Tungsten stable isotope variations investigated by double spike MC-ICPMS

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Introduction:

Stable isotope fractionations are strongly temperature dependent, and can thus be used for constraining high-temperature processes like planetary core formation [3-6]. This is because metal-silicate separation may induce a measurable variation due to a large difference in bond stiffness between the metal and the silicate phase. Investigating W stable isotope variations is particularly important given the link to the Hf-W chronometer, which is used to date core formation. Nevertheless, other processes operating in the solar nebula or during magmatic differentiation can potentially cause mass-dependent W isotope variations as well. In this study we aim to assess the magnitude and origin of stable W isotope variations among terrestrial and extraterrestrial materials using a new W double spike. Here we present preliminary results for one terrestrial standard and three meteorite samples.

Methods:

Single ^{180}W and ^{183}W spikes obtained from Oak Ridge National Laboratory were mixed in optimal proportions to produce a ^{180}W-^{183}W double spike, and then calibrated against the NIST SRM 3163 W standard. Samples were spiked, dissolved, and W was then separated by anion chromatography [7]. Tungsten isotope measurements were performed using a Neptune *Plus* MC-ICPMS in Münster. Deconvolution of the data was conducted using the *Double Spike Toolbox* software in Matlab [1], and data are reported in δ^{183}W/^{184}W as the ‰ deviation from NIST SRM 3163.

Results:

Our measurements of a terrestrial rock standard AGV-2, two chondrites Allende (CV3) and Kernouvé (H6), and an iron meteorite Henbury (IIIAB) reveal no resolvable W isotope fractionations of the δ^{183}W/^{184}W values from NIST 3163 and so we do not reproduce the large variations with a total range of 0.5 permil per amu reported by an earlier study [2]. To understand this discrepancy and to assess the full extent of W stable isotope variations we are currently obtaining more data for additional (extra) terrestrial samples.

[1] Rudge et al. (2009) *Chem. Geol.*, **265**, 420-431. [2] Breton & Quitté (2014) *JAAS*, **29**, 2284-2293. [3] Georg et al. (2007) *Nature*, **447**, 1102-1106. [4] Hin et al. (2013) *EPSL*, **379**, 38-48. [5] Moynier et al. (2011) *Science*, **331**, 1417-1420. [6] Burkhardt, C. et al. (2014) *EPSL*, **391**, 201-211. [7] Kruijer et al. (2013) *EPSL*, **361**, 162-172.