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Boron recycling across the Subduction Factory: Insights from SIMS measurements of metasomatized mantle xenoliths from Kamchatka arc

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There is no direct observation of element transfer through the subarc mantle. A novel approach to constrain element mobility in the mantle wedge is by studying metasomatized mantle xenoliths erupted by arc volcanoes. Here, we present boron contents and δ^{11}B of hydrous vein minerals, phlogopite and amphibole, in ultramafic mantle xenoliths from the Avachinsky and Shiveluch volcanoes in Kamchatka. They provide evidence of fluid/melt flow originating from dehydration/melting of the subducting plate.

New SIMS measurements reveal that B in phlogopite and amphibole is extremely low and range from 0.3 to 3.1 μg g^{-1} and from 0.2 to 6.4 μg g^{-1}, respectively. The δ^{11}B of phlogopite and amphibole are highly variable and range from -16.6 to - 0.5‰ (± 1.4‰) and from -12.1 to + 0.9‰ (± 1.6‰), respectively. The unexpectedly low B contents and highly variable but isotopically light δ^{11}B ratios of the metasomatic minerals may reflect sluggish slab dehydration under the arc front volcanoes. The well-documented and very large B outfluxes in the shallow parts of subduction zones[1] seem to be in stark contrast with the deep (100-150km) slab derived fluids as recorded in the hydrous minerals we studied.

References:

1. De Hoog, C.J. & Savov, I.P., 2018. Boron Isotopes as a Tracer of Subduction Zone Processes. In: Marschall H., Foster G. (eds) Boron Isotopes. Advances in Isotope Geochemistry. Springer Cham, 217-247.