Peridotite source for enriched Snaefellsnes off-axis lavas, Iceland

DAVID W. PEATE[1]

[1]Dept. of Earth & Environmental Science, University of Iowa, Iowa City IA 52242, USA. david-peate@uiowa.edu

Compositional heterogeneity in the Icelandic mantle can be broadly described as a mixture of a 'depleted' component (high $^{143}Nd/^{144}Nd$; low $^{206}Pb/^{204}Pb$), sampled by high-degree melts at the rift zones, and more fusible 'enriched' components (low $^{143}Nd/^{144}Nd$; high $^{206}Pb/^{204}Pb$), best seen in low-degree melts in the off-axis zones. Element and isotope features of the dominant 'enriched' component are generally attributed to recycled oceanic crust, but the lithology is less well-constrained. Two recent studies of rift zone lavas led to divergent opinions: a positive correlation between $^{187}Os/^{188}Os$ and Ni-enrichment in olivines suggested a pyroxenite component (Sobolev *et al.*, 2008), while modelling of major element compositions could be explained just through melting of variably fertile peridotite (Shorttle & Maclennan 2011). This study focuses on post-glacial lavas from the Snaefellsness off-axis zone that represent one 'enriched' extreme of Icelandic compositions, dominated by a mantle component with $^{206}Pb/^{204}Pb > 19$ and $^{143}Nd/^{144}Nd < 0.5129$. The relative abundances of transitional metals in mafic lavas can preserve a signal of lithological heterogeneities in mantle sources, and element ratios can be chosen (e.g. Fe/Mn, Zn/Fe, Co/Fe) that show limited fractionation during peridotite melting but are sensitive to melting of non-peridotite lithologies. Whole rock transition metal analyses of samples from the Snaefellsnes off-axis zone and the main rift zones have been acquired using a collision-cell ICP-MS method. These data show that Co/Fe has limited sensitivity in determining source lithology as it is strongly influenced by olivine addition/loss. Snaefellsness off-axis lavas have similar Fe/Mn, Zn/Fe, Co/Fe, and $^{187}Os/^{188}Os$ to the main rift lavas (despite lower $^{143}Nd/^{144}Nd$ and higher Nb/Zr), with values consistent with melting of a peridotite mantle source. PRIMELT2 modelling (Herzberg & Asimow, 2008) shows that the major element compositions of all Icelandic lavas (main rift, off-axis) can be explained using a peridotite mantle source. One location in the main rift zone (Skridufell) is an exception: its high Fe/Mn, Zn/Fe, & $^{187}Os/^{188}Os$, suggests a pyroxenite mantle source. These data are revealing how the isotopic diversity of the Icelandic mantle is linked to its lithological diversity.

[1] Herzberg & Asimow (2008). *G-cubed* Q09001. [2] Shorttle & Maclennan (2011). *G-cubed* Q11008. [3] Sobolev *et al* (2008). *Science* **321**, 536.