Boron isotopes in metamorphic olivine record external fluid infiltration during serpentinite dehydration in subduction zones

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Fluid sources and pathways at the interface between the subducting slab and overlying mantle wedge are poorly understood. Metamorphic olivines produced by serpentine dehydration at sub-arc depths contain significant concentrations of B which is a particularly powerful tracer of subduction zone fluid processes. Here we report *in situ* B isotope data in meta-serpentinites from high-pressure meta-ophiolites in the Western Alps (France, Italy) and Sierra Nevada (Spain), which allows direct comparison of $\delta^{11}B$ in metamorphic olivine and co-existing serpentine. We find high [B] (1.7-28.6 ppm) and $\delta^{11}B$ (+9.5 to +27.5 ‰) in metamorphic olivine as well as co-existing serpentine ([B] 1.6-50.5 ppm, $\delta^{11}B$ -4.7 to +24.4‰). Differences between $\delta^{11}B_{ol}$ and $\delta^{11}B_{srp}$ ($\Delta^{11}B_{ol\text{-}srp}$) are highly variable and may indicate significant isotopic disequilibrium. Importantly, there is a correlation between $[B]_{ol/srp}$ and $\Delta^{11}B_{ol\text{-}srp}$: samples with high $[B]_{ol/srp}$ have low $\Delta^{11}B_{ol\text{-}srp}$ (up to -10 ‰) whereas samples with low $[B]_{ol/srp}$ have high $\Delta^{11}B_{ol\text{-}srp}$ (up to +15‰). We suggest: B-depleted olivines represent equilibrium fractionation of the isotopes between olivine and serpentine. B-enriched olivines have equilibrated with externally-derived fluids most likely derived from subducting sediments, crust and other serpentinites. We conclude that open system dehydration is common in exhumed ophiolites, even in those that show little evidence based on their whole-rock B isotope signatures. We believe this provides direct evidence for large scale fluid mobility in or near the subduction interface.