Oxygen isotopes analysis of serpentine minerals by SHRIMP: analytical developments and geological applications

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Serpentinites play a crucial role in recycling fluids and elements from ocean floor to mantle through seafloor metamorphism and subduction. Information on the source(s) of fluids that interacted with serpentinites can be obtained using oxygen isotopes.

Fluid-rock interaction can occurr at different stages of metamorphism and thus serpentinites commonly preserve complex textures. In order to investigate these stages of metamorphism, *in-situ* analytical techniques able to resolve oxygen isotopic variations recorded at the microscale are necessary. We present the first investigation of oxygen isotopes in serpentine minerals by ion microprobe.

Due to significant instrumental mass fractionation, data obtained with ion microprobes should be corrected by analysing well-characterised reference materials. Reference values for three chemically homogeneous samples of antigorite, chrysotile, and lizardite were obtained by laser fluorination. Analysis for oxygen isotopes using the SHRIMP ion microprobe aimed to assess their reproducibility compared to San Carlos olivine as well as potential matrix bias and crystal orientation effects. The obtained data suggest reproducibility comparable to San Carlos olivine of ca. ±0.3-0.4 ‰ (SD at 95% c. l.) for all samples. Crystal orientation effects were identified only in chrysotile and no matrix bias were observed in the invetigated compositional range. The developed standards were used for analysing oxygen isotopic compositions of different serpentine polymorphs in ultrahigh-pressure serpentinites that are enclosed in metapelites from Tianshan (China). The $\delta^{18}O$ of high-pressure antigorite is ~ 6.0±0.4‰ (σ at 95% c. l.) resulting in a bulk rock $\delta^{18}O$ of ~ 4.8‰. This value is similar to bulk rocks in oceanic serpentinites and suggest that serpentinization most likely occurred during seafloor alteration. Despite the observation of crystal orientation effects in chrysotile, the highest $\delta^{18}O$ values measured in late chrysotile veins are comparable to those obtained in antigorite and allow to exclude interaction with fluids derived from the surrounding metasediments.