Geochemical effects of alteration and refertilization in abyssal peridotites

JAMES M. D. DAY1, RICHARD J. WALKER2 AND JESSICA M WARREN3

1Scripps Institution of Oceanography, La Jolla, CA 92093-0244, USA. jmdday@ucsd.edu
2University of Maryland, College Park, MD 20740, USA
3Stanford University, Palo Alto, CA, 94305, USA

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, 187Re-187Os and previously reported pyroxene 143Nd/144Nd data for variably altered and serpentinizedMid-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/Gdn = <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/Gdn = >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 187Os/188Os and pyroxene separate 143Nd/144Nd data show that AP have systematically lower 187Os/188Os than primitive mantle estimates, but have ε143Nd 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.