Tungsten stable isotope variability in geostandards and igneous rocks

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Tungsten stable isotope fractionation has only been investigated over the last few years, while it potentially provides strong constraints on various processes including core formation and fluid-rock interactions [1-3]. However, discrepancies exist between the various data sets and remain mostly unexplained.

Here we analysed a series of geostandards [AGV-2 (andesite), BCR-2 and BHVO-2 (basalts), OKUM (komatiite), GSP-2 and G3 (granites), and FeMn-1 (nodule)] including 4 samples reported in previous studies, as well as other igneous rocks representing both old terrestrial crust and recent one: 1 hawaian basalt, 1 komatiite from South Africa, and 4 granites showing various differentiation degrees. Several aliquots from the same batch of a given standard were analysed and different batches were also considered for each geostandard.

After digestion, tungsten was separated from the matrix elements using the procedure described in [4]. Isotope measurements were performed on a Neptune MC-ICPMS, and mass bias was corrected using standard-sample bracketing and Hf as an internal standard.

Data span over a range of 0.25‰.amu^{-1} in total. Reproducibility tested on different digestions of the same powder is excellent. Overall, data agree with the literature. However, different batches of the same geostandard seem to display different isotope compositions. These variations may be due to nugget effects, which could easily explain the differences observed between different studies. Hence geostandards are not suitable samples to compare results for W. The reliability of our procedure allows using W stable isotopes to investigate processes on the Earth or in the early solar system.

Noteworthy, granites show the largest isotope variations, that are apparently related to the differentiation degree. The W isotope composition is much more homogeneous among other types of samples.

[1] Abraham et al. (2015) JAAS 30, 2334-2342. [2] Krabbe et al. (2017) Chem. Geol. 450, 135-144. [3] Kurzweil et al. (2018) Chem. Geol. 476, 407-417. [4] Breton and Quitté (2014) JAAS 29, 2284-2293.