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Transitional retro-arc magmatism in southern Patagonia: alternatives to subslab models from the Sierra Baguales

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The southern Patagonian (South America) Neogene retro-arc magmatism has been associated to the opening of slab windows and/or slab tearing beneath the South American plate (1,2), as a consequence of the Chile ridge subduction and the melting of OIB-type asthenospheric mantle. This magmatic activity produced alkaline to subalkaline lavas throughout the Patagonian retro-arc region, in which transitional type lavas, with geochemical characteristics between intra-plate alkaline and arc calc-alkaline geochemistry, remain largely unconstrained in terms of spatial and temporal evolution of their geochemical signatures.

New geochemical data and detailed field investigations from the retro-arc lavas of the Sierra Baguales (southern Patagonia), located ∼100km east of the active volcanic front, are used to investigate the potential relationships between the geochemical signature and the Neogene geodynamics of the southern Patagonian subduction system. Results show that the Sierra Baguales plateau lavas are primitive magmas with a transitional subalkaline signature. The positive Pb and negative Nb anomalies are indicators of calc-alkaline magmas, but their enriched incompatible trace element patterns distinct them from typical arc volcanoes. A change in the composition of the emitted basalt is observed in the younger and less voluminous basaltic lavas in the same area. Some basalts have alkaline and OIB-like signature, where others are more depleted and similar to arc tholeiites, indicating different magma sources after the formation of the transitional plateau lavas.

Experimental results have demonstrated that melting of amphibole-rich rocks located in the lithospheric mantle are a viable mechanism for the origin of intra-plate alkaline volcanism (3). Likewise, amphibole-rich cumulates produced by calc-alkaline arc magma differentiation at lower crust levels could represent an alternative magma source in the sub-arc mantle. We will present a quantitative geochemical model to test the various hypotheses to produce transitional magmas, as well the spatially related OIB-like magmas, linking volcanic arc and retro-arc geodynamic and magmatic evolution, and considering the potential delamination (4) and partial melting of amphibole-rich cumulates from lower arc crust.

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