



## **Fluid-Mobile-Elements partitioning during serpentine formation: an experimental approach**

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Natural serpentinites observed in oceanic lithosphere and subducted ultramafic rocks presently exhumed contain high levels of trace elements, especially Fluid-Mobile-Elements (FME) relative to primitive mantle. FME concentrations are mainly controlled by fluid-rock interactions and represent excellent mass transfer's markers from mid-ocean ridge to subduction environment. Serpentinization processes have been experimentally investigated at different geological conditions (e.g. 1-2), but hydrothermal experiments have rarely considered the FME behavior during serpentine precipitation and new experimental data are required. In this context, we tackled an experimental study to better understand the liquid-solid partitioning and the element-trapping mechanisms into/onto serpentines of several FME.

For that purpose, we have performed two types of experiments. Firstly, we synthesized pure chrysotile from  $H_2SiO_3$ - $MgCl_2$  interaction in NaOH slurry (pH: 13.5 at 25°C) in presence of different concentrations of FME (As, Li, Cs, Sb and B). Secondly, to simulate hydrothermal alteration, we conducted olivine serpentinization reaction at 200°C, 82bar in NaOH solution doped with 200  $\mu g/g$  of one FME for different reaction time. High pH conditions favor a very fast kinetic (3) and avoid secondary phases formation.

Synthesis system enabled us to determine sequestration isotherms for each element of interest. Moreover, from FESEM observation we noted that Li and B sequestration induced the formation of larger chrysotile nanotubes at the same P-T conditions whereas As and Cs seem to have insignificant influence on the particle size.

For olivine alteration experiments, FESEM observations highlighted that olivine is replaced by an assemblage of chrysotile and brucite. TGA measurements allowed us to well characterize proportion of each phases and to determine serpentinization rate (3). ICPMS measurements and electron microprobe analyzes allowed us to characterized FME distribution and partitioning in experimental products. FME exhibit different behavior and have different effect on serpentinization processes. We indicate that the presence of Li in hydrothermal fluid increases considerably serpentinization kinetic rate. Electron microprobe mapping indicates that Sb and As are heterogeneously distributed during olivine serpentinization with evidences of co-precipitation whereas Cs seems homogeneously distributed in serpentine.

From this experimental study, we provide new results for understanding the behavior and the distribution of FME during hydrothermal serpentinization. They provide new insights to better interpret the fate of FME during serpentinization and their cycle in geological systems.

(1) Seyfried and Dibble (1980) GCA, 44, 309-321. (2) Malvoisin et al. (2012). JGR, 117. (3) Lafay et al. (2012). J. Cryst. Growth, 347, 62-72.