Iron stable isotope variations accompanying prograde metamorphism of basalts & gabbros from Alpine ophiolites

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Iron is a redox sensitive element and a major chemical constituent of the silicate rocks that form oceanic crust. During subduction the downgoing slab undergoes progressive dehydration and element loss to the sub-arc mantle. The transfer of iron in slab derived fluids could represent an important geochemical iron flux, and have a fundamental control on the redox state of the sub-arc mantle. Recent work [1] has demonstrated that prograde serpentinite dehydration in a subduction setting may result in the loss of iron from the slab, manifest by a progressive shift in the iron stable isotope composition with increasing metamorphic grade.

In order to determine and quantify the mobility of iron in slab derived fluids we have analysed samples of metabasalts and metagabbros from a suite of Alpine ophiolites. These fragments of fossil oceanic crust record prograde metamorphic conditions representative of the P-T path of basaltic crust during subduction. Samples from the Zermatt-Saas and Queryas ophiolites have been metamorphosed to both blueschist and eclogite facies. This provides a unique opportunity to examine the effect of subduction zone dehydration, critically at the blueschist-eclogite transition, on the distribution and oxidation state of iron in the subducting slab.

Initial results show that variations in iron isotope composition does not correlate with Mg# and other indicators of melt depletion. This suggests that the observed variations in isotope composition are not related to protolith heterogeneity, and could be linked to later stage processes. Despite this, there is no systematic correlation between δ^{56}Fe and metamorphic grade. Trace element data reveals varying degrees of sediment and fluid interaction with blueschist facies lithologies from the Queryas ophiolites but the effect of this on iron isotope systematics is unclear.

Future work will focus on characterising modern gabbroic altered oceanic crust, in conjunction with ophiolite samples displaying sediment interaction.

[1] Debret *et al*., (2015). *MinMag*, this volume.