In-situ isotopic analysis of sulfides in high-pressure serpentinites

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$\delta^{34}S$ values of sulfides provide information on sulfur sources and processes subsequent to sulfide crystallisation, such as fluid infiltration or loss, and are sensitive to the redox state of sulphur in the host mineral [1]. Therefore it may be possible to use $\delta^{34}S$ to constrain the redox state and fluxes of sulfur. Further, the proximity of serpentinites to ocean crust and metasediments may influence their isotopic signatures during subduction. For example, seafloor serpentinites associated with mafic intrusions have heavier $\delta^{34}S$ values [2].

In this study the redox state, the likelihood of sulfur addition to the sub-arc mantle from serpentinite dehydration, and the distribution of sulfur within subducted serpentinites from Alpine Corsica is investigated by a combination of petrographic analysis, in situ sulfur isotopic analysis and trace element analyses of sulfides hosted in these rocks.

Sulfur-derived from the mantle ($\delta^{34}S$ values ~ 0.1‰ [3]) was not the sole sulfur source in these samples with $\delta^{34}S$ values of 2.95–15.5‰ for all sulfides, with the heaviest values recorded in pyrites of the most metasomatised sample. Heavy $\delta^{34}S$ recorded in sulphides associated with the onset of exhumation could imply the mobilisation of oxidised sulfur (sulfate or SO_2) via slab derived fluids. Greater heterogeneity in $\delta^{34}S$ values in samples proximal to metagabbro, metabasalt and metasediments could reflect interaction of the serpentinite samples with these lithologies in the subduction channel and/or the sampling of different fluid sources.

EPMA mapping of pyrite and NanoSIMS mapping of pentlandite grains revealed fine scaled zonation of Co, Ni (pyrite) and additionally As and Cu (pentlandite). Lighter $\delta^{34}S$ values correlate with a higher concentration of Co in pyrite. The zonation might reflect infiltration of fluids from different sources, and therefore $\delta^{34}S$ values in the sulphides could be sensitive to the nature of fluids from which they grew. However, other factors e.g. element availability during mineral growth, pressure, temperature and local factors e.g. rates of diffusion could also be of importance.

[1] Evans *et al.*, (2014). *Chem Geol* **365** 1–19
[2] Alt *et al.*, (2012). *Chem Geol* **322-323** 268–277
[3] Alt et al., (1998). *J. Geophys. Res* **103** 9917–9929