

Rubidium isotopic evidence for sedimentary input to the mantle source of Lesser Antilles lavas

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Arc lavas are chemically distinct from mid-ocean ridge basalts, partly due to the incorporation of subducted continental and oceanic crustal components in their mantle sources. Understanding the origin of crustal signatures in arc lavas provides insights into crust-mantle interaction and mass exchange in subduction zones. Rubidium (Rb) is a highly incompatible element with a substantial fluid mobility. Due to its significant enrichment in the crust relative to the mantle and the inherent isotope variability in crustal materials, Rb isotopes have the potential to trace crustal recycling. However, the behavior of Rb isotopes during slab subduction and related processes remains poorly understood. Here, we present Rb isotope data of a set of arc lavas from Martinique Island, Lesser Antilles arc. The $\delta^{87}\text{Rb}$ (the permil deviation of the $^{87}\text{Rb}/^{85}\text{Rb}$ ratio from the NIST SRM 984 standard) of the studied arc lavas varies from a mantle-like value at $-0.08 \pm 0.03\text{‰}$ to a lower value of $-0.26 \pm 0.05\text{‰}$, with Rb content increasing from 3.8 $\mu\text{g/g}$ to 116 $\mu\text{g/g}$. Additionally, the arc lavas exhibit strong correlations between $\delta^{87}\text{Rb}$ values and radiogenic isotopic compositions (e.g., $^{87}\text{Sr}/^{86}\text{Sr}$, $^{143}\text{Nd}/^{144}\text{Nd}$, and $^{206}\text{Pb}/^{204}\text{Pb}$). To avoid post-eruption alteration effects, we selected samples with LOI values below 2 wt.%. The lack of correlation between $\delta^{87}\text{Rb}$ and LOI values rules out post-eruption alteration as a possible source of Rb isotopic variations. Magmatic differentiation is also unlikely to account for the observed Rb isotope variations, due to limited fractionation of Rb isotopes during mantle partial melting and basaltic differentiation². We suggest that the variation in Rb isotope compositions results from a contribution of isotopically light subducted sediments. This study demonstrates that Rb isotopes can provide records of crustal recycling in the mantle sources of arc magmas.

[1] Labanieh et al. (2010), *Earth Planet. Sci. Lett.* 298, 3546.

[2] Wang et al. (2023), *Geochim. Cosmochim. Acta* 354, 38-50.