Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35699

Extremely Enriched Radiogenic Sr-Nd Isotope Signatures in Iceland's Öræfajökull Endmember

VINCENT R. LAMBERTI[1], DR. ROBERT WILLIAM NICKLAS, PHD[2], DYLAN M. SEAL[1], ETHAN F. BAXTER[1] AND SÆMUNDUR A. HALLDÓRSSON[3]

[1]Boston College
[2]Lunar And Planetary Institute
[3]Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland

The volcanically-derived island of Iceland is situated along the Mid-Atlantic Ridge while being supplemented by a high buoyancy flux plume – both of which contribute to its singularly unique geological story. Ocean island basalts have long been known to host isotopic and trace element signatures significantly more variable than the much more voluminous mid-ocean ridge basalts. Numerous isotopic data have been reported from all three major modern Icelandic rift zones, but despite the great number of lavas analyzed, 99.9% of the variance can be accounted for by mixing between two endmembers, likely depleted mantle and enriched recycled oceanic crust [1]. The most notable exception to this two-endmember mixing is Öræfajökull, a historically active volcano located on the flank of the eastern rift zone, which exhibits radiogenic $^{87}Sr/^{86}Sr$, unradiogenic $^{143}Nd/^{144}Nd$, and radiogenic $^{207\text{-}208}Pb/^{204}Pb$ at intermediate $^{206}Pb/^{204}Pb$ compositions comprising a distinct "Öræfajökull" endmember. Primitive olivine-bearing lavas are relatively rare, with most of the eruptive activity being rhyolitic. In order to explore whether the endmember resides in the mantle or crust beneath Öræfajökull, Sr and Nd isotope systematics of bulk rocks and mineral separates from recently collected olivine-phyric lavas are herein reported.

This study characterized two distinct hand samples from the Öræfajökull region, "ÖR25" and "ÖR12". Both samples exhibit bulk compositions that plot within the well documented "Öræfajökull" range; however, significantly more enriched $^{87}Sr/^{86}Sr$ signatures (0.7063 and 0.7043) were recorded in two olivine fractions from ÖR25-1. The $^{143}Nd/^{144}Nd$ ratio measured in one of these olivine separates was 0.512896 (corresponds to $^{87}Sr/^{86}Sr$ of 0.7063). Both the Sr and Nd isotope signatures of the olivine are the most enriched yet found in Iceland. The relatively unaltered, pristine olivine crystals in ÖR25 (of a highly enriched mantle endmember influencing the Icelandic plume, as olivine likely formed before any crustal contamination. This endmember may be recycled radiogenic crustal material [2], [3], yet further modeling is necessary to constrain the magmatic source.

[1] Peate et al. (2010), *Journal of Petrology* 51, 1447-1475.

[2] Manning and Thirlwall (2014), *Contributions to Mineralogy and Petrology* 167, 159

[3] Torsvik et al. (2015), *Proceedings of the National Academy of Sciences* 112