Constraints on the W abundance of upper mantle from xenolithic peridotites

H. RIZO[1], R.L. RUDNICK[2], R.J. WALKER[3], R.W. CARLSON[4]

[1]Geotop-Université du Québec à Montréal, Québec, Canada; rizo.hanika@uqam.ca
[2]Department of Earth Science, U.C. Santa Barbara, USA; rudnick@geol.ucsb.edu
[3]Department of Geology, University of Maryland, USA; r.walker@umd.edu
[4]Department of Terrestrial Magnetism, Carnegie Institution for Science, USA; rcarlson@carnegiescience.edu

Well-resolved ^{182}W variations compared to terrestrial standards have been discovered in ancient to modern mantle-derived rocks. Given that ^{182}Hf decays into ^{182}W in the first 50 Ma of Solar system hystory, variations in ^{182}W reflect Hf/W fractionation early in Earth's history. Tungsten behaves as an incompatible element during igneous processes and W concentrations of mantle-derived magmas should be higher than their source, yet W concentrations of some mantle-derived rocks with ^{182}W anomalies are often unexpectedly high (up to a few ppm). This enrichment is difficult to explain by igneous processes alone, given estimates for the W concentration of the modern mantle of ~ 8 ppb [1]. The W concentration of mantle reservoirs are largerly based on data from mid-ocean ridge basalts, ocean island basalts, and ophiolites [1-3]. To understand the behaviour of W during mantle melting, and better constrain the W concentration of the upper mantle, we report W concentrations for well characterized mantle xenoliths from Hannouba and Yangyuan (China), and Shavaryn (Mongolia). Hannouba and Yangyuan samples have W concentrations ranging from 10 to 80 ppb; Shavaryn samples range from 20 to 150 ppb. Combined with major and trace element data, W concentrations of some of these mantle xenoliths suggest W enrichments occurred through re-fertilization and/or metasomatic overprinting. Nevertheless, other xenoliths show trends of W vs. MgO, Al_2O_3, CaO and SiO_2, for whole rocks, clinopyroxenes and spinels consistent with W depletion accompanying partial melt removal. This suggests that the best preserved and fertile mantle xenoliths can be used to constrain the W abundance of the upper mantle.

[1] Arevalo and McDonough (2008) EPSL 273, 656-665. [2] Ireland et al. (2009) GCA 73, 4517-4530. [3] Babechuk et al. (2010) GCA 74, 1448-1470. [4] O'Driscoll et al., (2015) J PETROL 56, 1797-1828.