Geochemical effects of alteration and refertilization in abyssal peridotites

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The majority of abyssal peridotites (AP) dredged or drilled from the ocean floor are partially to totally hydrothermally altered and/or weathered. It has also been shown that AP experience melt-refertilization during their residence in the mantle beneath ridges. The effects that these processes have on geochemical compositions in AP, most especially for the highly siderophile elements (HSE), remain poorly constrained. To further examine such effects, we present a comprehensive dataset of bulk-rock major-, trace- and HSE abundances, ^{187}Re-^{187}Os and previously reported pyroxene $^{143}Nd/^{144}Nd$ data for variably altered and serpentinized Mid-Atlantic (MAR), Gakkel, Central Indian (CIR) and South-West Indian Ridge (SWIR) AP.

New trace-element abundance data reveal that MAR AP have the most melt-depleted compositions (La/Gd_n = <0.5, where n = normalization to primitive mantle La/Gd = 1.153); Gakkel, CIR and SWIR AP show both melt-depleted and melt-refertilized (La/Gd_n = >1.2) compositions. We find no clear correlations between degree of serpentinization, or indices of melt-refertilization (e.g., La/Gd) and Os isotopes or inter-element HSE ratios in AP. Instead the combined bulk-rock $^{187}Os/^{188}Os$ and pyroxene separate $^{143}Nd/^{144}Nd$ data show that AP have systematically lower $^{187}Os/^{188}Os$ than primitive mantle estimates, but have ε_{Nd} values similar to the most depleted MORB (~+10 to +14) These observations indicate that Os isotopes and HSE abundances are faithful recorders of mantle compositions and robustly preserve information on mantle depletion events that have occurred in the oceanic mantle.