# Boron systematics in olivine-hosted melt inclusions indicate a deep-slab source for volatiles in Southern Chile, and magma-forearc interaction

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$\delta^{11}B$, trace, and volatile elements have been measured in olivine-hosted melt inclusions and embayments in scoria samples from the Andean Southern Volcanic Zone (SVZ). Bulk sediment from ODP core 1232A was also measured for $\delta^{11}B$. Inclusions preserve high $CO_2$ and $H_2O$, and thus represent the deep magma systems of their associated volcanics. $\delta^{11}B$ of the embayments overlap the melt inclusions, both are likely representative of variation in the mantle. B systematics of the arc-front and rear-arc indicate two-component mixing between an OIB-like mantle source and a single subduction component with $\delta^{11}B$~0‰. Clean systematics may uniquely result from the melt-inclusion approach, which mitigates contamination and alteration effects. The $\delta^{11}B$ of the SVZ subduction component is the lowest globally, while Apagado, which is trench-ward of the arc front, extends to $\delta^{11}B$~5‰. Apagado is also distinct in major and trace elements, suggesting a unique petrogenetic origin.

We model the effects of B-loss from the slab, with particular attention to the stability of phengite and the likely effects of shear-heating on early volatile loss. The composition of the down-going plate is constrained by the sediment, and B vs. $K_2O$ concentrations in altered MORB. The model is benchmarked against the B systematics of the Mariana arc, for which the early fluids lost from the slab have been directly measured in mud volcanoes. The model indicates high levels of B-loss and fractionation of the residual slab well before reaching the arc front. In the SVZ arc-front a mass-balance gap in B concentrations is best resolved by the contribution of a high $\delta^{11}B$ fluid sourced from deeper slab reservoirs. The higher $\delta^{11}B$ of the Apagado cone cannot be accounted for by additional deeply sourced fluids, and instead likely indicates direct interaction between ascending magma and B-rich materials in the fore-arc. The higher $\delta^{11}B$ seen in other volcanic arcs may be due to a similar process as suggested for Apagado.