Mass-dependent Mo isotope variations in oceanic basalts – a new tracer for mantle recycling processes

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How and to what extent crustal material is recycled into the deeper mantle as a result of plate tectonic processes is a long-standing but still not fully understood question in Earth Sciences. Indirect evidence from chemical as well as radiogenic isotope data in oceanic basalts suggest that such a process may indeed have operated over much of Earth's history. Yet, uncertainties in characterising the age of the presumed recycled crustal components as well as the wide range in their chemical composition do not allow us to verify the mantle recycling hypothesis. Technological advances now enable us to explore new isotopic tracers that could shed light on this question. One of these new tools are mass-dependent isotope variation of molybdenum (Mo). Mass-dependent Mo isotope data in clastic and chemical sediments are a well-established geochemical tool to study redox conditions in the Earth's water masses over the geological past [1-3]. Being an intrinsic property of rocks exposed to the hydrosphere (see Anbar [4] for an overview), mass-dependent Mo isotope variation in mantle-derived rocks from oceanic settings could therefore be used a tracer of recycled crustal material in the Earth's mantle.

In this contribution we provide a current overview over how different geological and magmatic processes – such as seawater alteration of oceanic crust, slab dehydration during plate subduction as well as magmatic emplacement – could affect the Mo isotopic composition of crustal components being transferred into the deeper mantle, as well as that of mantle melts that may contain such a recycled component. With this in mind, we explore the use of mass-dependent Mo isotope variations in mantle-derived rocks as a tracer of recycled crust in the mantle.

[1] Archer & Vance (2008) *Nature Geoscience* **1**, 597-600. [2] Barling *et al*. (2001) *EPSL* **193**, 447-457. [3] Siebert *et al*. (2003) *EPSL* **211**, 159-171. [4] Anbar (2004) *Rev. Min. Geochem*. **55**, 429-454.