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Mantle melting and melt refertilization beneath the Southwest Indian Ridge: Mineral composition of abyssal peridotites

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As one of the slowest spreading ridges of the global ocean ridge system, the Southwest Indian Ridge (SWIR) is characterized by discontinued magmatism. The 53°E segment between the Gallieni fracture zone (FZ) (52°20′E) and the Gazelle FZ (53°30′E) is a typical amagmatic segment (crustal thickness <2km) (Zhou and Dick, 2013) that opens a window to the mantle thus provides a chance to detect the mantle composition directly.

We examine the mineral compositions of 17 peridotite samples from the 53°E amagmatic segment. The results show that the peridotites can be divided into two groups. The Group 1 peridotites are characterized by clinopyroxenes having LREE depleted patterns that is typical for the abyssal peridotite, thus are thought to be the residue of the mantle melting. The Group 2 peridotites show the lowest HREE content within the SWIR peridotites but are anomaly enriched in LREE, with flat or U-type REE patterns, thus cannot be the pure residue of mantle melting. Mineral compositions of the Group 2 peridotites are more depleted than that of peridotites sampled near the Bouvet hot spot (Johnson et al., 1990), implying that the depleted mantle beneath the 53°E segment may be the residue of ancient melting event. This hypothesis is supported by the the low Ol/Opx ratios, coarse grain sizes (>1cm) Opx, and Mg-rich mineral compositions akin to harzburgite xenoliths that sample old continental lithospheric mantle (Kelemen et al., 1998). Melt refertilization model shows that Group 2 peridotites were affected by an enriched low-degree partial melt from the garnet stability field. These results indicate that depleted mantle which experiences ancient melting event are more sensitive to melt refertilization, thus may reduce the melt flux, leading to extremely thin crust at 53°E segment.

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References:

Johnson K T M, Dick H J B, Shimizu N. Melting in the oceanic upper mantle: An ion microprobe study of diopsides in abyssal peridotites[J]. Journal of Geophysical Research, 1990, 95(B3):2661-2678.

Kelemen P B, Hart S R, Bernstein S. Silica enrichment in the continental upper mantle via melt/rock reaction[J]. Earth & Planetary Science Letters, 1998, 164(1–2):387-406.

Zhou H, Dick H J. Thin crust as evidence for depleted mantle supporting the Marion Rise.[J]. Nature, 2013, 494(7436):195-200.