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Evidence for boron incorporation into the serpentine crystal structure

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Abstract

Serpentinite mud volcanoes from the Mariana forearc comprise B-rich mantle wedge peridotites serpentinized by slab fluids. The major component of these rocks are serpentine group minerals [$Mg_3Si_2O_5(OH)_4$], showing highly variable textural and geochemical features. Micro-Raman spectroscopy reveals that the serpentine minerals are well-crystallized lizardite and chrysotile. In situ SIMS spot analyses and element mapping via ToF-SIMS show that B is evenly distributed across serpentine grains, suggesting that serpentine, both lizardite and chrysotile in different textural regions, can host significant amounts of B (up to ~200 µg/g) into its crystal structure. As such structurally bound B can only be released during recrystallization or serpentine breakdown, our results have implications for modeling of the efficiency of cross-arc fluid mobile element recycling in subduction zones and stress the importance of the hydrated forearc mantle as a reservoir for fluid mobile elements.

Keywords: Boron, lithium, serpentine, SIMS, ToF-SIMS, micro-Raman spectroscopy, subduction, Mariana forearc