Significant vanadium isotope fractionation revealed in V minerals by femtosecond LA-ICP-MS

S. SCHUTH[1*], I. HORN[1], J. CIĄŻELA[1] AND S. WEYER[1]

[1]Leibniz University Hannover, Institute for Mineralogy, 30167 Hannover, Germany ([*] correspondence: s.schuth@mineralogie.uni-hannover.de)

Vanadium (V) is a very redox-sensitive trace metal that occurs in nature as V^{III}, V^{IV}, and V^{V}, e.g. in a variety of ore-forming minerals like vanadates (hosting V^{V}), sulfides (e.g., patrónite: $V^{IV}S_4$), silicates (e.g., roscoelite, hosting V^{III}), and hematite [1]. Similar to other redox-sensitive metals (e.g., Fe, Cu, U), the V isotope compositions of V minerals may provide valuable information for source fingerprinting and redox-controled processes during ore formation. This, however, has not yet been constrained.

Here, we present the first *in situ* V isotope analyses of several natural V minerals (vanadinite, descloizite, cavansite, patrónite, sincosite) conducted with femtosecond-laser ablation-high mass resolution-MC-ICP-MS. Measurements of V isotopes are challenging because of avery high ratio of ^{51}V (99.75%) to ^{50}V (0.25%), and isobaric interferences of ^{50}Cr and ^{50}Ti, and $^{36}Ar^{14}N^{+}$ on the low-abundant ^{50}V during MC-ICP-MS analyses. Thus, our approach is limited to minerals with high V and low Ti and Cr contents. For mass bias control, a Fe standard was added to the sample aerosol before and during analyses (see [2] for comparison). The $\delta^{51}V$ values were determined via standard-sample bracketing, where a pure V metal foil (Alfa-Aesar) served as the standard.

First results indicate a significant variation of $\delta^{51}V$ values between the analyzed minerals, ranging from –0.1 to –1.1‰ (2s.d.: 0.2‰). This spread is significantly larger than reported for peridotites and MORBs [3], and also exceeds the difference for $\delta^{51}V$ between the bulk silicate Earth and the meteorite average [4]. The extended range of $\delta^{51}V$ values suggests dissolution and/or reprecipitation processes due to redox variations, and demonstrates that V isotopes provide a new means for research in low-temperature environments.

[1] Nriagu J.O. (1998) *Vanadium in the environment*. J. Wiley & Sons. [2] Oeser M., et al. (2014) *Geostandards Geoanalytical. Res.* **38**, 311-328. [3] Prytulak J., et al. (2013) *Earth Planet Sci. Lett.* **365**, 177-189. [4] Nielsen S., et al. (2014) *Earth Planet Sci. Lett.* **389**, 167-175.