Quantifying weathering rates along a precipitation gradient on Basse-Terre Island, French Guadeloupe: Insights from U-series isotopes in weathering rinds

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Rock fragments entrapped in soils may form weathering clasts. A weathering clast contains a layer of alteration rind (solid weathering products) surrounding a core of unweathered parent material. The presence of thick rinds implies that little or no physical erosion has occurred to the rind materials after weathering. Weathering rinds thus provide an excellent yet simple system to study initiation of weathering at the rock-regolith interface. Furthermore, recent studies successfully utilized a novel U-series isotope chronometer to directly determine ages of weathering rinds, highlighting a new combined geochemical and isotopic approach to use weathering rinds to quantify long term weathering rates. Here, we applied petrographic, bulk chemical, electron microprobe, and U-series isotope techniques to charaterize weathering reactions and quantify weathering rates in rinds collected across a steep precipitation gradient on tropical volcanic Basse-Terre island in French Guadeloupe. New rinds were collected from a relatively dry part of the island (Deshaies: MAP 1800 mm and MAT 25°C), an ideal site to compare to the previously studied rind from the wet part of the island (Bras David: 3400 mm and MAT 25°C). The new weathering rates of the Deshaies rind range from ~0.1 to 0.2 mm kyr^{-1}, slower than the ~0.2 to 0.3 mm kyr^{-1} rates in the Bras David, highlighting the important role of precipitation on controlling weathering rates on this island. New results also revealed the importance of curvature and porosity during rind formation at the clast scale. Weathering rinds thus provide a promising system to study chemical weathering across environemntal gradients.