Vanadium isotopes – a potential new proxy for paleo-oceanography

A. BRÜSKE[1*], S. SCHUTH[1], L. XU[2], M. C. ARNOLD[1], N. PIERAU[1] AND S. WEYER[1]

[1]Leibniz University Hannover, Institute for Mineralogy, 30167 Hannover,Germany ([*]annika.brueske@hotmail.de)

[2]Chinese Academy of Geological Sciences, Institute of Mineral Resources, 100037 Beijing, China

Vanadium (V) has two stable isotopes with very different abundances (^{50}V = 0.25%, ^{51}V = 99.75%). It is, similar to U and Mo, a highly redox-sensitive metal. However in contrast to the latter, it occurs in nature in three different oxidations states (+3, +4, and +5). Therefore, fractionation of stable V isotopes is potentially a very sensitive redox indicator in low-temperature environment studies, e.g., in paleo-oceanography.

We determined the first δ^{51}V signatures of two profiles of early Cambrian black shales from the Niutitang formation in south China [1]. The V fraction was purified with a slightly modified ion chromatography method after [2] that quantitatively removed isobaric interferences of Cr and Ti on ^{50}V. Measurements were performed via standard-sample bracketing and high resolution-MC-ICP-MS (Thermo-Finnigan Neptune). In addition, we analysed U isotopes on the same samples according to the method described by [3].

The δ^{51}V values are given relative to an Alfa-Aesar standard solution. The samples showed variable δ^{51}V values ranging from –1.7 to –0.4‰ (average 2s.d. ±0.1‰, n=84). The δ^{238}U values range from –0.4 to +0.7‰ (average 2s.d. ±0.05‰). Interestingly, δ^{51}V and δ^{238}U values display a significant correlation. These coupled isotopic variations may be attributed to variations of redox conditions and likely trace events of coupled U-V mobilization and subsequent re-deposition. As it is well known that microbes are capable of V cycling [4] and U isotopes appear to be a sensitive monitor for biotic U reduction [5], the coupled V and U isotope fractionation may indicate that microorganisms have been an important driver for U and V reduction in early Cambrian times.

[1] Xu L., et al. (2012) *Chem. Geol.* **318**, 45-49 [2] Nielsen S., et al. (2011) *Geostandards Geoanalytical Res.* **35**, 293-306 [3] Weyer S., et al. (2008) *Geochim. Cosmochim. Acta* **72**, 345-359 [4] Zhang J., et al. (2014) *Chem. Geol.* **370**, 29-39 [5] Stylo M., et al. (2014) *Goldschmidt Conference Abstract* #2404