

Reconstructing the weathering history of La Réunion Island over the past 750 ka

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Weathering of volcanic rocks is suggested to be a substantial contributor to the global atmospheric CO₂ drawdown. Especially tropical volcanic islands with high and episodic precipitation events favour high denudation rates making them key regions in the global weathering cycle. In absence of orogenic uplift, weathering rates are expected to increase strongly following fresh lava emplacement and may closely correlate with erosion rates. Subsequently, weathering rates are expected to decrease as physical erosion slows and the exposed extrusive rock becomes increasingly weathered. Hence, the evolution of weathering over centennial to millennial timescales is linked to the formation of a volcano, where each eruption may reset the weathering cycle by providing fresh rock.

Here we present a geochemical investigation of two marine sediment cores (MD11-3342, MD11-3349) off the coast of La Réunion Island (Indian Ocean) that record sediment transfer from the hotspot volcano Piton des Neiges. By analysing the major and trace element composition of these sedimentary archives, of the bedrock of the island with its well-constrained extrusion phases, and of modern river sediments of the island, we reconstruct the weathering history of La Réunion over the last 750 ka.

We quantify the contributions of source rocks from the island's four main volcanic formations using a selection of immobile elements (Nb, Th, Hf, U, Ta, Yb), which are least influenced by sorting effects. Principal component analysis of immobile element ratios across different bedrock age-phases enabled us to characterize the geochemical signature of each volcanic building phase. Based on these distinct signatures, the contributions of the different building phases through time were calculated from inversion of a mixing model, which identifies the dominant bedrock phases influencing the sedimentary record. We then rely on the mobile elements Na, Ca, K, Mg, and Sr as recorders of the weathering intensity. Preliminary results reveal significant variations in the weathering intensities over time. The variability in weathering intensity presented by the archives can be tied to lava emplacement of the island's volcanic formation history.