The vanadium isotope composition of marine sediments

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Vanadium (V) is a redox sensitive element that has been widely used to constrain variation of redox conditions during many geological processes. With the development of new analytical methods, high precision V isotope analyses are now also possible. Recent theoretical and laboratory measurements have shown that the V isotope composition of marine sediments has the potential to provide new insights into the evolution of Earth-surface redox conditions [1, 2]. However, there has been limited exploration of the V isotope record of modern marine sediments. Furthermore, because of high lithogenic metal concentrations, the detrital fraction of V represents a substantial fraction of total V in many siliciclastic marine sediments. Because of these detrital contributions, it was necessary for us to develop a method to isolate the authigenic component from the bulk sediment.

In order to understand the isotopic fingerprint of V in sediments, we analyzed a diverse sample set encompassing a wide-range of well-documented depositional environments with diverse redox conditions. These samples include sediments from the continental margin off Argentina, the Peru upwelling area, Cape basin off Namibia, the Cariaco Basin and Black Sea. These sites spans a range of bottom water depths and oxygen concentrations from ~0 to 200μM. We will present new data generated by extracting the authigenic V fraction of these siliciclastic sediments using a partial HNO_3 digestion method developed in this study. Vanadium isotope compositions are presented for both bulk sediment and the leach fraction. Our results will provide important constraints on the use of V isotope as a paleoredox proxy, which might be sensitive to the the variations of seafloor low oxygen to mildly reducing area at local and/or global scales.

[1] Wu et al., (2015) EPSL, 426, 216-224.
[2] Wu et al., (2016) Goldschmidt Abstracts, 3443.