Veritas in Vanadium? Stable isotope signatures from the Marianas, MORB and magnetite

J. PRYTULAK[1]*, P. SOSSI[2], H.ST. C. O'NEILL[2], T. PLANK[3], T. ELLIOTT[4], S.G. NIELSEN[5] AND A.N. HALLIDAY[6]

[1]Imperial College London, UK (*correspondence: j.prytulak@imperial.ac.uk)
[2]Australian National Univeristy, AU
[3]LDEO, Columbia University, USA
[4]University of Bristol, UK
[5]Woods Hole Oceanographic Institute, USA
[6]Universtiy of Oxford, UK

Vanadium boasts plentiful oxidation states at terrestrial conditions, enticing study and speculation that its stable isotope variations are a potential proxy for oxygen fugacity (fO_2). Sadly, such a direct link between isotope composition and fO_2 is currently far from convincingly demonstrated. However, a small but growing dataset of V isotope variations exist and provide a baseline with which to compare magmas of different tectonic settings [1-3]. MORB have invariant V isotopes, irrespective of ocean basin, radiogenic isotope composition or common alteration processes [1]. Here we compare the tightly constrained MORB signature with subduction-related magmas, conventionally thought to arise from 'more oxidized' mantle sources. We show that, for a given MgO content, V isotopes are identical within analytical error between arc basalts from the Marianas and MORB. Furthermore, a striking trend to heavy isotope compositions with continued magmatic differentiation in Mariana lavas begs an explanation. Fractionation of magnetite is our prime suspect. We have therefore perfomed reconnaisance measurements of natural magnetite from different tectonic settings and find a large range in isotope values, comparable to that seen during differentiation (~2 per mil). Teasing out the direct controls on isotope variation (fO_2, composition, co-ordination chemistry…or some currently intangible parameter?) by measurement of experimentally synthesized material is now an essential step in establishing how the V isotope variations in spinel phases such as magnetite, ubiquitous to igneous processes, may be best utilized. The natural variation of V isotopes measured thus far is large, as is the continued allure of this isotope system to fulfill its potential as a powerful petrogenetic indicator.

[1] Prytulak, *et al* 2013. *EPSL* **365**, 177-189. [2] Prytulak, J., Nielsen, S.G., Halliday, A.N. 2011. *Geostand. Geoanal. Res.* **35**, 307-318. [3] Nielsen, S.G., Prytulak, J., Wood, B.J., Halliday, A.N. 2014. *EPSL,* **389**, 167-175.