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Scales of change: intra-flow, intra-volcano, and intra-volcanic chain B isotope variations

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Boron (B) is an ideal geochemical tracer for hydration of the overlying mantle wedge at subduction zones. Magmatic B-isotope compositions are useful in detecting and quantifying exchange processes between the slab and mantle due to B-affinity for silicate melts and aqueous fluids with no significant isotopic fractionation during crystallisation (e.g., 1, 2).

This study presents new whole-rock B-isotope data from eruptive units of stratovolcanoes of the Pleistocene-Holocene San Pedro-Linzor Volcanic Chain in the Central Andes (west to east/youngest to oldest): San Pedro (21°53'15"S, 68°23'30"W), Paniri (22°03'34"S, 68°13'42"W); and Toconce (22°11'17''S, 68°04'43''W). Our newly obtained $\delta^{11}B$ values are relatively low (San Pedro: -2.09‰ to +1.26‰; Paniri: -6.11‰ to +0.23‰; Toconce: -11.16‰ to -5.06‰) compared to mantle-derived magmas affected by fluids released by subducting altered oceanic crust (0 ‰ to 18‰; e.g., 1). This is consistent with suggestions that such low $\delta^{11}B$ values require a role for a ^{11}B-depleted component, like MORB-mantle ($\delta^{11}B$ = ca. -7.1‰) or Central Andean basement ($\delta^{11}B$ = ca. -8.9‰; e.g., 5). Since $^{87}Sr/^{86}Sr$ ratios from these volcanoes reflect significant degrees of crustal contamination (3, 4), their low $\delta^{11}B$ values likely also reflect contamination from low-$\delta^{11}B$ continental crust (6).

Based on $\delta^{11}B$-$^{87}Sr/^{86}Sr$ covariations (lower $\delta^{11}B$ and higher $^{87}Sr/^{86}Sr$ values = more contamination vs higher $\delta^{11}B$ and lower $^{87}Sr/^{86}Sr$ values = less contamination) our regional study reveals progressive lessening of crustal assimilation over time on 3 spatial scales: 1. within individual eruptive units from early-erupted distal samples to later-erupted proximal samples (initial to final effusion); 2. between stratigraphically older units to younger units within each volcano; and, 3. from the older volcano located within the interior of the Altiplano Puna Magma Body (APMB), a large long-lived, mid-crustal melt zone, to younger volcanoes located progressively towards its edge, i.e., Toconce to Paniri and to San Pedro.

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