Assessing sulfur isotope variability in the Icelandic mantle: evidence from subglacial glasses and melt inclusions

S.A. HALLDÓRSSON[1*], E. RANTA[1], J.GUNNARSSON ROBIN[1], E. BALI[1], A. CARACCIOLO[1], S. ONO[2], H. JEON[3], M.J. WHITEHOUSE[3], M.E. HARTLEY[4], J.K. DHALIWAL[5], S. MATTHEWS[6], A. STEFÁNSSON[1]

[1]Nordvulk, IES, University of Iceland, Reykjavík, Iceland (*correspondence saemiah@hi.is)
[2]MIT, Boston, MA, USA
[3]NORDSIMS, SMNH, Stockholm, Sweden
[4]University of Manchester, Manchester, UK
[5]University of California, Santa Cruz, CA, USA
[6]Johns Hopkins University, Baltimore, MD, USA

A considerable range in $\delta^{34}S$ values has been reported for Icelandic lavas [1], but potential flaws in older sulfur extraction methods [2] and the degassed nature of the analyzed lavas question the reliability of this dataset. We have therefore undertaken a systematic study following the newly proposed HF-extraction method [2] to evaluate the sulfur isotopic characteristics of Icelandic lavas. We focus on a suite of subglacial basalts (n=59) and a set of previously studied silicate melt inclusion from central Iceland (n=29) [3,4]. Select samples from subaerially-erupted lavas (n=15) exhibiting evidence for degassing have also been included. A new set of SIMS standards have been prepared following [2] for the purpose of obtaining high-quality $\delta^{34}S$ values from silicate glasses trapped in crystals.

Relatively high sulfur contents (>500 ppm) and S/Dy comparable to, but generally higher than, estimates for depleted MORB mantle (DMM: 150-310), are consistent with the relatively un-degassed nature of most samples analyzed. The entire sample suite records a large range in $\delta^{34}S$ values (-3.8 to +3.8‰ by SIMS and IRMS). Degassed samples display the highest $\delta^{34}S$ values whereas a more restricted range (-2.5 to +0.5‰) is observed for most samples containing >500 ppm. For this group, subglacial glass samples and silicate melt inclusions reveal overlapping $\delta^{34}S$ values, averaging at -1.2‰ (±0.6; 1σ, n=92), which is identical to estimates for DMM [2]. A group of high-MgO glasses record a large range in $\delta^{34}S$ values (from -3.8 to +0.5‰) at ~1100 ppm [S], exceeding greatly the range evident in another group of high-MgO glasses with ≤800 ppm [S]. This low-$\delta^{34}S$ group also reveals S/Dy as high as 615, suggesting primary (mantle-derived) controls on $\delta^{34}S$ values in Icelandic basalts.

[1] Torssander, P. (1989), CMP *102*(1), 18–23. [2] Labidi, J., et al. (2012). CG, *334*, 189–198. [3] Caracciolo et al. (2020) Lithos, *352-353*, [4] Bali et al. (2018) CMP, *173:9*.