

Denudation and weathering rates of tropical volcanic islands from combined beryllium and lithium isotopes

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Weathering of mafic rocks is thought to be a major sink of CO₂ and has been hypothesized to exert a significant influence on global climate over the Cenozoic. Tropical volcanic islands constitute hotspots of mafic rock weathering, because of a combination of high erosion rates and extreme precipitation events. However, it is still unclear how high weathering rates can be sustained long after the emplacement of a volcanic edifice, given the lack of tectonic uplift and the reported “ageing” of volcanic surfaces with respect to water-rock interactions. Faithful proxies of past weathering and erosion rates are thus needed to quantify the role of tropical volcanic island weathering on the Earth system.

In order to develop a method to reconstruct weathering and erosion rates of volcanic islands as a function of time over multi-kyr timescales, we combine for the first time the ¹⁰Be(meteoric)/⁹Be and $\delta^7\text{Li}$ proxies, which provide independent information on denudation rates and weathering intensity, respectively. These isotope tools are applied to detrital sediments from modern streams and from lacustrine records collected on the Guadeloupe (Carribean) and Réunion (Indian Ocean) tropical volcanic islands, where a wealth of gauging data is available from on-going monitoring programme in critical zone observatories. We verify the validity of the denudation rates and weathering intensity inferred from our isotope proxies measured in river material against gauging-derived data, and show how the paleo-record can be used to feed models for past tropical island landscape evolution and influence on the global carbon cycle.