Progressive melting of a heterogeneous mantle source beneath 9-10°N EPR.

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To better understand MORB petrogenesis and crustal accretion at fast spreading ridges we have initiated a study to measure Nd, Sr, Hf and Pb isotopic compositions and high precision trace element abundances in lavas from a variety of tectonic settings along and across the 9-10°N EPR ridge crest. In previous publications we have reported data for: 1) a suite of 20 axial lavas from 9-10°N [1], and 2) a suite of 15 off-axis lavas (within 5 kms of the ridge crest) from 9°48'-9°52'N [2]. In this study we present new Hf, Nd, Sr and Pb isotopic compositions and major- and trace-element concentrations for 14 samples selected from a suite of off-axis MORBs that extend eastward from the ridge crest at 9° 30'–34'N out to ~4 km on the Cocos plate. The geological context of all samples are well constrained as they were collected by submersible in areas that have been extensively imaged by remote sensing techniques.

Major and trace-element abundances for the 9° 30'–34'N off-axis lavas indicate that they are the most incompatible element enriched and evolved lavas along the 9-10°N EPR ridge crest [3]. Our new isotopic and trace element measurements further show that the Nd, Hf, Sr and Pb isotopic compositions of these lavas are enriched, variable and correlated with incompatible element enrichments. This isotopic enrichment contrasts with the depleted and uniform Nd, Hf, $^{208}Pb/^{206}Pb$ and Sr isotopic compositions of 9-10°N axial lavas and 9°50'N off-axis lavas.

The new isotope data require a heterogeneous mantle source beneath 9-10°N EPR. The only lavas which seem to preserve this heterogeneity are the 9°30'–34'N off-axis lavas, which come from a more magmatically deficient region and appear to represent low-degree melts. In contrast, the 9-10°N axial lavas and 9°50'N off-axis lavas come from more magmatically active regions of the ridge, and appear to represent larger melt fractions of a mantle source that is isotopically homogeneous over the length scale of melting. We attribute this difference in the isotopic characteristics of the lavas to progressive melting of a hetergeneous mantle source and not just simple crustal level mixing.

References

[1] Sims et al., (2002) *GCA* **66,** 3481-3504.
[2] Sims et al. (2003) G-cubed **4,** 10.
[3] Smith et al., (2001) G-cubed **2.**