Petrology of Mafic, Intermediate, and Silicic Lavas in an Abandoned Rift Zone, Laxárdalsfjöll, Iceland

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Abstract

A sequence of Tertiary lavas on the Skagi Peninsula, Iceland was erupted along a rift abandoned at 7 Ma. Previous reconnaissance mapping of Laxárdalsfjöll, in the southern Skagi Peninsula, identified an acid volcanic unit within an otherwise basaltic sequence. New mapping has further constrained the extent, lithologic diversity and origin of this unit. The lower 200 meters of stratigraphy exposed in the study area consists of aphyric basalts and basaltic andesites. Overlying this unit is the acid volcanic unit, a ~20 meter thick coarsely plagioclase-phyric andesite. The andesite exhibits field and petrographic evidence for magma mixing. In much of the study area a rhyolite lava of variable thickness overlies the andesite. The upper 250 meters contains lavas of variable composition, including basalts, andesites, and one dacite lava. Minor tuffs exist in this unit. Twelve samples were analyzed by XRF and eight by ICP-MS. On classification diagrams (e.g. TAS) samples plot as basalts, basaltic andesites, andesites, dacite and rhyolite. All plot on the tholeiitic trend on an AFM diagram. The basalts are moderately to highly evolved (48.1-53.2 wt % SiO_2, 3.5-7.0 wt % MgO). The upper basalts are more evolved on REE and incompatible element plots than the lower basalts. Silicic rocks range up to 75.3 wt % SiO_2. The felsic samples are parallel to but more enriched than the basalts on REE and spider plots. Trace element data display generally parallel REE patterns with modest LREE enrichment. A negative Eu-anomaly develops progressively in the intermediate to silicic rocks (rhyolite Eu/Eu* = 0.59). Spider plots show considerable LILE variation, including depletion in Sr and variable Zr. Generally the trace element patterns of the basalts resemble P-MORB and OIB. The geochemical data suggest that the flows originated from an enriched mantle source, not a shallow asthenospheric N-MORB mantle. This is consistent with the plume interpretation of Iceland. Dacites and rhyolites may be crustal melts or fractionates from a basaltic parent. Trace element variations suggest that the andesites are the result of mixing basaltic and dacitic magmas.

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