

The generation of intermediate compositions in Iceland. A simple mixing approach to a complex problem.

JOAQUIN A CORTES¹, AMANDA LOUISE HUGHES¹
AND DAVE MCGARVIE²

¹Edge Hill University

²Lancaster University

Presenting Author: joaquin.cortes@edgehill.ac.uk

The paucity of intermediate compositions (52-69 wt.% SiO₂) in Icelandic volcanic products has long been an issue when modelling magma petrogenesis, in particular when relying on a fractional crystallisation mechanism to generate rhyolitic magmas. Currently intermediate lavas constitute ~8 vol% of the volcanic deposits in Iceland[1] and are currently only found at few central volcanoes. This absence has been explained assuming that intermediate magmas are stalled in the Icelandic crust[2], while basalt and rhyolite lavas erupt more frequently.

Using data from GEOROC[3] we explored the distribution of intermediate compositions across Iceland and investigated different mechanisms to produce these compositions. Our results show that a large proportion of intermediates are found within flank zones, where volcanoes are larger, magma is expected to stall for longer in the crust, and rhyolite is a prominent product alongside basalts. Intermediate compositions are seldom found in rift zones, with Krafla and Askja the only exceptions, being the only rift volcanoes to erupt rhyolite alongside basalt.

We propose intermediates in Iceland are a product of magma mingling between basaltic magma (sourced from the MAR and Icelandic plume) and rhyolite magma (produced via partial melting of the Icelandic crust), analogue to the mechanism proposed for arc intermediates[4]. Their occurrence in Iceland is limited to specific conditions:

1. The volcano must be producing both basalt and rhyolite magmas.
2. The volcano must have a well-established plumbing system, where magma mixing is facilitated.

[1] Jónasson, K., (2007). *Journal of Geodynamics*, 43(1), 101-117.

[2] Thorarinnsson, S. (1967). *Geologische Rundschau*, 57, 1-20.

[3] GEOROC. (2022). *Ocean Islands-Iceland*. [Online]

[4] Reubi, O. and Blundy, J., (2009). *Nature*, 461(7268), 1269-1273.