Improved ion-exchange procedures for multiple transition metal isotope proxy studies

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Increasingly, multiple proxy or multiple isotope approaches are being used to tackle questions in the Earth Sciences [1,2]. Furthermore, the stable isotope systems of many of the transition metals have emerged as key tracers of many of these processes. For example, coupled molybdenum and uranium isotope studies have the potential to disentangle various processes controlling the redox chemistry in modern and ancient sediments [3]. Here we describe a new, multi-step chemical separation procedure that allows us to quantitatively, and with negligle blank contribution, isolate and measure the isotope systems of the transition metals Fe, Ni, Cu, Zn, Cd, Mo and U at high precision from a single sample aliquot from a range of sample matrix types. This approach thus allows direct comparison of each isotopic system, and limits the amount of sample that would otherwise be required.

These procedures have been tested and validated through analysis of four USGS rock standards (BCR-2, BHVO-2, Nod-A1 and Nod-P1). This study will focus on Fe, Ni, Cu, Zn & Mo where results obtained are in agreement with previously published values. We will further apply these new methods to study black shales spanning the end-Ordovician, a period of large scale global change. We will use Zn and Ni elemental and isotopic systematics to explore the links between expanded glaciation, oceanic anoxia and changes to the dynamics of the biological pump[4].

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