

Linking boron to sources in Aleutian volcanic rocks

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Boron concentrations in Aleutian volcanic rocks are variable from 5-68 ppm in the eastern and central parts of the arc and 4-14 ppm in the western Aleutians. Boron enrichments (e.g., B/La) in eastern and central Aleutian samples are linked to enriched Pb, Sr, and Nd isotopes, indicating a source for B primarily in subducted sediment. Western Aleutian lavas have ~4x more B than Pacific MORB, but Pb, Sr, and Nd isotopes that are (in the end-member samples) indistinguishable from Pacific MORB. Thus, the source of B in the western Aleutians is different than in the central and eastern arc. This distinctive source is evident because the long, oblique path into the western Aleutian subduction zone eliminates the dominant source for B (sediment) and reveals a second source. Assuming that B is transported principally by aqueous fluids or hydrous melts, this source must contain low abundances of Pb, Sr, and Nd. A clear candidate for this source is serpentinite in the mantle section of the subducting plate. If oblique subduction is accompanied by progressive heating and dehydration of the slab beneath the forearc, the western Aleutian rocks may carry serpentinite-derived B that is isotopically light and distinct from B in common arc rocks, which typically have $\delta^{11}\text{B}$ of -5 to +10 ‰. Global variation in $\delta^{11}\text{B}$ vs Nb/B(1) indicates that a source component with low $\delta^{11}\text{B}$ at Nb/B<1 likely contributes to common arc volcanic rocks. Deep-slab serpentinite in the western Aleutians may exemplify such a source.

(1) Ryan & Chauvel in Turekian and Holland (2014), Treatise on Geochemistry 2nd Edition, 479-508.