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The Fagradalsfjall and Sundhnúkur Fires of 2021–2024: Insights from trace element compositions of olivine

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Collection of liquid lava from the Sundhnúkur eruption (April 2024).

The Reykjanes Peninsula (RP) hosts several volcanic lineaments that have been periodically active in post glacial time. Since 2021, after 781 years of dormancy, ten eruptions have occurred along the Reykjanes Volcanic Belt (RVB) of the RP, with more expected in the future. To better understand the origins of this renewed volcanism and help forecast and mitigate against future eruptions, we have been performing high resolution syn-eruptive analyses of recently erupted RVP rocks (e.g., [1], [2], [3], [4]).

The presented study summarises preliminary data on the trace element composition of olivine from olivine tholeiitic basalts sampled during the Fagradalsfjall (2021–2023) and Sundhnúkur (2023– ongoing as of 26 February 2025) Fires in the RVB. Olivine compositions attest that the Fagradalsfjall and Sundhnúkur volcanic systems are connected at depth. Olivine crystals represent products of magmatic crystallisation, and the data imply a dominantly peridotite mantle source lithology that gave rise to their parental magmas. In addition, Sundhnúkur samples fit a trend of progressively changing data groups from the 2021 to 2023 Fagradalsfjall eruptions, implying that magmatic differentiation has taken place between the initial 2021 events and the subsequent eruptions. This appears to be the result of dominantly crystal–liquid fractionation, shifting the overall magma chemistry towards more evolved compositions with time. This implies that fractional crystallisation in sub-alkaline magma reservoirs operates on the scale of months or years, which is a fundamental advance in our understanding of these common magmatic systems.

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References

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