**5.3.71**

# Mantle source vs. contrasted continental crust contamination signatures in the NVZ revealed from an across-arc Sr-Nd isotopic study

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The Quaternary volcanism in the NVZ in Ecuador is characterized by a limited Sr-Nd isotope variation atypical of most continental arcs and despite a thick and contrasted continental crust.

Highly magnesian lavas (up to 11% MgO) have been erupted throughout the arc, providing a direct window on the sub-continental isotopic signature. An across-arc Sr-Nd isotope study shows that the source of Ecuadorian arc lavas has a moderate $^{87}Sr/^{86}Sr$-$^{143}/^{144}Nd$ signature (0.70406-0.512910). Some of the lavas in the arc front are shown to have undergone some continental crust contamination by the unradiogenic material of oceanic origin forming the bulk of the crust beneath it. Most of the lavas though display the original isotopic signature of their source. In the Main Arc, higher $^{87}Sr/^{86}Sr$ and lower $^{143}Nd/^{144}Nd$ indicate significant but limited interaction (<15%) with both the upper and lower more mature continental crust. Lavas from the back-arc, despite being emplaced over the Guyana craton show no sign of significant contamination and share the exact same isotopic signature with those from the arc front lavas. Despite discrete variations, the homogeneous isotopic signature of Ecuadorian NVZ lavas confirms that the continental crust plays a minor role in the genesis of the magmas and that most of the unusual geochemical characteristics of the latter can be traced down to the deep source in both the subducted oceanic crust and/or sub-arc mantle. [1].

Due to the limited involvement of the continental crust in the evolution of the magmas and the possibility to pinpoint exactly the isotopic signature of the sub-arc mantle, the ecuadorian margin proves to be the best natural arc laboratory to study the effect of crustal contamination on a range of isotopic systems.

**Reference**

[1] Bourdon E. et al. (2003) *EPSL* **205,** 123-138.

**5.3.72**

# Effects of subducting the Louisville Ridge and Osbourn Trough beneath the South Tonga arc

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Subduction of both the plume-generated Louisville Ridge and the late Cretaceous Osbourn Trough paleo-spreading centre takes place beneath the 450 km-long South Tonga segment of the Tonga–Kermadec subduction system. The predominantly submarine South Tonga arc was previously unsurveyed and features only 1 volcanic island (Ata). Surveying and sampling during cruise SO 167 of the FS *SONNE* revealed a continuous volcanic front, 10–15 km wide, comprising 27 semi-regularly spaced active stratovolcanoes typically with basal diameters of 10–25 km and heights of 1–2 km. The volcanic front is disturbed only in the vicinity of Ata, where 10 major edifices and numerous smaller constructs extend the width of the front to 50 km. This greater width reflects a transient 40 km westward migration of the front and enhanced constructional volcanism as the Louisville Ridge dehydrates and passes under the arc.

The South Tonga arc volcanoes show considerably more geochemical and isotopic variation than the better-known subaerial Central Tonga volcanoes. High-Mg basalt, andesite, and rhyodacite associated with calderas (often > 6 km in diameter) are common. Overall, these lavas define a low-K suite with strong enrichment in the fluid-mobile elements and extreme depletion in the fluid-immobile elements relative to MORB [e.g., $(La/Yb)_N$ < 1.1; Nb/Yb 0.09–0.27). Specific incompatible element ratios distinguish some volcanoes and are randomly distributed along the arc segment. These characteristics are long-lived, and best explained by interaction of ascending magma with sub-arc lithosphere in a volcano-specific manner. They provide support to models invoking significant lithospheric processing of magma in oceanic settings.

Passage of the Louisville Ridge beneath the arc is associated with the eruption of lavas with $(La/Yb)_N$ > 1.1, higher Th/U, and other anomalies prior to and during the westward migration of the volcanic front. In contrast, lavas erupted during the eastward return of the front have relatively normal South Tonga compositions, suggesting rapid flushing of ridge-derived fluids from the sub-arc mantle. Volcanoes that overlie the subducting Osbourn Trough at 23.5–24.7°S exhibit a marked change in caldera-style to diatreme-like craters up to 1.1 km-deep. Associated changes in magmatic volatile content driving these eruptions probably reflect dehydration of mantle extensively serpentinised when spreading stalled at the Osbourn Trough.