Stable tungsten isotope fractionation during magmatic processes

S.E. MAZZA[1*], A. STRACKE[2], J. GILL[3], AND T. KLEINE[1]

[1]Institut für Planetologie, University of Münster, Germany (*correspondence: mazza@uni-muenster.de)
[2]Institut für Mineralogie, University of Münster, Germany
[3]Department of Earth & Planetary Sciences, University of California Santa Cruz, USA

Modern analytical techniques make it possible to resolve differences in stable isotope ratios of the heavy elements, even the generally sub per mil variations produced at magmatic temperatures. Recent studies have reported stable W isotope fractionation amongst different reference materials, and observed that chemically more evolved rocks tend to low isotope ratios [1]. This study further investigates the stable W isotopic composition of magmatic rocks from Earth's continental crust and mantle to evaluate whether large-scale silicate Earth differentiation induces significant stable W isotope fractionation.

Reference materials from the Geological Survey of Japan and several ocean island basalts (OIBs) were investigated using double spike MC-ICPMS. Tungsten was separated from the sample matrix using anion exchange chromatography following previously developed protocols [1]. Data reduction was performed with the Double Spike Toolbox [2] and W isotope ratios are reported as the ‰ deviation from NIST SRM 3163, i.e., $\delta^{184/183}$W. Reproducibility of the spiked NIST 3163 standard solution used to bracket the samples was ±0.021 for $\delta^{184/183}$W. USGS rock standard GSP-2 was used as an internal standard, yielding 0.033±0.012 (n=8) $\delta^{184/183}$W which is within the expected range for this lab ($\delta^{184/183}$W = 0.024±0.010, n=17).

Our first results show a narrow range in $\delta^{184/183}$W among the investigated samples, between ~0.002 and ~0.047 $\delta^{184/183}$W. The $\delta^{184/183}$W in OIBs are within error, and range from ~0.020 (Rurutu) to ~0.046 (Atiu), suggesting that there is no significant W stable isotope variation among different OIB sources. However, our results reveal slightly lower isotope ratios in more chemically evolved samples (rhyolite JR-1 and granodiorite JG-1), in agreement with [1]. This isotopic fractionation is only present in the Japanese rock standards, some of which are subduction related. This may result from stable W isotope fractionation during fluid-induced melting of the sub-arc mantle or by magmatic processes during magma differentiation. We are currently testing this hypothesis through analyses of an additional, well characterized suite of arc samples. With these new results we hope to have a better understanding of the stable W isotopic composition of different silicate reservoirs and the processes that are responsible for stable W isotope fractionation.

[1] Krabbe et al. (2016) *Chem. Geo.*, **450**, 135-144. [2] Rudge et al. (2009) *Chem. Geo.*, **265**, 420-431.