Icelandic plume.

[1] Hallis et al., Science, 2015, 350, 795-797