Changes in Mn oxidation state and U immobility in weathering rinds

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We present x-ray microprobe and U-series isotope analyses of a single oriented weathering clast collected from the B horizon of a weathered Quaternary volcanoclastic debris flow on Basse Terre Island, Guadeloupe. The sample consists of an unweathered andesitic core surrounded by a weathering rind, and an indurated crust that separates the rind from the overlying soil matrix. U activity ratios indicate leaching of U from the matrix and U immobility in the crust and weathering rind. U/Th disequilibria dating indicate that rind age increases away from the core-rind boundary to a maximum of 72 ka. This translates to a rind-advance rate of 0.2 mm yr^{-1}, broadly consistent with rind advance rates calculated elsewhere on Basse Terre Island. Unlike previously studied clasts, the preservation of the rind-soil interface permits characterization of weathering reactions between the weathering core, the rind, and the surrounding soil matrix, shedding insights into communication between the enveloping weathering rind and host regolith. We document depletion of Mn in the weathered rind relative to the core, but accumulation of Mn along the edges of the crust that is consistent with precipitation of Mn oxide minerals. We hypothesize that Mn^{2+}-bearing fluids either infiltrating through the soil or leaching from the core during *in situ* weathering of the core are precipitating within the rind and crust. The accumulated Mn oxide precipitates may provide the reactive substrate for U immobilization.