The behaviour of Fe and S during serpentinite dehydration

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Serpentinite rocks, formed by hydrothermal alteration of peridotites compose ~70% of the oceanic crust [1], which later sinks into subduction zones. Serpentines carry ~12 wt.% H_2O and thereby introduce large amounts of water into the upper mantle [2] when dehydrating during subduction. Additionally, serpentinites contain 2-6 wt% of magnetite [3] and up to 0.8 wt% of sulfur, mostly in the form of pyrite [4]. During mineralogical changes in subducting slab, the speciation of Fe and S is likely to change, which potentially affect fO_2 and, therefore the mobility of metals and volatile elements [5].

This experimental work is dedicated to the characterization of iron and sulfur speciation during serpentinite dehydration. Three different starting materials composed of powdered mineral mixtures were used: Fe(III)-antigorite (atg), atg + magnetite, atg + pyrite. Runs were performed at 2 GPa, between 400 and 900°C in piston-cylinder apparatus. Experimental products were first characterized by X-ray powder diffraction and electron microprobe before being characterized by XANES spectroscopy at the iron and sulfur *K*-edges.

Our results show that in the temperature window where antigorite is found to partially dehydrate, both iron and sulfur are progressively reduced. In consequence, the properties of antigorite dehydration fluids will depend on the amount of ferric iron and sulfide phases in serpentinites, a parameter inherited from pre-subduction processes.

[1] Hacker et al. (2003) *J. Geophys. Res.* **108**, article number 2029. [2] Ulmer & Trommsdorff (1995) *Science* **268**, 858-861. [3] Debret et al. (2014) *EPSL* **400**, 206-218. [4] Alt et al. (2013) *Lithos* **178**, 40-54. [5] Pokrovski & Dubrovinsky (2011) *Science* **331**, 1052-1056.