Highly siderophile element behaviour of the mantle at fast and intermediate spreading ridges

M. PAQUET[1], J.M.D. DAY[1], D.B. BROWN[1], C.L. WATERS[1]

[1]Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92093, USA

(paquet@ipgp.fr; jmdday@ucsd.edu; dbbrown@ucsd.edu; clwaters@ucsd.edu)

The composition of the mantle provides fundamental constraints for models of Earth formation and evolution. In particular, the highly siderophile elements (HSE: Os, Ir, Ru, Pt, Pd, Re) are considered to reflect ~0.5 to 0.8 wt.% late accretion that was relatively homogeneously distributed within the bulk silicate Earth [1]. Currently, data for direct oceanic mantle materials comes from abyssal peridotites from ultra-slow to slow spreading ridges (e.g., Gakkel Ridge, Southwest Indian Ridge, Mid-Atlantic Ridge [2]). Limited data are available on the HSE abundances and Os isotopic composition of mantle beneath intermediate and fast spreading centers. Here, we report new mineral chemistry, bulk-rock major-, trace- and HSE abundance data and $^{187}Os/^{188}Os$ ratios for Pacific Antarctic Ridge (PAR) and Pacific (Hess Deep) abyssal peridotite samples. PAR full spreading rate ranges from 60-100 mm/yr, whereas Hess Deep samples come from a region of fast spreading (135-150 mm/yr). Abyssal peridotites from two fracture zones on the PAR define different degrees of melt depletion (8-10 and 11-17%, respectively), yet show similar ranges and averages in $^{187}Os/^{188}Os$ (0.1272±41 & 0.1264±27) that are more radiogenic than for the Hess Deep (0.1247±15; >16% melt depletion). PAR samples with low degrees of melt depletion have primitive mantle-like HSE patterns with variable rhenium depletion, whereas samples with higher degrees of melt depletion have more variable Re, Pd and Pt abundances. The new results show that abyssal peridotites from fast to intermediate spreading ridges reveal few if any systematic differences in the distribution and behaviour of the HSE, or in degrees of melt depletion, compared with slow to ultraslow spreading ridges. This observation comes despite the significant differences in melt generation processes at these ridges and are consistent with abyssal peridotites representing residues after both modern and ancient melt depletion.

[1] Becker, H. et al. (2006) GCA, 70, 4528-4550; [2] Day, J.M.D. et al. (2017) GCA, 200, 232-254.