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Geographical variations of Holocene basalt compositions in Iceland: implications for the mantle lithology

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The composition of Recent basalts along an axis orthogonal to the Mid-Atlantic Ridge has been measured in Iceland. The basalts become increasingly silica saturated towards the centre of Iceland. Incompatible trace element- and Sr and Nd isotope ratios also vary systematically with maximum or minimum values at the extreme west or south east.

The geographical difference of the basalt compositions shows strong correlation between major and trace elements and isotope ratios. These variations are unlikely caused by crustal contamination since the Icelandic basalt crust is too young to have much radiogenic 87Sr/86Sr. Therefore, the different alkalinity, trace element-, and isotope ratios are more likely reflecting the compositional variability of the Icelandic mantle. Beneath the centre of Iceland the mantle is less radiogenic in Sr than at the periphery, where more alkaline basalt melts with up to 10 times higher [La/Yb]n are produced. The geographical variations of the Icelandic basalts suggest that relatively enriched mantle is preferentially melted beneath the periphery of the island, away from the rift zones.

Garnet pyroxenite veins are likely to be an important component of the otherwise lherzolitic mantle. The garnet signature, high La/Yb and low Lu/Hf, is more pronounced in basalts from the far W and SE part of the transect compared to those from Mid-Iceland. This decreasing signal towards the centre of the island is consistent with increasing proportions of lherzolite melt in the total melt fraction forming the basalts. Hence, melts of the enriched fertile mantle are less diluted at the periphery but overwhelmed in Mid-Iceland.