Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30923

Multi-year oxygen isotope record of Fagradalsfjall and Sundhnúkur Fires, Iceland: constraints on mantle source and magmatic evolution

FRANCES M. DEEGAN[1], VALENTIN R TROLL[1], ILYA N. BINDEMAN[2], LUIGI DALLAI[3], THOR THORDARSON[4], ÁRMANN HÖSKULDSSON[4], LUKÁŠ KRMÍČEK[5], WILLIAM M. MORELAND[6] AND PROF. JAMES M.D. DAY[7]

[1]Uppsala University
[2]University of Oregon
[3]Sapienza University of Rome
[4]University of Iceland
[5]Czech Academy of Sciences
[6]Icelandic Meteorological Office
[7]University of California at San Diego, Scripps Institution of Oceanography

The Reykjanes Peninsula (RP), SW Iceland, hosts several linear volcanic vent systems that have been periodically active in post-glacial time. In 2021, following 781 years of dormancy, the RP entered a new eruption period with the onset of the 2021-23 Fagradalsfjall Fires, which comprised three effusive eruptions (the Geldingadalir, Meradalir, and Litli-Hrútur events). Late in 2023, volcanic activity shifted westwards to the Sundhnúkur vent system, marking the onset of the Sundhnúkur Fires, which to date comprise seven effusive eruptions. To better understand the origins and evolution of the magma feeding these eruptions, we present $^{18}O/^{16}O$ data (as $d^{18}O$ values) and major and trace element data for lava and tephra samples from seven eruptions that took place between 2021 and 2024. Using these data, we constructed an almost four-year-long time-series of magmatic $d^{18}O$ values for the Fagradalsfjall and Sundhnúkur Fires. This dataset represents an exceptionally long record of oxygen isotope variations for an active Icelandic basaltic rift system, providing unique insight into the $d^{18}O$ composition of the mantle beneath SW Iceland and magma differentiation processes. The data reveal subtle changes in $d^{18}O$ values, with $d^{18}O$ values similar to mid-ocean ridge basalt (MORB) dominating in 2022 and 2023. The exceptionally fresh nature of the samples coupled with their MORB-like $d^{18}O$ values make these samples a benchmark for mantle $d^{18}O$ values in the North Atlantic region. However, from late 2023 onwards, $d^{18}O$ values show a change that coincides with a shift to shallower (~5 km) magma residence prior to eruption (Troll et al. 2024, Terra Nova 36, 447-456), which suggests that oxygen isotope ratios can be modified by crustal differentiation processes over timescales of less than a year.